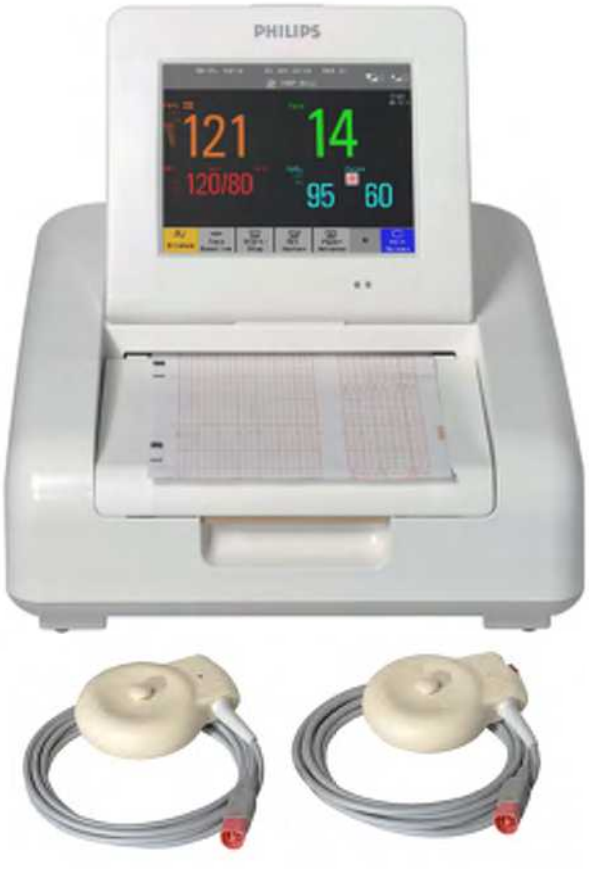
Obstetrical Care



SERVICE GUIDE

Avalon Fetal Monitor

FM20

FM30

FETAL MONITORING

PHILIPS

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Table of Contents

1

Introduction

This Service Guide contains technical details for the Avalon FM20 and FM30 Fetal/Maternal Monitors. It provides a technical foundation to support effective troubleshooting and repair. It is not a comprehensive, in-depth explanation of the product architecture or technical implementation. It offers enough information on the functions and operations of the monitoring systems so that engineers who repair them are better able to understand how they work. It covers the physiological measurements and the monitor hardware that acquires and displays them.

The *Avalon FM20/FM30 Fetal Monitor Service Guide* supplements the maintenance and troubleshooting procedures, carried out by the operator, that are described in the *Instructions for Use*. Refer to the *Instructions for Use* for maintenance and troubleshooting procedures that may be performed during normal operation.

Only qualified service personnel should attempt to install the system, disassemble the monitor, remove or replace any internal assemblies, or replace the transducer cable or belt buttons.

Who Should Read This Guide

This guide is for biomedical engineers or technicians responsible for troubleshooting, repairing, and maintaining Philips' Avalon fetal monitors.

You must:

- understand English
- be familiar with standard medical equipment installation procedures
- be familiar with current conventional technical terms as used throughout this guide

What to Do Next

Familiarize yourself with the contents of this guide and the *Instructions for Use* before attempting to service or repair the system.

Repair Strategy

The Service Support Tool software helps you to determine whether a fault is a hardware or software problem. The main replaceable parts are:

- unit exchange for the transducers
- replacement of
  - the top cover assembly
  - the bottom housing
  - the power supply assembly
  - the display assembly
  - the recorder adapter board
  - the paper drawer assembly
  - the paper sensor assembly
  - the stepper motor assembly
  - the SpO_2 assembly
  - the noninvasive blood pressure assembly
  - the main CPU board
  - the bus master board
  - the socket connector block
  - the transducer cable
  - the transducer belt button

See Chapter 9, “Parts” for part numbers, and Chapter 8, “Disassembly and Reassembly” for repair details.

Repair or replacement of individual components on the boards is not supported, and should never be attempted.

For tests that you are required to perform after repairs, refer to “When to Perform Test Blocks” on page 24.

Manufacturer’s Information

Philips Medizin Systeme Böblingen GmbH

Hewlett-Packard-Str. 2

71034 Böblingen, Germany

Passwords

In order to access different modes within the monitor a password may be required. The passwords are listed below.

Monitoring Mode: No password required

Configuration Mode: 71034

Demo Mode: 14432

Service Mode: 1345

Refer to Chapter 11, “Understanding Configuration” before making any changes to the monitor configuration.

Warnings and Cautions

In this guide:

- A **warning** alerts you to a potential serious outcome, adverse event or safety hazard. Failure to observe a warning may result in death or serious injury to the user or patient.
- A **caution** alerts you where special care is necessary for the safe and effective use of the product. Failure to observe a caution may result in minor or moderate personal injury or damage to the product or other property, and possibly in a remote risk of more serious injury.

2

Site Preparation

Introduction

This section describes the procedures you should follow to plan and prepare a site for an Avalon FM20/FM30 fetal monitor installation.

- Site planning.
- Roles and responsibilities for local and Philips personnel.

Site Planning

The careful planning of the site for the FM20/FM30 monitor is essential for its safe and efficient operation. A consulting schedule should be established between the Customer and Philips Sales and Support Representatives, to ensure that all preparations are completed when the system is delivered.

The site planning phases prior to equipment installation are:

Location: Planning the location of the various system components.

Environment: Confirming and correcting, as necessary, the environment of the proposed installation site(s).

System Capabilities: Explaining the possibilities for system expansion.

Mounting: Referencing the mounting hardware information website for the listing of suitable mounting hardware recommended for use with the various system components, and all details on the available mounts and accessories.

Cabling: Identifying the requirements for the cabling, conduiting and faceplates for connecting the various system components.

Roles and Responsibilities

This section describes the procedures necessary to prepare a site for a system installation. The procedures are grouped into two parts: procedures that local staff or contractors are responsible for, and procedures that Philips personnel are responsible for.

Site Preparation Responsibilities

Local Staff

- Ensure that all safety, environmental and power requirements are met.
- Provide power outlets.
- Prepare mounts, and consult Philips for detailed mounting requirements.

- Pull cables, install conduit, install wallboxes.

Philips Personnel

- Provide the customer with the safety, environmental and power requirements.
- Assemble mounts, as necessary.
- Provide requirements for cabling.

Procedures for Local Staff

The following tasks must be completed **before** the procedures for Philips personnel may be started.

- Providing Power Outlets

  Provide a power outlet in the vicinity (1 m or 3 ft) or any peripheral equipment.

WARNING Only the power cables provided with the system may be used. For reasons of safety, power (mains) extension cables or adapters shall not be used.

- Preparing Mounts

  Where ceiling, wall, or shelf mounts are required for mounting the equipment, the customer is responsible for the following:

  – Providing and installing all hardware which is required to install the mounting hardware supplied by Philips as detailed in the installation notes.

  – Making sure that all ceilings, walls, and mounting rails that supports mounting hardware are suitable for their proposed load.

WARNING It is the customer's responsibility to have the attachment of the mounting hardware to the ceiling, wall, or mounting rail and the construction of the ceiling, wall, or mounting rail evaluated for structural integrity and compliance with all local, state and any other required codes by a registered, professional, structural and/or mechanical engineer.

Although considerable effort has been made to ensure the safety of the ceiling mount installation and or mounting guidelines, it is to be understood that the installation itself is beyond the control of Philips Medical Systems. Accordingly, Philips Medical Systems will not be responsible for the failure of any such installation.

- Providing Conduit

  – Providing conduit and/or trunking of a sufficient cross-sectional area for the planned cables and possible future expansion (for additional components or systems).

  – Providing and/or installing suitable wall boxes to accommodate the faceplates.

- Pulling Cables

WARNING NEVER run power cables through the same conduit or trunking used for system cables.

- Installing Wall Boxes

It is the customer's responsibility to provide and install wallboxes to house faceplates. The customer must notify the Philips installation coordinator of which size is to be used.

Procedures for Philips Personnel

Before you begin the procedures in the installation sections, ensure that the customer has completed all necessary preparations outlined in the previous section, “Procedures for Local Staff.”

Site Requirements

The site requirements are listed in this section.

Space Requirements

The situating of the monitor should be planned such that the nursing staff are able to monitor the patient with relative ease, with all patient connectors and controls readily available and the displays clearly visible. The location should also allow access to service personnel without excessive disruption and should have sufficient clearance all round to allow air circulation.

Dimensions and weight:

Monitor:

Size (W x H x D): 335 x 286 x 133 mm (13.2 x 11.3 x 5.2 in)

Weight; 5.1 kg (11.2 lb)

Transducer:

Size (diameter): 83 mm (3.27 in)

Weight (without cable): 190g (6.7 oz.)

Environmental Requirements

The environment where the FM20/FM30 monitor will be used should be reasonably free from vibration, dust and corrosive or explosive gases. The ambient operating and storage conditions for the FM20/FM30 monitor must be observed. If these conditions are not met, the accuracy of the system will be affected and damage can occur.

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Monitor (M2702A/M2703A)		
Temperature Range	Operating	0°C to 45°C (32°F to 113°F)
	Storage	-20°C to 60°C (-4°F to 140°F)
Humidity Range	Operating	<95% relative humidity @ 40°C/104°F
	Storage	<90% relative humidity @ 60°C/140°F
Altitude Range	Operating	-500 to 3000 m/-1640 to 9840 ft.
	Storage	-500 to 3000 m/-1640 to 9840 ft.

Transducers (M2734A/M2735A/M2736A)		
Temperature Range	Operating	0°C to 40°C (32°F to 104°F)
	Storage	-40°C to 60°C (-40°F to 140°F)

Transducers (M2734A/M2735A/M2736A)		
Humidity Range	Operating	<95% relative humidity @ 40°C/104°F
	Storage	<90% relative humidity @ 60°C/140°F
Altitude Range	Operating	-500 to 3000 m/-1640 to 9840 ft.
	Storage	-500 to 3000 m/-1640 to 9840 ft.

SpO_2 Sensors	
Operating Temperature Range	0°C to 37°C (32°F to 98.6°F)

Safety Requirements (Customer or Philips)

The monitor is an electrical Class II device in which the protection against electric shock does not rely on basic insulation and a protective earth conductor but on double and/or reinforced insulation.

WARNING

- Always use the supplied power cord with the earthed mains plug to connect the monitor to an earthed AC mains socket. Never adapt the mains plug from the power supply to fit an unearthed AC mains socket.
- The protective earth conductor is required for EMC purposes. It has no protective function against electric shock! The protection against electric shock in this device is provided by double and/or reinforced insulation.
- Do not use additional AC mains extension cords or multiple portable socket-outlets. If a multiple portable socket-outlet without an approved isolation transformer is used, the interruption of its protective earthing may result in enclosure leakage currents equal to the sum of the individual earth leakage currents, so exceeding allowable limits.

Electrical Requirements (Customer or Philips)

Line Voltage Connection

The FM20/FM30 monitor uses < 60 W.

Line Voltage: the FM20/FM30 monitor may be operated on ac line voltage ranges of 100 to 240V (50/60 Hz).

Connecting Non-Medical Devices

The standard IEC-60601-1-1 applies to any combination of devices, where at least one is a medical device. Therefore IEC-60601-1-1 must still be met after all devices are connected.

WARNING

- Do not use a device in the patient vicinity if it does not comply with IEC-60601-1. The whole installation, including devices outside of the patient vicinity, must comply with IEC-60601-1-1. Any non-medical device, **including a PC running an OB TraceVue system**, placed and operated in the patient's vicinity must be powered via an approved isolation transformer that ensures mechanical fixing of the power cords and covering of any unused power outlets.
- Do not connect any devices that are not supported as part of a system.

Whenever you combine equipment to form a system, for example, connecting the monitor to an OB TraceVue system, perform a system test according to IEC 60601-1-1 (see "System Test" on page 36).

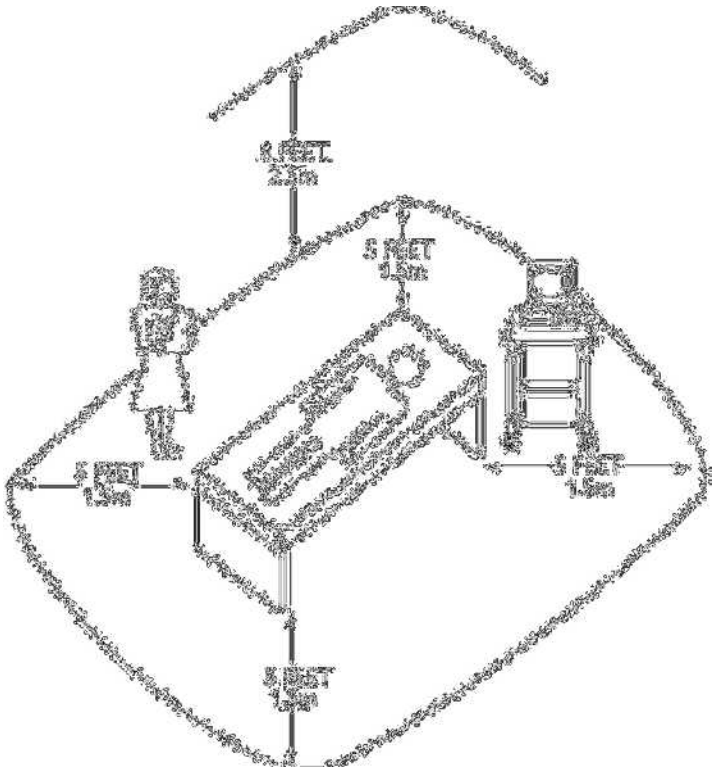


Figure 1 Equipment Location in the Patient Vicinity

Cabling Options and Requirements for Connection to OB TraceVue

For cabling options and requirements for connection to an OB TraceVue system, refer to the **OB** *TraceVue Site Preparation Guide* and the *OB TraceVue Service Guide*.

Mounting Options

See "Mounting Hardware" on page 97 for a list of mounting options. Refer to "Mounting Instructions" on page 12, or contact your local Philips representative for advice on mounting the monitor.

Input Devices

The following tables describes the input devices which can be connected to the monitor via the optional PS/2 interface.

Product Option Number	Part Number	12NC Part Number	Description
M8024A #A01	862454	9898 031 24741	Slimline Keyboard with integrated Trackball
M8024A #B01	M4046-60104	4512 610 00661	Optical Mouse USB / PS/2
M8024A #C01	M4046-60103	4512 610 00651	Wired Track Ball USB / PS2
M8024A #C02	M4046-60105	4512 610 00671	Wireless Track Ball
M8024A #C03	M4046-60106	4512 610 00681	Wired off table Track Mouse

3

Installation Instructions

The information contained in this chapter, **in addition to that given in the *Instructions for Use*,** should enable the monitor to be installed ready for use (the preparation and planning should be adhered to as specified in the "Site Preparation" chapter). Safety checks and inspection procedures for mounts are explained in the "Testing and Maintenance" chapter, and configuration of the system is explained in the "Configuration" chapter.

Please keep the packing materials until you have completed the initial inspection, in case there is a defect on arrival.

Initial Inspection

Inspect the delivery on arrival.

Mechanical Inspection

Open the shipping container(s) and examine each part of the instrument for visible damage, such as broken connectors or controls, or scratches on the equipment surfaces. If the shipping carton/container is undamaged, check the cushioning material and note any signs of severe stress as an indication of rough handling in transit. This may be necessary to support claims for hidden damage that may only become apparent during subsequent testing.

Electrical Inspection

The instrument has undergone extensive testing prior to shipment. Safety testing at installation is not required (except in situations where devices are interconnected forming a system, see "Connecting Non-Medical Devices" on page 143). An extensive self check may be performed. This recommendation does not supersede local requirements.

All tests are described in the "Testing and Maintenance" chapter of this manual.

Claims for Damage

When the equipment is received, if physical damage is evident or if the monitor does not meet the specified operational requirements of the patient safety checks or the extended self check, notify the carrier and the nearest Philips Sales/Support Office at once. Philips will arrange for immediate repair or replacement of the instrument without waiting for the claim settlement by the carrier.

Repackaging for Shipment or Storage

If the instrument is to be shipped to a Philips Sales/Support Office, securely attach a label showing the name and address of the owner, the instrument model and serial numbers, and the repair required (or symptoms of the fault). If available and reusable, the original Philips packaging should be used to provide adequate protection during transit. If the original Philips packaging is not available or reusable please contact the Philips Sales/Support Office who will provide information about adequate packaging materials and methods.

Mounting Instructions

Every type of compatible mounting solution is delivered with a complete set of mounting hardware and instructions. Refer to the Site prep chapter for a list of mounting options. Refer to the documentation delivered with the mounting hardware for instructions on assembling mounts.

WARNING It is the customer's responsibility to have the attachment of the mounting hardware to the ceiling, wall, or mounting rail and the construction of the ceiling, wall, or mounting rail evaluated for structural integrity and compliance with all local, state and any other required codes by a registered, professional, structural and/or mechanical engineer.

Ensure that this commitment has been met before assembling mounts.

Line Voltage Selection

You do not need to set the line voltage, as this is done automatically by the power supply. The monitor has a wide-range power supply that allows you to operate the monitor from an AC (alternating current) power source of 100 V to 240 V (± 10%) and 50 to 60 Hz (± 5%).

Connecting the Monitor to AC Mains

The monitor is an electrical Class II device in which the protection against electric shock does not rely on basic insulation and a protective earth conductor but on double and/or reinforced insulation.

WARNING

- Always use the supplied power cord with the earthed mains plug to connect the monitor to an earthed AC mains socket. Never adapt the mains plug from the power supply to fit an unearthed AC mains socket.
- The protective earth conductor is required for EMC purposes. It has no protective function against electric shock! The protection against electric shock in this device is provided by double and/or reinforced insulation.
- Do not use AC mains extension cords or multiple portable socket-outlets.

Connecting the Monitor to Non-Medical Devices

Connect the monitor to an obstetrical surveillance system, such as OB TraceVue, via the optional system interface. For cabling requirements, refer to “Cabling Options and Requirements for Connection to OB TraceVue” on page 9. For safety-related information, refer to “Connecting Non-Medical Devices” on page 8, and “System Test” on page 36.

Checking and Setting Line Frequency

Before using the monitor, check that the line frequency setting is correct for your location, and change the setting if necessary in Configuration Mode.

WARNING An incorrect line frequency setting can affect the ECG filter, and disturb the ECG measurement. Ensure the line frequency setting is correct.

To set the line frequency:

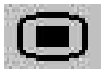
1 Enter the **Main Setup** menu.

2 Select **Global Settings**.

3 Select **Line Frequency** and select **50Hz** or **60Hz** from the pop-up list.

Checking/Setting Paper Scale

You can check the paper Scale Type (**US** for paper with a scale of 30-240, or **Europe** for paper with a scale of 50-210) in the Fetal Recorder menu. In Monitoring Mode, you can see this setting (grayed out), but you cannot change it. It can be changed in Configuration Mode.

1 Enter the **Main Setup** menu by selecting the SmartKey  .

2 Select **Fetal Recorder**.

3 Check the current setting for Scale Type. If it is not appropriate, change it in the Fetal Recorder menu in Configuration Mode:

Select **Scale Type** to toggle between **US** and **Europe**.

Checking/Setting Paper Speed

You can choose a paper speed of 1, 2, or 3 centimeters per minute (cm/min). The default setting is 3 cm/min.

As a change in paper speed results in a change in the appearance of a FHR trace, you are advised to ensure ALL monitors in your institution are set to the same speed.

To set the paper speed:

1 Enter the **Main Setup** menu using the SmartKey  .

2 Select **Fetal Recorder**.

3 In the Recorder menu, you can see the current speed setting. Select **Recorder Speed**.

4 Select the desired speed from the given choices: **1**, **2** or **3** cm/min.

PS/2 Keyboard/Mouse

Switch off the monitor before connecting any PS/2 compatible device.

Connect the PS/2 connector to the PS/2 Interface board in the monitor at the slot indicated by the appropriate symbol.

The default keyboard language setting for all initial configurations is “US”. However, the monitor will not automatically select the best matching language for the keyboard depending on the language of its software. This means that there is no such choice as “Automatic” for the keyboard language.

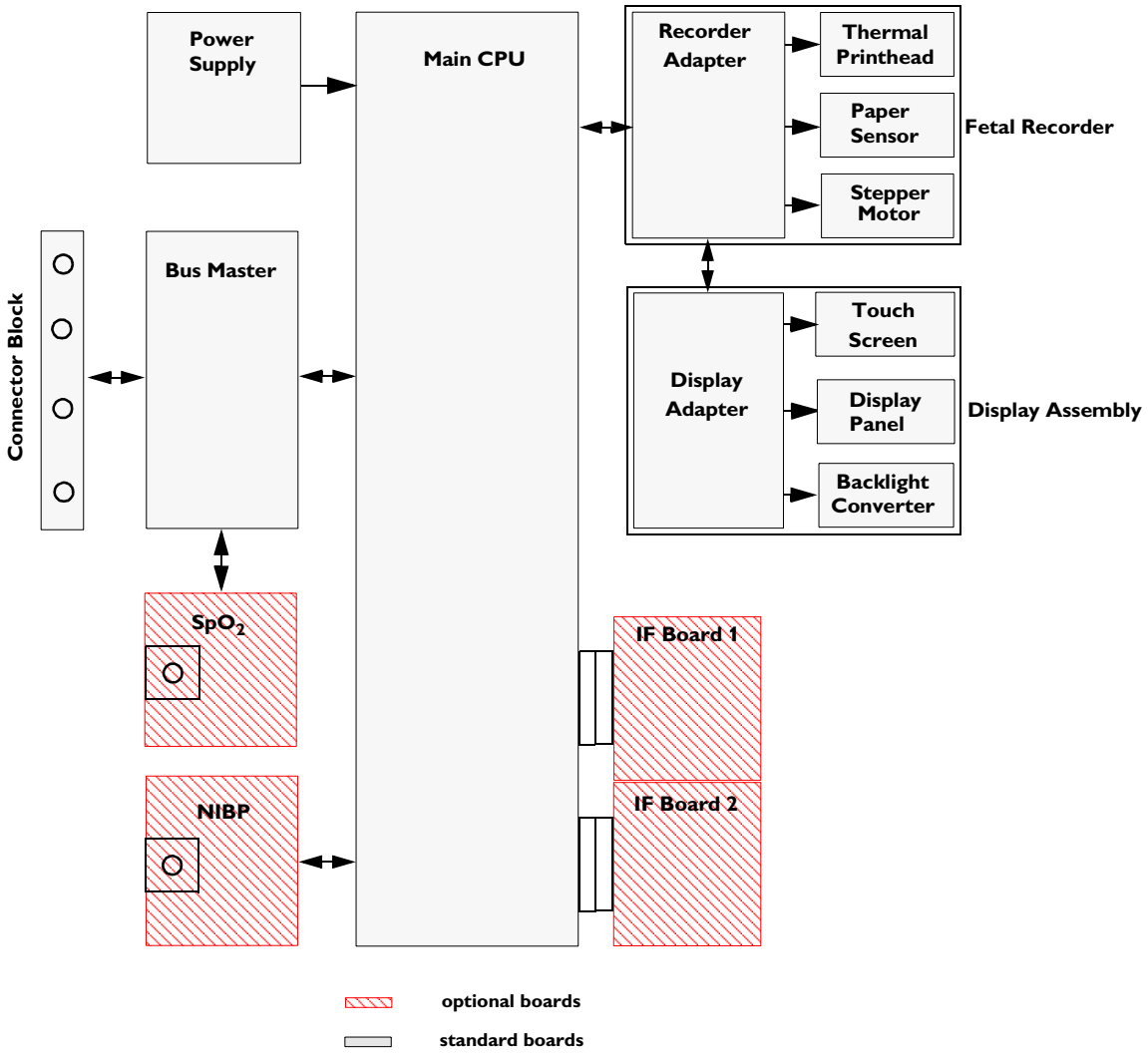
To configure the keyboard language manually, go to Service Mode, select **`Main Setup`** -> **`Hardware`** -> **`Keyboard`** and then select the proper language. Please note that this setting does not clone.

4

Theory of Operation

This chapter describes the functional operation of the monitor and the transducers. It incorporates features of the mechanical design, indicating the physical relationship of the assemblies and components.

Monitor Hardware Overview



The monitor consists of nine main functional components:

- Power supply M2703-60001
- Connector Block (1253-8415)
- Bus Master Board (M2703-66460)
- Main CPU Board (M2703-66450)
- Fetal Recorder (Thermal Printer Unit)
- Display Assembly (M2703-64503)
- Noninvasive Blood Pressure Board (optional, M2703-64502)
- SpO_2 Board (optional, M2703-66453)
- Input /Output Interface Boards (optional):
  - LAN / RS232 (M2703-67501)
  - Dual PS/2 (M8086-67501)

Power Supply

The power supply is a wide-range input switching unit, with an output of 24V. It is located in the bottom housing assembly.

Connector Block

Any compatible fetal transducer, patient module or remote event marker can be connected in any order to the monitor via the sockets on the Connector Block. The Connector Block is located on the Bus Master Board, and is exchangeable.

Bus Master Board

The signals from the transducers or sensors are conveyed from the sensor sockets on the Connector Carrier Board (M2703-66421) to the Bus Master Board (M2703-66420).

The Bus Master Board is responsible for transducer detection, communicates with the connected transducers via a CAN bus, and communicates parameter data to the Main CPU Board via a serial link for further processing and display.

Main CPU Board

The Main CPU Board controls the monitor's human interface, and is responsible for the final processing of data from the Bus Master Board. It sends this data to the TFT display, and to the thermal printer unit for recording traces and other patient data. It also controls the optional LAN/RS232 and PS/2 interface boards.

Fetal Recorder (Thermal Printer Unit)

The fetal recorder is located in the Top Cover Assembly. The recorder consists of the following major parts:

- Recorder Adapter Board
- Thermal Line Printhead (TLPH)
- Paper Sensor
- Stepper Motor

Recorder Adapter Board

Recorder signals are handled by the Recorder Adapter Board (M2703-66430), connected to the Main CPU Board. Video signals to the display are also wired through this board, and connection to the Display Adapter Board is made via a silver-colored 50-pin ribbon cable.

The recorder unit, including the TLPH, is connected to the Recorder Adapter Board via a white 50-pin, ribbon cable. The stepper motor and the paper sensor are also connected to the Recorder Adapter Board. The Recorder Adapter Board is connected to the Main CPU Board via a 154-pin connector.

Thermal Line Printhead (TLPH)

The TLPH is located on its own holder in the recorder chassis.

Paper Sensor

The paper sensor hardware consists of a reflective light sensor that detects the black marks on the trace paper, and paper-out. It is attached to the RFI Bracket, and connected to the Recorder Adapter Board via a removable cable connector.

Stepper Motor

The stepper motor is a bipolar motor controlled by a micro-stepping motor driver on the Recorder Adapter Board. The motor is located on the recorder chassis and is connected to the Recorder Adapter Board via a removable cable connector.

LCD Display and Touchscreen

The LCD Display Assembly consists of a four-wire resistive touchscreen, a 6.5” TFT panel, and a backlight inverter, all connected to the Display Adapter Board (M2703-66440) and fitted into the display housing.

The board is connected to the Recorder Adapter Board (M2703-66430) via a 50-pin ribbon cable. The green power LED is incorporated into the Display Adapter Board.

Noninvasive Blood Pressure Assembly

The optional Noninvasive Blood Pressure Assembly (M2703-64602) is located in the front lefthand corner of the bottom housing assembly. It is connected via a serial link to the Main CPU Board.

SpO_2 Assembly

The optional SpO_2 Assembly (M2703-64603) is physically located on the Bus Master Board, but sends data directly to the Main CPU Board via a serial link.

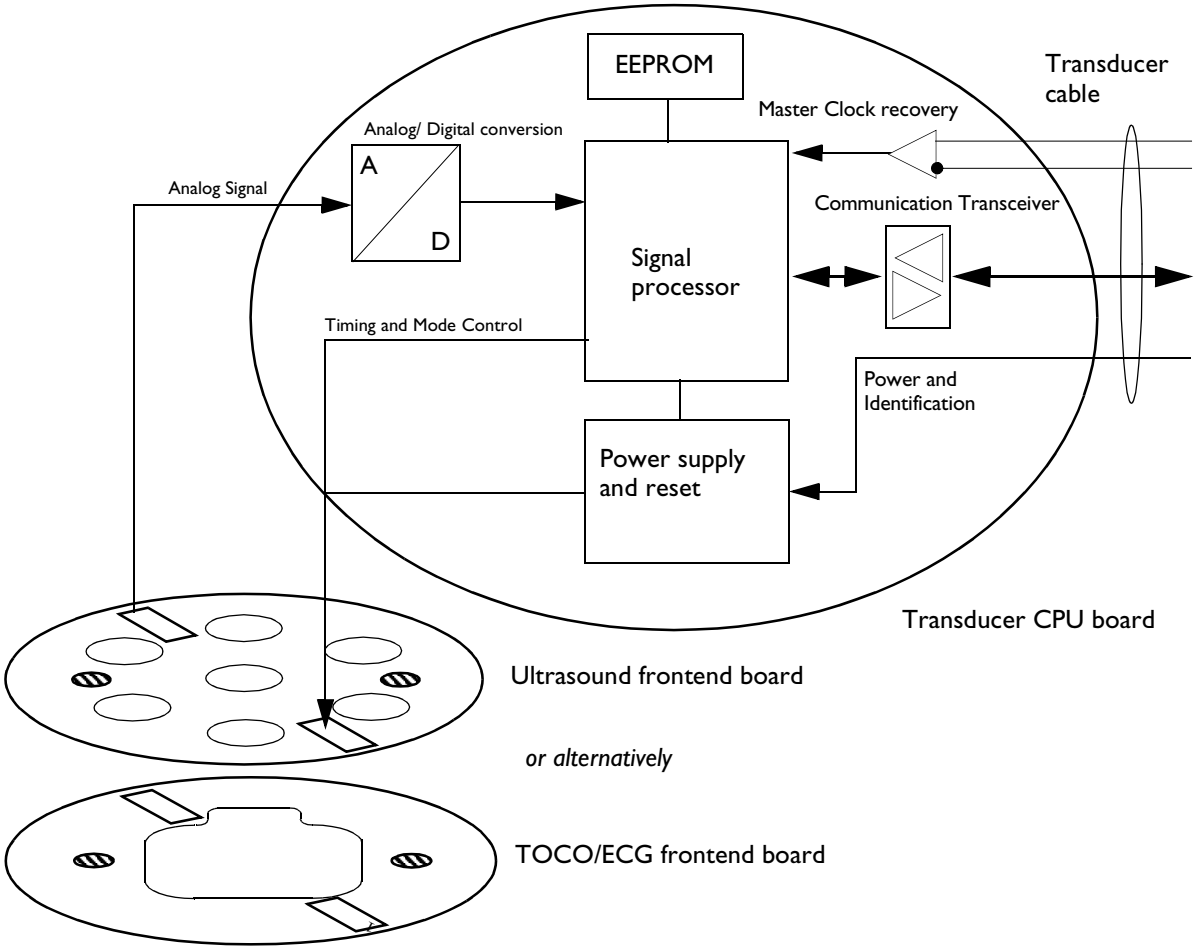
Input/Output Interface Boards

There are two optional interface boards available:

- LAN/RS232 Interface Board, used for connecting to a PC running the Support Tool and to a surveillance and documentation system such OB TraceVue.
- PS/2 Interface Board, used for connecting an external keyboard or mouse.

The interface boards plug into the two interface slots on the underside of the device, and are controlled by the Main CPU Board.

Transducer Hardware Overview



Transducer Types

Transducers consist of the following types:

- US
- Toco
- Toco+ (includes DECG/MECG and IUP capability)

They all share the same power supply, and analog-to-digital conversion circuitries. The processor software is also the same for all transducers. The frontends, however, are specific to each transducer type.

