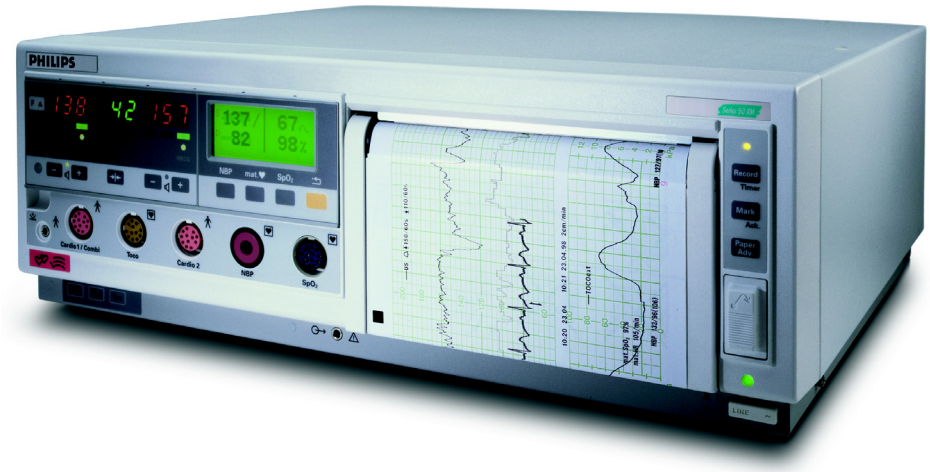
Obstetrical Care



SERVICE GUIDE

Series 50 XM

M1350B

Series 50 XMO

M1350C

Fetal/Maternal Monitors

FETAL MONITORING

PHILIPS

Printed in Germany 10/04

Part Number M1350-9000U
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Series 50 Fetal Monitors
Series 50 XM (M1350B)
Series 50 XMO (M1350C)

SERVICE GUIDE

M1350-9000U
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PHILIPS

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

Contents

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1
General Information

Introduction

About this Guide

This guide tells you how to install, service and repair a Series 50 XM Fetal/Maternal monitor or a Series 50 XMO Fetal/Maternal monitor. It describes all the system hardware and software, and tells you how to test the system and diagnose operating and service problems. It also tells you what upgrade paths are available and how to follow them.

It gives instructions for both a Series 50 XM Fetal/Maternal monitor and a Series 50 XMO Fetal/Maternal monitor. The features available on the monitor you are installing or servicing depend on which options have been purchased. All instructions apply to a fully equipped monitor. If your monitor does not have a described parameter, then you can ignore that part of the instruction and skip to the next point.

The illustrations in this book show the Series 50 XMO Fetal/Maternal monitor, with the fetal pulse oximetry[1] ($FSpO_2$) parameter and maternal parameters.

Who This Guide is For

This guide is for technical personnel installing and servicing the monitor. They must have a good understanding of medical equipment installation procedures. Conventional current technical terms are used throughout this guide. Familiarity with such terms is assumed.

What to do Next

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

Conventions Used in This Guide

This guide uses the following conventions for notes, cautions, and warnings.

Warning
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.

1. Currently not available in the U.S.A.

Caution
A caution alerts you to situations 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.

Note— **A note calls your attention to an important point in the text.**

Symbols

Symbols used in this guide are:

Symbol	Meaning
	**Equipotential Terminal** This symbol is used to identify terminals which are connected together, bringing various parts of an equipment or system to the same potential, not necessarily being earth potential (the value of potentials of earth may be indicated adjacent to the symbol).
	**International Caution Symbol** This symbol indicates that the operator should refer to the product instruction manual before beginning a procedure.
	**Protective Earth Terminal** This symbol identifies the terminal for connection to an external protective earth.
●	**Positive Confirmation Symbol** This symbol against an item in a table means "applies to the item".
-	**Not Applicable Symbol** This symbol against an item in a table means "not applicable".

Unpacking and Checking the Shipment

Initial Inspection

The monitor and any supporting options ordered are supplied packed in protective shipping cartons. Before unpacking, visually check the packaging and ensure that there are no signs of mishandling or damage.

Open the package carefully and remove the instrument and accessories. Remove the accessories packed in the base before you dispose of the packing.

Check that the contents are complete and that the correct options and accessories have been delivered (refer to Table 1-1).

Claims for Damage

If the shipping cartons are damaged, contact the carrier.

If any of the equipment is damaged, contact both the carrier and your local Philips service organization for repair or replacement arrangements.

Repacking

Retain the original packing carton and material, in case you need to return equipment to Philips for service. If you no longer have the original packing materials, Philips can advise you on alternatives.

Table 1-1 Contents Checklist

Description	Fetal and maternal	Fetal only	Fetal and $FSpO_2$	Fetal and maternal and $FSpO_2$
Fetal Monitor	**M1350B**	**M1350B (Option C03)**	**M1350C (Option C03)**	**M1350C**
Fetal Accessories				
Combined $FSpO_2$/DECG/MECG Patient Module M1365A with DECG adapter cable M1362B	-	-	1	1
External Toco Transducer (M1355A)	1	1	1	1
Ultrasound Transducer (M1356A)	2	2	2	2
	Only one transducer is supplied if option C01 was ordered			
ECG-only Patient Module (M1364A) with DECG cable M1362B	1	1	-	-
MECG adapter cable M1363A for use with Patient Module (M1364A)	1	1	1	1
Reusable Transducer Belts (includes belt fastening buttons) (M1562A/B)	4	4	4	4
Transducer Knob Adapters (M1356-43203)	1 pack of 3 pieces	1 pack of 3 pieces	1 pack of 3 pieces	1 pack of 3 pieces
Fetal Scalp Electrodes 15133D (Europe) or 15133E (USA)	5	5	5	5
Fetal Scalp Sensor FS14 (M1366-60001)	-	-	1	1

Table 1-1 Contents Checklist

Description	Fetal and maternal	Fetal only	Fetal and $FSpO_2$	Fetal and maternal and $FSpO_2$
Fetal Monitor	**M1350B**	**M1350B (Option C03)**	**M1350C (Option C03)**	**M1350C**
Maternal Accessories				
Adult NIBP Cuff (M1574A)	1	-	-	1
Large Adult NIBP Cuff (M1575A)	1	-	-	1
NIBP monitor-to-cuff interconnect tubing (3.0m) (M1599A)	1	-	-	1
Reusable adult finger SpO_2 transducer M1191A and cable M1940A	1	-	-	1
Standard Accessories				
Remote Event Marker (15249A)	1	1	1	1
Power Cord (Part no. depends on country option)	1	1	1	1
Equipotential Cable 8120-2961 (USA) 8120-4808 (Europe)	1	1	1	1
Fetal Recording Paper M1910A (USA/Canada) M1911A (Europe) M1913J (Japan)	1 pack	1 pack	1 pack	1 pack
Aquasonic Gel 40483A or Ultrasound Transmission Gel 40404A	1	1	1	1
Documentation				
Instructions for Use (language as appropriate for your country)	1	1	1	1
Quick Reference Guide (language as appropriate for your country)	1	1	1	1
Service Guide (CD-ROM, English only)	1	1	1	1
Error Reference Card (English only)	1	1	1	1
Sensor Placement Guide (for $FSpO_2$)	0	0	1	1
Pocket Guide to Fetal Monitoring (only supplied with English shipments)	1	1	1	1