Functional Description of the Transducer CPU

The CPU section of the transducers is made up of the following main functional blocks:

- CPU (micro controller)
- Analog-to-Digital Converter
- Communication Transceiver (CAN bus driver)
- EEPROM

CPU (Micro Controller)

A single-chip processor is used to control the transducer, generate the frontend control signals, control the analog-to-digital signal conversion, and to perform the signal processing.

Analog-to-Digital Converter

Analog-to-digital (A/D) signal conversion is carried out by the 16-bit AD converter. Digital signals are directly communicated from the A/D converter to the CPU.

Communication Transceiver (CAN Bus Driver)

The communications transceiver (CAN bus driver) communicates directly with the transducer CPU, and allows the transducer to communicate with the Bus Master Board via the CAN bus.

EEPROM

The serial EEPROM stores all non-volatile data required to operate the transducer (for example, calibration and correction factors for frontend gains and offsets, country-specific information, serial numbers and error logs).

Toco Transducer Frontend

Uterine activity is measured by evaluating the hardness of the mother's abdomen with a pressure sensitive resistor bridge (strain gauge sensor element). The strain gauge sensor element requires an excitation voltage and its differential output signal is proportional to the pressure applied to it. A DC excitation voltage is used, and the resulting output signal is fed directly to an A/D signal converter before being sent to the processor.

Ultrasound Transducer Frontend

The ultrasound frontend is a pulsed Doppler system with a 1.0 MHz ultrasound frequency, and a pulse repetition rate of 3 kHz. Seven ultrasound crystals are used as transmitter and receiver.

Toco+ Transducer Frontends

Several parameter frontends are combined on one board. In addition to the Toco frontend, additional supported parameters are DECG, MECG and IUP.

A seven-pin 'D-type' socket carries all parameter related inputs and outputs. An external mode resistor, connected to one of the pins, automatically detects which mode to set when an adapter cable is plugged in (whether it is DECG, MECG, or IUP).

Toco Frontend

See "Toco Transducer Frontend" on page 19.

IUP Frontend

Intrauterine pressure (IUP) is measured via a piezo resistive bridge with AC excitation connected to the RA / LA input pins of the ECG amplifier. A/D conversion of the IUP signal is done by the 16-bit A/D converter.

ECG Frontend

The ECG frontend measures both DECG and MECG, using a 3-lead system (RA, LA and reference electrode). The ECG mode is automatically detected when an adapter cable is attached. Input lines are ESD protected.

5

Interfaces

There are two interface boards available as options for the Avalon fetal monitors:

- LAN / RS232 system interface
- Dual PS/2 interface

The interfaces are “plug-and-play” boards, and fit into dedicated slots on the underside of the monitor. See “Removing the Interface Boards” on page 87 for details of how to remove and fit the boards.

LAN / RS232 Interface

The LAN / RS232 system interface has two fully isolated ports:

- The LAN connection can be used for connecting the monitor to PC for configuration or upgrade using the Support Tool, and for future system expansion.
- The RS232 connection can be used for connecting the monitor to an obstetrical information and surveillance system, such as OB TraceVue.

Dual PS/2 Interface

This interface provides two PS/2 ports to enable the monitor to be connected to off-the-shelf, “plug-and-play” input devices:

- **Mouse:** any specified PS/2 mouse or trackball may be used for navigation and data entry.
- **Computer keyboard:** a PS/2 computer keyboard can be used for data entry instead of the on-screen pop-up keyboard.

6

Testing and Maintenance

This chapter contains the testing and maintenance procedures to ensure the proper functioning of the monitor and accessories, covering preventive maintenance, performance assurance and safety.

Carry out the procedures as specified in the following sections.

For detailed instructions on how to clean the monitor, transducers and accessories, see the monitor's *Instructions for Use*.

Recommended Frequency

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

Table 1: Suggested Testing Timetable

Tests		Frequency
Preventive Maintenance	Noninvasive Blood Pressure Calibration	Once every two years, or as specified by local laws (whichever comes first).
Other Regular Tests	Visual Inspection	Before each use.
	Recorder Maintenance	Once a year, or if the printout is degraded.
	Testing Transducers and Patient Modules	Once a year, or if you suspect the measurement is incorrect.
Performance Assurance Tests	Noninvasive Blood Pressure Performance Tests	Once every two years, or if you suspect the measurement is incorrect.
	SpO_2 Performance	
Safety Tests	Enclosure Leakage Current Patient Leakage Current	Once every two years and after repairs where the power supply is removed or replaced, or the monitor has been damaged by impact.

When to Perform Test Blocks

This table tells you when to perform specific test blocks. See page 25 for test details.

Table 2: When to perform test blocks

Service Event	Test Block(s) Required - Complete these tests
Installation	Perform Visual, Power On, Performance test blocks (see Table 3).
Preventive Maintenance	Perform Noninvasive Blood Pressure Performance tests blocks (see Table 3).
Other Regular Tests and Tasks • Visual Inspection • Transducer and Patient Module Testing • Recorder Maintenance	 Perform Visual test block (see Table 3). See “Testing Transducers and Patient Modules” on page 26. Regular cleaning and maintenance (see “Fetal Recorder Maintenance” on page 26 Perform the recorder selftest (see “Fetal Recorder Selftest Report” on page 40).
Repairs • Repairs when the monitor has been damaged by impact. • Repairs where the power supply has been removed or replaced. • All other repair events.	 Perform Visual, Power On and Performance test blocks, and when the monitor has been damaged by impact, or where the power supply has been removed or replaced, perform safety test blocks (see Table 3). Perform Visual, Power On and Performance test blocks (Table 3).
Upgrades For upgrade information refer to “Upgrades” on page 105.	 Perform Visual, Power On, Performance test blocks (see Table 3).
Combining or Exchanging System Components	Perform the System Test (see Table 3 and “System Test” on page 36).
All other service events	Perform Visual, Power On and Performance test blocks (see Table 3).

Test Reporting

Authorized Philips personnel report test result back to Philips to add to the product development database. Hospital personnel, however, do not need to report results.

How to Carry Out the Test Blocks

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

Table 3: 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 monitor, transducers, patient modules 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
Noninvasive Blood Pressure Performance Tests	Perform the Accuracy Test (see page 31)	X1 = value displayed by monitor Difference ≤ 3mmHg	PN:P/X1 or PN:F/X1
	Performance Leakage Test (see page 32)	X2 = leakage test value X2 < 6 mmHg	PN:P/X2 or PN:F/X2
	Performance Linearity Test (see page 32)	X3 = value displayed by monitor Difference ≤ 3mmHg	PN:P/X3 or PN:F/X3
	Performance Valve Test (see page 32)	X4 = value < 10 mmHg	PN:P/X4 or PN:F/X4
SpO_2 Performance Test	Perform the SpO_2 Performance Test (see page 32)	Value should be between 95% and 100%	No reporting necessary
Safety (1)	Perform Safety Test: Sum of Functional Earth and Enclosure Leakage Current - Normal and Single Fault Conditions.	With mains cable: Maximum leakage current (X1) ≤ 100µA	S(1):P/X1 or S(1):F/X1
Safety (2)	Perform Safety Test: Patient Leakage Current - Single Fault Condition, mains on applied part.	Maximum leakage current (X2) ≤ 50µA @ 264V	S(2):P/X2 or S(2):F/X2
System	Perform the system test according to sub clause 19.201 of IEC 60601-1-1, if applicable, after forming a system.	Enclosure Leakage Current: ≤ 100µA (Normal Condition) ≤ 300µA (Single Fault Condition) Protective Earth Leakage Current of Multiple Portable Socket-Outlets: ≤ 500µA Patient Leakage Current: ≤ 10µA	System test:P or System test: F

Preventive Maintenance Procedures

The preventive maintenance tasks are restricted to the noninvasive blood pressure measurement calibration. Carry out the noninvasive blood pressure measurement performance tests at least every two years, or as specified by local laws (whichever comes first).

Other Regular Tests

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

Visual Check

Check all exterior housings for cracks and damage. 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. On the Toco+ transducer and the patient module, ensure that the adapter cable socket is not damaged. Check that all mountings are correctly installed and secure. Refer to the instructions that accompany the relevant mounting solution.

Fetal Recorder Maintenance

The recorder platen, thermal printhead and paper sensor should be cleaned at least once a 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 printhead using a cotton swab moistened with 70% Isopropyl alcohol based solution.
- Check the paper sensing mechanism is dust free.

Testing Transducers and Patient Modules

If any of the following tests fail, repeat the test using another transducer. If the second transducer passes the tests, confirming that the first transducer is defective, contact your service personnel.

If the second transducer also fails the tests, contact your Philips Service Engineer or Response Center.

Ultrasound Transducer Electrical Check

CAUTION 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.

To test an ultrasound transducer:

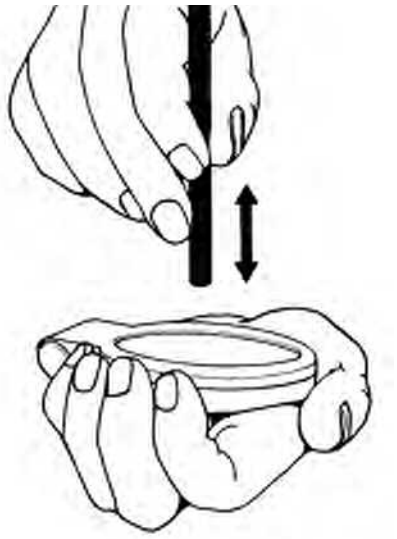
1 Switch on the monitor and the recorder.

2 Connect the transducer to the fetal monitor.

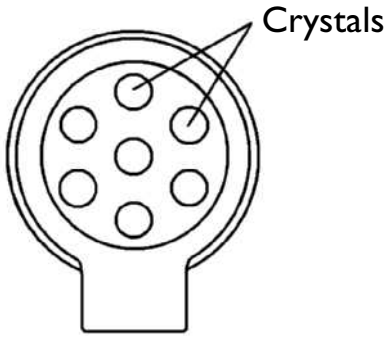
3 Select the fetal heart sound for this channel.

4 Increase the loudspeaker volume to an audible level.

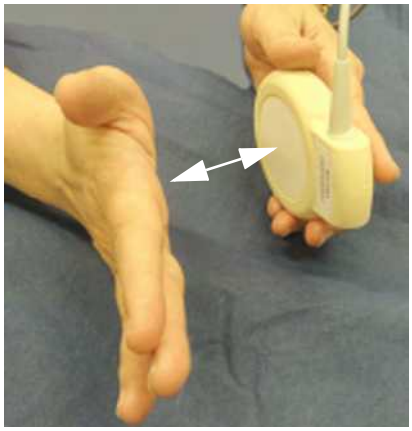
5 The ultrasound transducer contains seven piezoelectric crystals. Basic functioning of each can be verified by holding a flat bottomed pencil or similar above each crystal and moving it up and down as shown.



6 A sound should be heard for each crystal tested. The pencil should be held two to three centimeters from the transducer surface when the test is carried out.



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



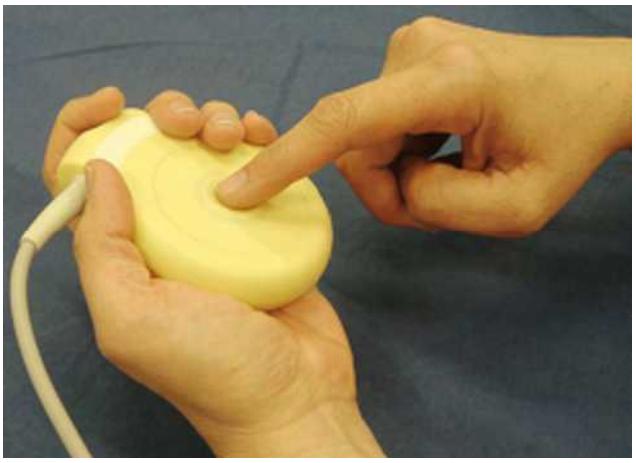
Toco Transducer Electrical Check

To test a Toco transducer:

1 Switch on the monitor and the recorder.

2 Connect the transducer to the fetal monitor.

3 Gently apply pressure to the Toco sensor.



4 Check that the value on the display and paper shows this change in pressure.

5 Lay the transducer face up on a hard, flat surface for a few seconds.

6 Press the Toco Baseline Key to re-adjust the Toco display to 20.

7 Turn the transducer over so that the Toco sensor is resting on the flat surface. You should see a marked increase in the value of the Toco reading in the Toco display.

Toco display = 20

Toco display = 35 - 45

Testing the Patient Module (M2738A)/Toco+ Transducer (M2735A): DECG Mode

1 Switch on the monitor and the recorder.

2 Connect the patient module or Toco+ transducer to the fetal monitor.

3 Attach the DECG adapter cable M1362B to the socket on the patient module or Toco+ transducer.

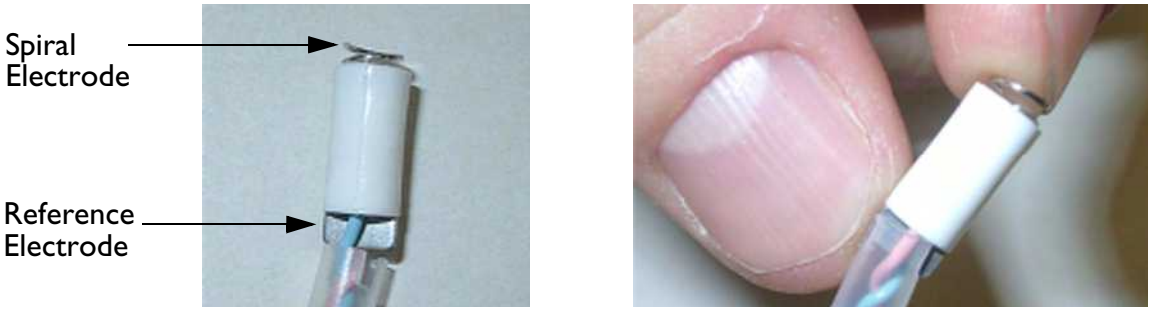
4 Ensure that the DFHR channel display on the fetal monitor shows the **DECG LEADS OFF** INOP with the DECG adapter cable attached.

5 Take a Fetal Scalp Electrode, and connect it to the DECG adapter cable.

6 *EITHER*

Make a short between the spiral electrode and the reference electrode with your fingers (it is best to wet your fingers first). Use a **sterile** Fetal Scalp Electrode.

CAUTION The tip of the spiral electrode is sharp. Take care not to injure your fingers.



OR

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: the **DECG LEADS OFF** INOP should disappear.

If the test results are not as outlined above, repeat the test with another ECG transducer. If this does not solve the problem, try the following:

- Check tall connections.
- If the **DECG LEADS OFF** INOP is still displayed, the DECG adapter cable may be defective. Replace the adapter cable.

If the problem persists, replace the transducer.

Testing the Patient Module (M2738A)/Toco+ Transducer (M2735A): MECG Mode

1 Switch on the monitor and the recorder.

2 Connect the patient module or Toco+ transducer to the fetal monitor.

3 Attach the MECG adapter cable M1363A to the red color-coded socket on the patient module or Toco+ transducer

4 *EITHER*

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

OR

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.

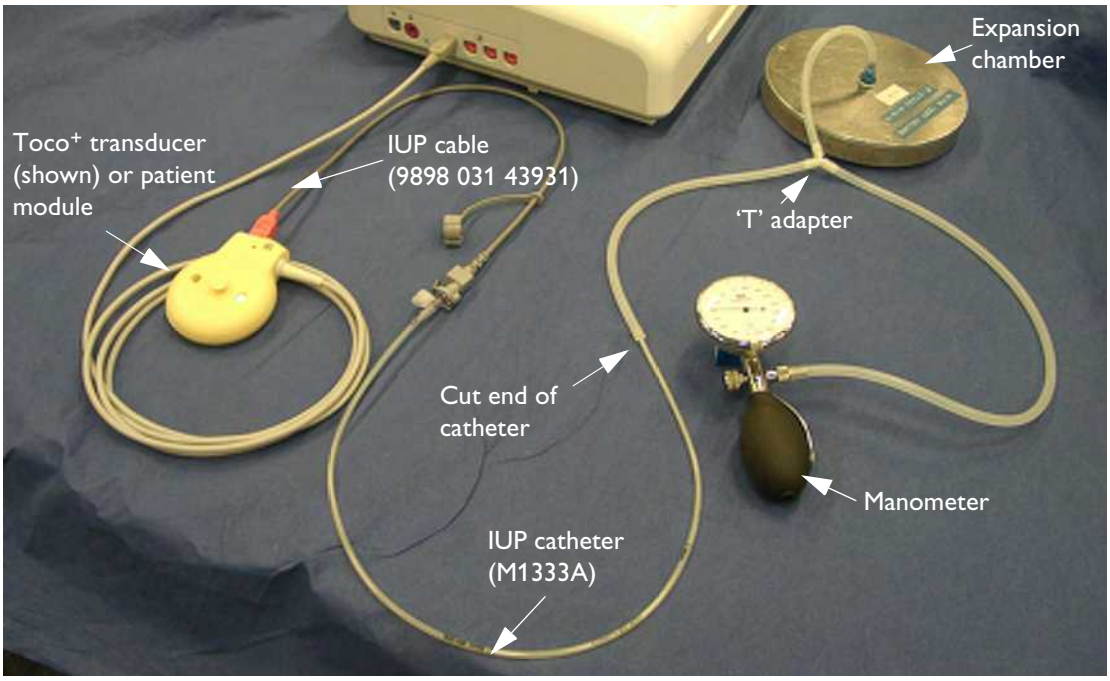
Result: You should see MECG values displayed on the maternal display or annotated on the recorder trace.

If the test results are not as outlined above, repeat the test with another ECG transducer. If this does not solve the problem:

- The MECG adapter cable may be defective. Replace the adapter cable, and repeat the test.
- Check all connections.

Testing the Patient Module (M2738A)/Toco+ Transducer (M2735A): IUP Mode

To test the IUP functionality of the patient module or the Toco+ transducer, you need the following:



- Manometer.
- Expansion chamber.
- Three lengths of silicone tubing with a 'T' adapter.

1 Switch on the monitor and the recorder.

2 Connect the patient module or Toco+ transducer to the fetal monitor.

3 Attach the IUP adapter cable (9898 031 43931) to the socket on the patient module or Toco+ transducer.

4 Cut the sensor tip off an IUP catheter (M1333A).

5 Connect the catheter to the IUP adapter cable.

6 Connect the silicone tubing to the test volume chamber and the manometer as shown in the picture.

7 Connect the cut end of the catheter to the silicone tubing.

8 Apply a pressure of 80 mmHg ± 5 mmHg with the manometer. Check that the value on the display and on trace corresponds to this pressure. Slowly release the pressure, and check that the value on the display and on trace shows this change in pressure.

Performance Assurance Tests

Some of the following test procedures must be performed in service mode. To enter service mode select **Operating Modes** in the main menu. Then select **Service Mode** and enter the password.

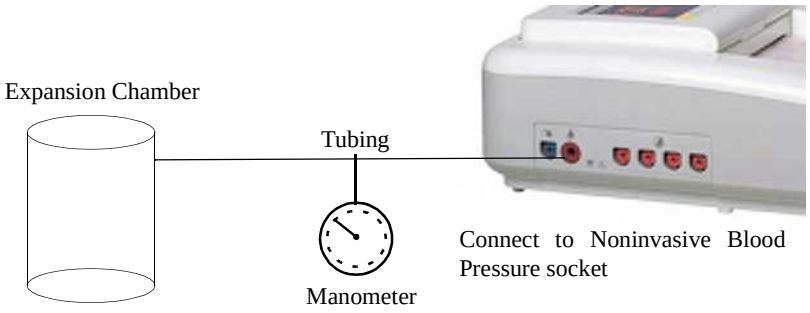
Noninvasive Blood Pressure Performance Tests

This section describes noninvasive blood pressure test procedures. The monitor must be in service mode.

Table 3 gives the expected test results for each of the tests.

Accuracy Test

This test checks the performance of the noninvasive blood pressure measurement. Connect the equipment as shown:



Tools required:

- Reference manometer (includes hand pump and valve), accuracy 0.2% of reading.
- Expansion chamber (volume 250 ml +/- 10%)
- Appropriate tubing.

In service mode, the systolic and diastolic readings indicate the noise of noninvasive blood pressure channels 1 and 2 respectively. When static pressure is applied, the reading in noninvasive blood pressure channel 1 should be below 50. The value in parentheses indicates the actual pressure applied to the system.

1 Connect the manometer and the pump with tubing to the noninvasive blood pressure connector on the monitor and to the expansion chamber.

2 In service mode, select the **Setup NBP** menu.

3 Select **Close Valves: On**

4 Raise the pressure to 280 mmHg with the manometer pump.

5 Wait 10 seconds for the measurement to stabilize.

6 Compare the manometer values with the displayed values.

7 Document the value displayed by the monitor (X1).

8 If the difference between the manometer and displayed values is greater than 3 mmHg, calibrate the noninvasive blood pressure measurement. If not, proceed to the leakage test.

9 To calibrate the noninvasive blood pressure measurement, select **Close Valves off** then **Calibrate NBP** and wait for the instrument to pump up the expansion chamber.Wait a few seconds after pumping stops until **EnterPrVal** is highlighted and then move the cursor to the value shown on the manometer. If one of the following prompt messages appears during this step, check whether there is leakage in the setup:

– NBP unable to calibrate–cannot adjust pressure

– NBP unable to calibrate–unstable signal

10 Press **Confirm**.

If the INOP NBP Equipment Malfunction message occurs in monitoring mode, go back to service mode and repeat the calibration procedure.

Leakage Test

The noninvasive blood pressure leakage test checks the integrity of the system and of the valve. It is required once every two years and when you repair the monitor or replace parts.

1 If you have calibrated, repeat steps 2 to 6 from the accuracy test procedure so that you have 280 mmHg pressure on the expansion chamber.

2 Watch the pressure value for 60 seconds.

3 Calculate and document the leakage test value (X2).
X2 = P1 - P2
where P1 is the pressure at the beginning of the leakage test and P2 is the pressure displayed after 60 seconds.
The leakage test value should be less than 6 mmHg.

Linearity Test

1 Reduce the manometer pressure to 150 mmHg.

2 Wait 10 seconds for the measurement to stabilize.

3 After these 10 seconds, compare the manometer value with the displayed value.

4 Document the value displayed by the monitor (X3)

5 If the difference is greater than 3 mmHg, calibrate the noninvasive blood pressure measurement (see steps 9 to 10 in the accuracy test procedure).

Valve Test

1 Raise the pressure again to 280 mmHg.

2 Select **Close valves: Off**.

3 Wait five seconds and then document the value displayed. The value should be less than 10 mmHg.

4 Document the value displayed by the monitor (X4).

SpO_2 Performance Test

This test checks the performance of the SpO_2 measurement.

Tools required: none

1 Connect an adult SpO_2 transducer to the SpO_2 connector.

2 Measure the SpO_2 value on your finger (this assumes that you are healthy).

3 The value should be between 95% and 100%.

Safety Tests

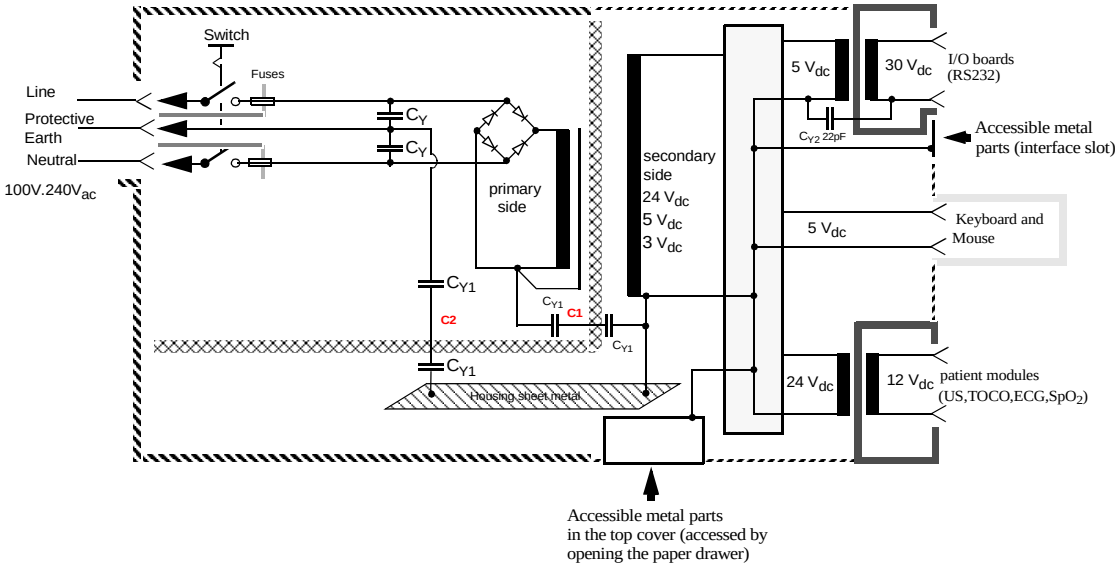
You are recommended to file the results of safety tests. This may help to identify a problem early particularly if the test results deteriorate over a period of time.

Warnings, Cautions, and Safety Precautions

- These tests are a proven means of detecting abnormalities that, if undetected, could prove dangerous to either the patient or the operator.
- You can perform all tests using commercially available ***Safety Analyzer*** test equipment. You can perform basic measurements with widely available multifunction instruments such as the HP 3469A multimeter or equivalent.
- The consistent use of a ***Safety Analyzer*** as a routine step in closing a repair or upgrade is emphasized as a mandatory step to maintain approval agency status. You can also use the ***Safety Analyzer*** as a troubleshooting tool to detect abnormalities of line voltage and grounding plus total current loads.
- For Europe and Asia/Pacific, the monitor complies with:
  IEC60601-1:1988 + A1:1991 + A2:1995 = EN60601-1:1990 +A1:1993 + A2:1995
  For USA, the monitor complies with:
  UL60601-1
- Additional tests may be required according to local regulations.
- Normally, a ***Safety Analyzer*** is used to perform these procedures. Popular testers include the DEMPSEY 232D, or for use in Europe, testers like the Rigel, Metron or Gerb. Follow the instructions of the Instrument manufacturer.
- Any device that is connected to the medical device must comply with IEC60601-1, and UL60601-1:2003 for the USA, if within the patient vicinity and be separately tested at the same intervals as the monitor. Devices forming a system must comply with IEC60601-1-1.
- Any device that is connected to the medical device must comply with IEC60601-1-1 if outside the patient vicinity and be tested accordingly.
- Perform safety tests as described on the following pages.

Electrical Isolation Diagram

This diagram gives an overview of the electrical isolation of the monitor. Accessible metal parts are identified (see arrows).

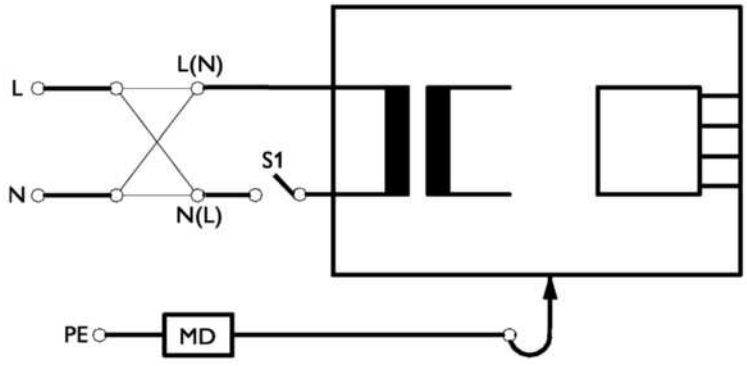


Safety Test Procedures

Use the test procedures outlined here **only** for verifying safe installation or service of the product. The setups used for these tests and the acceptable ranges of values are derived from local and international standards but may not be equivalent. These tests are not a substitute for local safety testing where it is required for an installation or a service event. If using the Metron Safety tester, perform the tests in accordance with your local regulations, for example IEC60601-1, UL60601-1 (US), CD IEC62353, and IEC60601-1-1. The Metron Report should print results as detailed in this chapter, together with other data.

S(1): Sum of Functional Earth and Enclosure Leakage Current Test

Test to perform:



This test measures leakage current of exposed metal parts of the FM20/FM30 monitor and the functional earth leakage current. It tests normal and reversed polarity. Perform the test with S1 closed (Normal Condition) and with S1 open (Single Fault Condition).

NOTE The protective earth conductor is required for EMC purposes. It has no protective function against electric shock. The protection against electric shock is provided by double and/or reinforced insulation.

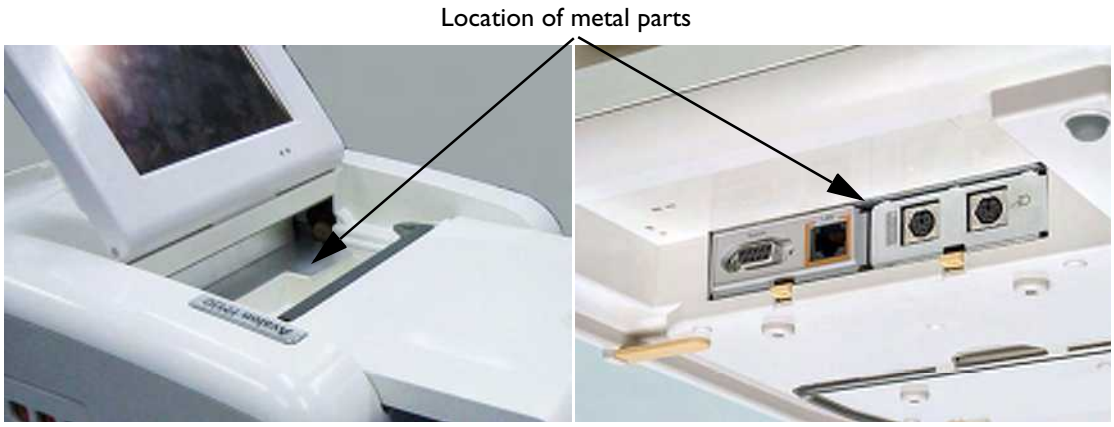
This safety test is based on IEC 60601-1 and CD IEC62353 (date of circulation:2004-04-09)

For measurement limits, refer to test block Safety (1), "Test and Inspection Matrix" on page 25.

Report the highest value.

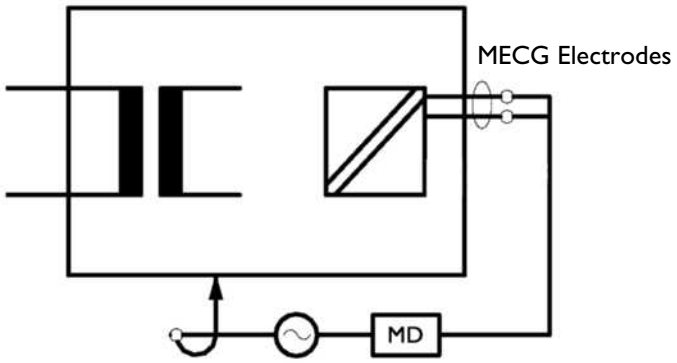
You can find metal parts of the device:

- In the top cover (accessed by opening the paper drawer).
- In an interface slot located in the bottom housing (you need to remove the interfaces if they are fitted).



S(2): Patient Leakage Current - Single Fault Condition (SFC), Mains on Applied Part

Test to perform:



This test measures patient leakage current from applied part to earth caused by external main voltage on the applied part of 264V. Each polarity combination possible shall be tested. This test is applicable for ECG measurement inputs.

This safety test is based on IEC 60601-1 and CD IEC62353 (date of circulation:2004-04-09)

For measurement limits and test voltage, refer to test block Safety (2), "Test and Inspection Matrix" on page 25.

Report the highest value.

System Test

After mounting and setting up a system, perform system safety tests according to IEC60601-1-1.

What is a Medical Electrical System?

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

General Requirements for a System

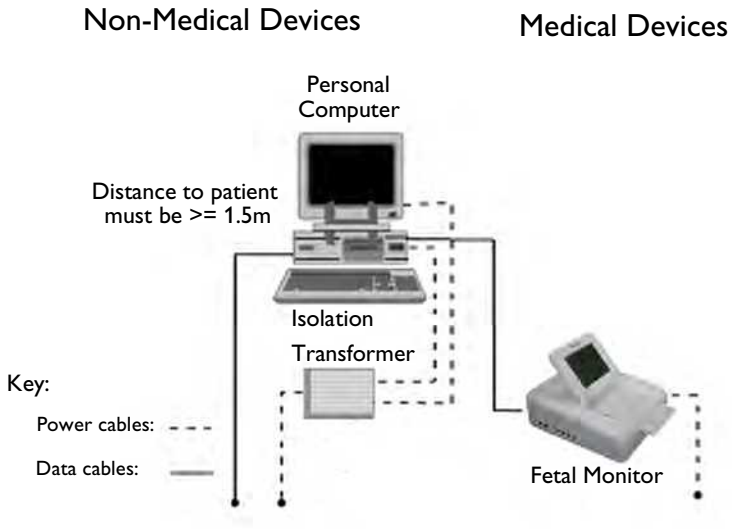
After installation or subsequent modification, a system must comply with the requirements of the system standard IEC/EN60601-1-1. Compliance is checked by inspection, testing or analysis, as specified in the IEC60601-1-1 or in this book.

Medical electrical equipment must comply with the requirements of the general standard IEC/EN60601-1, 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 IEC60601-1-1. 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 are situated at the patient's bedside.



WARNING

- Do not use additional AC mains extension cords or multiple portable socket-outlets. If a multiple portable socket-outlet without an approved isolation transformer is used, the interruption of its protective earthing may result in enclosure leakage currents equal to the sum of the individual earth leakage currents, so exceeding allowable limits.
- 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 isolation transformer that ensures mechanical fixing of the power cords and covering of any unused power outlets.

Touchscreen Calibration

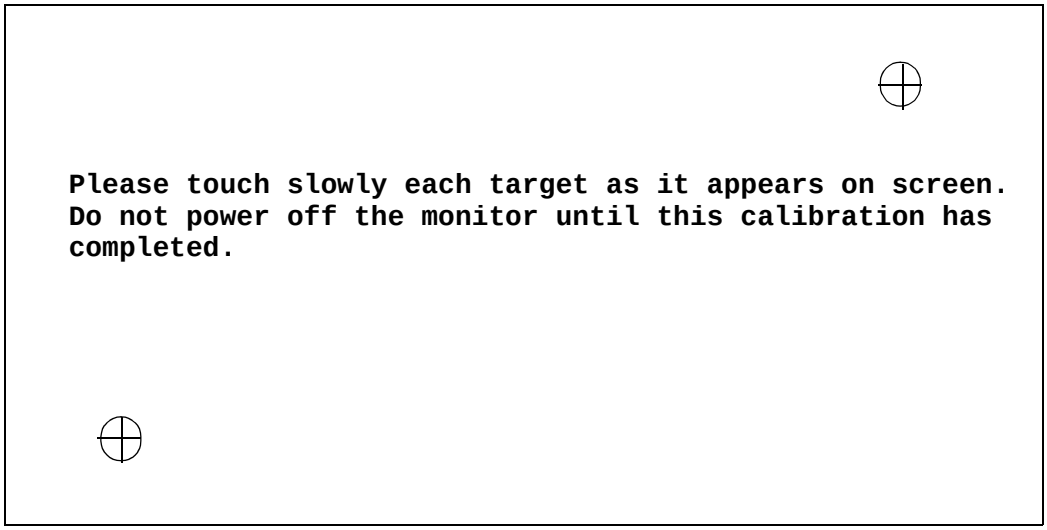
To access the touchscreen calibration screen:

1 Enter service mode

2 Select **Main Setup**

3 Select **Hardware**

4 Select **Calibrate Touch**



Make sure you complete the calibration procedure without powering off the monitor mid-way. If the monitor is powered off after the first point is touched, the touch panel will be deactivated until the touch calibration is performed again.

If the touchscreen is accidentally mis-calibrated by selecting the wrong spot, you must use another input device to re-enter calibration mode. If you have the support tool, you can select **Reset Touch Calibration to Default** and it will create a rough calibration which will allow you to access the calibration menu again via the touchscreen.

Disabling/Enabling Touch Operation

To disable touchscreen operation of the monitor, press and hold the **Main Screen** key for about three seconds. A red padlock will blink on the key. Press and hold the **Main Screen** key again for about three seconds to re-enable touchscreen operation.

Checking the Fetal Recorder Offset

The easiest way to check the recorder offset is to connect a *resting* Toco transducer (one that is not under any load) to the monitor and then change the offset setting until the trace is recording 20 units on the paper. Due to the delay between changing the offset setting and seeing the change on the paper, you may have to repeat this procedure to set the offset.

When viewed from the front of the monitor, 0 is the setting that prints the trace the furthest to the right, and 10 is the setting that prints the trace furthest to the left. If the trace from the resting Toco transducer is printed below the 20 unit gridline, you need to increase the offset setting. If the trace is printed above the 20 unit gridline, you need to decrease the offset setting. When the trace is recording 20 units, the offset is correctly set.

Setting the Fetal Recorder Offset

To set the fetal recorder offset, you first need to run the fetal recorder calibration:

1 In **Main Setup**, select **Fetal Recorder** to enter the Fetal Recorder menu.
The current setting for the recorder offset is shown (but it is still grayed out, and you cannot select it yet).

2 Select **Calibration** to start the recorder calibration printout.

3 The recorder stops, and the **Cal. Offset** becomes selectable. Select **Cal. Offset**, and select the offset value from 0 to 10 from the list, as appropriate. The recorder then finishes the calibration printout.

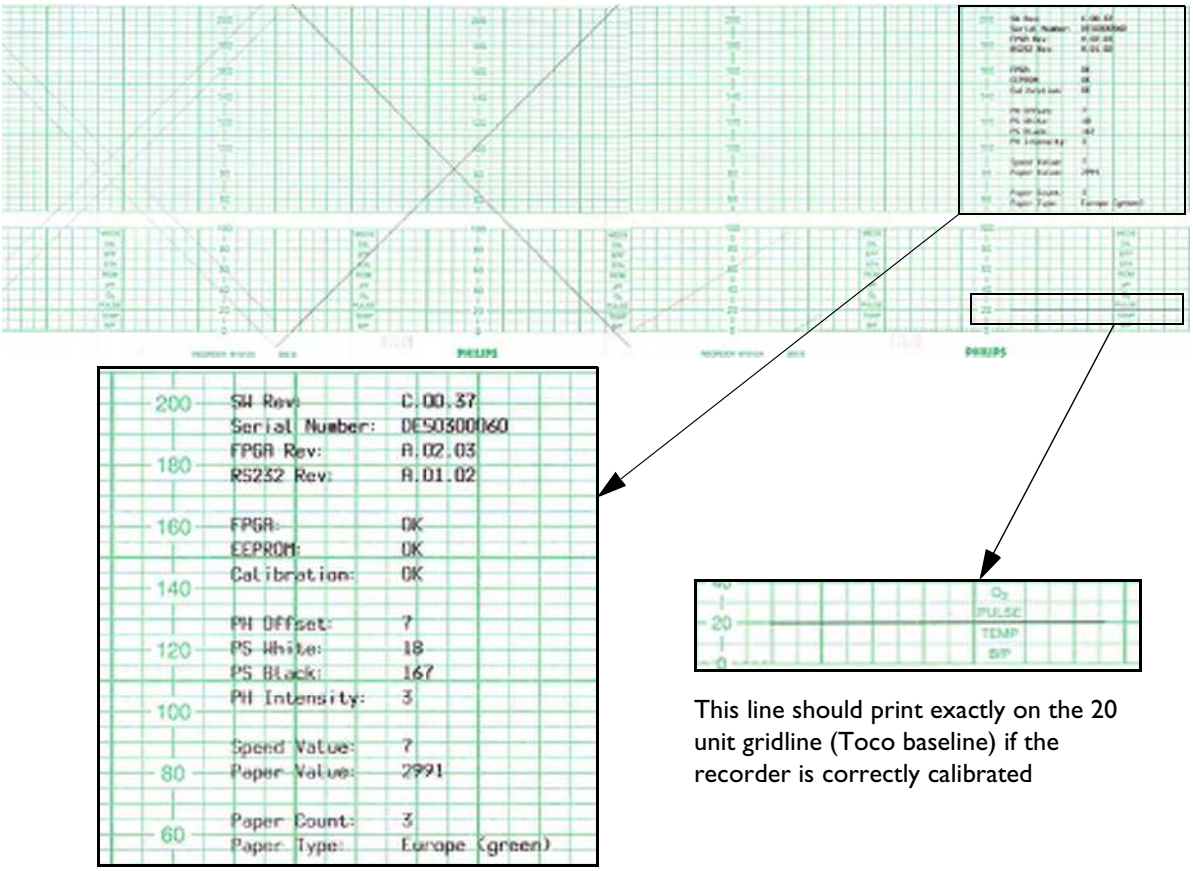
4 Repeat if necessary until the trace is recording 20 units on the paper in Monitoring Mode, matching the value displayed on the screen.

Fetal Recorder Selftest Report

To verify your printer configuration, or if you doubt the performance of the recorder, you may want to print a test report.

To print a selftest report, in Service Mode, select **`Main Setup -> Fetal Recorder-> Selftest.`**

Here is an excerpt from a sample test report to give you an idea what it looks like (the exact appearance may vary slightly):



Example of selftest report

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, FHR1) are inoperative.

If the any of the above conditions are not met, replace the printhead (see “Removing the Thermal Line Printhead (TLPH)” on page 72).

Ensure that all printed lines are straight. If the lines are not straight, there may be a problem with the paper recorder speed.

7

Troubleshooting

A list of system error messages and troubleshooting information for common problems you may encounter while using the monitor and its accessories is given in the *Instructions for Use*. This chapter provides a guide for qualified service personnel for troubleshooting problems that cannot be resolved by the user.

CAUTION If the troubleshooting procedure requires you to disassemble the monitor or transducers, be certain to follow the disassembly and reassembly procedures given in Chapter 8, “Disassembly and Reassembly”.

Who Should Perform Repairs

Only qualified service personnel should open the monitor housing, remove and replace components, or make adjustments. If your medical facility does not have qualified service personnel, contact Philips’ Response Center or your local Philips representative.

WARNING **High Voltage** - Voltages dangerous to life are present in the instrument when it is connected to the mains power supply. Do not perform any disassembly procedures with power applied to the instrument. Failure to adhere to this warning could cause serious injury or death.

Replacement Level Supported

The replacement level supported for this product is to the printed circuit board (PCB) and major subassembly level. Once you isolate a suspected PCB, follow the procedures in Chapter 8, “Disassembly and Reassembly” to exchange the PCB with a known good replacement. Check to see if the symptom disappears and that the monitor passes all performance tests. If the symptom persists, swap back the replacement PCB with the suspected malfunctioning PCB (the original PCB that was installed when you started troubleshooting) and continue troubleshooting as directed in this chapter.

Hardware Revision Check

Some troubleshooting tasks may require that you identify the hardware revision of your monitor’s main board. To check your hardware revision:

1 Enter the Main Setup menu and select **Revision**.

2 Select **Product**.

You see the hardware revision in the pop-up window, along with the serial number, part number, and the software revision.

The following table shows which part number corresponds to which hardware revision:

Hardware Revision	Board Number	Description
A.00.05	M2703-66510	Main CPU Board

Software Revision Check

Some troubleshooting tasks may require that you identify the software revision of your monitor. You can find the software revision along with other information, such as the system serial number, in the monitor revision screen.To access the monitor revision screen:

1 Enter the Main Setup menu and select **Revision**.

2 Select **Product**.

You see the software revision in the pop-up window, along with the serial number, part number, and the hardware revision.

NOTE The part numbers listed in the monitor revision screen do not necessarily reflect the part numbers required for ordering parts. Please refer to Chapter 9, “Parts” for the ordering numbers.

NOTE The system serial number can also be found on the lower right corner on the front of the monitor.

Obtaining Replacement Parts

See Chapter 9, “Parts” section for details on replacement parts.

Troubleshooting Guide

Problems with the monitor are separated into the categories indicated in the following sections and tables. Check for obvious problems first. If further troubleshooting instructions are required refer to the Troubleshooting Tables.

Taking the recommended actions discussed in this section will correct the majority of problems you may encounter. However, problems not covered here can be resolved by calling Philips Response Center or your local representative.

Checks for Obvious Problems

When first troubleshooting the instrument, check for obvious problems by answering basic questions such as the following:

1 Is the power switch turned on?

2 Is the AC power cord connected to the instrument and plugged into an AC outlet?

Checks Before Opening the Instrument

You can isolate many problems by observing indicators on the instrument before it is necessary to open the instrument.

Checks with the Instrument Switched On, AC connected

The green power LED lights for about 1.5 seconds after switching on, and then goes out, and remains unlit doing normal operation. The location of the green LED is shown in the following photograph:

Individual Parameter INOPs

If you see any of the following parameter INOPs:

DECG EQUIP MALF	IUP EQUIP MALF
ECG EQUIP MALF	NBP EQUIP MALF
Fetrec EQUIP MALF	OB EQUIP MALF
FHR1 EQUIP MALF	SpO_2 EQUIP MALF
FHR2 EQUIP MALF	SpO_2 SENSOR MALF
FHR3 EQUIP MALF	TOCO EQUIP MALF

try exchanging the relevant component (transducer, sensor, patient module or board) with a known good replacement, following the procedures in Chapter 8, “Disassembly and Reassembly”. Check to see if the INOP disappears, and that you can measure the parameter in question normally. If the INOP persists, swap back the original component and continue troubleshooting as directed in this chapter.

In the case of the INOPs **`FHR1 EQUIP MALF`**, **`FHR2 EQUIP MALF`**, and **`FHR3 EQUIP MALF`**, when there are two or more ultrasound transducers attached to the monitor, identify the transducer for which the INOP was issued, using the blue transducer Finder LED. Touching a numeric on the screen makes the Finder LED light on the transducer providing the measurement. If you cannot identify the suspected transducer directly because the transducer Finder LED does not light due to the defect, identify the other, functioning transducers by activating their Finder LEDs, thus finding the defective one by a process of elimination.

Initial Instrument Boot Phase

The following table describe the regular initial boot phase of the monitor. If the boot phase does not proceed as described below go to Boot Phase Failures for Troubleshooting information.

Time (sec.) after Power On	Boot Phase Event
0	Switch the monitor on using the On/Off switch.
2	The green AC Power LED lights for about 1.5 seconds.
3.5	Green AC Power LED is turned off, and remains off.
5	You hear a 'pop' from the loudspeaker
6-8	Boot Screen with the Philips Logo appears on the display. Test Sound is issued.
8-10	Boot Screen with the Philips Logo disappears
	Fixed screen elements (for example smart keys, alarm fields) appear on the screen.
10-15	First measurement information appears on the screen, touchscreen is functional.

Troubleshooting Tables

The following tables list troubleshooting activities sorted according to symptoms.

How to Use the Troubleshooting Tables

The possible causes of failure and the remedies listed in the troubleshooting tables should be checked and performed in the order they appear in the tables. Always move on to the next symptom until the problem is solved.

Boot Phase Failures

Screen is Blank

Touchscreen Not Functioning

General Monitor INOP Messages

Alarm Tones

Fetal Recorder

LAN / RS232

Boot Phase Failures

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Green LED does not light up, and no test tone is heard	No AC mains connection	Check that the power cord is not damaged and is properly connected to the monitor. Check that the power cord is correctly connected to a powered AC mains socket.
	Power supply defective	Remove power supply and check if output voltage is within the specifications (24V). Measure on multi-colored wired connection between red and black wires Exchange power supply if defective
	Power On/Off switch defective	Replace power supply
	Aborted/interrupted or inconsistent software configuration	Perform a software upgrade using the Support Tool.
	Main CPU Board defective	Replace Main CPU Board. Add boards in reverse order and try again with each board.
Green LED does not light up, but you hear a test tone	Display Assembly not connected to the Main CPU Board	Check if Display Assembly is connected correctly to the Recorder Adapter Board. Check that the multi-pin connector between the Recorder Adapter Board and the Main CPU Board
	Touch controller defective	Replace the Display Assembly.
	Display Adapter Board defective	Disconnect and reconnect the flat cable of the Display Adapter Board and check again
	LED defective	Try to switch on the monitor. If it operates normally, the LED is defective. Repair is effected by replacing the Display Assembly.
Green LED stays on continuously	Main CPU Board defective	Try loading new software. If this does not solve the problem, replace Main CPU Board.
Green LED blinks (indicating cyclic reboots)	Hardware failure	Connect Support Tool directly to monitor with crossover cable and start “search for defective devices” If no device is detected, proceed as described above in the section “Green LED stays on continuously”
	Software fault	If the Support Tool can detect the device and it indicates the Operating Mode is ‘Boot’, download and store the status log. Reload software and re-clone the monitor. If this fixes the problem e-mail the status log to your local response center
	Hardware failure	If this does not rectify the problem, follow the instructions under “Green LED stays on continuously”.

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
No Test Sound issued or INOP **Speaker Malfunct.** issued	Speaker cable disconnected	Check speaker connections.
	Speaker defective	Check for INOPs and follow instructions Exchange speaker
	Main CPU Board defective	Exchange Main CPU Board

Screen is Blank

The information listed in this table is only valid if the boot phase has completed without error. See Boot Phase Failures table for a description of the boot phase.

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Display is blank or brightness is reduced	Display Adapter Board cable not connected	Check cable connection of Display Assembly to the Recorder Adapter Board.
	Backlight tubes defective	Replace Display Assembly.
	Backlight inverter defective	
	Display adapter board defective	
	LCD flat panel defective	
	Main CPU Board defective	Replace Main CPU Board.

Touchscreen Not Functioning

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Touchscreen not functioning	Touchscreen functionality has been temporarily disabled	Check if touchscreen functionality has been temporarily disabled (padlock symbol on Main Screen key). If yes, press and hold the Main Screen key to re-enable touchscreen operation.
	Touch screen cable not connected	Check connection from the Display Assembly to the Recorder Adapter Board. If the problem is not resolved, check that the multi-pin connector between the Recorder Adapter Board and the main CPU Board.
	Touch controller defective	Replace Display Assembly
	Touch Sensor defective	
	Main CPU Board defective	Replace Main CPU Board
Touch Position invalid	Touch not calibrated	Perform touch calibration: 1. Enter the Main Setup Menu 2. Select Hardware 3. Select Calibrate Touch See “Touchscreen Calibration” on page 37

General Monitor INOP Messages

INOP Message	Possible Causes of Failure	Failure Isolation and Remedy
CheckInternVoltage	Problem with the voltages (5V) in the monitor	Remove all I/O boards and put them back in one at a time to isolate any defective board. If this does not resolve the problem, replace the main board.
Check Monitor Temp	The temperature inside the monitor is too high	Check the environment for possible causes.
	Main Board defective	Replace Main Board.
Check Settings	INOP occurs during normal operation, indicating a possible monitor software problem	Check the monitor and patient settings before you resume monitoring. If the settings are unexpected, there may be a problem with the monitor software. 1 Silence the INOP. 2 Load the User Defaults (see "Loading the User Defaults" on page 110). 3 If this is unsuccessful, try loading the Factory Default (see "Loading the Factory Default" on page 109), and reconfigure the monitor in Configuration Mode, and save the new settings in the User Defaults. If the INOP persists, there is an unresolved software problem. Report the problem to factory support.
	INOP occurs after a software upgrade, indicating a possible incomplete or unsuccessful upgrade	Clone the correct settings via the Support Tool.
Internal.Comm.Malf.	Main CPU Board defective	Replace Main CPU Board.
Settings Malfunc.	Problem during cloning process.	Reclone configuration file.
	Memory space in which the settings are stored has been corrupted	Reclone configuration file. This will reload the memory space.
	Main CPU Board defective	Replace Main CPU Board.

Keyboard/Mouse Not Functioning

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Keyboard/Mouse attached directly to the monitor not functioning	Keyboard/Mouse not connected properly	Check cabling
	Keyboard/Mouse defective	Replace Keyboard/Mouse
	PS/2 I/O board is not properly plugged in	Ensure the PS/2 I/O board is properly plugged in. If necessary, remove the board and plug it in again.
	PS/2 I/O board defective	Replace I/O board

Alarm Tones

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
INOP Message **`Speaker Malfunct.`** is displayed	Speaker cable disconnected	Reconnect speaker cable
	Speaker defective	Replace speaker
	Sound amplifier on Main CPU Board defective	Main CPU Board
Alarm occurs but no alarm sound is issued	Volume set to 0	Increase volume
	Speaker defective	Replace speaker
	Sound amplifier on Main CPU Board defective	Main CPU Board

Alarm Behavior

If your monitor did not alarm in the way in which the end user expected, please consult the *Instructions for Use* for possible setup issues or configuration settings which could affect alarm behavior.

Fetal Recorder

Symptom	Possible Cause	Corrective Action
Paper empty warning is issued in the status line at the bottom of the screen, but paper is not out.	Drawer is open.	Close the drawer.
	Paper jam.	Open the drawer, remove paper, tear off scrumpled paper and re-load, or load a new pack of paper. Close the drawer.
	Paper sensor dirty.	Clean paper sensor (see Chapter 6, “Testing and Maintenance”).
	Paper sensor defective.	Exchange paper sensor (see Chapter 8, “Disassembly and Reassembly” and Chapter 9, “Parts”.

Symptom	Possible Cause	Corrective Action
No paper transport.	Poor connection.	Check all internal connectors.
	Paper jam.	Open the drawer, remove paper, tear off scrumpled section of paper and re-load, or load a new pack of paper. Close the drawer.
	Motor cable is disconnected.	Check that the motor cable is properly connected to the Recorder Adapter Board.
	Motor is defective.	To test the functioning of the motor, open the drawer and press the recorder **Start/Stop** key to start the recorder. A good motor should rotate for between one and three minutes (depending on the paper speed). If the motor does not rotate, replace the motor (see "Removing the Stepper Motor" on page 78).
	Drawer is open.	Close the drawer.
The recorder appears to be running normally, but the paper remains blank	Thermal Printhead is disconnected.	Check the connection. Then run the recorder Selftest to verify correct printing (see "Fetal Recorder Selftest Report" on page 40).
	Thermal Printhead is defective.	Replace the Thermal Printhead. Then calibrate the recorder (see "Setting the Fetal Recorder Offset" on page 39).
	The wrong side of the paper is facing up.	Load the paper correctly, the right way up.
No recorder key is available on the screen, and the INOP **FetRec MALF** is issued.	The recorder has not been calibrated.	Calibrate the recorder (see "Setting the Fetal Recorder Offset" on page 39).
	EEPROM on the Recorder Adapter Board is defective	Exchange the Recorder Adapter Board and calibrate the recorder (see "Setting the Fetal Recorder Offset" on page 39).
	Recorder Controller on the Main CPU Board is defective.	Exchange the Main CPU Board and calibrate the recorder (see "Setting the Fetal Recorder Offset" on page 39).

Symptom	Possible Cause	Corrective Action
The INOP **Check Paper** is issued.	The drawer is open and there is paper on the paper sensor.	Ensure the paper is loaded correctly, and close the drawer.
	Paper jam.	Open the drawer, remove paper, tear off scrumpled section of paper and re-load, or load a new pack of paper. Close the drawer.
	Paper sensor dirty.	Clean paper sensor (see Chapter 6, “Testing and Maintenance”).
	Paper sensor defective.	Exchange paper sensor (see Chapter 8, “Disassembly and Reassembly” and Chapter 9, “Parts”.
	The platen is dirty.	Clean the platen (see Chapter 6, “Testing and Maintenance”).
	Paper is not approved by Philips.	Use only paper approved by Philips.
	Inadequate contrast of paper marks.	Use only Philips approved paper. Calibrate the recorder.
The INOP **WRONG PAPER SCALE** is issued.	Paper with the wrong scale has been loaded (for example, European paper has been loaded instead of US paper).	Check, and if necessary, replace the paper pack with one with the correct scale. Check, and if necessary, change the paper scale setting to the correct setting for the paper used.
Bad or distorted printout within the first 1 cm of the trace.	Paper drawer was not fully closed.	Always ensure the paper drawer is fully closed before starting recording.
Poor print quality.	Heat setting needs adjusting.	Adjust the Thermal Printhead heat setting. Then run the recorder Selftest to verify correct printing (see “Fetal Recorder Selftest Report” on page 40).
	Thermal Printhead dirty.	Clean the Thermal Printhead (see Chapter 6, “Testing and Maintenance”). Then run the recorder Selftest to verify correct printing (see “Fetal Recorder Selftest Report” on page 40).
	Thermal Printhead failure.	Exchange the Thermal Printhead (see “Removing the Thermal Line Printhead (TLPH)” on page 72 and “Replacing the TLPH” on page 73). Then run the recorder Selftest to verify correct printing (see “Fetal Recorder Selftest Report” on page 40).
Paper not feeding properly.	Paper incorrectly loaded.	Load paper correctly.
	The platen is dirty.	Clean the platen (see Chapter 6, “Testing and Maintenance”).
Trace is not printed correctly with reference to the paper gridlines.	Offset needs adjusting.	Calibrate the recorder and change the offset (see “Setting the Fetal Recorder Offset” on page 39).

LAN / RS232

Symptoms	Cause of Failure	Failure Isolation and Remedy
External device (such as a surveillance system like OB TraceVue) not receiving data	The LAN/RS232 port is not configured for data export	Check configuration of the LAN/RS232 ports in configuration mode
	The cable between the external device and the monitor is not connected correctly or defective	Check cable and replace if necessary
	The external device does not support the version of the data export protocol used in the monitor	Check if the device supports the version of the data export protocol. Upgrade device or monitor if necessary (if matching versions exist).
	A terminal concentrator is used in between the device and the monitor and a protocol with dynamic speed negotiation is used	Some terminal concentrators do not support changing the transmission speed (baud rate) dynamically. Check if the connection works without the concentrator
	The LAN/RS232 board is in a wrong slot (slot has been changed after software configuration or an additional board has been plugged in)	Verify correct placement of the I/O boards
	The LAN/RS232 board is defective	Check board and replace if necessary

Transducers

Symptoms	Possible Cause	Failure Isolation and Remedy
Transducer appears not to work, and the transducer Finder LED does not light when you touch the parameter field on the screen. INOP **OB EQUIP MALF** is displayed.	Defective transducer cable.	Visually inspect the transducer cable and the cable connector for damage. If there are obvious signs of damage, replace the cable.
	Defective connector block.	Visually inspect the connector block and the sensor sockets for damage. If there are obvious signs of damage, replace the connector block.
	Transducer or connector block is defective.	Try plugging the transducer into a different sensor socket. • If the Finder LED works, then the original socket is defective. Replace the connector block. • If the Finder LED still does not light in any of the other sockets, try using a known good transducer. If the Finder LED lights, the original transducer is defective: replace it.
	Bus Master Board is defective.	Try using a known good transducer. If the Finder LED does not light in any of the sockets using a known good transducer, then the Bus Master Board is defective. Replace the Bus Master Board.
	No power to Bus Master Board.	If both the SpO_2 board and the Bus Master Board are not working, exchange the power supply.
Transducer appears not to work, but the transducer Finder LED lights when you touch the parameter field on the screen. INOP **OB EQUIP MALF** is displayed.	Bus Master Board is defective.	Replace Bus Master Board.
All transducers (US, Toco, IUP and ECG) do not work. INOP **OB EQUIP MALF** is displayed.		

Symptoms	Possible Cause	Failure Isolation and Remedy
Transducer is connected, INOP **OB EQUIP MALF** is displayed.	Main CPU board is defective.	Replace Main CPU Board.
	Transducer defective.	Replace transducer.
	Interrupted transducer upgrade, or software based malfunction of the transducer, including communication problems between the Bus Master Board and the transducer.	Perform software upgrade of the transducer with the Support Tool.
Transducer belt button is broken or damaged.	Mechanical damage.	Replace the belt button. Handle transducers with care. **Never use a transducer with a broken or damaged knob.**

Status Log

Many events that occur during start-up or regular monitoring are logged in the Status Log. The Status Log can be cleared. Not all entries in the Status Log are errors. You can print the Status Log only via the Support Tool.

Monitor Id.	Code	No.	Date Time
H 18202	20100	1	4 Apr 05 16:37
C 1721	21050	1	4 Apr 05 15:37

The Status Log window shows logged events which caused a reboot of the monitor.

To enter the Status Log Window, select Main Setup -> Revision. The following list opens up:

- **Status Log**
- **Product**
- **Appl. SW**
- **Config**
- **Boot**
- **Language**
- **OB**
- **FetRec**

Select **Status Log.**

The first column in the log identifies the event class (“C”: caused a cold start, “H”: caused a hot start, “N”: no restart, for information only). Column 3 and 4 identify the event source and event code. Column 4 counts the number of occurrences of the event. The last column shows the time and date of the last occurrence of the event.

The following pop-up keys overlay the SmartKeys:

Clear StatLog		M2703A	

Clear StatLog

This key clears the currently displayed Status Log

M2703A

This key switches to the Monitor Revision Window

If an event occurs repeatedly, contact your Philips Service Representative.

NOTE It is possible, using the support tool, to download the status log and send it to your Philips Service Representative as a file (for example via e-mail).

Troubleshooting with the Support Tool

Using the support tool you can:

- access the full status log which can be saved as a file
- reload software
- identify defective devices
- reset touch screen calibration

For details on how to perform these tasks see the Support Tool User Manual.

Troubleshooting the Individual Measurements or Applications

For problems isolated to an individual parameter or application, please consult the *Instructions for Use* and configuration information.

If the *Instructions for Use* did not resolve an individual parameter problem, then another transducer or patient module should be tried.

If you are getting questionable readings for individual measurements you may want to do the performance assurance tests in Chapter 6, “Testing and Maintenance”.

The performance of the individual applications are affected by the configuration of the monitor. When contacting Philips support you may be asked about the configuration of the monitor to aid in troubleshooting.

8

Disassembly and Reassembly

WARNING

- Before attempting to open or disassemble the monitor, disconnect it from the AC mains supply.
- Energized circuits are accessible with the covers open. Do not work on the monitor with the covers open and AC power connected. Only qualified service personnel should open or disassemble the monitor.
- Performance verification: do not place the system into operation after repair or maintenance has been performed, until all performance tests and safety tests listed in Chapter 6, “Testing and Maintenance” have been performed. Failure to perform all tests could result in erroneous parameter readings, or patient/operator injury.

CAUTION Observe ESD (electrostatic discharge) precautions when working within the unit.

Introduction

Remember to store all screws and parts in a safe place for later refitting.

How to Use this Chapter

The disassembly sections detail the step-by-step procedures you use to access replaceable parts of the monitor and the transducers.

The monitor consists of two major assemblies:

- The top cover assembly
- The bottom housing assembly

The top cover assembly consists of the top cover housing, the display assembly, the recorder assembly, and the recorder adapter board.

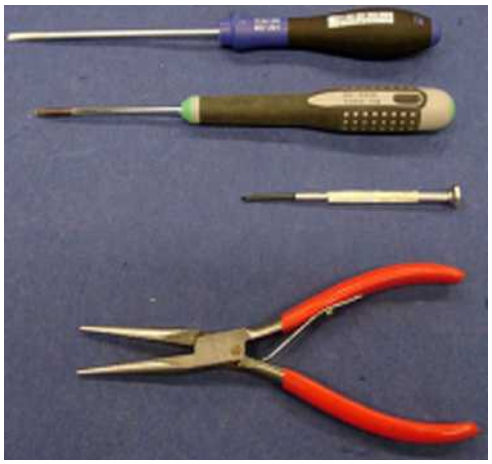
The bottom housing assembly consists of the bottom housing, the power supply assembly, the main CPU board, the bus master board, and depending on the options ordered, the noninvasive blood pressure assembly, the SpO_2 assembly, the input device interfaces, and the RS232/LAN interface.