Optional Accessories

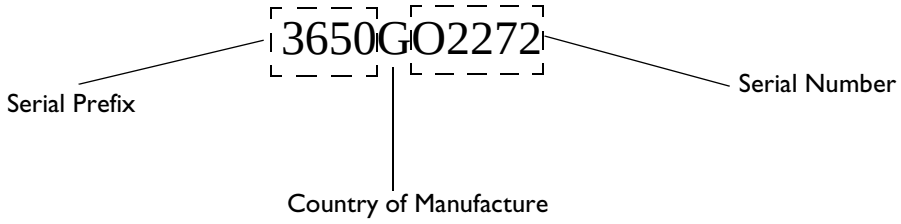
In addition to the items mentioned in the previous table, the following are delivered when the appropriate option has been ordered:

Table 1-2 Optional Accessories

Description	Quantity	Re-Ordering Number
IUP Pressure Transducer, including Transducer Holder CPJ84022.	1	CPJ840J5
IUP Sensor-Tip Pressure Catheters (disposable)	1 box of 10	M1333A
Adapter Cable for disposable IUP Sensor-Tip Pressure Catheters	1	M1334A
Barcode Reader plus Barcode Booklet	1	M1350-68730
Dual Serial Interface Board	1	M1350-66533
Cable (Serial)	1	M1350-61609 (for external devices)
OBMS/ODIS System Interface Board (inc. RS422)	1	M1350-66532

Instrument Identification

Philips uses a two-section serial number (“XXXXGOOOOO'') for instrument identification. This is located on labels attached to the monitor. One label is on the right side of the monitor, the other label is identical and attached to the base of the monitor. The first four digits are the Serial Prefix Number, and identify the modification standard of the instrument. The last five digits are the Serial Number of the instrument. The letter that separates the serial prefix and suffix designates the country in which the instrument was manufactured, “G'' = Germany.



Service Philosophy

Any errors produced are marked on the trace paper with the symbol ⚠ and a specific error message is shown on the monitor display. In addition, the errors are reported on the system error log (see page 24 for instructions on how to print the error log). Read the error messages and system error log to determine whether the fault lies in the hardware or firmware. These problems can be repaired by board replacement or unit exchange. Do not attempt component-level board repair.

Overview of the Service Tests

The system contains resident tests to enable monitoring of system status and errors that occur.

- Power-On Self Test (see page 112)
  This is invoked whenever the system is switched on.
- Performance Assurance Tests
  - Parameter Test (see page 112)
    This checks the processing of the signal from the transducers.
  - Quick Test (see page 114)
    This checks the display, recorder and complete instrument hardware and software.
- Service Tests
  These are invoked by connecting the monitor to a PC and using a software service tool to assess, test and configure the system.
  - Cyclic Test (see page 116)
  - Permanent Test (see page 116)
- Safety Tests
  These test the electrical safety of the monitoring system and must be carried out after upgrades and repairs. You must use a safety testing tool.
  - Instrument Safety Test (see page 120)
  - System Test (see page 120)
  - Safety Test Blocks (see page 119)

About the Monitor

The monitor has five color- and mechanically-coded input sockets:

- **Cardio 1/Combi** for fetal heart rate (FHR) and fetal oxygen saturation ($FSpO_2$)
- **Cardio 2** for fetal heart rate
- **Toco** for uterine activity
- **NPB** for external blood pressure (NIBP)
- **SpO_2** for maternal pulse oximetry

When a transducer is connected, the monitor automatically selects the correct operating mode. The unit can:

- monitor FHR using both direct ECG (DECG) and ultrasound (US)
- monitor maternal heart rate using ECG
- monitor twins using either DECG and ultrasound or dual ultrasound
- monitor uterine activity (Toco) externally or internally
- detect fetal movements (FMP) using ultrasound (optional)
- measure maternal blood pressure externally (optional)
- measure maternal pulse oximetry (optional)
- display maternal ECG waveform and record “snapshot” ECG waveform (optional)
- monitor $FSpO_2$ (optional)

A series of error messages appear in the instrument's display if certain measurements cannot be carried out. Built-in check facilities give you a greater monitoring confidence because most of the instrument functions can be checked quickly and easily.

The Performance Plus Package signal processing technique used by the instrument ensures that the information provided by the monitor is very accurate. Ultrasound FHR traces are comparable with direct ECG FHR traces and variability recorded in the ultrasound mode is almost identical to that recorded in the DECG mode.

The recorder uses a high resolution thermal array print head which gives a very reliable and good quality trace. Automatic annotation capabilities include time, date, paper speed and monitoring methods. Nursing notes can also be documented using an optional barcode reader.

Either of the monitors can be upgraded to include all parameters, depending on availability within the country of purchase.

Overview of the Monitor

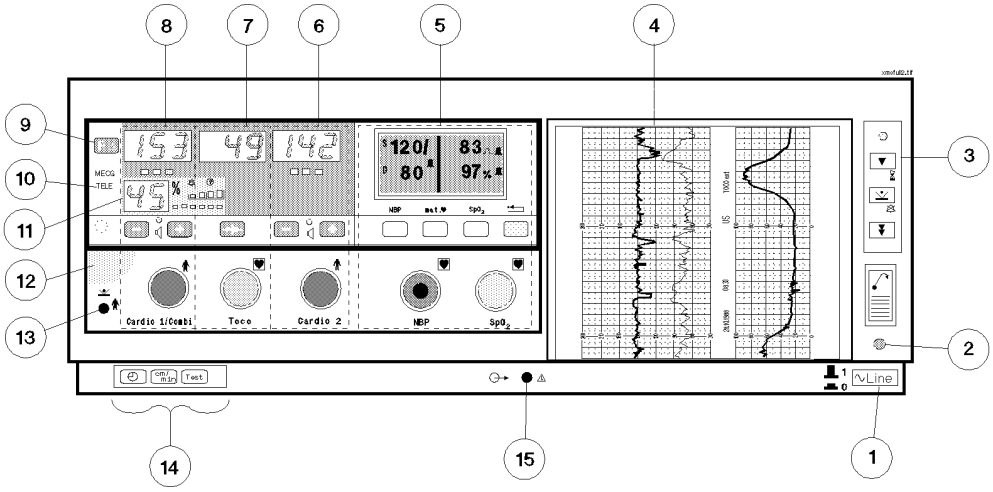


Figure 1-1 Major Parts

1. Monitor On/Off Switch
2. Monitor On/Off Light
3. Recorder Keys
4. Recorder
5. Maternal Parameters (optional)
6. Cardio 2 Channel
7. Toco Channel
8. Cardio 1/Combi Channel
9. Function Key
10. Telemetry Indicator
11. $FSpO_2$ parameter (optional)
12. Opening Recess
13. Socket for Remote Event Marker
14. Setting Keys
15. Service Socket