All part numbers of spare parts are listed in Chapter 9.

Tools Required

CAUTION When replacing the front cover, do not over-torque the screws. Excessive torque may damage the plastic screw mountings.

You need the following tools:



- Flat-head screwdriver, head thickness 0.5 mm to fit transducer screw
- Torx-head screwdriver, size T-10, minimum shaft length 80mm
- Small flat-head screwdriver, 2.0-3.0 mm
- Long-nosed pliers

Serial Numbers

The serial number of the monitor appears on the device nameplate at the rear of the bottom housing. It is also stored electronically in the power supply.

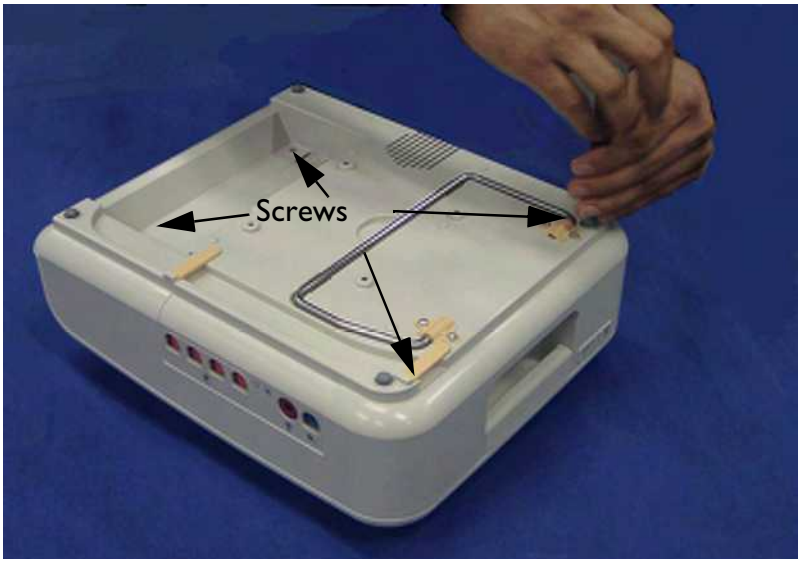
- If you change the bottom housing, remove the nameplate from the old housing and fit it to the new housing.
- If you exchange the power supply of the monitor, you may have to re-enter the monitor serial number afterwards. Check the serial number of the monitor in the Support Tool device view to see whether this is necessary: if the sixth digit of a monitor serial number is an “X”, you must re-enter the serial number, which you will find on the nameplate. Refer to the *Support Tool Instructions for Use* for details of how to change or re-enter a serial number.

Removing the Top Cover Assembly

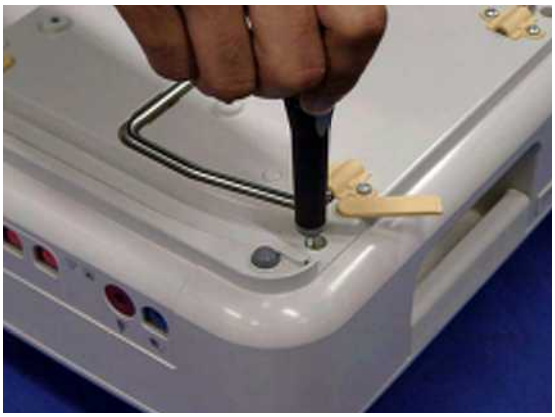
1 First fold the display completely flat.

1 Carefully place the monitor upside down. To avoid scratches, place the unit on some cloth or other soft surface.

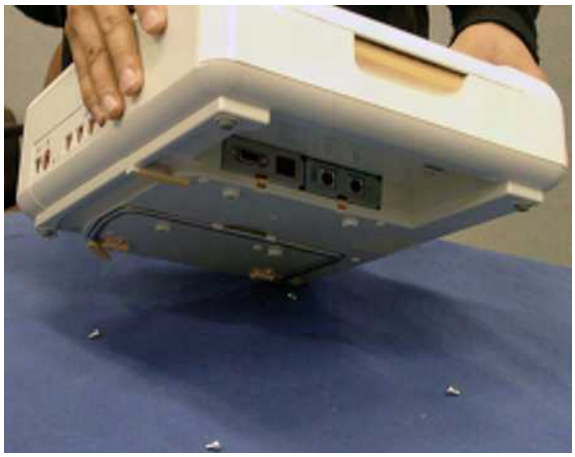
2 Remove the four screws securing the top cover assembly to the bottom housing, using a T-10 Torx driver.



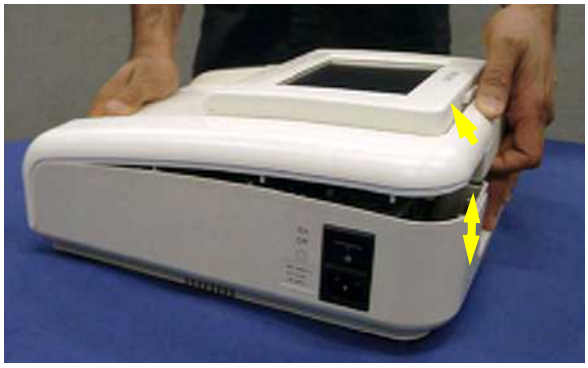
3 To gain access to the screw in the rear right hand corner, release the cable guide aside as illustrated.

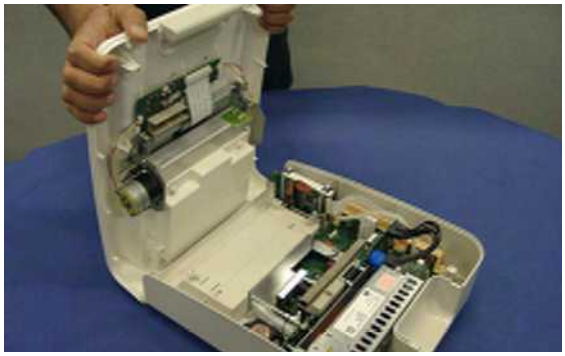


4 Holding both top cover and bottom housing assemblies together, place the monitor upright again.

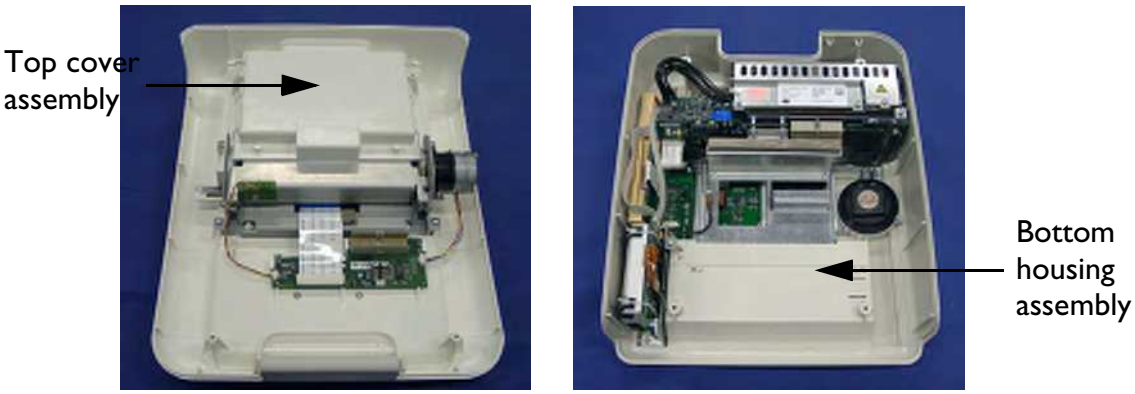


5 Separate the top cover from the bottom housing from the front of the monitor as illustrated.





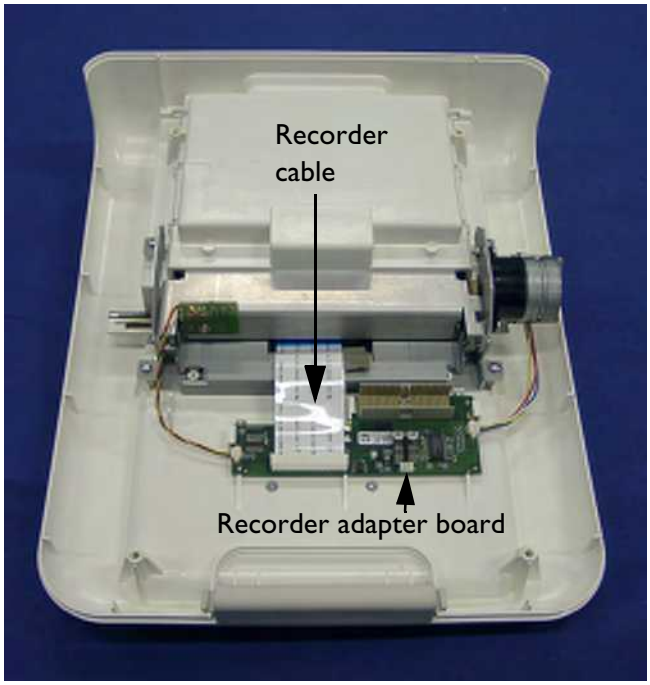
6 The top cover assembly is now separated from the bottom housing assembly.



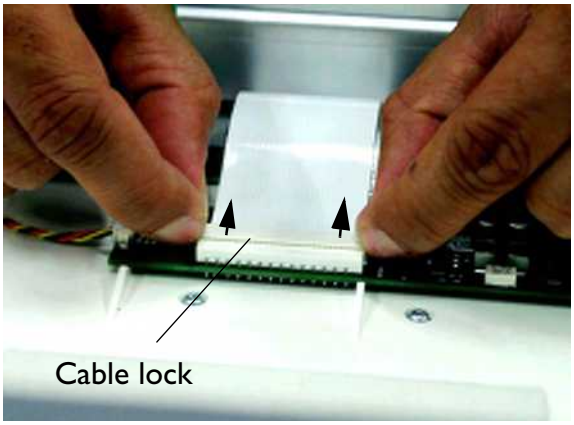
Removing the Display Assembly

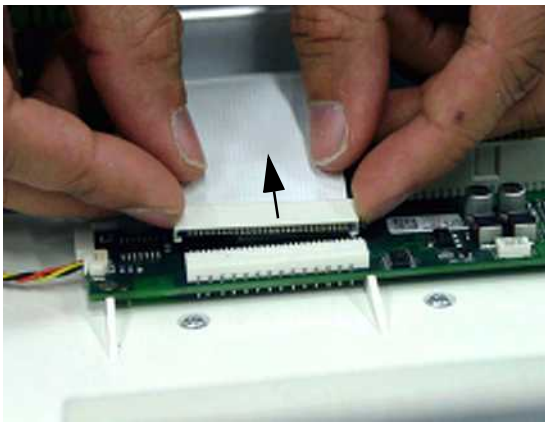
1 Remove the top cover assembly (see page 57).

2 Place the top cover assembly top down on a cloth or other soft surface.

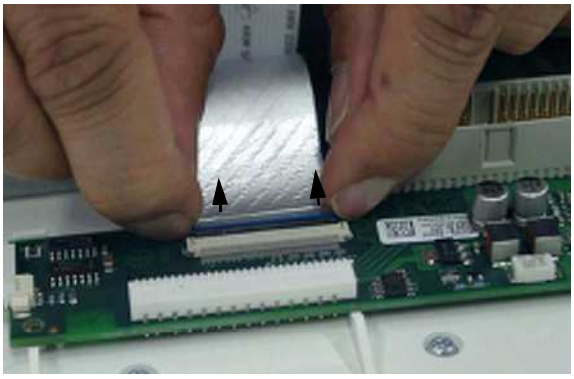


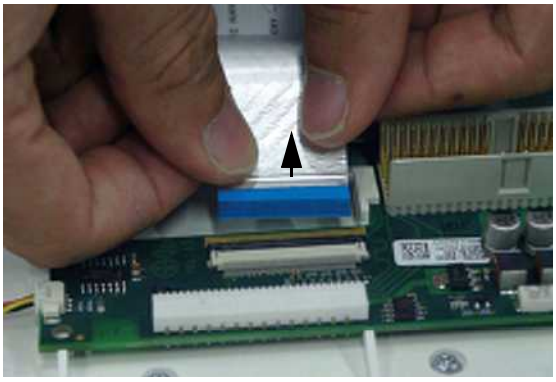
3 First release the cable lock by moving it in the direction of the arrows, then disconnect the white recorder ribbon cable from the recorder adapter board.





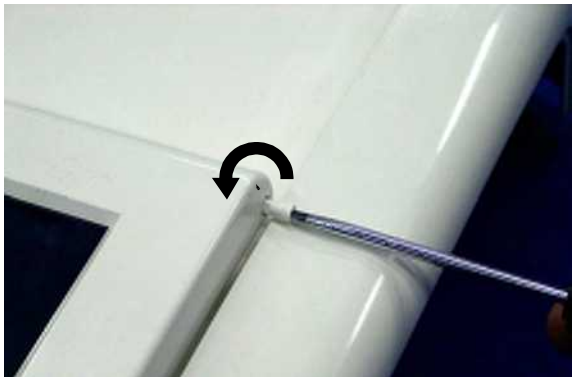
4 Next, disconnect the silver display ribbon cable from the recorder adapter board after releasing the cable lock.

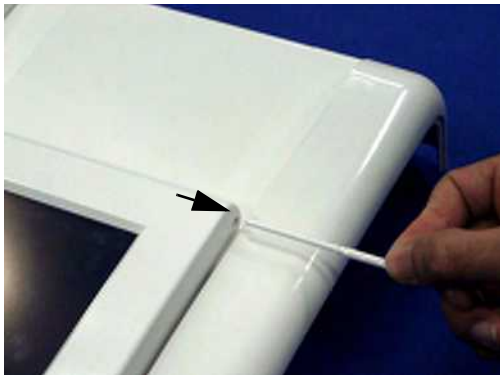




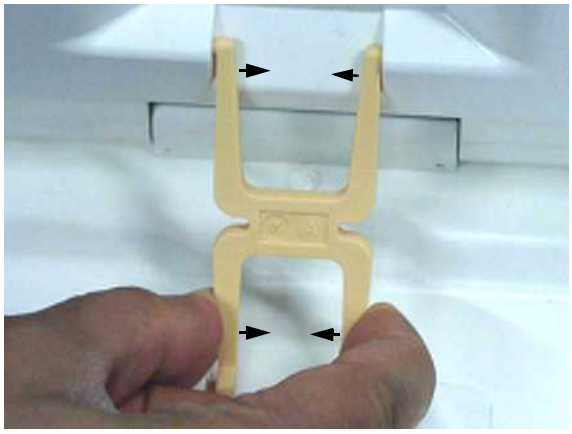
5 Turn over the top cover assembly.

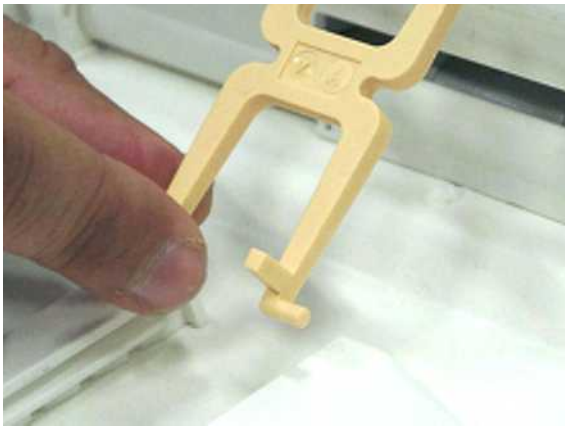
6 Remove the two plastic hinge pins on either side of the display housing. Release them by turning the slotted head anti-clockwise with a small flat-bladed screwdriver.



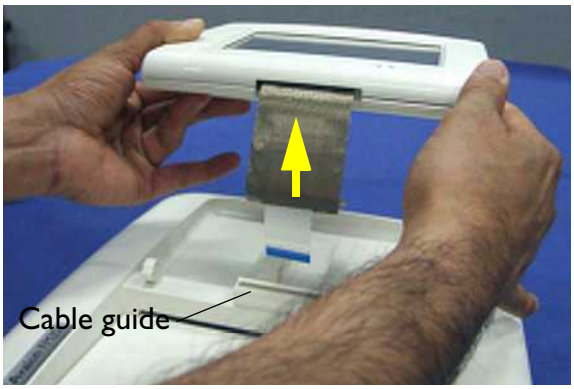


7 Squeeze the arms of the ratchet clip to remove it from the slots on the rear of the display housing and the top cover as illustrated.





8 Gently pull the display ribbon cable through the cable guide, and remove the display assembly.



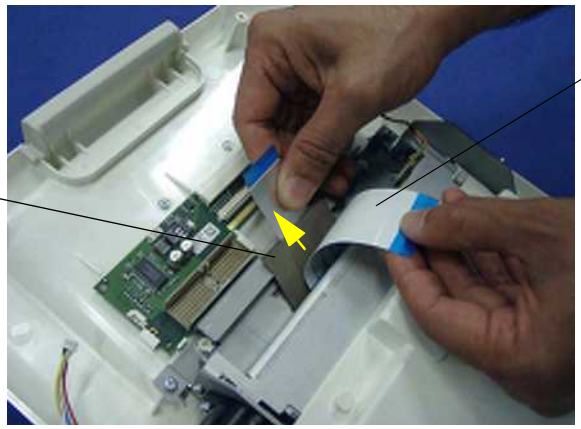
Replacing the Display Assembly

Replacing the display assembly is the reverse of the removal procedure.

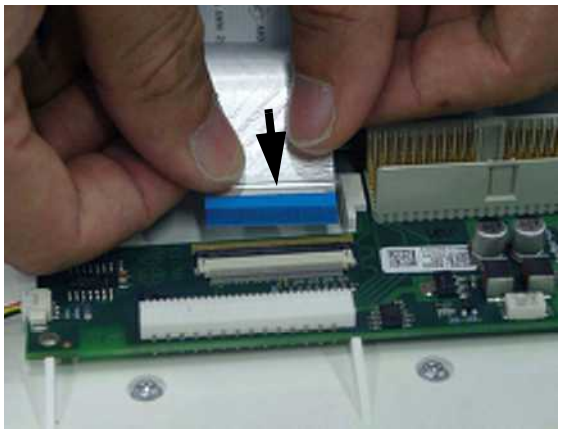
1 With the top cover assembly facing upwards, feed the display ribbon cable through the cable guide in the top cover assembly.

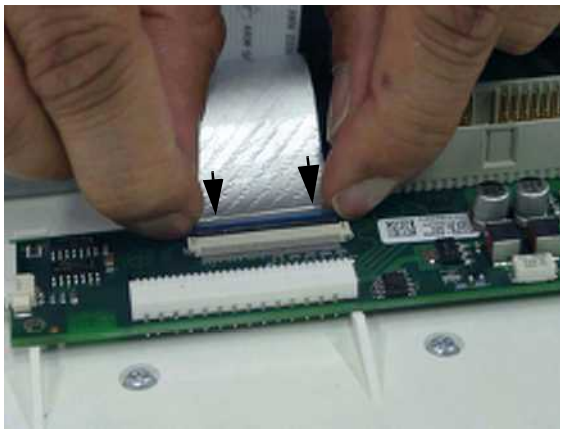
2 Carefully turn over the top cover assembly together with the display assembly.

3 Gently pull the display ribbon cable fully through the cable guide.

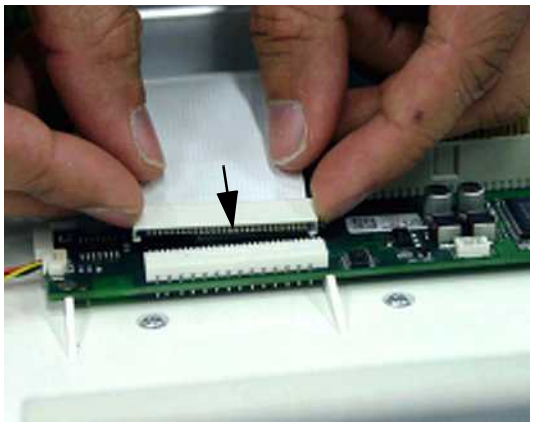


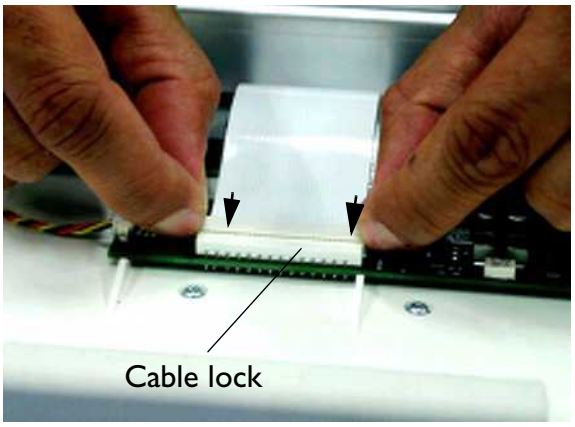
4 Reconnect the display ribbon cable to the recorder adapter board, ensuring that the cable lock is secure after fitting.



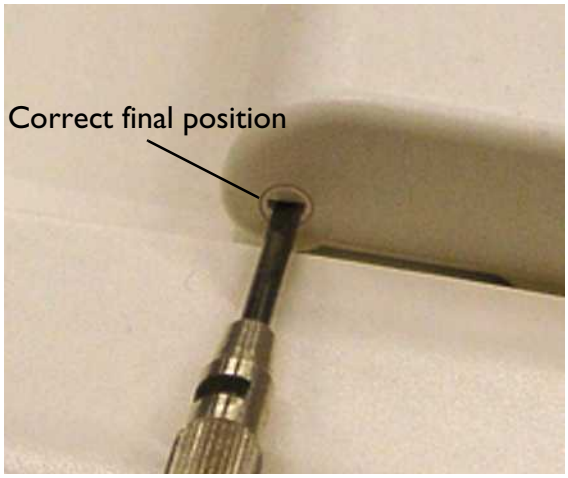


5 Reconnect the white recorder ribbon cable to the recorder adapter board, ensuring the cable lock is secure after fitting.





6 Refit the plastic hinge pins. Do not apply excessive force when refitting the hinge pins. Turn the head of the hinge pin gently with a small screwdriver. You will feel when the pin is seated correctly, the head should be flush with the surface, and the slot in the head of the pin should be pointing in the same plane as the side of the display assembly housing.



7 Refit the ratchet clip into the slots on the rear of the display housing and the top cover, as a reversal of the removal procedure.

Recorder Disassembly

The recorder consists of the following major sub-assemblies:

- Drawer Assembly
- Recorder Chassis
- Thermal Line Printhead (TLPH) Holder
- Recorder Adapter Board
- Stepper Motor

Removing the Drawer Assembly

1 Press the paper table release to unlock the paper drawer and then pull the table forward to open it fully.

2 Squeeze the two plastic lugs on the underside of the drawer to release the drawer, and then pull to remove the drawer. (Here shown with the top cover removed.)

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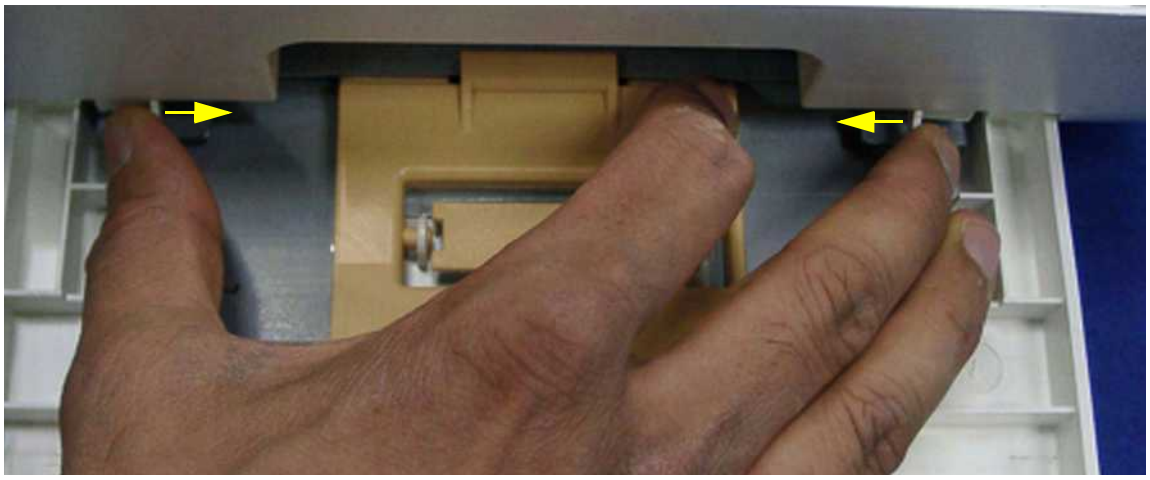
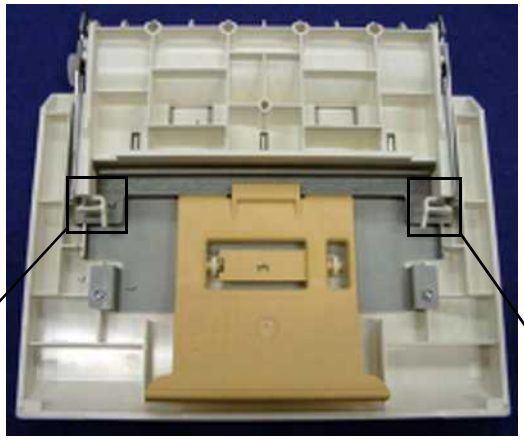
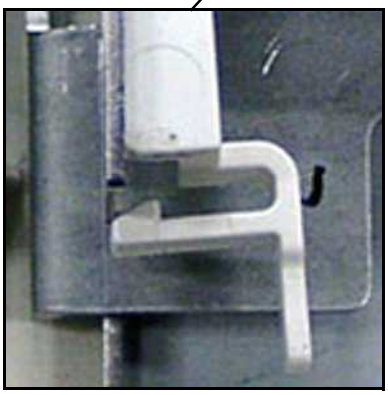
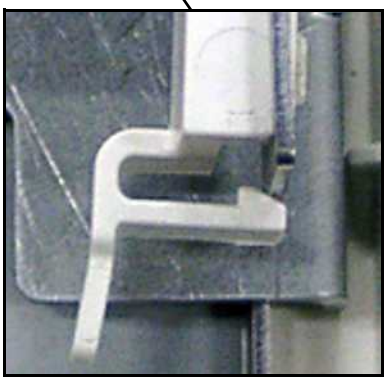




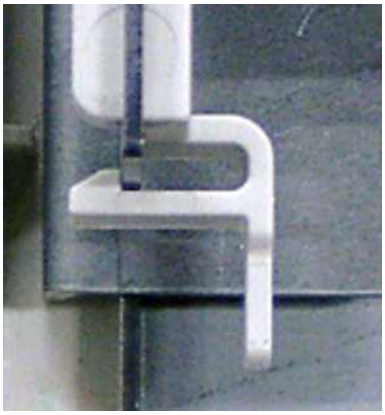


Detail showing plastic hooks open

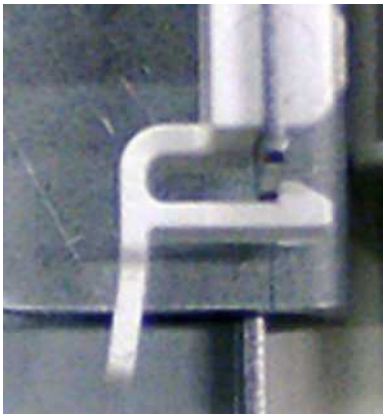


Replacing the Drawer Assembly

Before replacing the drawer assembly, refer to the previous photographs, and study the detail showing the position of the plastic hooks when the drawer is fixed in position.

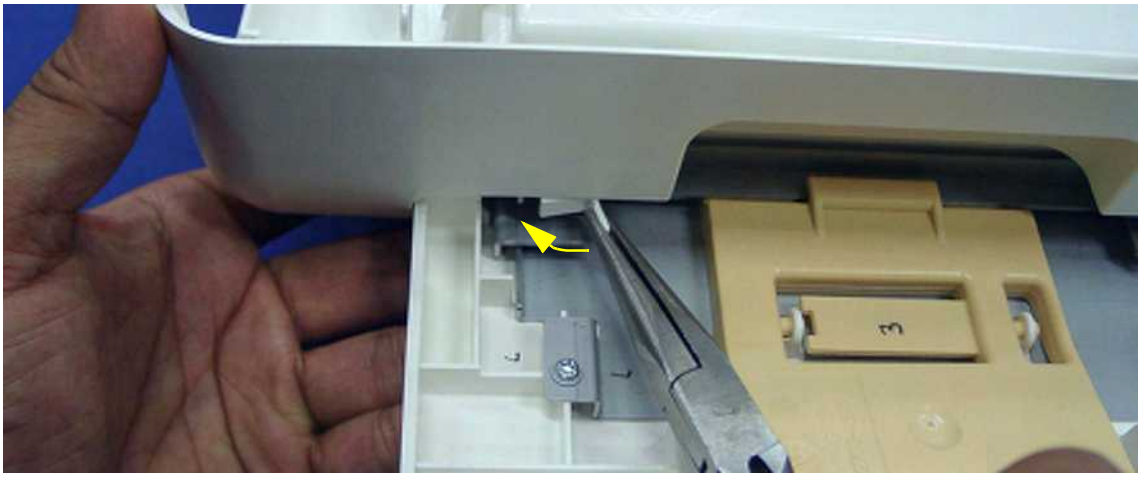


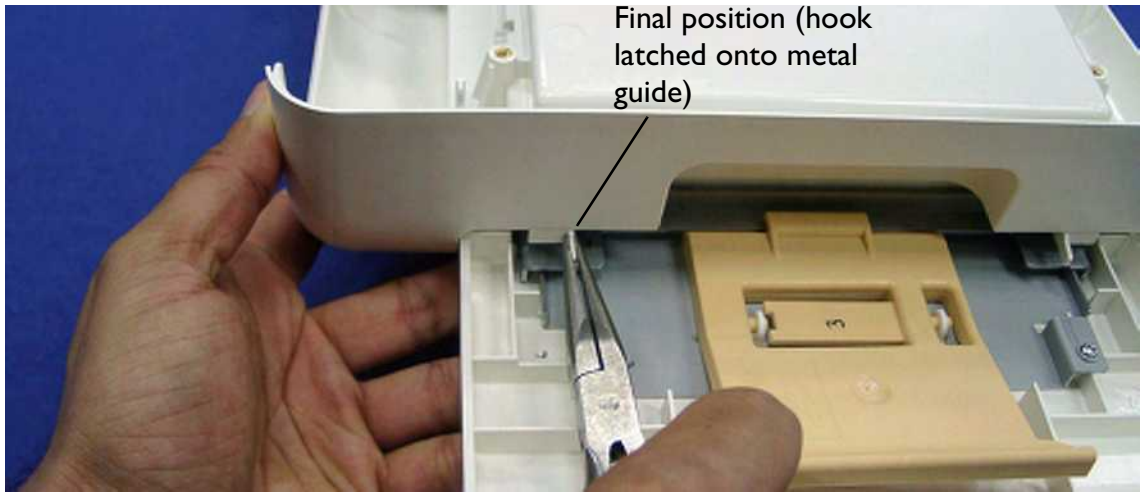
Detail showing plastic hooks latched onto metal guide. This is how the hooks should be when the drawer is fixed in position.



1 Slide the drawer into the drawer recess on the top cover, and check that it is located correctly on the runners.

2 Latch the two plastic hooks onto the metal guides to secure the drawer in place. You will find it easier to use a long-nosed pair of pliers to move the hook into position, as shown in the following photographs.