Cardio and Toco Channels

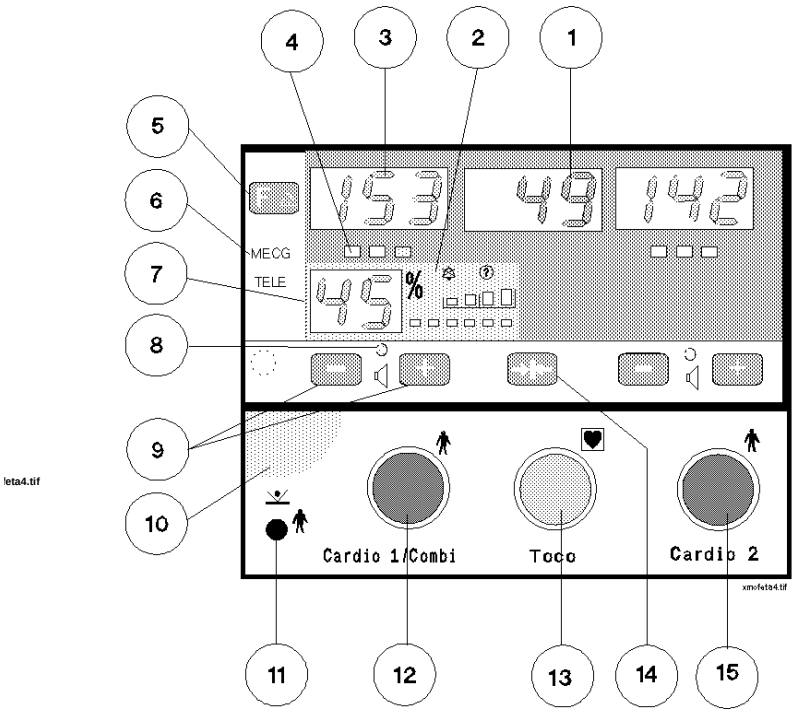


Figure 1-2 Cardio and Toco Channels

1. **Toco Display** shows uterine activity.
2. **Fetal SpO_2 display** shows fetal pulse indicator, signal quality, alarm status, and cross channel verification plus indicator.
3. **Cardio Display** shows the FHR.
4. **Signal Quality Indicator** shows the quality of heart rate signal detected by the transducer:
   - Green (optimum).
   - Yellow (fair to potentially poor).
   - Red (unacceptable).
5. **Function Key selects menus for:**
   - FMP, twins offset, logic, FHR alert and $FSpO_2$
   - returns to normal display.
6. **MECG Indicator** shows when MECG is being measured through this channel. (Indicator location different for Series 50 XM).
7. **Fetal SpO_2** display shows current value of $FSpO_2$.
8. **Speaker Lamp** shows which heartbeat is heard from the loudspeaker.
9. **Volume Keys** set the volume and select the channel to which you are listening. Changes current setting of FMP, twins offset, logic, FHR alert and $FSpO_2$ alarms.
10. **Recess** for use when tilting the display.

11. **Remote Event Marker Socket** for connecting remote event marker (15249A)
12. **Cardio 1/Combi Transducer Socket**. You can connect:
    - $FSpO_2$/ECG combined patient module (M1365A)
    - ECG only patient module (M1364A)
    - An ultrasound transducer (M1356A).
    - A DECG transducer (M1357A).
    - A US/MECG Combi transducer (M1358A).
    - An MECG transducer (M1359A).
13. **Toco Transducer Socket**. You can connect:
    - An external Toco transducer (M1355A).
    - An IUP transducer (1290C or M1333A).
14. **Toco Baseline Key** zeroes the Toco display and trace to 20 units (when monitoring uterine activity externally) or 0 units (when monitoring uterine activity internally).
15. Cardio 2 Transducer Socket for connecting:
    - ECG only patient module (M1364A)
    - US transducer (M1356A)
    - DECG transducer (M1357A)
    - MECG transducer (M1359A)

Maternal Parameters

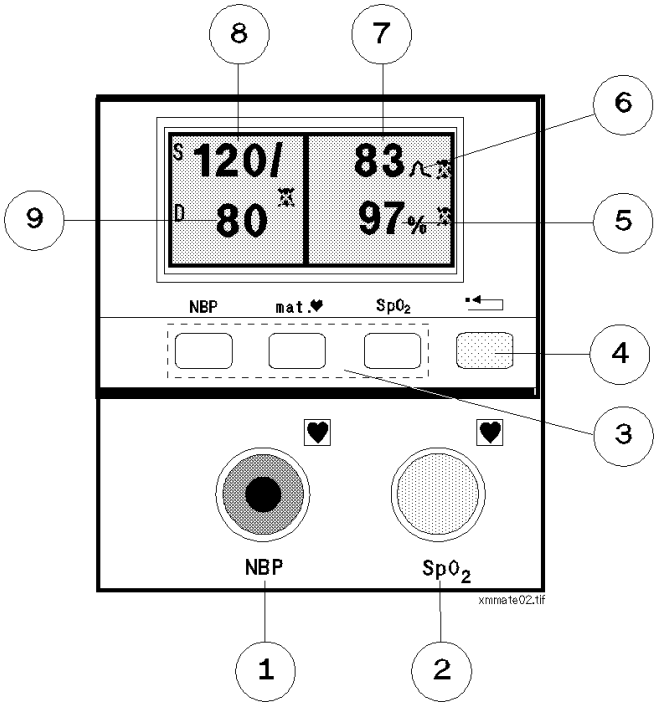


Figure 1-3 Maternal Parameters

1. **NBP Cuff Socket**. You can connect:
   - An NBP cuff interconnect tubing (M1599A) and cuff (M1574A).
2. **SpO_2 Transducer Socket**. You can connect:
   - An SpO_2 transducer (M1940A adapter cable connected to M1191A transducer).
3. **Softkeys** for operating and setting maternal parameters. They are:
   - NBP selects modes and alarm limits for NBP.
   - mat ♥ selects modes and alarm limits for MHR.
   - Sp02 selects modes and alarm limits for SpO_2.
4. **Reset Key (yellow)**

   One short press
   - Acknowledges warning message
   - Acknowledges alarm

   One press, held for two seconds (from maternal main screen only)
   - Accesses volume and contrast setup

   Two presses within one second (from maternal main screen only)
   - Displays current maternal alarm limits
5. **SpO_2 Value** indicates the current reading for patient's oxygen saturation level.

6. **MHR Icon** indicates source of MHR

    indicates heart rate value taken from MECG measurement.

    indicates pulse rate value taken from SpO_2 measurement.

    indicates average pulse rate taken from NIBP measurement.

7. **Maternal Heart Rate** shows current heart rate or pulse rate.
8. **Systolic Value** shows the value for the systolic parameter of the most recent external blood pressure measurement.
9. **Diastolic Value** shows the value for the diastolic parameter of the most recent external blood pressure measurement.

Recorder Keys

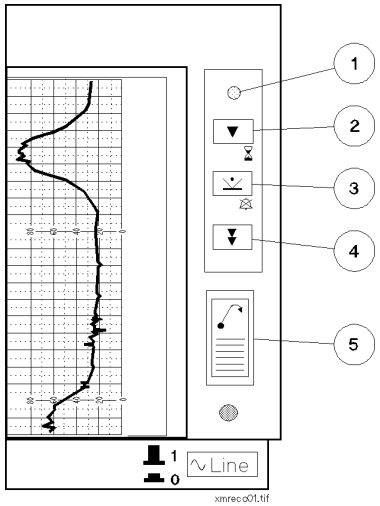


Figure 1-4 Recorder Keys

1. **Recorder On/Off Light**. On when the recorder is switched on. Flashes when monitor detects five or fewer pages remaining in the pack or if the paper runs out.
2. **Recorder On/Off Key**.

   Single press turns recorder on/off

   2-second press starts NST timer. Recorder must be off.

3. **Event Marker Key**. Press to record an event on the paper. Acknowledges all alerts and alarms.
4. **Paper Advance Key**. Press once to advance the paper automatically to the next fold. Press a second time to stop paper before fold. Tear paper at fold. Never pull paper to advance it.
5. **Paper-Eject Key**. Press once to unlock the drawer, and then *press a second time and hold* to remove the paper.

Setting Keys

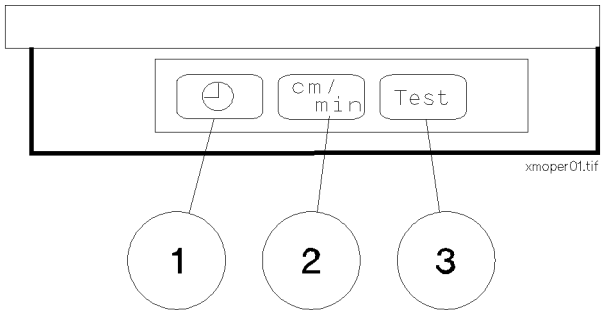


Figure 1-5 Setting Keys

1. **Time and Date Key**. Used when changing the time and date. Press to show the current time in the Cardio 1/Combi and Toco displays, to cycle through the settings to be changed (hours, minutes, day, month and year) and to return to the normal display.
2. **Paper Speed Key**. Used when changing the paper speed. Press to show the current paper speed in the Cardio 1/Combi display, and to return to the normal display.
3. **Test Key**. Used to start monitor self test.

Rear Panel (Slot Positions)

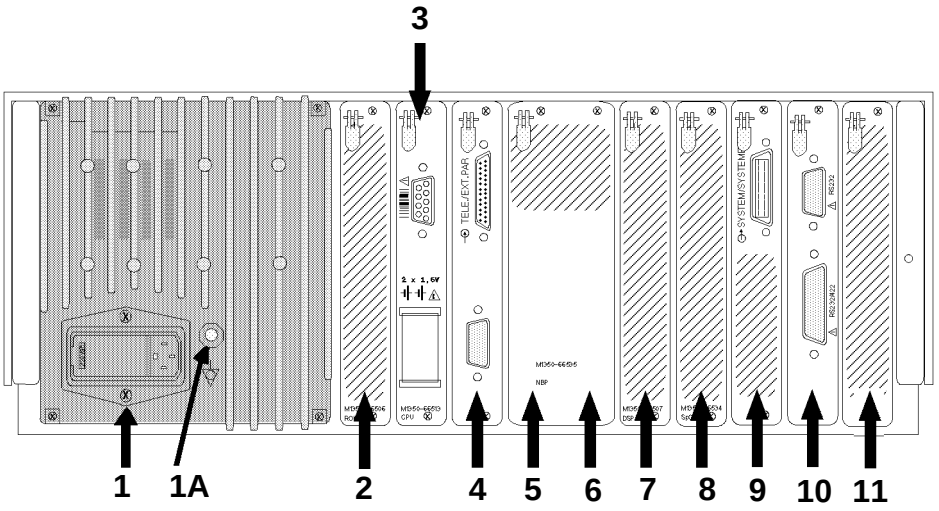


Figure 1-6 Rear Panel (Slot Positions)

Slot Number	Description
1	Power Supply with Power Cord Connection, including Equipotential Grounding Point (**1A**)
2	ROM Board (M1350-66506)
3	CPU Board with Barcode Reader Interface (M1350-66513)
4	Telemetry Interface Connector (M1350-66536) and System Interface Connector (RS232) (lower)
If the monitor has NIBP:	
5 & 6	External Blood Pressure Board (M1350-66535). Optional. Connected to Slot 5, but physically occupies both Slot 5 and Slot 6 (there is a double slot cover in this case).
7	Digital Signal Processor (DSPII) (M1350-66507).
If the monitor does not have NIBP:	
5	Slot empty (there is a single slot cover in this case).
6	Digital Signal Processor-CoP Board (M1350-66505). Optional. (Note: **only** in conjunction with M1350-66504.
7	Digital Signal Processor-CPU Board (M1350-66504). Optional. (Only with M1350-66505) ***OR*** Digital Signal Processor (DSPII) (M1350-66507). Optional. Here, Slots 5 and 6 are empty.
Other monitor options:	
8	Maternal SpO_2 Board (M1350-66534). Optional.
9	OBMS/ODIS Analog Interface (optional) (M1350-66532). Optional.
10	Dual Serial Interface (DSIF) (M1350-66533), External Fetal Pulse Oximeter/Adult Pulse Oximeter Interface (M1350-66534). All optional.
11	Fetal SpO_2 Board (M1350-66540). Optional.

Note— **The DIF board (M1350-66515) is located in Slot 0 inside the monitor (not visible from the rear).**

2
Pre-Installation Checks

Power Source Requirements

The monitor can be operated from an ac source of 100 to 120 or 220 to 240 volts (±10%) at 50Hz or 60Hz (±5%). The system will be set to the correct voltage at the factory.

Prior to installing the system, check that the systems voltage has been set correctly. The voltage and fuse values are shown on the rear panel.

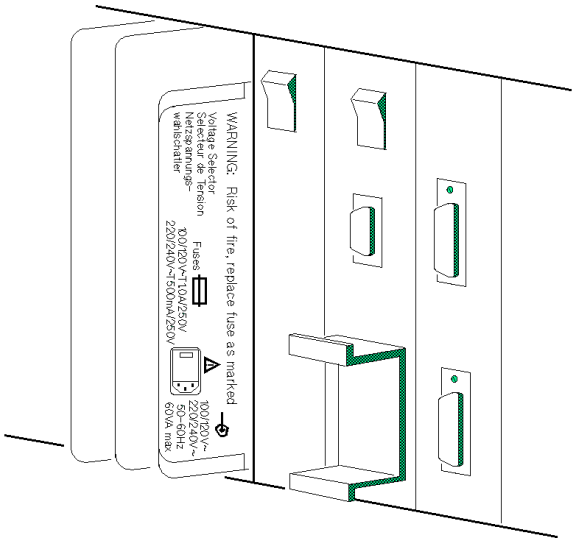


Figure 2-1 System Voltage and Fuse Values on the Rear Panel

Caution
If the voltage has been set incorrectly you must reset it before you connect the system to the local line power supply. See "Setting the Required Voltage" on page 16. Ensure that you use the correct fuse for the voltage setting.