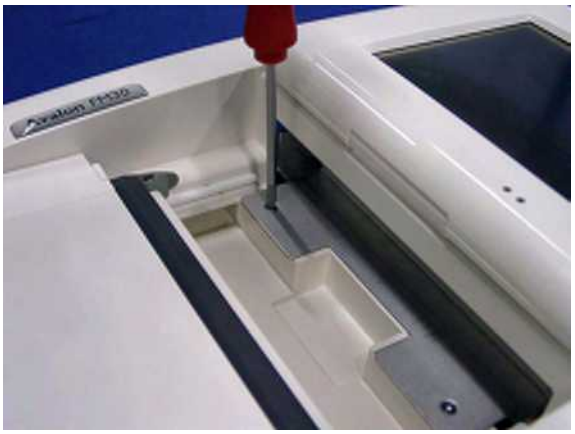

Final position (hook latched onto metal guide)

Removing the Recorder Chassis

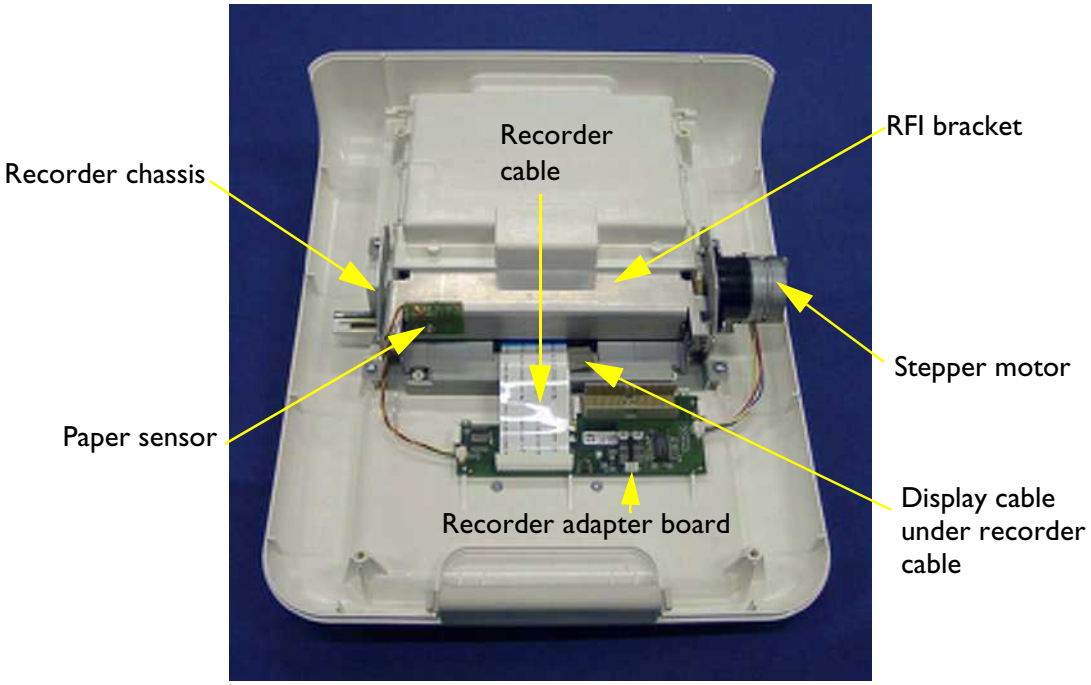
1 Remove the top cover assembly (see page 57).

2 Slide open the paper drawer, to gain access to the two countersunk screws (in the following photographs, we have removed the drawer assembly).

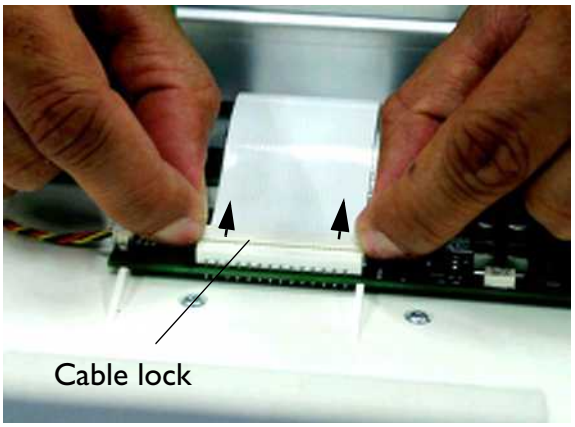
3 Remove the two countersunk screws.

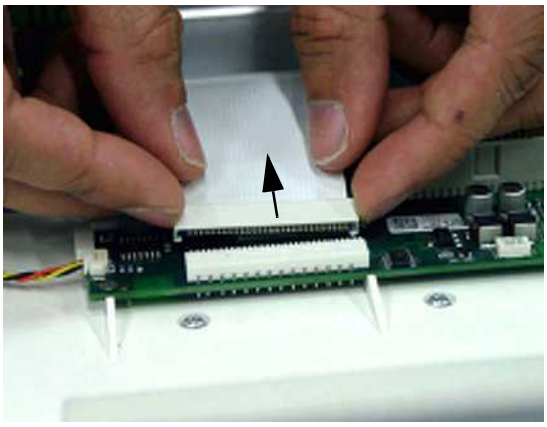


4 Turn over the top cover assembly and place it top down on a cloth or other soft surface.

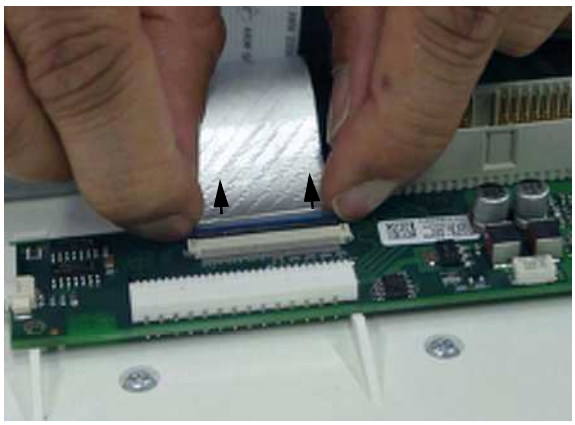


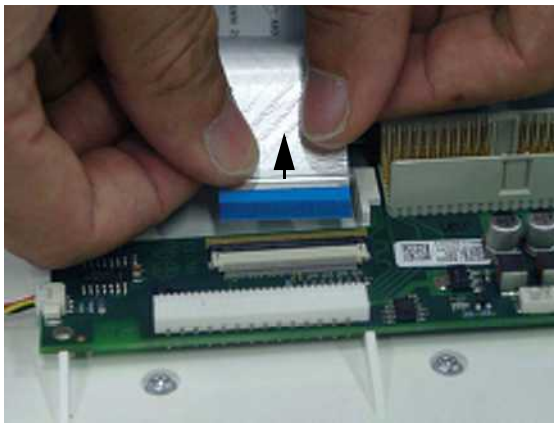
5 First release the cable lock by moving it in the direction of the arrows, then disconnect the white recorder ribbon cable from the recorder adapter board.



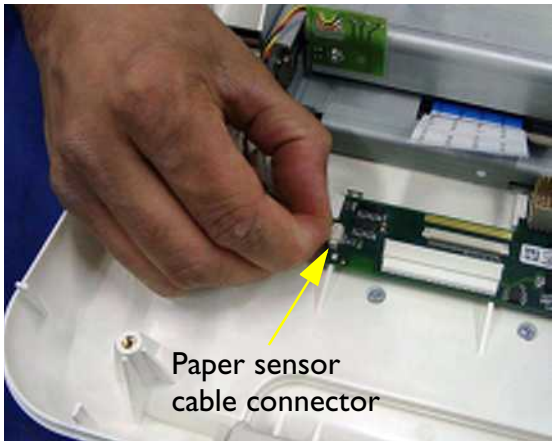


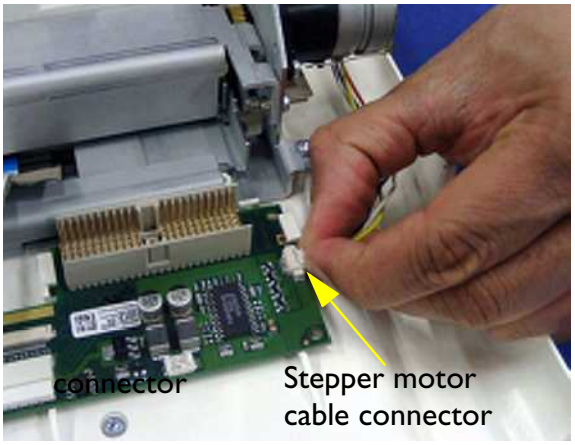
6 Next, disconnect the silver display ribbon cable from the recorder adapter board after releasing the cable lock.



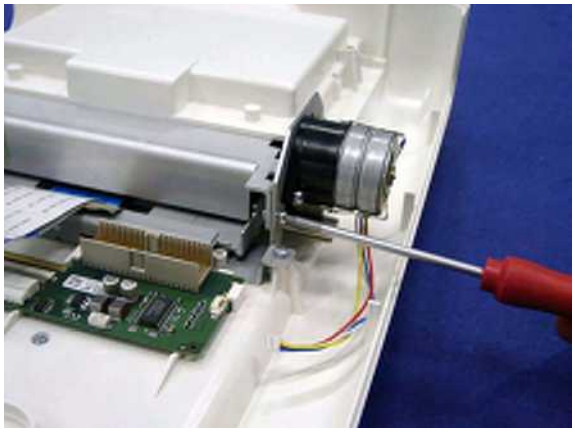


7 Disconnect the stepper motor the paper sensor cable connectors from the recorder adapter board.

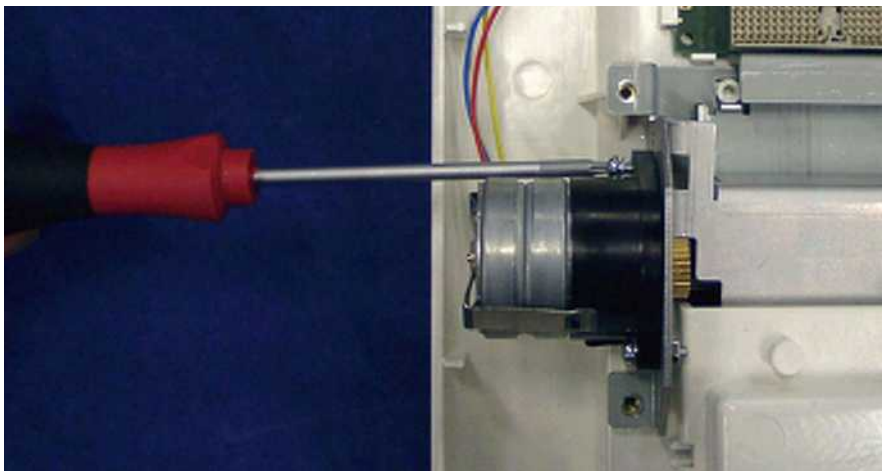




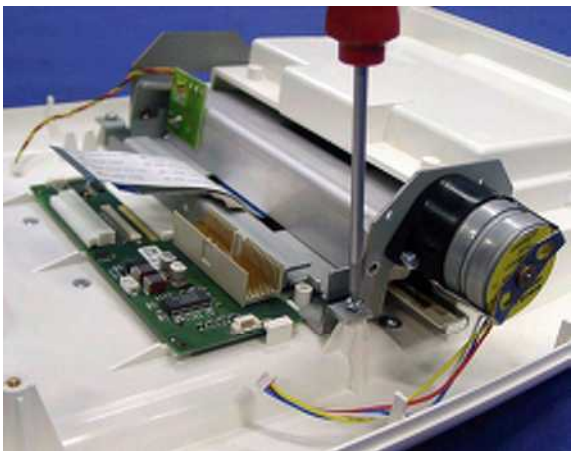
8 Remove the two screws (one on each side) fastening the RFI bracket to the recorder chassis.

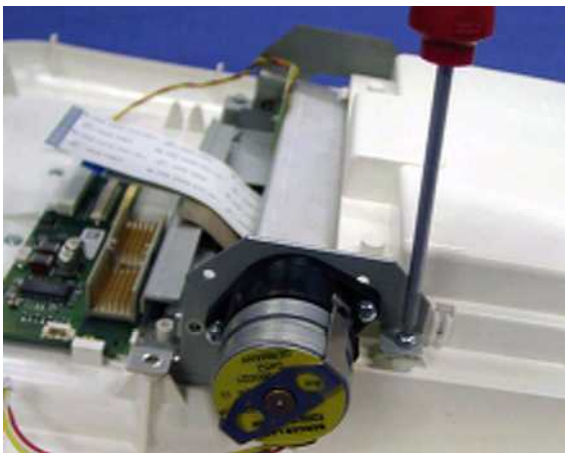


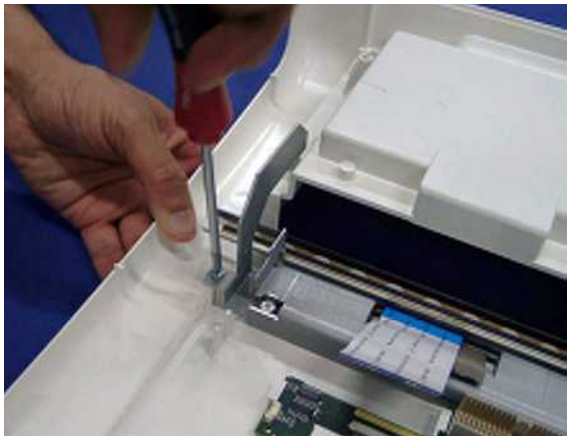
9 Partially unscrew the screw nearest the recorder adapter board holding the stepper motor to the recorder chassis, until the thread no longer protrudes. This allows the necessary clearance for removing the RFI bracket.

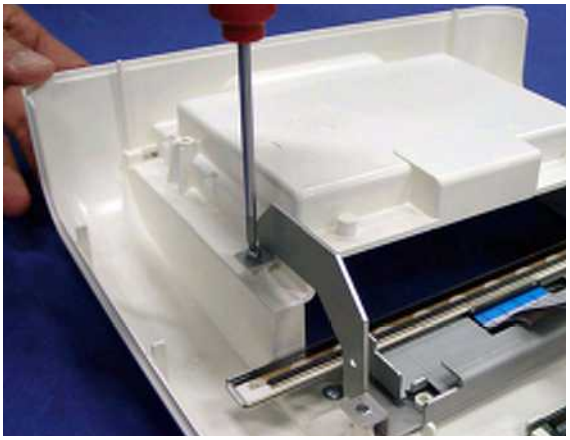


10 Remove the four screws holding the recorder chassis.

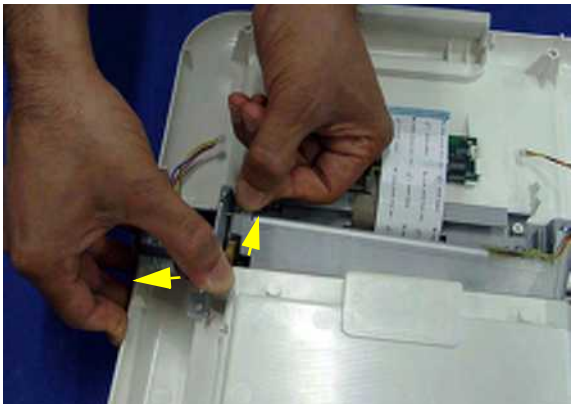




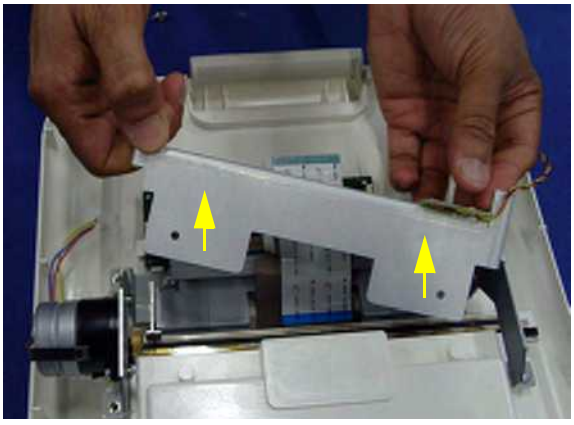




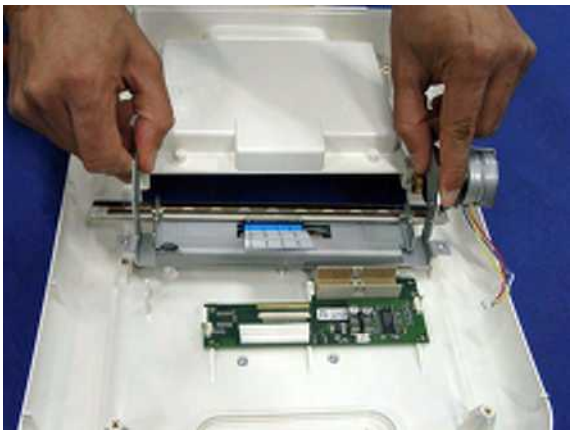
11 Free the RFI bracket on the stepper motor side by applying a little sideways pressure to the recorder chassis, while at the same time pulling the RFI bracket forwards.

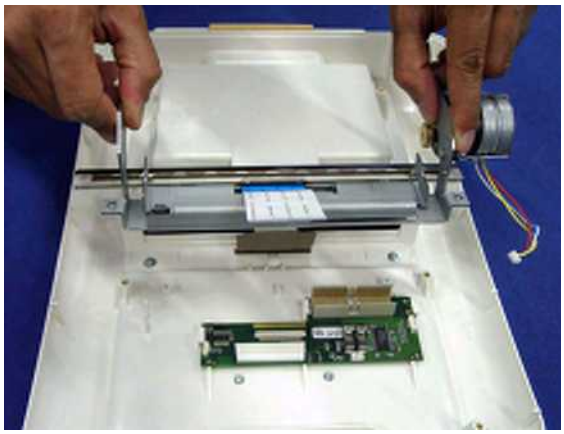


12 Remove the RFI bracket.



13 Lift out the recorder chassis.





Removing the Thermal Line Printhead (TLPH)

1 Remove the recorder chassis as described in the section “Replacing the Recorder Chassis” on page 74”.

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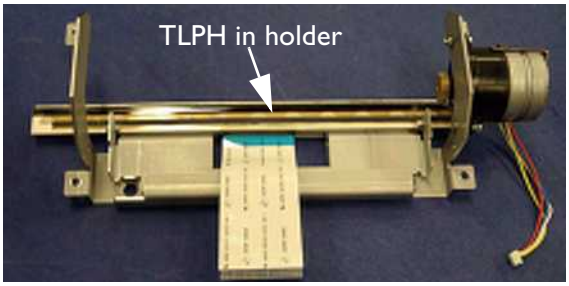
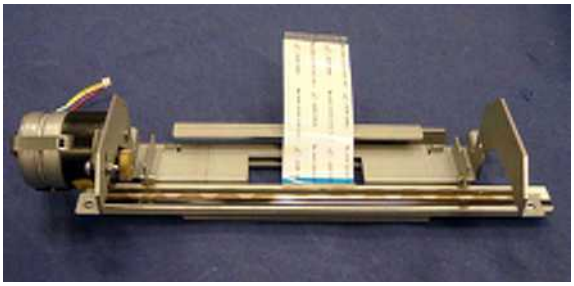
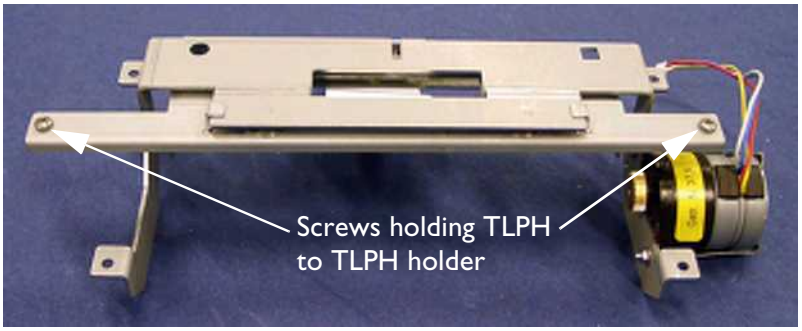
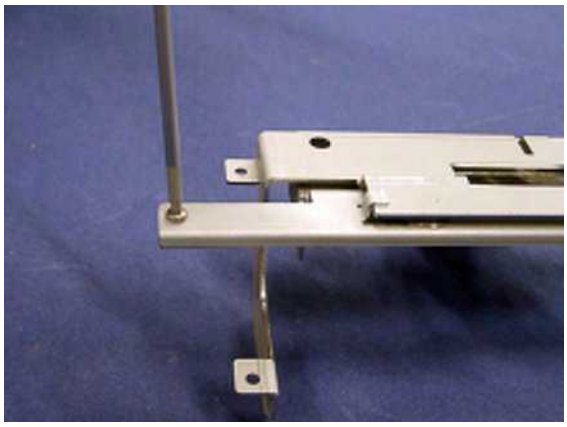


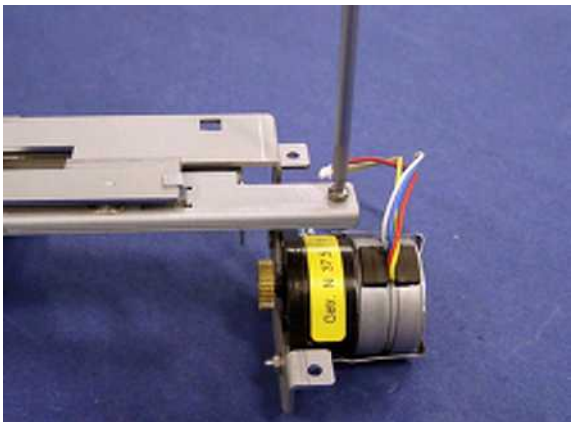


2 Turn the recorder chassis over.

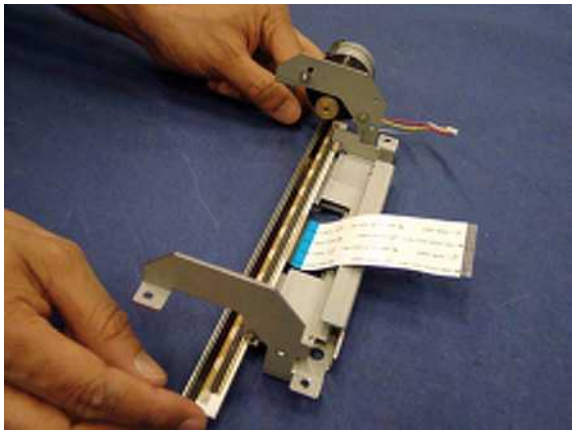


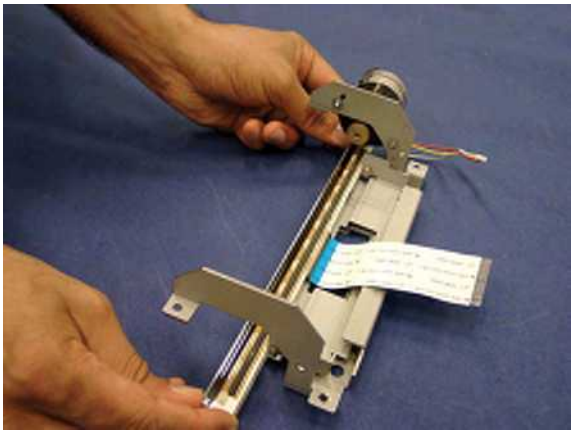
3 Remove the two screws holding the TLPH to the TLPH holder.

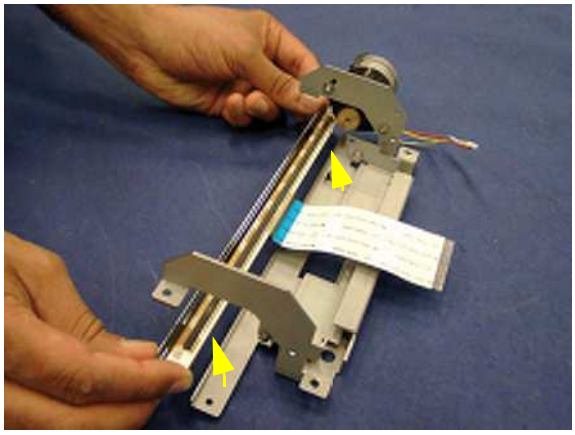


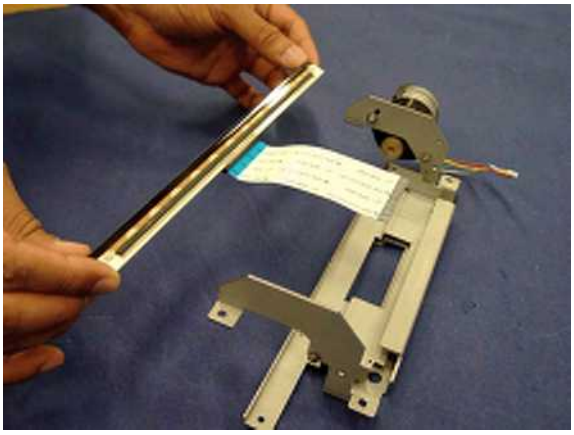


4 Turn the chassis assembly over again, and carefully remove the TLPH from the holder as shown.









Replacing the TLPH

The procedure for replacing the TLPH is a reversal of the removal procedure.

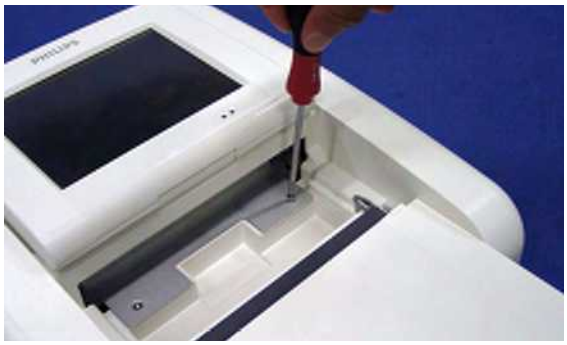
Replacing the Recorder Chassis

The procedure for replacing the recorder chassis is a reversal of the removal procedure (see “Replacing the Recorder Chassis” on page 74 for the sequence).

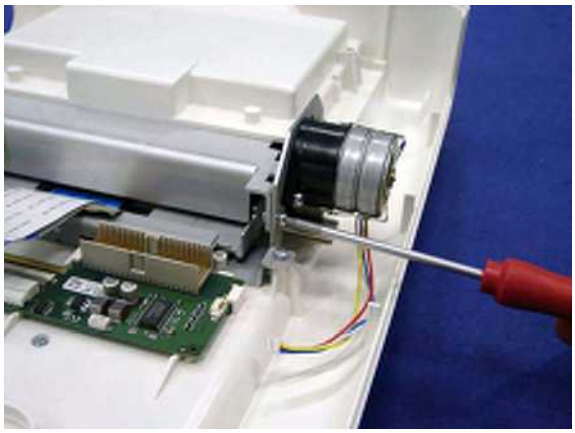
1 Ensure that the TLPH holder has been fitted to the recorder chassis, as described in the previous section.

2 Place the recorder chassis into position, and drive the four fixing screws in lightly. Do not tighten yet!

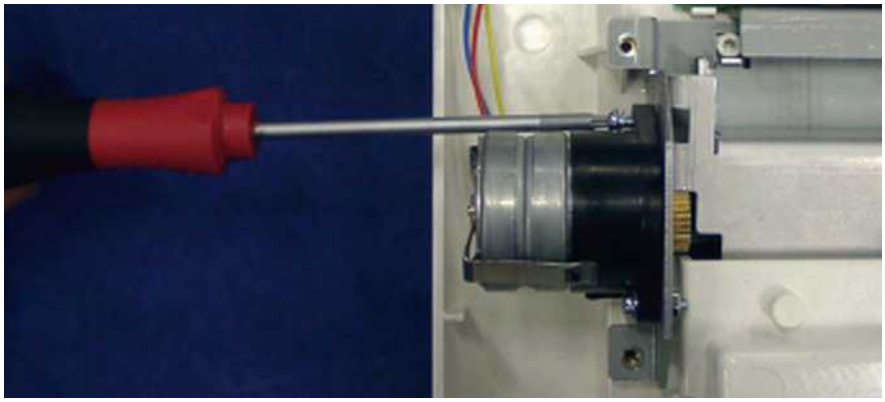
3 Turn over the top cover housing, then secure the two countersunk screws. This centers the recorder chassis correctly.



4 Turn over the top cover again, and replace the RFI bracket, reversing the removal procedure. Secure the RFI bracket to the recorder chassis with the two screws.



5 Tighten the stepper motor screw that you loosened to allow removal of the RFI bracket.



6 Now tighten the four screws to secure the recorder chassis.

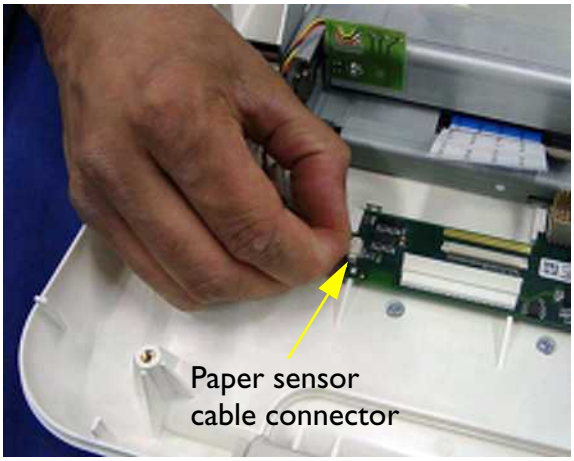
7 Ensure that you reconnect the paper sensor cable and the stepper motor cable to the recorder adapter board.

Removing the Paper Sensor Assembly

1 Remove the top cover assembly (see “Removing the Top Cover Assembly” on page 57).

2 Place the top cover assembly top down on a cloth or other soft surface.

3 Disconnect the paper sense cable connector from the recorder adapter board.



4 Turn over the top cover and remove the screw holding the paper sensor to the RFI bracket.

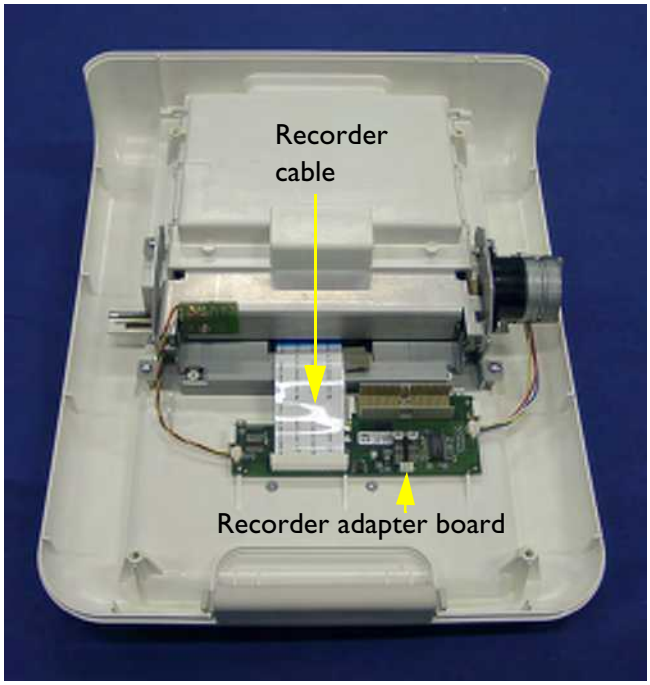
Replacing the Paper Sensor Assembly

The procedure for replacing the paper sensor is a reversal of the removal procedure. Ensure that the paper sensor cable is properly connected to the recorder adapter board.