Setting the Required Voltage

1. Using a flat blade screwdriver, open the panel on the rear of the monitor.

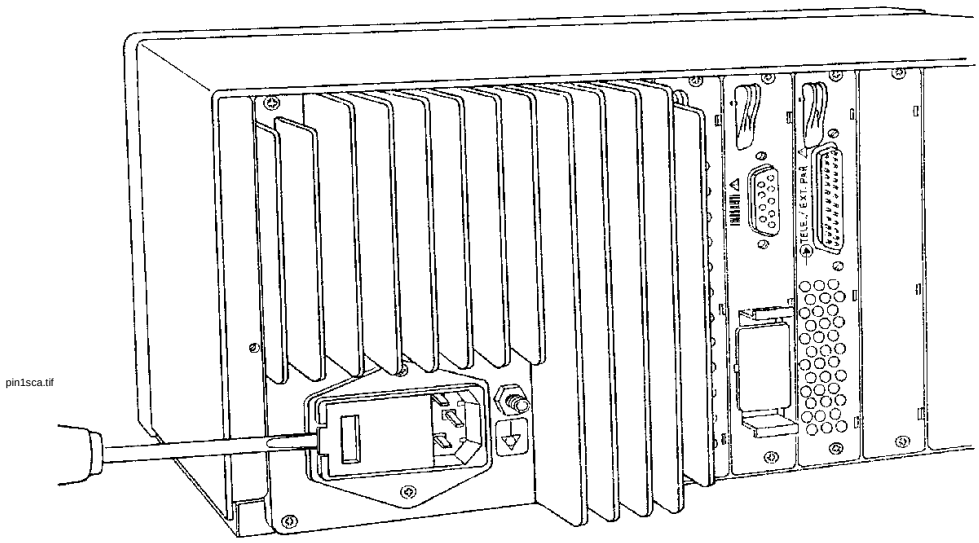


Figure 2-2 Opening the Rear Panel

2. Remove the voltage selector drum, turn it to the voltage required, and replace it.

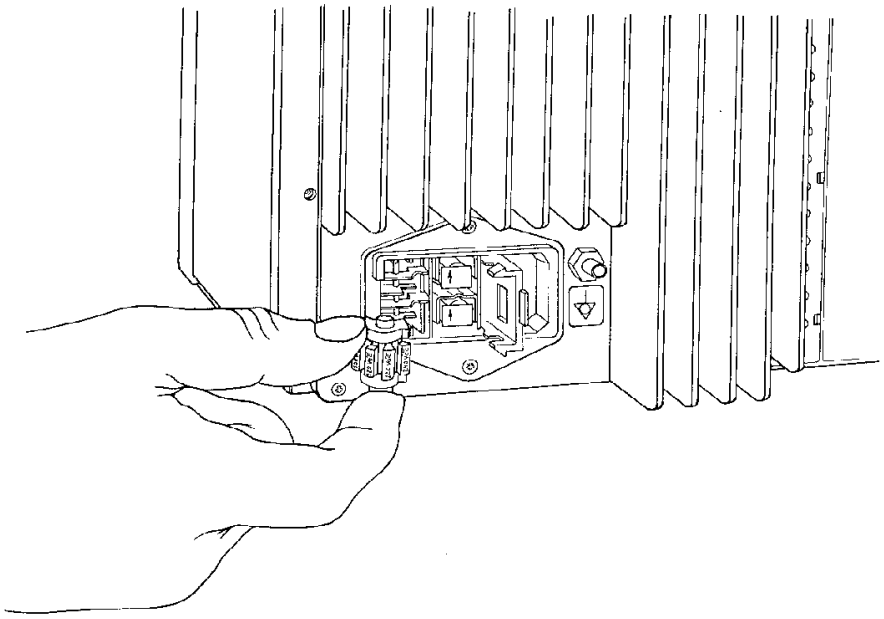


Figure 2-3 Voltage Selector Removal and Replacement

3. Close the rear panel and check that the correct voltage setting is shown (see Figure 2-1).

Installation

For installation instructions, please refer to the Instructions for Use.

3
Configuring the Monitor

Introduction

This chapter describes the tasks you must carry out to configure the monitor. This involves the following service tasks:

- Configure the monitor
- Configure the recorder
- Print and clear the error log
- Set the time and date format to the local standard

Some configuration tasks can be completed by connecting a PC to the monitor, some by using pushbuttons on the monitor itself. Most can be performed using whichever method is more convenient for you: see Table 3-1 for a list of tasks and methods. To find out how to set the time, date, and paper speed, see Chapter 4.

Configuration Tasks

The following table shows you which configuration actions can be carried out using pushbuttons on the monitor and which can be carried out using a PC connected to the service socket.

Table 3-1 Configuring the Monitor

Task	Buttons	PC
Configure the time format	Yes	Yes
Configure the date format	Yes	Yes
Configure the IUP format	Yes	Yes
Configure the paper format	Yes	Yes
Configure the recorder print offset	Yes	Yes
Configure the recorder heat adjust	Yes	Yes
Alert acknowledgment at marker button	Yes	No
Run the cyclic test	No[1]	No
Read the options installed	No	Yes
Read the Error Log	No	Yes
Print the Error Log	Yes[2]	Yes[3]
Clear the Error Log	Yes[2]	Yes
Write the serial number and set the options	No	Yes
Configure the language option	Yes	No
Enable alert acknowledgement	Yes	No
Note Output to System	Yes	No
NIBP paper save mode	Yes	No
MECG trigger click volume	Yes	No
$FSpO_2$ response time	Yes	No
$FSpO_2$ Inop alarm	Yes	No
$FSpO_2$ alarm volume	Yes	No

1. However you can run the Permanent Test, which is similar. See “Printing and Clearing the Error Log” on page 24.
2. See “Printing and Clearing the Error Log” on page 24.
3. To print the error log from a PC, first save the error log from the pegserv tool as a text file.

Configuring the Monitor Using Pushbuttons

You can set the time format, date format, IUP scale, paper format, recorder scale offset, recorder heat and language option using pushbuttons. To change a setting:

1. Disconnect all transducers from the Monitor and disconnect or switch off Telemetry.

2. While pressing F.⚠ , press Test . The display shows **C01** in the US1/US display and **0** or **1** in the Toco display.

3. Toggle through the menu by pressing + or − until you arrive at the menu item you want to change. The menu items and their settings are shown in Table 3-2.

4. Press →|← to change the setting (**0** or **1**).

5. Press Test to store the new settings. If yo do not press any keys for about 15 seconds, the settings will be automatically stored.

Table 3-2 Configuration Options

Menu	Setting	Options	Default
C01	Time Format	0=AM/PM 1=24-hour	1
C02	Date Format	0=US (month/day/year) 1=Europe (day.month.year)	0
C03	IUP Format	0=mmHg 1=kPa	0
C04	Paper Format	0=US (30-240) 1=Europe (50-210)	0
C05	Recorder Print Offset [1] 0 to 11	0=right 11=left	0
C06	Recorder Heat Adjust 0 to 11	0=minimum 11= maximum	11
C07	Language Option	1=US International 2=French 3=German 4=Dutch 5=Spanish 6=Italian 10=Japanese 13=Chinese (simplified) 17=Russian	1
C08	Recorder Marker[2]	0=normal 1=system acknowledge	0
C09	Note Output to System (Roman 8)	0=transmission off 1=transmission on	1
C10	DSIF	Refer to Table 3-3	0

Table 3-2 Configuration Options

Menu	Setting	Options	Default
C11	External Toco gain	0=100% External Toco gain 1=50%	0
C12	Refer to Table 3-5		
C13	OBMS and Telemetry/ System boards[3]	0=RS422 System Interface on **OBMS board active** 1=RS232 System Interface on Telemetry/System board active	1
C14	Analog fetal movements	0=off 1=on	0
C16	NIBP paper save mode	0=off 1=on	0
C17	MECG trigger click volume	0=off 1=quiet 2=medium 3=loud	2
C18 (XMO only)	$FSpO_2$ response time[4]	0=slow 1=fast	1
C19 (XMO only)	$FSpO_2$ Inop alarm	0=off 1=on	0
C20 (XMO only)	$FSpO_2$ alarm volume	0=off 1=quiet 2=medium 3=loud	2

1. To find the correct setting, connect a Toco transducer to the monitor and then change the setting until the trace is recording 20 units on the paper. Because of the 8-second time-out feature, and the delay between changing the setting and seeing the change on the paper, you may have to repeat this procedure to set the offset.
2. If the alert acknowledgement function is on, the fetal monitor adds the alert acknowledgement function on the recorder marker button. This alert acknowledgement is given only to the central station after a request from the central station (communication is via the digital interface.)
3. With this setting you can switch the control between the RS232 port on the new Telemetry/System board M1350-66536 and the RS422 port implemented on the System Interface board M1350-66532. If only one of them is built into the fetal monitor this one will be active regardless of the setting.
4. Response mode is an output-average filter. You can select whether the monitor averages samples over a short time (approximately 10 seconds) or longer period (approximately 50 seconds). The times vary according to the heartrate and signal quality and those quoted here are valid for good signal quality and a heartrate in the 120 bmp range. The fast response mode, because it requires fewer samples, allows you to see sudden changes in output more easily. Fast response mode is indicated on the trace by  .

Table 3-3 Service Setting C10 Options (DSIF Configuration Options)

Connector 1 (9pin)	Connector 2 (25 pin)	C10 Option
See Table 3-4[1]		0
Dinamap 1846/8100	Nellcor N-200	1
Colin BP-8800	Nellcor N-200	2
78352/4C	Nellcor N-200	3
Accutorr - all models	Nellcor N-200	4
Philips CMS, all models Philips 26/24 Series	Nellcor N-200	5
Dinamap 1846/8100	Nellcor N-400	11
Colin BP-8800	Nellcor N-400	12
78352/4C	Nellcor N-400	13
Accutorr - all models	Nellcor N-400	14
Philips CMS Philips 26/24 Series	Nellcor N-400	15

1. The service setting C10=0 ensures the compatibility of older monitors with external devices and will not normally be needed with the M1350B and M1350C

Table 3-4 Service Setting C10 = 0 (DIP Switch Settings on the DSIF Board)

Connector 1 9 pin female	Connector 2 25 pin female	Switch Settings							
		1	2	3	4	5	6	7	8
Dinamap 1846 (600Bd)	Nellcor N-200 (2400Bd)	▲	▲	▲	▲	▲	X	X	X
Philips CMS and Philips 26/24 Series (9600Bd)	Nellcor N-200 (2400 Bd)	▼	▲	▲	▲	▲	X	X	X
Accutorr (9600Bd)	Nellcor N-200 (2400Bd)	▲	▼	▲	▲	▲	X	X	X
Colin BP-8800 (4800Bd)	Nellcor N-200 (2400Bd)	▼	▼	▲	▲	▲	X	X	X
78352/4C (9600Bd)	Nellcor N-200 (2400Bd)	▲	▲	▼	▲	▲	X	X	X

Table 3-5 Service Setting C12 Options

NST Timer	Auto Recording Off	Acoustic Paper Out Alert	Option \ Number
No	No	No	0
Yes	No	No	1
Yes	Yes	No	2
No	No	Yes	3
Yes	No	Yes	4 (default)
Yes	Yes	Yes	5 (Japan)

Printing and Clearing the Error Log

To print or clear the error log:

1. Disconnect all transducers from the monitor and disconnect, or switch off, Telemetry.
2. Make sure the recorder is on.
3. While pressing F.⚠ press Test
   - **C01** is shown in the US1/US display.
   - **0** or **1** is shown in the Toco display.
4. Press F.⚠ again to select the Function Menu:
   - **A01** (Print the Error Log) is shown in the US1/US display.
     To print the Error Log, press →|← . The display shows **nnn nnn nnn**.
   - Press + again to select **A02** (Clear the Error Log).
     To clear the Error Log, press →|← . The display shows **nnn nnn nnn**.

The following shows an example of an error log

Table 3-6 Example of an Error Log

506	0005	98/09/14	11:27	98/09/14	16:53
FIC					
0540	0008	98/09/14	11:27	98/09/14	16:54
E1C6	0005	98/09/14	11:27	98/09/14	16:53
021A	0002	98/09/14	16:24	98/09/14	16:25
OPTIONS FMP UStwin, Fet.Alert,					
DATE:	SW_REV	INSTR_ID			
95/09/15/	C.01.00	M1350C 2445G35213			
BOARDS					
Pos.	00	515	ID_2		
Pos.	01	502			
Pos.	02	506			
Pos.	03	513			
Pos.	04	536	ID_2		
Pos.	05				
Pos.	06				
Pos.	07	507			
Pos.	08				
Pos.	09				
Pos.	10	540			
Pos.	11				
SERVICE SETTINGS:					
C01	01				
C02	01				
C03	00				
C04	00				
C05	00				
C06	02				
C07	03				
C08	00				
C09	01				
C010	02				
C011	01				
C012	02				
C013	00				
C014	00				
C016	01				
C017	00				
C018	01				
C019	00				
C20	00				
FSP02 SW_REV:					
NPB FMHP 5.0.1					
NPB FSPO2 ERRORS:					
540	0002	98/09/14	11:27	98/09/14	16:53

The error log is divided into seven sections that contain the following information:

Section 1

1. The error code
   For example 506
2. The number of times the error has occurred.
   For example 0005 (note that the error counter uses hexadecimal notation)
3. The date and time the error first occurred.
   For example 98/09/14 11:27
4. The date and time the error last occurred.
   For example 98/09/14 16:23

The remaining lines in section 1 (if any) beneath the factory information code (FIC) are not errors. Take no action.

Section 2

All built in options in the fetal monitor are written. For example Fet.Alert indicates fetal alerting.

Section 3

This shows information about the monitor itself:

DATE	SW_REV	INSTR_ID
Current date[1]	Software revision	Product number and monitor serial number

1. This is taken from the monitor's internal clock.

Section 4

The final three digits of all boards connected into the fetal monitor. For example in Pos.05 is board M1350-66536.

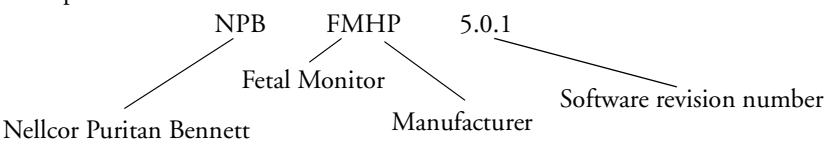
Section 5

The complete configuration made using the monitor's push buttons is listed for easy validation and documentation.

Section 6

The revision number of the $FSpO_2$ software.

Example:



Section 7

The error code, occurrences, and times and dates thereof are shown specifically for the $FSpO_2$ board in exactly the same way as other boards are displayed in Section 1 of the error log.

Changing the Time Format

To change the time format from AM/PM format to 24-hour format, do the following:

1. Disconnect all transducers from the Monitor and disconnect or switch off Telemetry.
2. While pressing F.⚠ press Test .
3. Press ⇥ to change the setting to **1**.
4. Press **Test** to store the new settings.

Full details about changing the time and date formats are given in Chapter 4.

Configuring the Monitor Using a PC

The service software kit (M1360C Option 875, part number M1360-68875) allows you to carry out various extended configuration and service functions on the monitor. Contact your Philips Sales Office for details.

The service software disk can be run on an industry standard PC. There is also an adapter cable (M1360-61675) to connect the monitor to the PC.

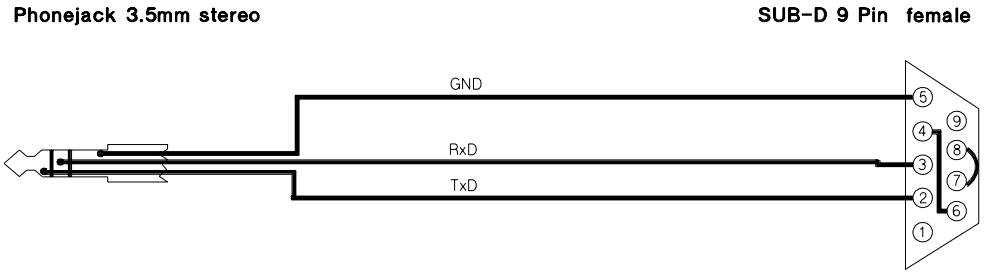


Figure 3-1 Cable for an Industry Standard compatible PC

Installing the Service Program

Before you install the program, ensure that the serial port COM1 is set up as follows:

Transmission Rate	9600 BPS
Parity	None
Word length (bits)	8
Stop-bits	1

This is done by giving the mode command (**`mode com1:96,N,8,1`**) at the DOS prompt. Refer to your MS-DOS Manual for details.

To install the program:

1. Switch on the PC.
2. Create a directory for the program files. For example, to create a directory called **`service`**, at the DOS prompt type in:

   ```
   md service
   ```

   and press Enter .
3. Insert the program disk into drive A.
4. At the DOS prompt type **`A:`** and press Enter .
5. At the **`A:`** prompt, type:

   ```
   copy pegserv.exe c:\service
   ```

   and press Enter . Where *service* is the directory you created to contain the program files.