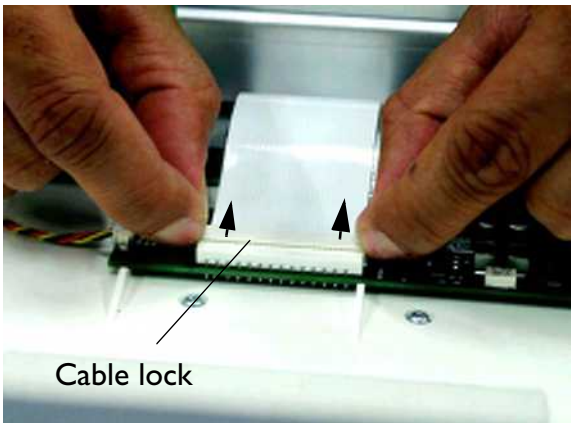
Removing the Recorder Adapter Board

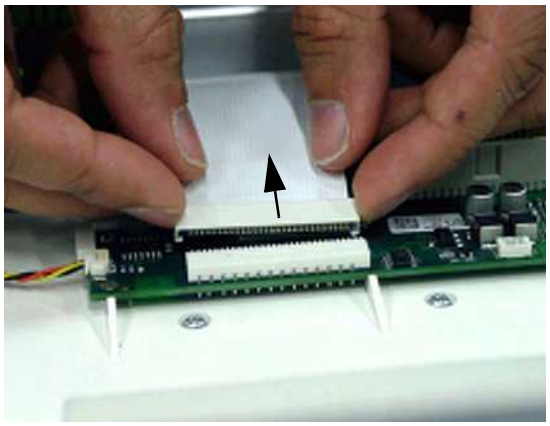
1 Remove the top cover assembly (see “Removing the Top Cover Assembly” on page 57).

2 Place the top cover assembly top down on a cloth or other soft surface.

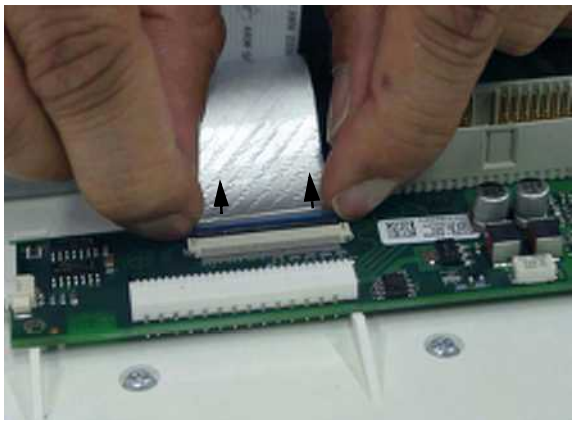


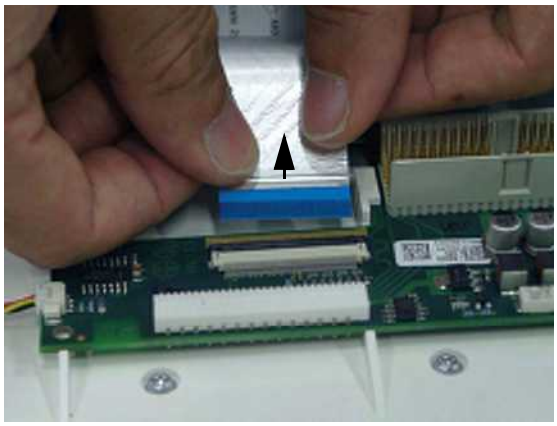
3 First release the cable lock by moving it in the direction of the arrows, then disconnect the white recorder ribbon cable from the recorder adapter board.



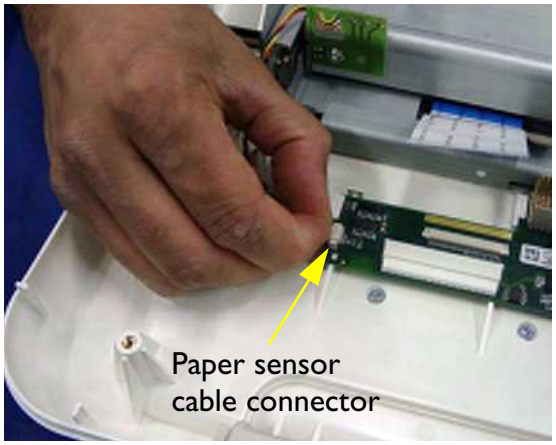


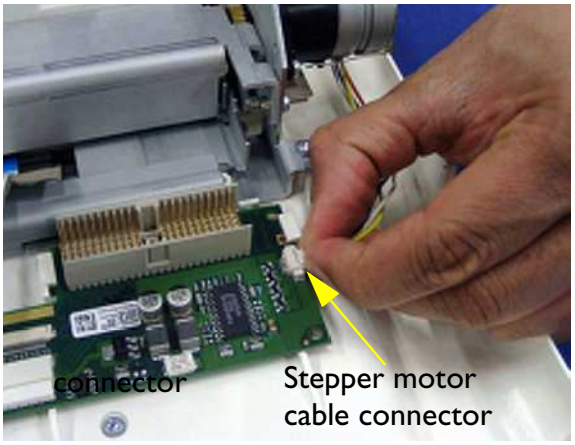
4 Next, disconnect the silver display ribbon cable from the recorder adapter board after releasing the cable lock.



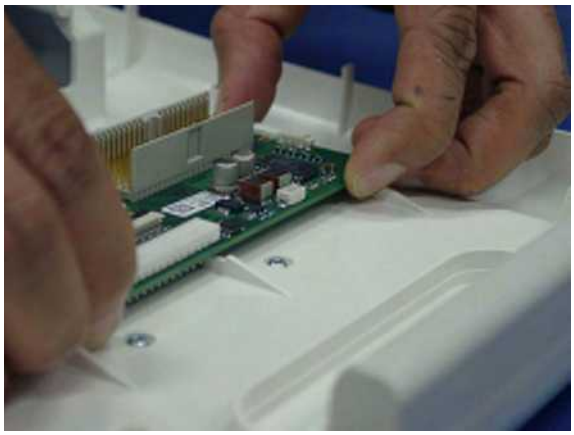


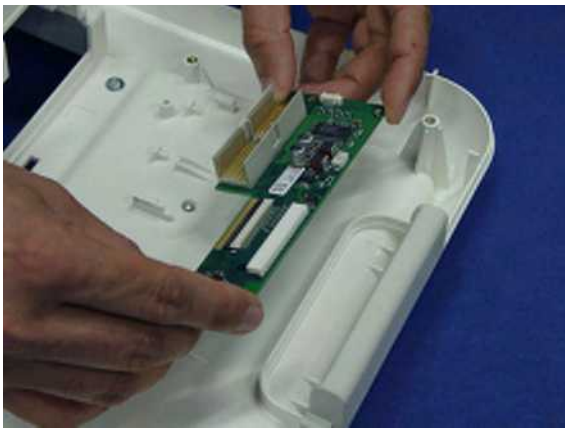
5 Disconnect the stepper motor the record-sense cable connectors from the recorder adapter board.





6 With all cables disconnected, remove the recorder adapter board.





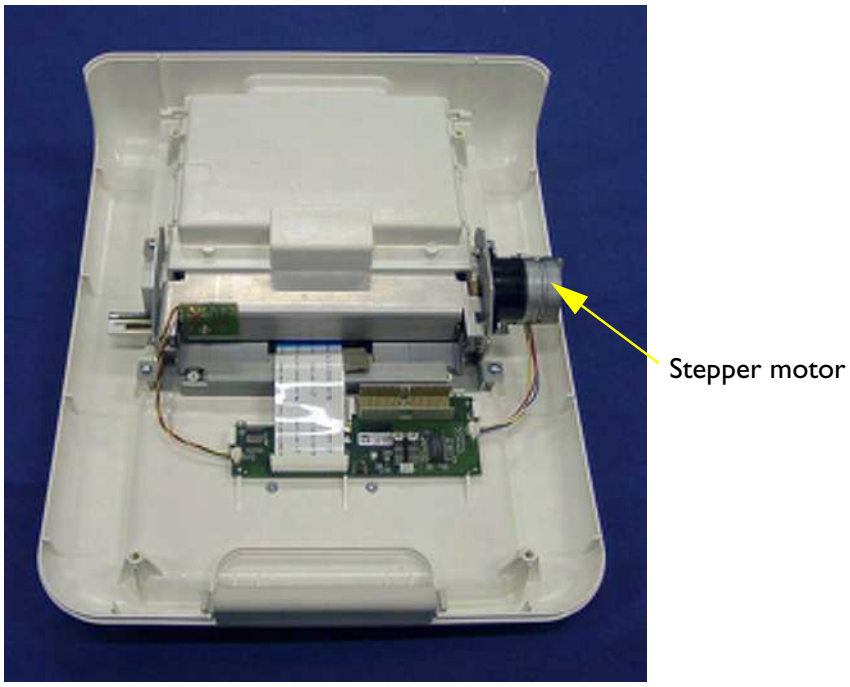
Replacing the Recorder Adapter Board

The procedure to replace the recorder adapter board is a reversal of the removal procedure. Ensure that all cables are firmly reconnected.

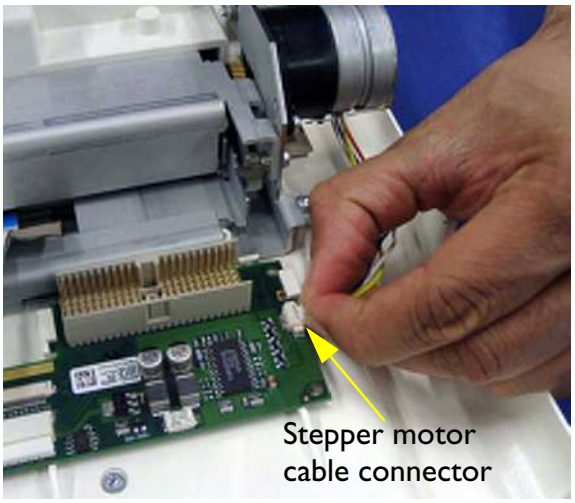
Removing the Stepper Motor

1 Remove the top cover assembly (see “Removing the Top Cover Assembly” on page 57).

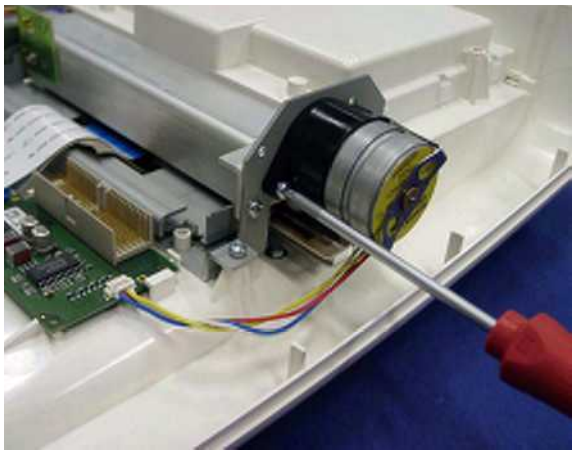
2 Place the top cover assembly top down on a cloth or other soft surface.

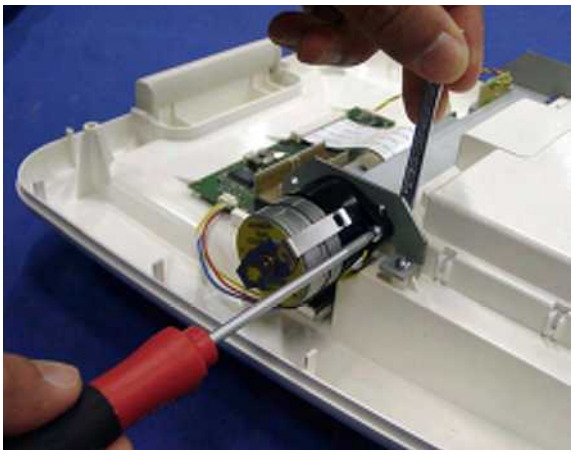


3 Disconnect the stepper motor cable connector from the recorder adapter board.

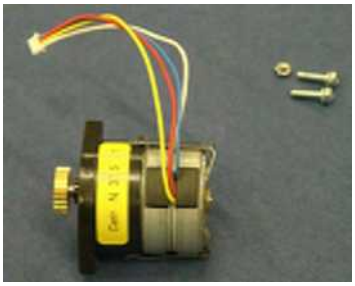


4 Remove the two screws holding the stepper motor to the recorder chassis. Note that the upper screw is secured with a small nut.





5 Remove the stepper motor.



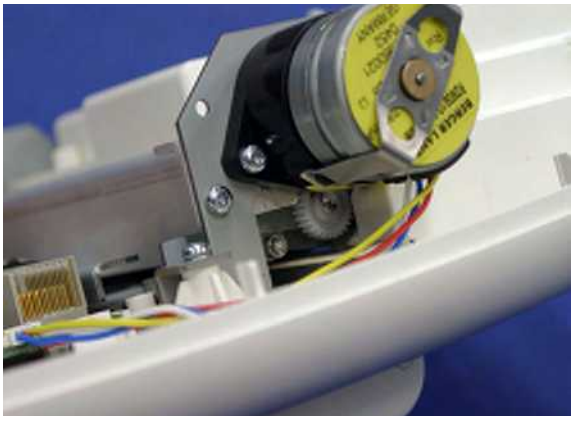
Replacing the Stepper Motor

1 Refit the stepper motor to the recorder chassis, but do NOT tighten the screws yet! The upper slot on the stepper motor allows fine adjustment when meshing the gears together.

2 Close the drawer assembly.

3 Gently mesh the stepper motor gear with that of the paper roller.

CAUTION Do NOT press the gears together or exert any pressure on the stepper motor spindle.

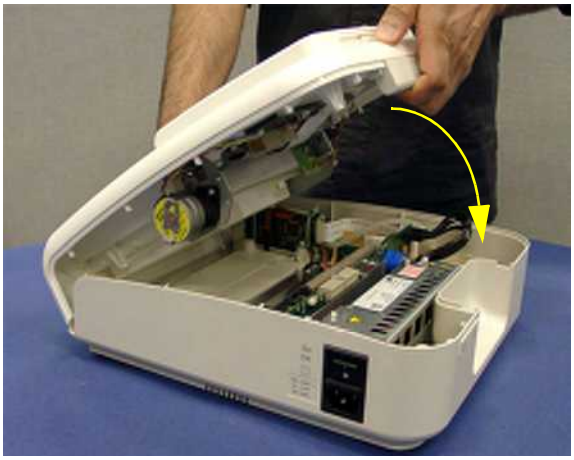


4 When in place, tighten the screws, remembering that the upper screw is secured with a small nut.

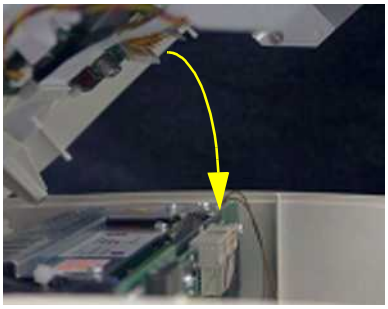
Replacing the Top Cover Assembly

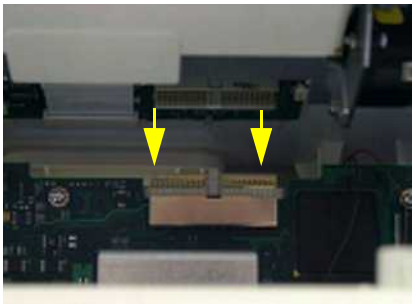
1 Ensure all items are replaced in the top cover assembly. Check that all the cables are reconnected.

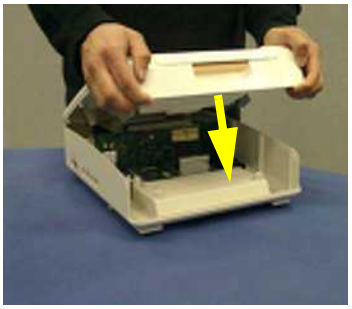
2 Carefully align the front edge of the top cover assembly with the front edge of the bottom housing assembly.



3 With the front edge of the top cover still located in the front edge of the bottom housing, gently lower the top cover, making sure the multi-pin connector on the recorder adapter board aligns with the socket on the main CPU board.







4 Place the top cover back to its normal position. Apply a little pressure to seat the multi-pin connector.

5 Holding both assemblies together, carefully place the unit upside down on a soft surface to prevent scratching or other damage.

6 Refit the four screws securing the top cover assembly to the bottom housing, using a T-10 Torx driver, as a reversal of the procedure in "Removing the Top Cover Assembly" on page 57. Turn the monitor the right way up.

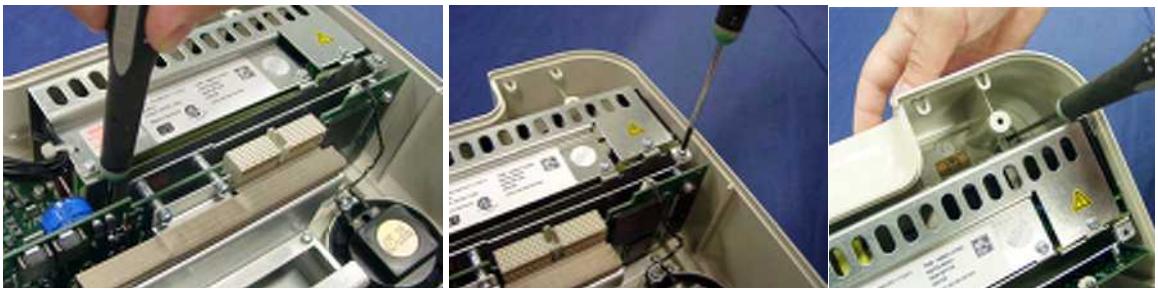
CAUTION When replacing the top cover, do not over-torque the screws. Excessive torque may damage the screw mountings.

Removing the Power Supply Assembly

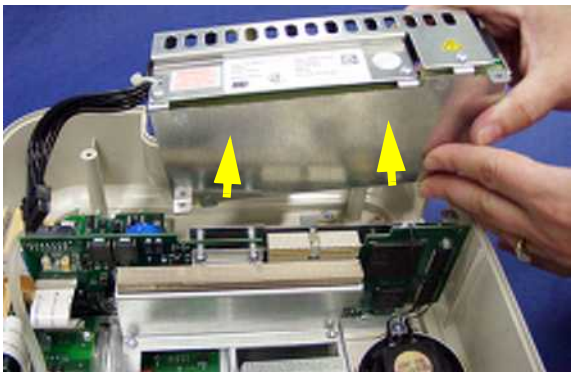
1 Remove the top cover assembly (see page 57).

2 Disconnect the power supply cable connector from the main CPU board. While removing the connector, support the end of the main CPU board to prevent excessive flexing.

3 Remove the three screws securing the power supply



4 Lift the cable end of the power supply assembly with one hand, while guiding the power socket/on/off switch free of the aperture in the bottom housing, then lift out the power supply

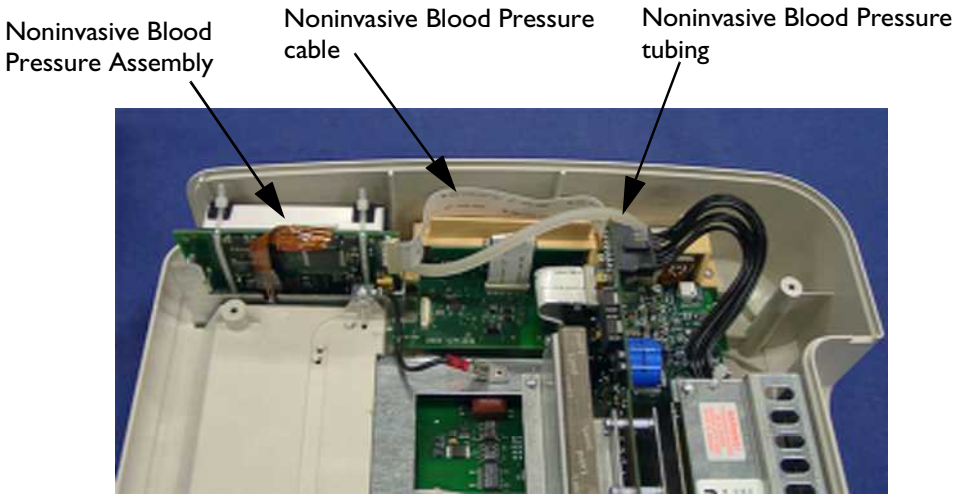


Replacing the Power Supply Assembly

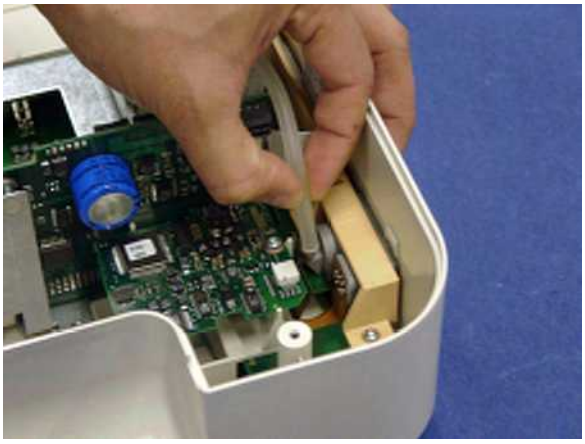
The procedure to replace the power supply assembly is a reversal of the removal procedure. Remember to reconnect the power supply cable connector.

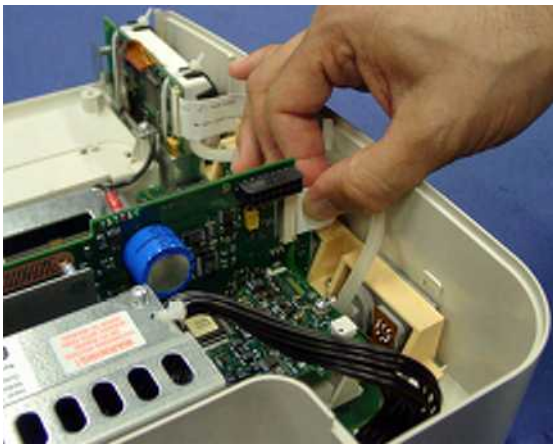
Removing the Noninvasive Blood Pressure Assembly

1 Remove the top cover assembly (see page 57).
The NiBP assembly is identified in the next picture.

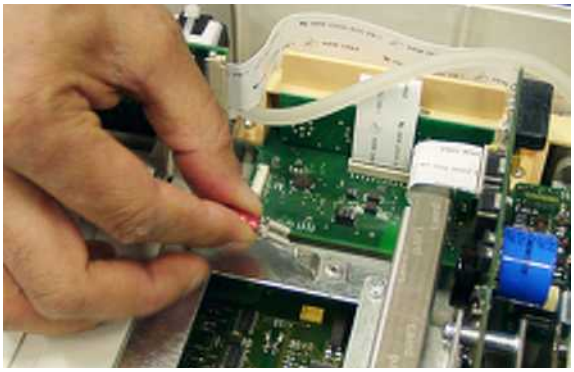


2 Disconnect the tubing from the noninvasive blood pressure connector, and the ribbon cable from the main CPU board.

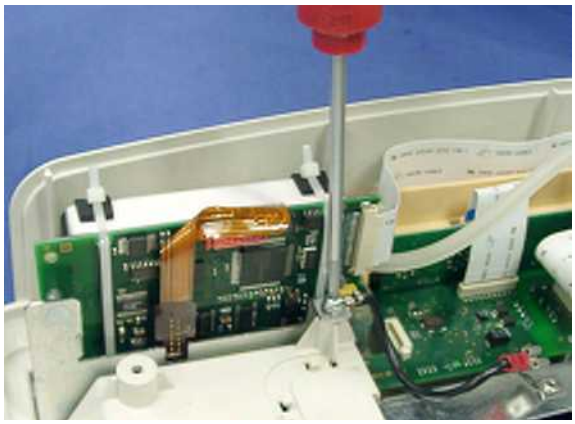


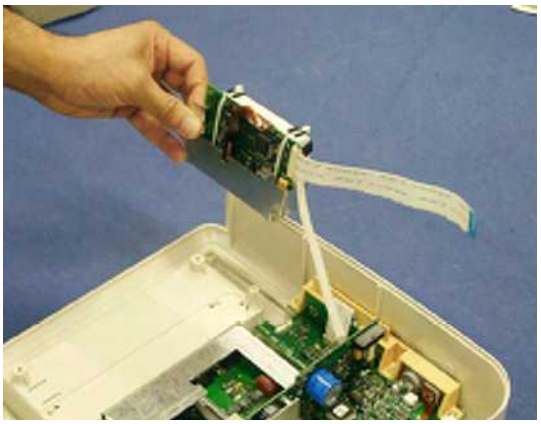


3 Disconnect the grounding cable's spade connector.

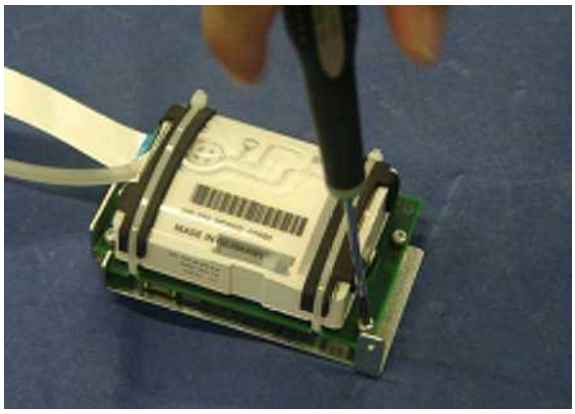


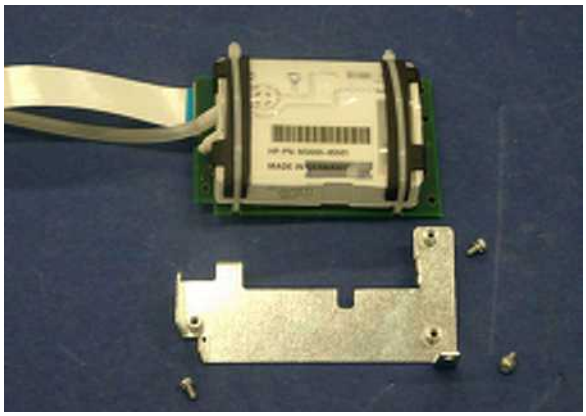
4 Remove the two screws holding the noninvasive blood pressure assembly to the bottom housing, then remove the noninvasive blood pressure assembly.

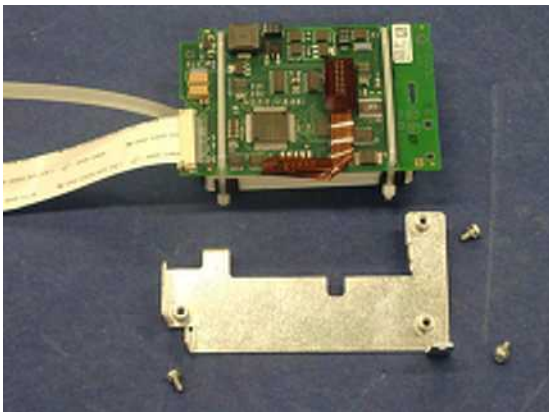




5 To separate the noninvasive blood pressure assembly from the noninvasive blood pressure assembly holder, remove the three screws.





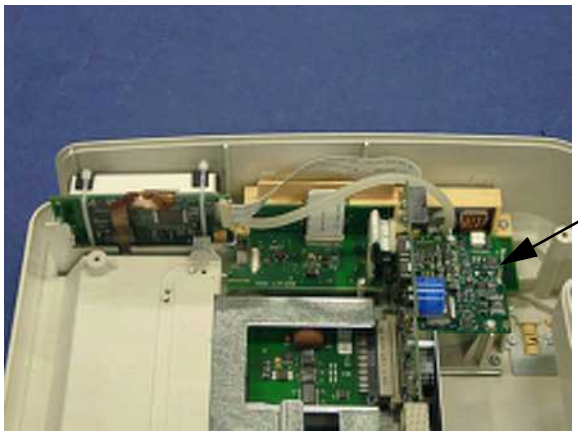


Replacing the Noninvasive Blood Pressure Assembly

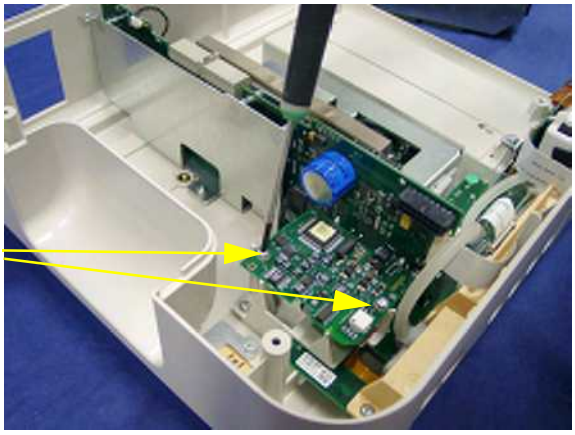
The procedure to replace the noninvasive blood pressure assembly is a reversal of the removal procedure.

Removing the SpO_2 Assembly

1 Remove the top cover assembly (see page 57).
The SpO_2 assembly is identified in the next picture.

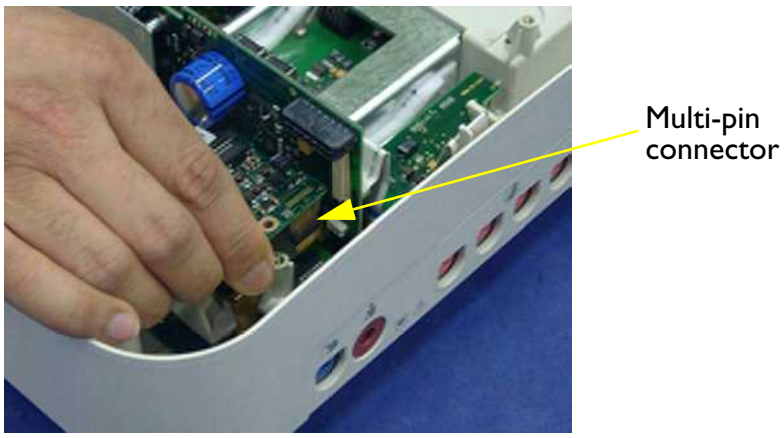


2 Remove the two screws holding the SpO_2 assembly.

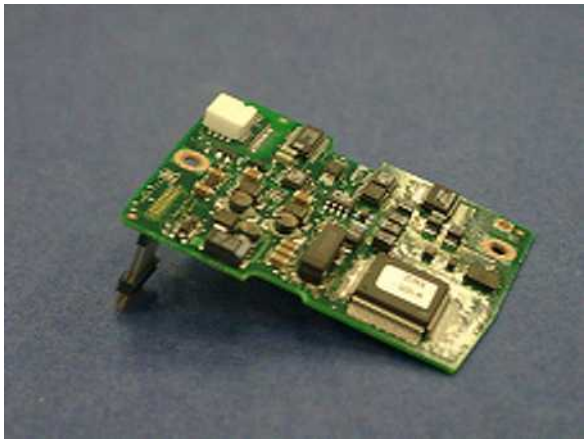


3 Remove the flat brown cable from the rear of the SpO_2 sensor socket.

4 Lift the side of the SpO_2 assembly nearest the SpO_2 socket, carefully disconnecting the multi-pin connector shown.



5 Remove the SpO_2 assembly.



Replacing the SpO_2 Assembly

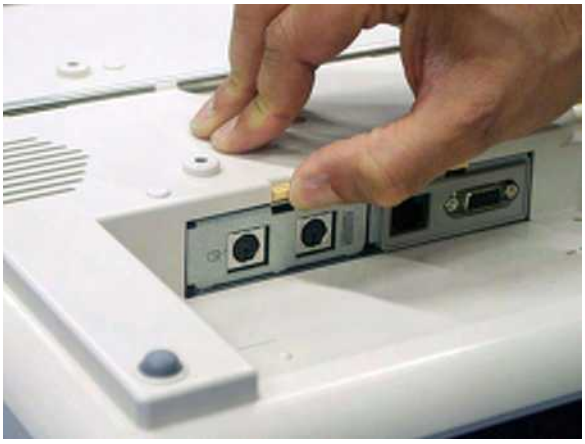
The procedure to replace the SpO2 assembly is a reversal of the removal procedure.