   The program is copied to **`c:\service`**

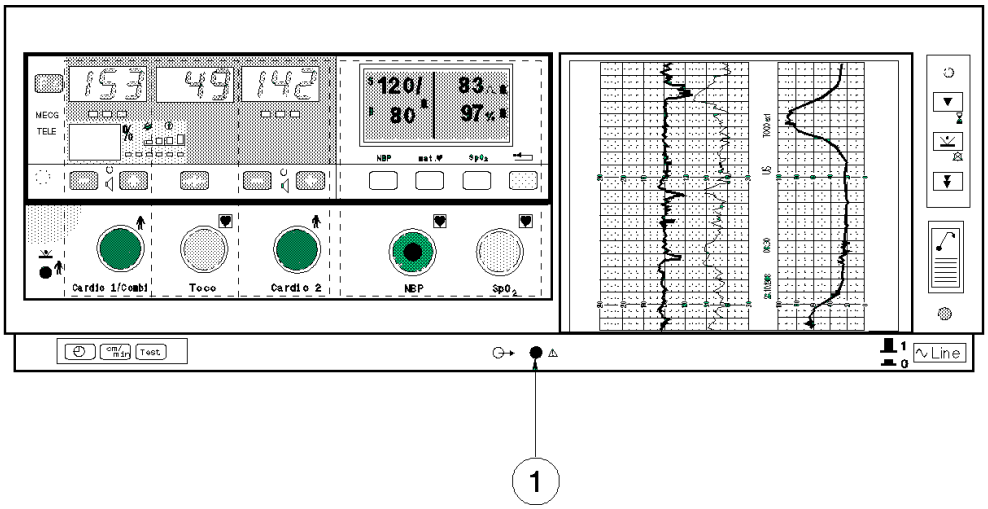
Serial Interface Connection

Make sure that the serial interface configuration on the PC is set up as follows:

Datacom-Configuration Parameter	Serial
Transmission Rate (BPS)	9600
Word Length (bits)	8
Stop-Bits	1
Parity	None
%ON / %OFF Pacing	Off
CTS Line	Regard
DSR Line	Regard
DCD Line	Ignore
Power to Interface	Off

Connecting the PC to the Monitor

Connect the cable from the PC to the service socket (1). If you are using an HP PC, use only the COM1 port.



xmofull1.gif

Figure 3-2 Service Socket

Loading the Service Program

1. Switch on both the monitor and the PC.
2. Now load the program.

If you are using the PC in DOS mode, do one of the following.

- If the program files are contained in a directory, change to that directory and enter:

  `pegserv`

- If you want to load the program from drive A (or another drive):

  i. Insert the program disk into drive A (or other).

  ii. Select **`DOS-Commands`** and press Enter.

  iii. At the DOS prompt type **`A:`** and press Enter.

  iv. Type **`pegserv`** and press Enter.

If you are using Windows 95/98/NT:

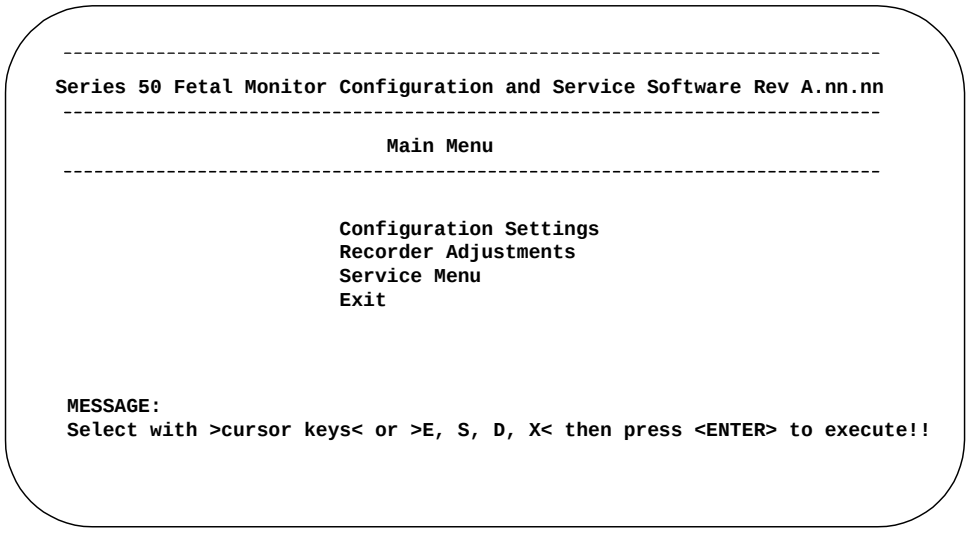
- Start the service program by double-clicking on the **`pegserv`** icon or on the filename **`pegserv.exe`**

3. The program is now loaded and ready for use.

Using the Service Program

When the program has been loaded onto your PC, the main menu is displayed. (If the menu is not displayed, an error message is displayed along the bottom of the screen.)

Main Menu



To select an item from the menu, move the cursor to the item you require and press Enter :

- Use the arrow keys ▲, ▼, ◀, ▶ keys on the keypad, or the **E**, **S**, **D** or **X** keys to move the cursor.

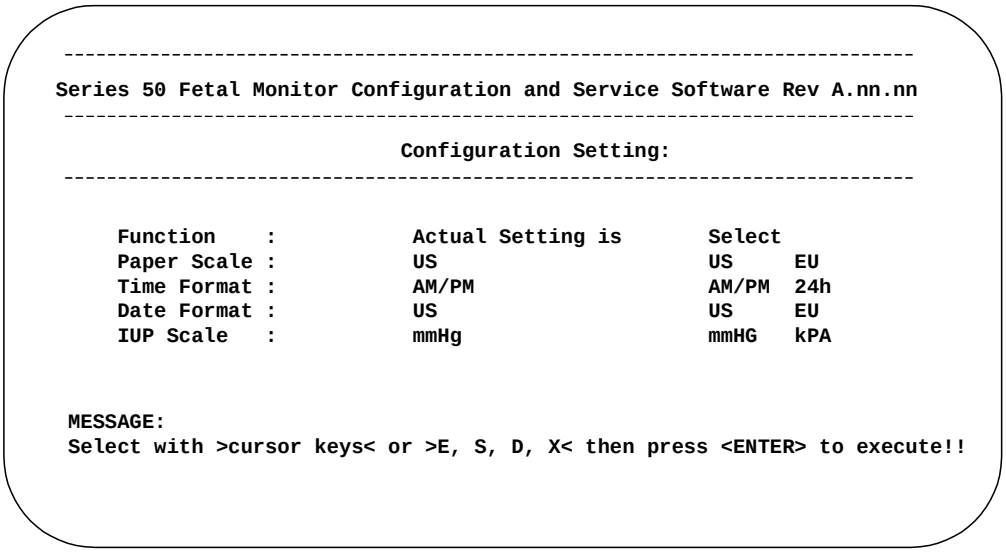
Messages are displayed along the bottom of the screen while the Service Program is working, for example:

Reading Recorder Adjustments from the Monitor.

Reading Serial Number from the Monitor.

Clearing the Error Log.