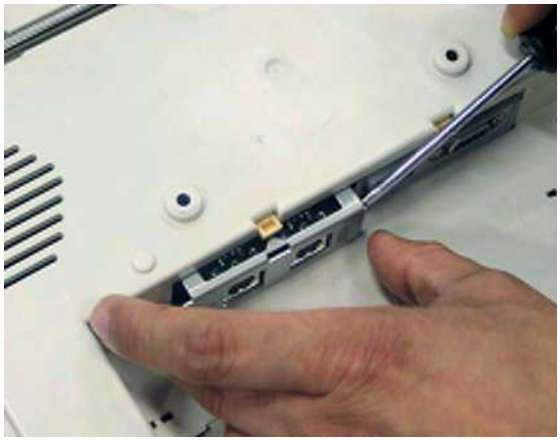
Removing the Interface Boards

The interface boards can be accessed from the underside of the monitor's housing.

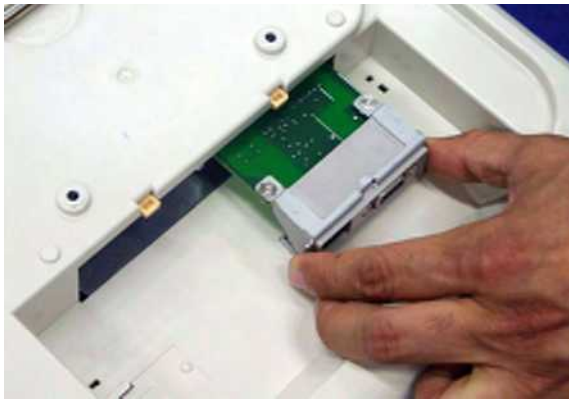
1 Turn the monitor upside down on a non-scratch surface.

2 Release the board by pressing the clip that keeps the board in place, as shown. Use a small flat-headed screwdriver to gently prise the board out if it is too tight to pull out with your fingers.





3 Pull the board out.

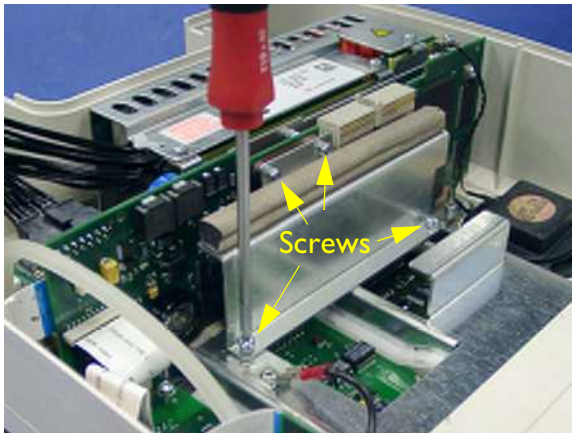


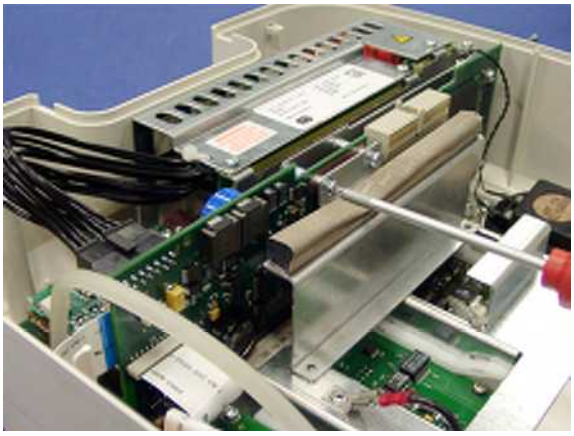
Removing the Main CPU Board

To remove the main CPU board, proceed as follows:

1 Remove the top cover assembly (see page 57).

2 Remove the screws holding the metal shield.





3 Remove the shield.

4 Disconnect the loudspeaker cable (1), the power supply cable (2), the bus master board cable (3), and the noninvasive blood pressure cable (4) from the main CPU board.

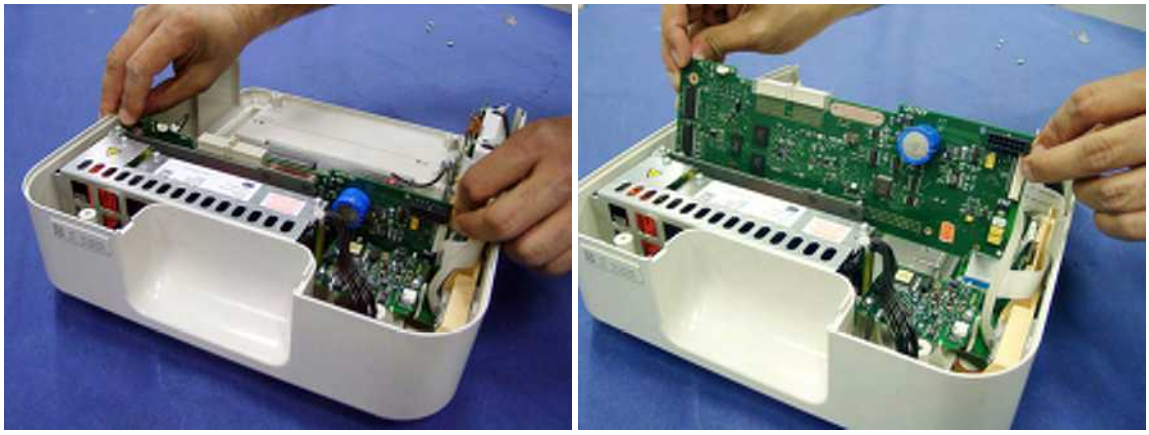

1


2


3


4

5 Remove the main CPU board by lifting it straight up.



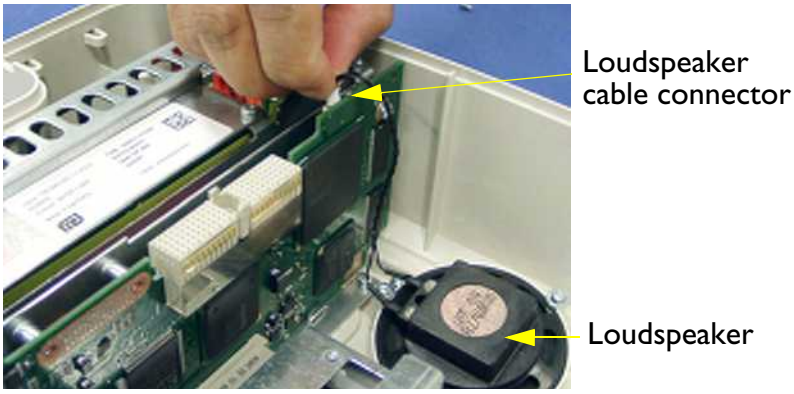
Replacing the Main CPU Board

The procedure to replace the main CPU board is a reversal of the removal procedure. Ensure all the cables are properly reconnected.

Exchanging the Loudspeaker

1 Remove the top cover assembly (see page 57).

2 Disconnect the loudspeaker cable connector from the main CPU board.



3 Remove the three screws holding the loudspeaker, and remove the loudspeaker.

4 Refit the loudspeaker, making sure to refit the o-ring gasket. If a new gasket is required, it is available as part of the bottom housing small parts kit. (See “Small Parts Kit - Bottom (M2703-64203)” on page 102.)

Exchanging the Transducer Cable

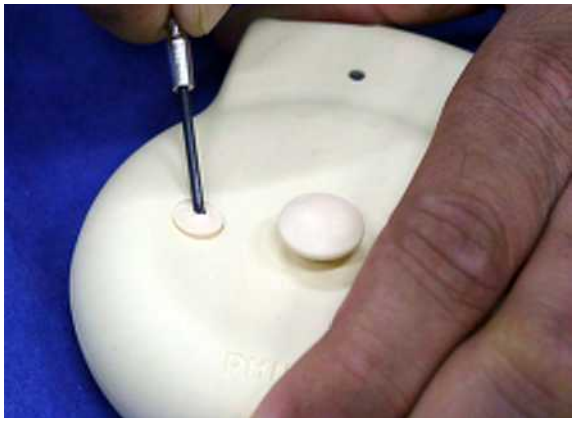
See the "Transducer Cable Assembly (M2735-64201)" on page 101 for items that come with the cable.

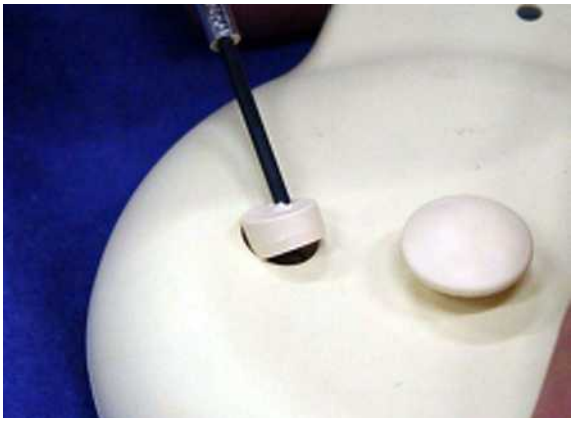
Important when fitting the screw covers! Do NOT remove the screw covers from the frame to which they are attached. Leave them in place, as it is the only way to align the screw covers correctly. They detach from the frame when you press them into position.

To exchange a transducer cable:

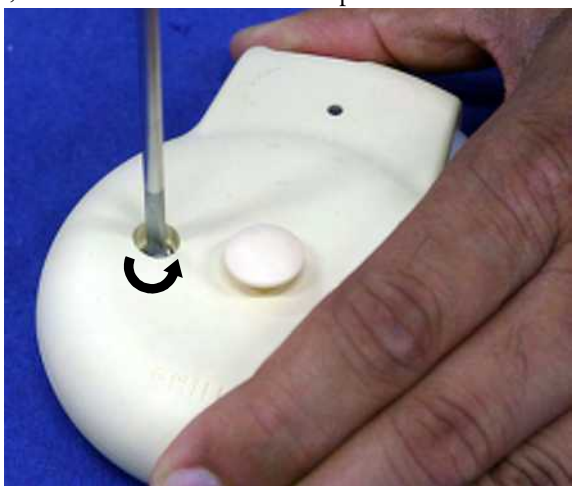
1 Pierce a screw cover with a small, flat-bladed screwdriver. **Important! Do NOT try to prise out a screw cover from the side, without piercing it, as this will damage the transducer top cover.**

1 Gently rock the screwdriver back and forth until the screw cover comes out. Repeat to remove all three screw covers

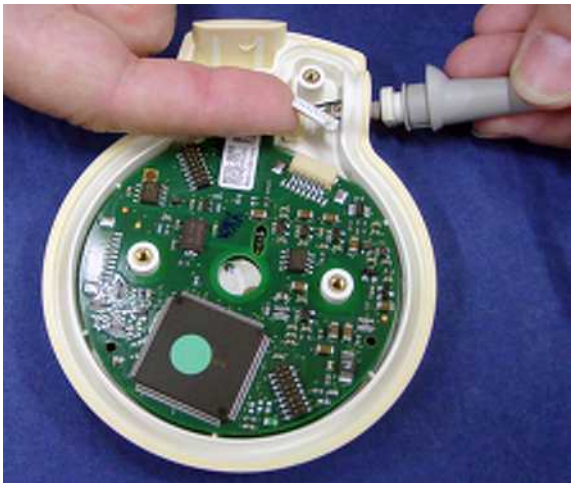




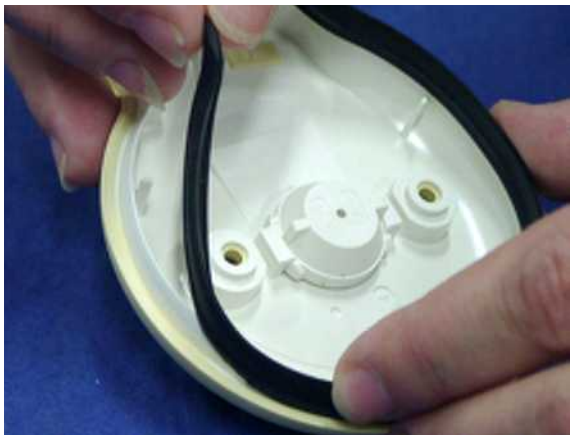
2 Remove the three screws, and remove the transducer top cover.



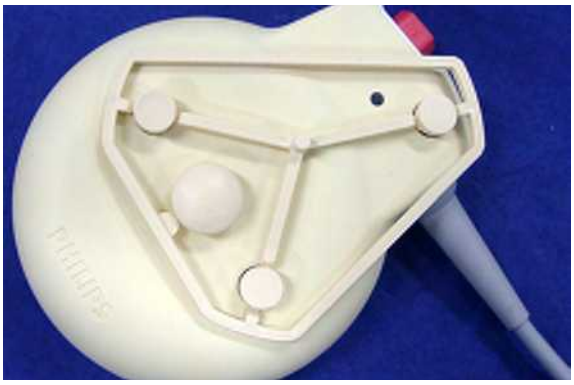
Disconnect the small cable connector, remove the old cable, and fit the new cable (as a reversal of the removal procedure).

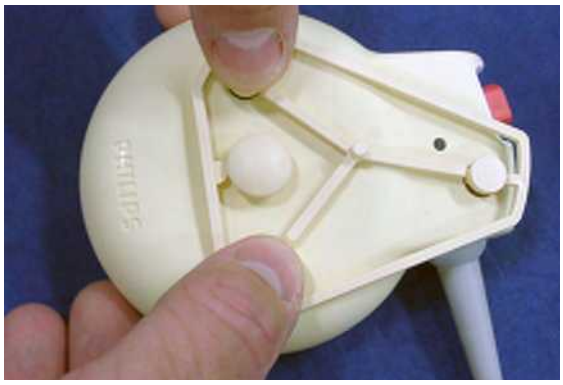


3 Remove the sealing gasket from the top cover, and replace it with the new one supplied with the cable. **While handling a Toco/Toco+ transducer, take care not to displace the strain gauge.** Fit a new gasket to the top cover, ensuring the gasket is properly seated, replace the top cover and secure it with the three screws.



4 Leaving the screw covers attached to the frame, carefully align the screw covers with the screw recesses in the top cover. Next, partially press in two of the covers at the same time, then press in the third one (they detach from the frame as you push them in). Then make sure all three covers are pushed completely into the recesses.



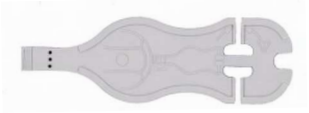


Exchanging the Transducer Belt Button

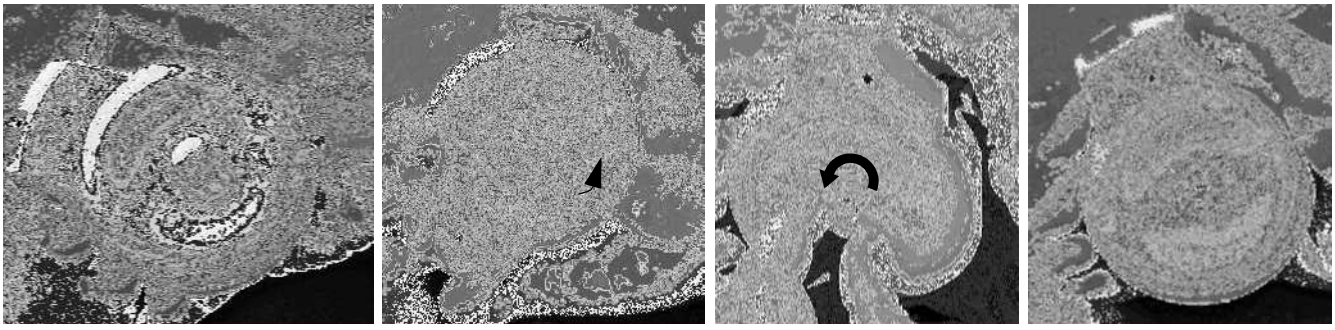
CAUTION NEVER immerse a transducer in liquid if the belt button has been removed, or is loose, broken or damaged.

M2703-64204
Replacement Belt Button Kit
Contents:

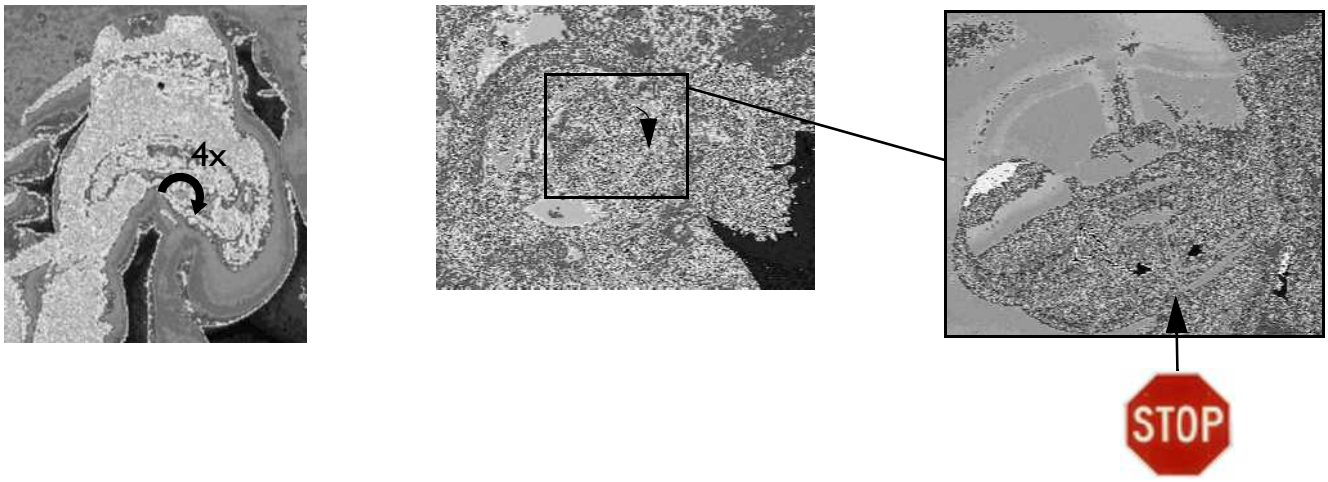
 x5

 x1

1 Remove the belt button using the tool provided with the belt button kit.

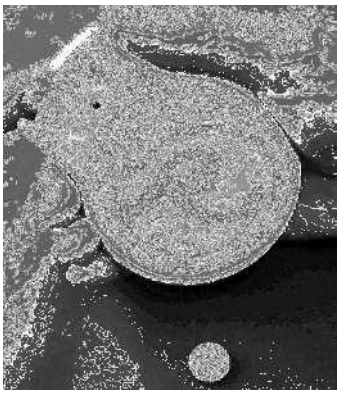
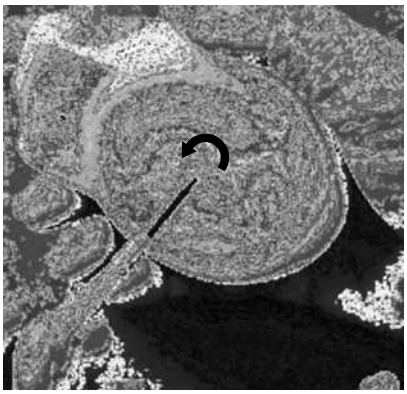
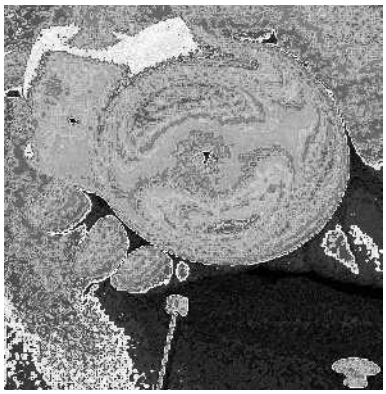


2 Dispose of the old belt button. Take a new belt button and fit it to the transducer. Initially, screw the button in by hand about four turns, then complete the job with the supplied tool. Stop applying force when the head of the tool makes contact with the body of the tool at the point indicated by the arrows.



If the belt button is broken: 

1 Remove the threaded part left in the top cover with a small, flat-bladed screwdriver (2.0-3.0 mm).

2 Then fit a belt button as described on page 92.

9

Parts

Spare parts, along with part numbers, are listed in the tables that follow.

Monitor

Description	New Part Number		Exchange Part Number		Qty
	Part No.	Alternative Identifier	Part No.	Alternative Identifier	
Cover, Connector Symbol without SpO_2 and Noninvasive Blood Pressure	M2703-44103	4512 610 10311	-	-	1
Cover, Noninvasive Blood Pressure Symbol	M2703-44105	4512 610 10321	-	-	1
Cover, all inc. SpO_2 and Noninvasive Blood Pressure Symbol	M2703-44106	4512 610 10331	-	-	1
Cover, Connector Text without SpO_2 and Noninvasive Blood Pressure	M2703-44113	4512 610 10341	-	-	1
Cover, Connector Noninvasive Blood Pressure Text	M2703-44115	4512 610 10351	-	-	1
Cover, Connector inc. SpO_2 and Noninvasive Blood Pressure Text	M2703-44116	4512 610 10361	-	-	1
Power Supply Assembly	M2703-60001	4512 610 07261	M2703-68001	4512 610 07271	1
Loudspeaker Assembly	M2703-60002	4512 610 10231	-	-	1
Paper Sensor Assembly	M2703-60003	4512 610 10411	-	-	1
Stepper Motor Assembly	M2703-60004	4512 610 10401	-	-	1
Bottom Housing Assembly	M2703-64101	4512 610 10221	-	-	1
Top Cover Housing	M2703-64102	4512 610 10391	-	-	1
Top Cover Assembly	M2703-60502	4512 610 11201	-	-	1
Display Assembly (see page 101 for assembly contents)	M2703-64503	4512 610 10441	M2703-68503	4512 610 11221	1

Description	New Part Number		Exchange Part Number		Qty
	Part No.	Alternative Identifier	Part No.	Alternative Identifier	
Noninvasive Blood Pressure Assembly	M2703-64502	4512 610 10271	M2703-68502	4512 610 10551	1
Housing Connector Noninvasive Blood Pressure	1253-8416	4512 610 10281	-	-	1
SpO_2 Board	M1020-66513	4512 610 10601	-	-	1
Housing Connector SpO_2	1253-8422	4512 610 10301	-	-	1
Paper Drawer Assembly	M2703-64651	4512 610 10431	-	-	1
Main CPU Board	M2703-66510	4512 610 11171	M2703-68510	4512 610 11181	1
Bus Master Board	M2703-66520	4512 610 11191	-	-	1
Socket Connector Block	1253-8415	4512 610 10261	-	-	1
Recorder Adapter Board	M2703-66530	4512 610 11211	-	-	1
Thermal Line Printhead	1810-2440	4512 610 10381	-	-	1
LAN / RS232 Interface Assembly	M2703-67501	4512 610 10531	-	-	1
Input Device Interface (2x PS/2)	M8086-67501	4512 610 10991	-	-	1
Lever Stop (pack of 5)	M2703-64205	4512 610 10521	-	-	1
M2703A Small Parts Kit - Top (see page 102 for kit contents)	M2703-64202	4512 610 10491	-	-	1
M2703A Small Parts Kit - Bottom (see page 102 for kit contents)	M2703-64203	4512 610 10501	-	-	1

Transducers

Description	New Part Number		Exchange Part Number		Qty
	Part No.	Alternative Identifier	Part No.	Alternative Identifier	
Toco Transducer	M2734-60501	4512 610 10451	M2734-68501	4512 610 11231	1
Toco+ Transducer	M2735-60501	4512 610 10461	M2735-68501	4512 610 11241	1
US Transducer	M2736-60501	4512 610 10471	M2736-68501	4512 610 11251	1
Cable Assembly (for all transducers; see page 101)	M2735-64201	4512 610 10481	-	-	1
Belt Button Kit, with tool, pack of 5, “Belt Button Kit (M2703-64204)” on page 102	M2703-64204	4512 610 10511	-	-	1

Patient Modules

Description	New Part Number		Exchange Part Number		Qty
	Part No.	Alternative Identifier	Part No.	Alternative Identifier	
ECG/IUP Patient Module	M2738-60501	4512 610 11261	M2738-68501	4512 610 11271	1
Remote Event Marker	-	9898 031 43411	-	-	1

Mounting Hardware

Description	Product Option Number	Part No.	Alternative Identifier	Qty
Flash Wall Mount for flat wall mounting)	M2740A #A01	M2740-64001	4512 610 09061	1
Mounting Arm with Tray	M2740A #A05	M2740-64002	4512 610 09071	1
Cart with fixed angle mount and two drawers	M2740A #C01	M2740-64003	4512 610 09081	1
Roll Stand with Tray	M2740A #R01	M2740-64005	4512 610 09101	1
Wall Channel required for mounting of wall mounts (options A01 and A05)	M2740A #R01	5061-8324	4512 610 09111	1

Assembly and Kit Contents

The tables in this section provide additional information by listing the contents of assemblies and kits.

Bottom Housing Assembly (M2703-64101)

Assembly Contents		
Sub-Assembly	**Contents**	**Qty**
Bottom Housing Assembly	Housing, Bottom	1
	Feet	1
Model/Serial Number Plate		1
Support Sub-Assembly	Support	1
	Pin, DIN 6325, 2.5 x 8	2
	Hinge Support	2
	Bracket	2
	Screw M3 x 6	4
	Catch, I/O Board	2
	Cable Holder	2
	Pin for Cable Holder	2
Main Chassis Sub-Assembly	Chassis, sheet metal	1
	Standoff, M3 x 18	2
	Standoff, M3 x 10	2
	Standoff, M3 x 6	2
	Press Nut, M3	2
	Clip, RFI	4
	Cover, Board Guide	1
	Guide, I/O mid upper	3
	Guide, I/O mid lower	3
	RFI-Clip	2
	Screw, Torx, with washer, M3 x 6	5
	Holder, Loudspeaker	1
	Screw, Loudspeaker Holder	2

Power Supply Assembly (M2703-60001)

Power Supply Assembly Contents	Qty
Power Supply Angle	1
Power Supply Frame	1
Nut, press in M3	3
Insulation	1
Screw with washer, M3 x 6	3

Top Cover Assembly (M2703-60052)

Top Cover Assembly Content		
Sub-Assembly	**Contents**	**Qty**
Top Cover Housing	See "Top Cover Housing (M2703-64102)" on page 100.	1
Recorder Chassis	Chassis, sheet metal	1
	Nut, press-in CLS-M3-0	1
	Pilot Pin TPS-3MM-10	1
Stepper Motor Assembly	See "Stepper Motor Assembly (M2703-60004)" on page 100.	1
Thermal Line Printhead (TLPH) Holder Assembly	TLPH Holder (sheet metal)	1
	Spacer, Center	1
	Spacer, Left	1
	Ball Bearing	2
	Screw with washer, Torx M3 x 6	2
Thermal Line Printhead (TLPH) Assembly		1
RFI Bracket	Bracket RFI (sheet metal)	1
	Nut, press-in CLS-M3-1	2
	Roller Distance	1
	Ball Bearing	1
	Screw with washer, Torx M3 x 6	2
Paper Sensor Assembly	See "Paper Sensor Assembly (M2703-60003)" on page 100.	1
Recorder Adapter Board		1

Top Cover Housing (M2703-64102)

Top Cover Housing Contents	Qty
Top Cover	1
Handle	1
Paper Drawer Runner	2
Runner End-stop (left)	1
Runner End-stop (right)	1
Screw, Torx M3 x 8	4
Leaf Spring	1
Label, Avalon FM20	1
Label, Avalon FM30	1

Stepper Motor Assembly (M2703-60004)

Stepper Motor Assembly Contents	Qty
Stepper Motor	1
Connector Housing	1
Connector Contact	1
Gearbox	1
Pinion	1

Paper Sensor Assembly (M2703-60003)

Paper Sensor Assembly Contents	Qty
Paper Sensor, including cable and connectors	1
Nut, press-in M3	1
Screw, Torx M3 x 6	1

Drawer Assembly (M2703-64651)

Drawer Assembly Contents	Qty
Paper Drawer Cover	1
Platen (including bearing, rod, pinion)	1
Platen Holder	1
Chassis Guide	1

Drawer Assembly Contents	Qty
Lever Stop	1
Latch	1

Display Assembly (M2703-64503)

Display Assembly Contents	Qty
Housing, Bottom	1
Housing, Top	1
Clamp	1
Pin	2
Display Holder, lefthand	1
Display Holder, righthand	1
Backlight Tube	2
Hinge	2
Chassis Guide	1
Cable Guide, rear	1
Board Holder	5
Stop Lever	1
Ribbon Cable	1
PCA Touch Control	1
Inverter Board	1
TFT Display Unit	1
Touchscreen	1
Gasket (1050 mm)	1

Transducer Cable Assembly (M2735-64201)

Cable Assembly Contents	Qty
Transducer Cable (for all fetal transducers)	1
Sealing Gasket	1
Screw Shoulder M2.5	3
Screw Cover (pack of 3)	1
Transducer Belt Button	1

Small Parts Kit - Top (M2735-64202)

Small Parts Kit (Top) Contents	Qty
Label, Avalon FM20	1
Label, Avalon FM30	1
Lever Stop	2
Cable Guide Front	1
Cable Guide Rear	1
Hinge	2
Pin	2
Belt Button (pack of 3)	1
Screw, Torx M3 x 4	5
Screw, Torx M3 x 6, with washer	10
Screw, Torx M3 x 8	5
Screw, 30 x 8	2

Small Parts Kit - Bottom (M2703-64203)

Small Parts Kit (Bottom) Contents	Qty
Loudspeaker Insulator (O-ring)	1
Noninvasive Blood Pressure Tube	1
Belt Clip	1
Belt Button (pack of 3)	1
Frame Connector Block	1
Flat Flexible Cable for Connector Block	2
Connector Interface SpO2 / Noninvasive Blood Pressure	1
Avalon Tool	1
Screw, Torx M3 x 4	5
Screw, Torx M3 x 6, with washer	10
Screw, Torx M3 x 12	5
Screw, 30 x 8	3

Belt Button Kit (M2703-64204)

Small Parts Kit (Bottom) Contents	Qty
Belt Buttons	5
Avalon Tool (for removing/replacing transducer belt buttons)	1

10

Upgrades

The software of the monitor and the transducers can be upgraded by a software download from a PC running the Support Tool. You connect the monitor to the PC via a LAN connection. You need:

- Industry standard PC
- Support Tool
- LAN / RS232 system interface
- LAN interface cable for the Support Tool

Several Avalon fetal monitors can be upgraded in parallel with the Support Tool. All monitors in an installation can be upgraded at once, if desired.

The transducers can be upgraded one at a time, even though more than one may be plugged into the monitor at the same time.

Refer to the *Support Tool Instructions for Use* for details of the upgrade procedure. Contact Philips Support for further details.

For tests to perform after upgrading, see “When to Perform Test Blocks” on page 24.

11

Understanding Configuration

This chapter, together with the Settings appendix, is for anyone making permanent changes to the configuration of an Avalon Fetal Monitor. You must understand English, be familiar with the monitor and its *Instructions for Use*, know how to make changes to measurements and settings in Monitoring Mode, and understand the clinical implications of any changes you make.

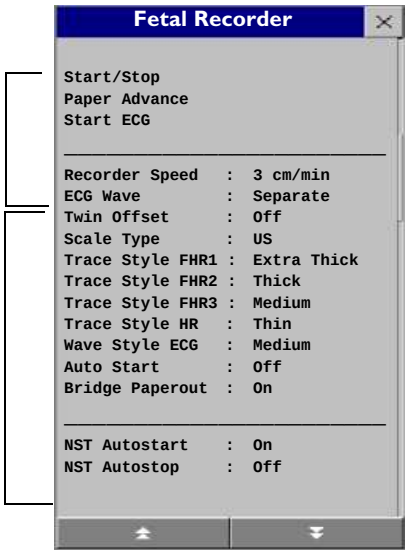
WARNING Changing the configuration may alter the way the monitor performs when monitoring patients. Do not change anything unless you are aware of the possible consequences, especially if you are monitoring a patient while in Configuration Mode.

What is Configuration Mode?

Configuration Mode is a password-protected operating mode that lets expert users make permanent changes to the monitor configuration. It is an extension of Monitoring Mode; it contains all of the settings available in Monitoring Mode plus the settings that are accessible only in Configuration Mode.

For example, the **Fetal Recorder** menu accessible in Monitoring Mode contains these settings (not in exact order).

In Configuration Mode you can change these additional settings.



Understanding Settings

You can change two main categories of settings in Configuration Mode: Global Settings, and the monitor and measurement settings stored in User Defaults. The monitor ships with preset configurations for Global Settings and the Factory Default settings that are suitable for common monitoring situations. This guide tells you how to develop your own configurations.

Active Settings are the current settings the monitor uses, including any adjustments made by the last user. Active Settings are not permanent, but are retained after a loss of mains power.

The User Defaults is a complete configuration of monitor and measurement settings blocks stored in the monitor's long-term memory. You can change individual settings and store them in the User Defaults. In other words, you can store the Active Settings, modified to your preference, in the User Defaults. Alternatively, you can load a complete configuration (taken from another monitor, for example) into the User Default from the Support Tool. The User Defaults is the user's preferred configuration, and these personalized settings can be restored by loading the User Defaults.

Following a patient discharge, or if the monitor was turned off for more than one minute, the User Defaults is automatically loaded if **`Automat. Default`** is set to **`Yes`**.

The Factory Default is a complete configuration predefined at the factory. The monitor is shipped with these settings. You cannot modify it. In Configuration mode, you can load the Factory Default as the Active Settings. You can use the Factory Default as the basis for producing your own User Defaults.

Global Settings are typically set once at monitor installation by service personnel and include settings such as **`Line Frequency`**, or **`QRS Type`**. Global settings are independent of the User Defaults, so when you load the Factory Defaults, Global Settings remain as they were. They can only be changed in Configuration Mode and are automatically stored to the monitor's permanent memory with each change. Global settings can be cloned.

Hardware Settings are typically set once at monitor installation by service personnel. Most hardware settings can only be changed in Service mode. Hardware settings include settings such as **`Keyboard`** layout, the configuration of the **`RS232`** interfaces, or the **`Intensity`** setting for the thermal printhead. Like Global settings, they are independent of the User Defaults, and any changes you make to the Hardware Settings configuration are automatically stored, there is no need to save them in an extra step. Unlike Global Settings, hardware settings must be entered for each monitor individually, because they **cannot be cloned.**

Entering and Leaving Configuration Mode

Only people authorized to do so by their institution should make changes in Configuration Mode. They require the Configuration password.

Switching between Monitoring and Configuration Mode does not affect the active settings. You can even continue to monitor patients while in Configuration Mode. The password for Configuration Mode is given in Chapter 1.

To enter Configuration Mode:

1 In the **`Main Setup`** menu, select **`Operating Modes`**.

2 Select **`Config`** and enter the password.

The monitor displays **`Config`** in the center of the Screen while you are in Configuration Mode.

Before you leave Configuration Mode, always be sure to store any changes you made. You must store the changes you made in the User Default.

To leave Configuration Mode either:

- In the **Main Setup** menu, select **Operating Modes** and then select the operating mode you require or
- Switch the monitor off, then switch it on again.
  - If you switch the monitor off and then on again after less than one minute, it returns in Monitoring Mode with the same settings ("hotstart").
  - If you leave the monitor switched off for more than one minute, the User Default is loaded when you switch back on if **Automat. Default** is set to **Yes**.

Storing Changes in the User Defaults

You can load a complete configuration for the monitor via the Support Tool, or you can change individual settings within the Active Settings. The monitor remembers any changes made when you switch between Monitoring Mode and Configuration Mode. The changes made in Configuration Mode can be stored permanently in the User Defaults.

1 Make the changes to the individual measurements or monitor settings.

2 Select the **Defaults** SmartKey  .

3 Select **Store Defaults** from the pop-up keys at the bottom of the screen.

Load Defaults	Store Defaults		Factory Default

4 Select Confirm to store the settings in the User Default.

To store the current settings as user defaults select Confirm	Confirm	Cancel

Be aware that if you don't store changes they will be reset to the monitor's stored configuration when you:

- change from Configuration or Monitoring Mode to Service or Demonstration Mode.
- switch off the monitor for more than one minute and **Automat. Default** is set to **Yes**.

Loading the Factory Default

Load the Factory Default to restore the Active Settings to those that were set at the factory and shipped with the monitor. You may want to do this to fall back to a known, reliable configuration, or you may want to use the default settings as a basis for making your own customized settings that you would save as the User Defaults.

To load the Factory Defaults:

1 Select the **Defaults** SmartKey  .

2 Select **Factory Default** from the pop-up keys at the bottom of the screen.

Load Defaults	Store Defaults		Factory Default

3 Select Confirm to load the settings stored in the User Defaults.

To reset the current settings to the factory defaults select Confirm	Confirm	Cancel

When you load the Factory Default, note that:

- Global Settings are not reset.
- Hardware Settings are not reset.
- Paper **Scale Type** and **Recorder Speed** settings are not reset. These are globally applicable values, although they are not part of the Global Settings as such.
- If the **NBP Sys/Dia Only** setting in the User Interface menu was originally set to **Yes** in the initial configuration provided by the factory, this will be reset to **No**. Remember to change the setting back to **Yes** if necessary.

Loading the User Defaults

Load the User Defaults to restore the Active Settings to the stored customized settings:

1 Select the **Defaults** SmartKey  .

2 Select **Load Defaults** from the pop-up keys at the bottom of the screen.

Load Defaults	Store Defaults		Factory Default

3 Select Confirm to load the settings stored in the User Defaults.

To reload the user default settings select Confirm	Confirm	Cancel

When you load the User Defaults, note that:

- Global Settings are not reset.
- Hardware Settings are not reset.

Loading Configurations Using the Support Tool

Use of the Support Tool is restricted to technical personnel who have been trained in its use by Philips.

Using the Support Tool you can clone multiple monitor configurations and store the configuration file in a format that can be e-mailed.

The Support Tool lets you make a backup of your configuration and any changes you make. See the Support Tool *Instructions for Use* for details about storing, cloning, and maintaining your configurations.

If you make a lot of configuration changes to monitors throughout your institution, you are strongly advised to acquire the Support Tool so that you can backup this work and restore configurations if necessary.

About Configuration Files (.cfg)

Each.cfg file contains all the settings saved in a configuration. These are complete configurations including all measurement and monitor settings. Files of the format.cfg can only be read and modified using the Support Tool. A checksum protects the contents of the configuration files, checking for example whether files were corrupted during e-mail transfer. Corrupted files will be rejected by the Support Tool.

There are two kinds of configurations:

- **initial configurations** are configurations provided by the factory. Each initial configuration supports all languages that the monitor is currently shipped with. Initial configuration files cannot be modified using the Support Tool. When an initial configuration is cloned to a monitor, the configuration is automatically adjusted to incorporate some monitor-specific attributes, for example, the language and product options. Cloning this configuration from the monitor back to the Support Tool changes it to a single-language user configuration that can then be modified using the Support Tool.
- **user configurations** are configurations that can be edited, deleted, or added to using the Support Tool. They can either be copied from a monitor or from a configuration stored with the Support Tool files on your computer. As user configurations are language dependent, always use a configuration taken from a monitor with the correct language. If you clone a user configuration to a monitor with a different language, all user adjustable texts are reset to factory defaults the first time you switch the monitor on.

Selecting the Correct Configuration

When cloning configurations, always use a configuration designed for the target device, and with the same options for application area (Hxx Option) and number of waves (Axx Option).

This is an example of an Avalon configuration file:
`H70 A01, SVGA, FM20-30, initial, C.00.xx, Rev 001.cfg`

The name of a configuration file consists of codes to identify, where appropriate:

- the **`Hxx`** (application area) option and **`Axx`** (wave number) it is optimized for,
- the resolution of the majority of Screens supplied with the config file.
- the monitor model (**`FM20 and MP30`** in our example) that the config file is optimized for.
- the word "**`initial`**" to mark an initial configuration provided by the factory.
- the software revision of the product it is optimized for (**`C.00.xx`** in our example). The letter "x" is a placeholder for any number from 0 to 9.
- the revision code (**`Rev 001`** in our example) used to track changes during the configuration creation process (only the latest revision is bundled with the tool).

12

Configuration Settings Appendix

The monitor is pre-configured with factory defaults settings when it is shipped. This section documents these factory default configuration settings. If you change the User Defaults, this document will no longer reflect your configuration, so you must note any changes you make in the editable version of this appendix provided on the documentation CD-ROM. The initial configuration of your monitor may vary slightly depending on your geography and on the options purchased.

In most cases, there is one set of factory default settings listed in the tables under "Factory Defaults". Where there is more than one set of defaults (due to geography-specific options, for example), these are noted in the tables. The tables contain a blank section called "User Defaults", where you can document your preferred, customized settings saved to the User Defaults.

Documenting Monitor Configurations

To help you document your monitor's configuration, the configuration tables from this appendix are also provided as a Word document on the documentation CD-ROM supplied with the monitor. To document the configurations you create, edit this document using a word-processing program to reflect the configuration and then save it under an appropriate name.

As Philips cannot take responsibility for changes made to this document in the *.doc format, you must only use the.pdf version of this appendix as a reference for the initial configuration settings supplied with the monitor.

The configuration implications are only provided in the.pdf version of this appendix. You must read this document before you modify monitor configurations.

Using the Configuration Tables

The "breadcrumb trail" at the top of each table indicates the path you should follow to access the settings in the table: in this example, to configure the fetal recorder settings, in the **`Main Setup`** menu, select **`Measurements`** and then select **`Fetal Recorder`**.

Configuration Table Example

This is a (shortened) example of a configuration table, as you will find it in the following sections of this manual.

Item Name	Factory Defaults	Choice	User Defaults
Recorder Speed	3 cm/min	1, 2, 3 cm/min	
Scale Type	Geography-specific	US (scale = 30-240) Europe (scale = 50-240)	
Trace Style FHR1	Extra Thick	Thin, Medium, Thick, Extra Thick	
Trace Style FHR2	Thick		
Trace Style FHR3	Medium		
Trace Style HR	Thin		
Wave Style ECG	Thin		
ECG Wave	Separate	Separate, Overlap	
Auto Start	Off	Off, On	

Item Name The leftmost column in each table lists the individual configuration items. These items correspond to the menu items in the relevant setup menu in the monitor.

Factory Defaults This section deals with the factory default settings for each configuration item. Factory defaults may be different for different H (application area) options. If this is the case, a note is made in the table.

Choice This lists the possible choices for the settings you can configure.

User Defaults In each table, columns are left blank for you to enter the settings you change.

NOTE You cannot print out the configuration from the monitor: these tables are your only documentation of the configuration you implement for each monitor. We strongly recommend that you always write down any changes you make and keep this record safely.

Understanding Configuration Implications

When you permanently change any element of the configuration, you must consider the effect of the new configuration on both patient and application behavior. For more information on the context of the configuration settings, see the monitor *Instructions for Use*. Always ensure that the monitor users are aware of the configuration settings.

Measurement-Related Settings

This section lists all the measurement-related settings. They define how the monitor measures patient data. Document the settings you configure in the empty columns.

Read any information on Configuration Implications at the end of the sections before you make any configuration changes.

Color Configuration

The color setting for each measurement defines the color for its numeric (and wave, if applicable). The color setting for Pulse is taken from the active pulse source. The choice for color is: **Red, Green, Yellow, Blue, magenta, Cyan, White, Pink, Orange, Light Green, Light Red**

Configuring FHR (Ultrasound)

Main Setup --> Measurements --> FHR(1/2/3)

Item Name	Factory Defaults	Choice	User Defaults
US Volume	6	0..10	
High Limit	150 bpm	70..210 bpm, in 10 bpm steps	
Low Limit	110 bpm	60..200 bpm, in 10 bpm steps	
FHR Alarms	On	Off, On	
FHR	On	Off, On	
Fetal Movement	On	Off, On	
High Delay	60 sec	10..300 sec, in 10 second steps	
Low Delay	60 sec	10..300 sec, in 10 second steps	
SignalLoss Delay	60 sec	10..300 sec, in 10 second steps	
Color	Orange	See “Color Configuration” on page 115	

FHR Configuration Implications

High Limit/Low Limit All FHRs share the same alarm limits, and can be set from any FHR channel.

FHR Alarms This lets you switch **On** FHR alarms. Your monitor must be configured to alarm mode **All** to enable the FHR alarms.

Fetal Movement Fetal movement profile can be enabled from any FHR channel, even though the fetal movement detection itself only applies to FHR1.

Configuring Toco

Main Setup --> Measurements --> Toco

Item Name	Factory Defaults	Choice	User Defaults
Toco Gain	100%	50%, 100%	
Toco	On	Off, On	
Color	Green	See "Color Configuration" on page 115	

Configuring IUP

Main Setup --> Measurements --> IUP

Item Name	Factory Defaults	Choice	User Defaults
IUP Unit	mmHg	mmHg, kPa	
IUP	On	Off, On	
Color	Green	See "Color Configuration" on page 115	

Configuring DFHR (DECG)

Main Setup --> Measurements --> DFHR

Item Name	Factory Defaults	Choice	User Defaults
High Limit	150 bpm	70..210 bpm, in 10 bpm steps	
Low Limit	110 bpm	60..200 bpm, in 10 bpm steps	
FHR Alarms	On	Off, On	
FHR	On	Off, On	
Arrhythmia	On	Off, On	
High Delay	60 sec	10..300 sec, in 10 second steps	
Low Delay	60 sec	10..300 sec, in 10 second steps	
SignalLoss Delay	60 sec	10..300 sec, in 10 second steps	
Color	Orange	See "Color Configuration" on page 115	

DFHR Configuration Implications

Your monitor must be configured to alarm mode **All** to enable the FHR alarms.

High Limit/Low Limit All FHRs, including DECG, share the same alarm limits, and can be set from any FHR channel.

FHR Alarms This lets you switch **On** FHR alarms.

Arrhythmia This lets you switch artifact suppression **On** (artifacts are suppressed) and **Off** (no artifact suppression: use this setting if you suspect fetal arrhythmia).

Configuring MHR (ECG)

Main Setup --> Measurements --> ECG

Item Name	Factory Defaults	Choice	User Defaults
High Limit	120 bpm	31..300 bpm in steps of 1 bpm (31 to 40 bpm) in steps of 5 bpm (40 to 300 bpm)	
Low Limit	50 bpm	30..295 bpm in steps of 1 bpm (30 to 40 bpm) in steps of 5 bpm (40 to 295)	
Alarms	On	Off, On	
MECG	On	Off, On	
QRS Volume	1	0..10	
Δ ExtrTachy	20 bpm	0..50 bpm, in steps of 5 bpm	
Tachy Clamp	200 bpm	150..240 bpm, in steps of 5 bpm	
Δ ExtrBrady	20 bpm	0..50 bpm, in steps of 5 bpm	
Brady Clamp	40 bpm	30..100 bpm, in steps of 5 bpm	
Color	Red	See “Color Configuration” on page 115	

ECG Configuration Implications

Your monitor must be configured to alarm mode **All** to enable the MHR alarms.

High Limit/Low Limit MHR (MECG) and Pulse share the same alarm limits. These alarm limits apply to the current alarm source, either HR or Pulse. Note that if you change the High/Low alarm limits in the Setup ECG menu, this will also change the High/Low alarm limits in the Setup Pulse menu and vice versa.

MHR Alarms This lets you switch **Off** MHR alarms. If you change the **Alarms** setting in the Setup ECG menu, this will also change the **Alarms** setting in the Setup Pulse menu and vice versa.

Δ ExtrTachy, Δ ExtrBrady Extreme bradycardia and extreme tachycardia alarms are based on the HR/Pulse limit alarms. In Configuration Mode, you use the **Δ ExtrTachy** and **Δ ExtrBrady** setting to define the difference between the heart rate limit and the extreme limit. For example, if the heart rate high limit is 120 bpm and the difference is 20 bpm then the extreme tachycardia limit is 140. HR and Pulse share the same alarm limits. The **Δ ExtrTachy** and **Δ ExtrBrady** settings apply to the current alarm source, either HR or Pulse. If you change the **Δ ExtrTachy** or **Δ ExtrBrady** setting in the Setup ECG menu, this will also change the **Δ ExtrTachy** or **Δ ExtrBrady** setting in the Setup Pulse menu and vice versa.

Tachy Clamp, Brady Clamp The Brady and Tachy clamp allows you to configure a safety threshold for the extreme bradycardia and tachycardia alarm limits. For example, if the low heart rate limit is 50 bpm and the **Δ ExtrBrady** setting is 20 bpm (50 bpm - 20 bpm = 30) with a Brady clamp set at 40, the resulting extreme bradycardia limit would be 40 bpm (instead of 30 bpm). If the clinician sets the HR alarm limit above or below the limit clamps for an individual patient, the limit clamps become the extreme brady or extreme tachy alarm (these are red alarms). Be sure to set the clamps beyond the configured HR limits.
HR and Pulse share the same alarm limits. The Tachy **Clamp** and **Brady Clamp** settings apply to the current alarm source, either HR or Pulse. If you change the **Tachy Clamp** or **Brady Clamp** setting in the Setup ECG menu, this will also change the **Tachy Clamp** or **Brady Clamp** setting in the Setup Pulse menu and vice versa.

Alarms Off Note that changing the **Alarms Off** setting in the Setup ECG menu also changes the **Alarms Off** setting in the Setup Pulse menu and vice versa.

Configuring Pulse

Main Setup --> Measurements --> Pulse

Item Name	Factory Defaults	Choice	User Defaults
High Limit	120	31..300 bpm in steps of 1 bpm (31 to 40 bpm) in steps of 5 bpm (40 to 300 bpm)	
Low Limit	50	30..295 bpm in steps of 1 bpm (30 to 40 bpm) in steps of 5 bpm (40 to 295)	
Alarms	On	Off, On	
Pulse	On	Off, On	
Δ ExtrTachy	20 bpm	0..50 bpm, in 5 bpm steps	
Tachy Clamp	200 bpm	150..240 bpm, in steps of 5 bpm	
Δ ExtrBrady	20 bpm	0..50 bpm, in 5 bpm steps	
Brady Clamp	40 bpm	30..100 bpm, in steps of 5 bpm	

Configuring SpO_2

Main Setup --> Measurements --> SpO_2

Item Name	Factory Defaults	Choice	User Defaults
High Limit	100	51..100 bpm, in 1 bpm steps	
Low Limit	90	50..99 bpm, in 1 bpm steps	
Desat Limit	80	50..99 bpm, in 1 bpm steps	
Alarms	On	Off, On	
SpO_2	On	Off, On	
QRS Volume	1	0..10	
Tone Modulation	Yes	Yes, No	
Tone Mod. Type	Enhanced	Enhanced, Standard	
Average	10 sec	20, 10, 5 sec	
High Alarm Delay	10 sec	0..30 sec, in 1 second steps	
Low Alarm Delay	10 sec	0..30 sec, in 1 second steps	
Desat Alarm Delay	20 sec	0..30 sec, in 1 second steps	
NBP Alarm Suppr.	On	Off, On	
Color	Cyan	See "Color Configuration" on page 115	

SpO_2 Configuration Implications

SpO_2 The **On/Off** state of the SpO_2 measurement cannot be preconfigured. SpO_2 is automatically switched **On** when an SpO_2 sensor is connected to the monitor.

Average The SpO_2 numeric represents an average value calculated from the sum of SpO_2 values measured during the averaging time. **Average** lets you adjust the averaging time between **5**, **10**, and **20** seconds.

High/Low/Desat Alarm Delay The alarm delay defines the amount of time that the averaged SpO_2 value needs to be above or below the corresponding alarm limits before an alarm is activated.

NBP Alarm Suppr. Set **NBP Alarm Suppr.** to **On** to suppress INOPs that would otherwise be generated when you measure NBP on the same limb as SpO_2. If **NBP Alarm Suppr.** is configured to **On**, the monitor automatically remembers the SpO_2 value measured before cuff inflation and suppresses any SpO_2 INOPs while the cuff is inflated.

Configuring Noninvasive Blood Pressure (NBP)

Main Setup --> Measurements --> NBP

Item Name	Factory Defaults	Choice	User Defaults
Pulse(NBP)	On	Off, On	
Alarms from	Systolic	Sys., Dia., Mean, Sys & Dia, Dia & Mean, Sys & Mean, Sys&Dia&Mean	
Sys. High	160	95..270 mmHg	
Sys. Low	90	30..155 mmHg	
Alarms	On	Off, On	
NBP	On	Off, On	
Repetition Time	15 min	1, 2, 2.5, 3, 5, 10, 15, 20, 30, 45, 60, 120 min	
Auto/Manual	Manual	Auto/Manual	
Unit	mmHg	mmHg, kPa	
Done Tone	Off	Off, On	
Start Time	Synchronized	Synchronized, NotSynchron.	
VP Pressure	60 mmHg	20..120 mmHg in 5 mmHg steps	
Reference	Auscultatory	Auscultatory, Invasive	
NBP Time	Meas Time	Meas Time, Next Meas	
Color	Red	See “Color Configuration” on page 115	
Closevalves[1]	Off	Off, On	

1.Service Mode only.

NBP Configuration Implications

Start Time If you set **Start Time** to **Synchronized**, the monitor will time the second measurement in a series to coincide with the next easy-to-document time. For example, if you start the first measurement at 08:23, and the **Repetition Time** is set to 10 minutes, the monitor will automatically perform the next measurement at 8:30, then 8:40 and so on.

Done Tone Set **Done Tone** to **On** if you want to hear a short prompt tone at completion of each NBP measurement.

VP Pressure This setting determines the cuff pressure used during a Veni Puncture inflation. The cuff deflates automatically after a set time (170 seconds) if it is not manually deflated beforehand.

Reference The NBP measurement reference method can be **Auscultatory** or **Invasive**. **Invasive** delivers NBP values that very closely approximate values measured intra-arterially. **Auscultatory** delivers NBP values that very closely approximate values measured using the manual cuff method. The two references can exhibit a difference of 20 to 30 mmHg in patients with elevated pressures, with the auscultatory reference registering the lower values.

Monitor-Related Settings

This section lists all the monitor-related settings (anything other than measurements). Read any information on Configuration Implications at the end of the relevant tables before you make any configuration changes.

Configuring Alarms

Main Setup --> Alarms --> Alarm Settings

Item Name	Factory Defaults	Choice	User Defaults
Alarm Volume	5	0..10	
Alarms Off	3 min	1, 2, 3 min, infinite	
Visual Latching	Red&Yell	Red&Yell, Red Only, Off	
Audible Latching	Red&Yell	Red&Yell, Red Only, Off	
Alarm Sounds	Traditional	Traditional, ISO	
Alarm Low	4	0..10	
Alarm Text	Standard	Standard, Extended	
Alarm Mode	INOP Only	All, INOP Only	

Alarm Settings Configuration Implications

Alarm Volume Use this setting to define the base volume of the red and yellow audible alarm indicators and the INOP tones.

Alarms Off Use this setting to determine how long the monitor's alarm capabilities will be switched off when the user selects the **Alarms Off** or **Pause Alarms** key. Possible choices are: **1min**, **2min**, **3min**, **Infinite**. Be aware that if you configure **Alarms Off** to **Infinite**, all of the monitor's alarming capabilities will be permanently switched off when the user selects the **Alarms Off** key.

Alarm Low Use this setting to define a minimum value for the alarm volume. The alarm volume cannot be set lower than this value.

Alarm Sounds Use this setting to change the alarm sound of the monitor to suit the alarm standards valid in your hospital.

- **Traditional**: The traditional ("Carenet") sounds used in previous HP/Agilent/Philips patient monitor generations.
- **ISO**: A new set of alarm sounds that complies with the ISO/IEC Standard 9703-2.

Alarm Text Use this setting to define how alarm messages are presented on the monitor screen:

- **Standard**: Alarm texts are displayed in text form, for example ** **FHR1 LOW**
- **Extended**: Alarm texts are displayed as numeric values, for example, ** **FHR1 94 < 110**, where the second number shows the current alarm limit, and the first number shows the maximum amount by which this limit was exceeded.

Alarm Mode There are possible alarm modes for the monitor:

- **All**: Patient alarms and INOPs are enabled, with all audible and visual indicators active.

– **INOP only**: Only INOPs are enabled, with audible and visual indication active. This the default alarm mode. Note that in **INOP only** mode, no patient alarms are enabled or indicated. No alarm limits or alarm off icons are displayed. No patient alarm settings are available in the setup menus.

Configuring the NST Timer

Timer configuration settings are **unique settings**. They are the same in every Profile and they are automatically included in each Monitor Settings Block when you store them.

Main Setup --> NST

Item Name	Factory Default	Choice	User Default
Run Time	20 min	10..60 minutes, in increments of 5 minutes	
Notification	Sound	Alarm, Sound, No Sound	
Timer Volume	4	0..10	

NST Timer Configuration Implications

Run Time The run time can be set between 10 and 60 minutes.

Notification When the NST timer expires, its color changes from blue to green, and a message appears in the monitor status line on the Main Screen. The setting **Notification** lets you configure an alarm or a single tone as additional means of notification:

- Select **Alarm** to receive an INOP alarm when the timer expires.
- Select **Sound** to hear a single tone when the timer expires.
- Select **No Sound** for no additional notification.

Configuring Fetal Recorder Settings

Main Setup --> Fetal Recorder

Item Name	Factory Defaults	Choice	User Defaults
Recorder Speed	3 cm/min	1, 2, 3 cm/min	
Scale Type	Geography-specific	US (scale = 30-240) Europe (scale = 50-240)	
Trace Style FHR1	Extra Thick	Thin, Medium, Thick, Extra Thick	
Trace Style FHR2	Thick		
Trace Style FHR3	Medium		
Trace Style Toco	Thick		
Trace Style HR	Thin		
Wave Style ECG	Thin		
ECG Wave	Separate	Separate, Overlap	
Auto Start	Off	Off, On	
Bridge Paperout	On	Off, On	

Item Name	Factory Defaults	Choice	User Defaults
NST Autostart	On	Off, On	
NST Autostop	Off	Off, On	
Twin Offset	Off	Off, On	
Cal. Offset[1]	Calibrated at factory	0=right, 11=left	
Intensity[1]	3	1..5	

1.Can be changed in Service Mode only

Recorder Configuration Implications

`Scale Type` The initial setting depends on the geography-specific factory configuration, in conjunction with Line Frequency. The recorder speed and paper scale type settings are not reset when the Factory Default is reloaded. They are globally applicable values, although they are not part of the Global Settings as such.

`Cal. Offset` To find the correct setting, connect a resting Toco transducer (one that is not under any load) to the monitor and then change the offset setting until the trace is recording 20 units on the paper. Due to the delay between changing the offset setting and seeing the change on the paper, you may have to repeat this procedure to set the offset.

Configuring User Interface Settings

`Main Setup --> User Interface`

Item Name	Factory Defaults	Choice	User Defaults
QRS Volume	1	0..10	
QRS Low	0	0..10	
QRS Type[1]	QRS Tone	QRS Tone, QRS Type	
Prompt Volume	8	0..10	
Tone Modulation	Yes	Yes, No	
Tone Mod. Type	Enhanced	Standard, Enhanced	
Global Speed	25mm/s	6.25, 12.5, 25, 50 mm/sec	
Touch ToneVolume	1	0..10	
Timer Volume	4	0..10	
Brightness	Optimum	1..10, Optimum	
Standby Brightness	Optimum	1..10, Optimum	
Display Units	No	Yes, No	
Alarm Limits	Yes	Yes, No	
NBP Time	Meas Time	Meas Time, Next Meas	
NBP Sys/Dia Only	No	Yes, No	
Wave Line Style	Thin	Thin, Medium, Thick, Extra Thick	

1.This setting can also be changed in Global settings.

User Interface Configuration Implications

QRS Volume Sets the default volume of the QRS tone.

QRS Low Defines the minimum QRS tone volume that can be selected by the user while in Monitoring Mode.

QRS Type Select **QRS Tone** or **QRS Tick**. If **Tone Modulation** is set to **Yes**, the **QRS Type** automatically switches to **QRS Tone**.

Prompt Volume Defines the volume of the tone the monitor emits to draw the user's attention to a prompt message shown in the monitor's prompt/status line.

Tone Modulation if you set **Tone Modulation** to **Yes**, the pitch of the SpO_2 tone will change with the measured SpO_2 level.

Tone Modulation Type This setting lets you choose between **Standard** and **Enhanced**. **Standard** is the regular Nellcor behavior. **Enhanced** results in a larger (and therefore more obvious) frequency decrease for each drop in SpO_2 level.

Global Speed The **Global Speed** setting defines the speed of ECG waves on the screen.

Touch Tone Volume The **Touch Tone Volume** setting defines the volume of the tone you hear every time you select a field on the monitor screen. You may want to set this to 0 if you want to operate the monitor in a quiet environment.

Timer Volume determines the volume of the notification tone for the NST timer.

Brightness Defines the default brightness for monitoring.

Standby Brightness Lets you choose a brightness setting for when the monitor is in Standby.

Wave Line Style This setting lets you configure the thickness of all waves on the screen. For better visibility over a distance you might want to use **Medium** or **Thick**. The choices are: **Thin**, **Medium**, **Thick**, **Extra Thick**.

Alarm Limits If **Alarm Limits** is set to **Yes**, the alarm limits are displayed next to the measurement numerics.

NBP Time If **NBP Time** is set to **Meas Time**, the time shown beside the NBP numeric will show the timestamp of the most recent NBP measurement. If set to **Next Meas**, and NBP mode is set to Auto, and the time until the next automatic measurement is shown.

NBP Sys/Dia Only If the **NBP Sys/Dia Only** setting in the User Interface menu was originally set to **Yes** in the User Defaults and you load the Factory Default, this will be reset to **No**. Remember to change the setting back to **Yes** if necessary.

Hardware Settings

This section lists all the Hardware settings. These settings are set once per monitor. Any changes you make to the Hardware Settings configuration are automatically stored, there is no need to save them in an extra step. Hardware settings must be entered for each monitor individually, they are stored in the monitor, and they are **not cloned**.

Document the settings you configure in the empty column.

Main Setup - -> **Hardware**

Item Name	Factory Default	User Defaults
Calibrate Touch	n/a	
Keyboard[1]	US	
MIB/RS232[1]	n/a	

1.Service mode only.

Keyboard This setting is available in **Service Mode only** and allows technical personnel to select the language of the keyboard that is connected to the P/S2 interface connector.

MIB/RS232 Reserved for future use.

Global Settings

This section lists all the Global Settings. Global Settings are set once per monitor and are independent of the User Defaults. Any changes you may configure are automatically stored, there is no need to save them.

Document the settings you configure in the empty column of the table below.

Read any information on Configuration Implications at the end of the sections before you make any configuration changes.

Main Setup - -> **Global Settings**

Item Name	Factory Defaults	Choice	User Defaults
Line Frequency	Geography-specific	50 Hz, 60 Hz	
QRS Type	QRS Tone	QRS Tone (most countries) QRS Tick (Japan)	
Automat. Default	Yes	Yes, No	

Global Settings Configuration Implications

Line Frequency Use the **Line Frequency** setting to configure the correct line frequency for the AC Power, either 50 Hz or 60 Hz. If the Line Frequency is incorrectly set, this may affect the ECG signal quality.

QRS Type Select **QRS Tone** or **QRS Tick**. If **Tone Modulation** is set to **Yes**, the **QRS Type** automatically switches to **QRS Tone**.

Automat. Default

– If **Automat. Default** is set to **Yes**, and the monitor is switched off for more than one minute, the User Defaults is reloaded in the monitor. Any unstored changes made to the active settings are lost.

– If **Automat. Default** is set to **No**, and the monitor is switched off for more than one minute, the active settings from the most recent session are retained. Automatic Default does not

affect the monitor behavior when you discharge a patient. After discharge, the User Defaults is always restored.

If the monitor is switched off and then on again in less than one minute, all active settings are retained, irrespective of the **Automat. Default** setting.

Index

T

U

V

W