Configuring the Monitor



To change a setting:

1. Using the appropriate keys, move the cursor to the selection you require.
2. Press Enter .

To return to the Main Menu:

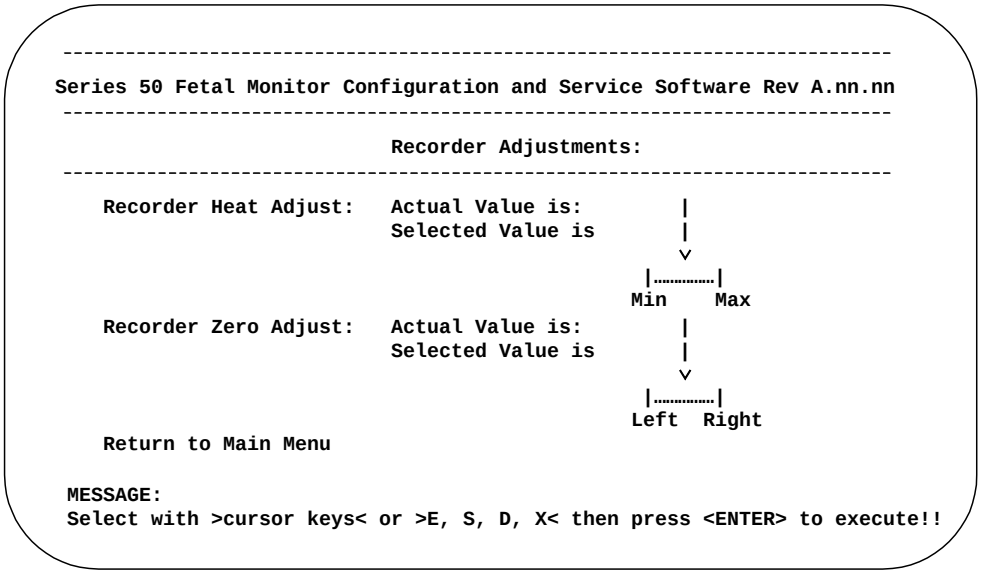
1. Move the cursor to **Return to Main Menu**.
2. Press Enter .

Example
On the screen above, the actual setting of the paper scale is **US**. To change this to **EU**, move the cursor to **EU** in the **Select** column and press Enter . The program will reconfigure the monitor for the European paper scale.

The settings on your monitor may be different from those shown.

Adjusting the Recorder

The Recorder Heat-Adjust is to compensate for different tolerances in the paper.



To change a setting:

1. Using the appropriate keys, move the cursor to the new value you require.
2. Press Enter .

To return to the Main Menu:

1. Move the cursor to **Return to Main Menu**.
2. Press Enter .

Example
On the screen above, the actual value of the recorder zero-adjust is **Left**. To change this to **Right**, move the cursor to **Right** in the **Selected Value is:** column and press Enter . The program will adjust the recorder accordingly. The values shown on your monitor may be different from those shown.

Service Menu

To select an item from the menu, move the cursor to the item you require and press Enter.

Note

Before you select **Cyclic Test**, you must connect ultrasound, Toco and DECG transducers to the monitor.

The serial number and software revision of your monitor may be different from those shown.

```
--------------------------------------------------------------------------------
Series 50 Fetal Monitor Configuration and Service Software Rev A.nn.nn
--------------------------------------------------------------------------------
                            Service Menu
--------------------------------------------------------------------------------

 Serial Number           : 2948G00010
 Software Revision       : A.02.03

             Cyclic Test
             Read options
             Read ErrorLog
             Clear ErrorLog
             Write Ser.nr./Set Options
             Fetal Heart Rate Alerting
             Return to Main Menu
MESSAGE:
Select with >cursor keys< or >E, S, D, X< then press <ENTER> to execute!!
```

Running the Cyclic Test

The Cyclic Test is a continuous Self Test. Any errors are written to the Error Log and can be read using **Read ErrorLog**. Press any key to stop the test and return to the Service Menu. During the test the keys on the front of the monitor are disabled.

```
--------------------------------------------------------------------------------
Series 50 Fetal Monitor Configuration and Service Software Rev A.nn.nn
--------------------------------------------------------------------------------



  CYCLIC TEST is started
  It starts a continuous self test of the monitor


  Press any key to stop this test
  Read ErrorLog to see the errors that occurred while self testing



MESSAGE:
```

Reading the Options This lists the options installed on the monitor. Press any key to return to the Service Menu. The options on your monitor may be different from those shown.

```
 ------------------------------------------------------------------------
Series 50 Fetal Monitor Configuration and Service Software Rev A.nn.nn
 ------------------------------------------------------------------------

                        Implemented Options :


 - Fetal Movement Profile
 - External Twin Monitoring









 MESSAGE:
 Press any KEY to continue!
```

Reading the Error Log This displays the error log. (See Chapter 10 for a list of error log messages.)

```
> PAGE 1 <              Errorlog of : 2948G00010


                        Err. Count 1st Date+Time last Date+Time
                        Code nnnn yy/mm/dd HH:MM yy/mm/dd HH:MM
                        |-|  |--|  |------.----|  |------.----|









 Use >W< to Write ErrorLog Data to File >ErrLog.DAT<
 use CursorKey >Down< or >X< to see next Page, <ENTER> to leave
```

The error log lists:

- The monitor's serial number.
- The error code and the number of times the error has occurred.
- The date and time the error first occurred.
- The date and time the error last occurred.

Up to 16 error messages can be displayed on a screen. To see the next or previous screen, use the s or t keys on the keypad, or the E or X keys. At the end of the Error Log, **`No more Data`**

`available` is displayed.

Press SHIFT PrtSc to print a page on LPT1.

Press Enter to return to the Service Menu.

To write the error log data to a file, press the W key. The data is then stored as **`ERRLOG.DAT`** in the directory containing **`PEGSERV.EXE`**. The data is stored as ASCII characters, and therefore the file can be printed using the DOS Command **`print ERRLOG.DAT`**. The file is overwritten each time you press the W key.

Clearing the Error Log

```
--------------------------------------------------------------------------------
Series 50 Fetal Monitor Configuration and Service Software Rev A.nn.nn
--------------------------------------------------------------------------------
                            Service Menu
--------------------------------------------------------------------------------

 Serial Number           : 2948G00010
 Software Revision       : A.02.03

            Cyclic Test
            Read options
            Read ErrorLog
            Clear ErrorLog              Are you sure?
            Write Ser.nr./Set Options
            Fetal Heart Rate Alerting
            Return to Main Menu
MESSAGE:
Select with >cursor keys< or >E, S, D, X< then press <ENTER> to execute!!
```

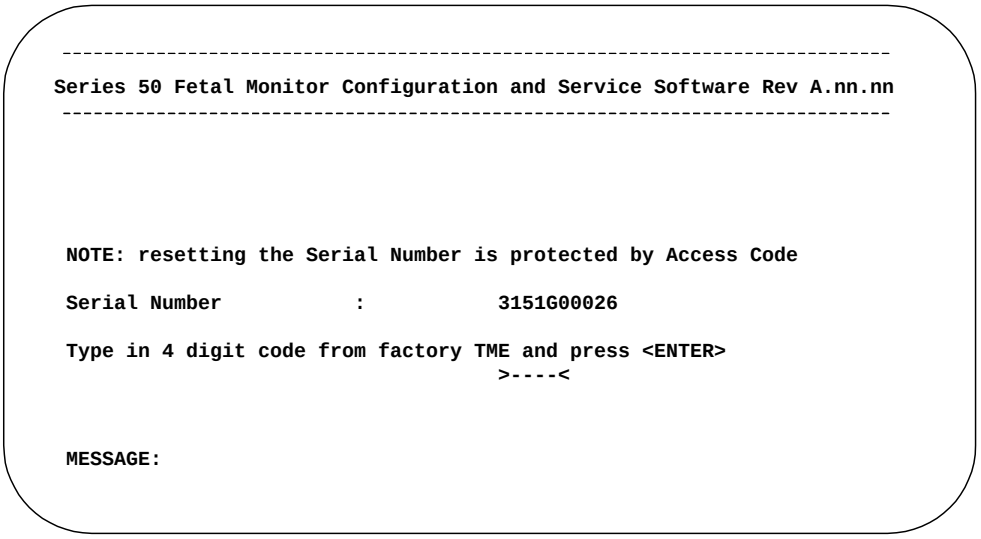
The confirmation message **`Are You Sure?`** asks if you do want to clear the error log:

- Press Y to clear the error log, OR
- Press N.

You then return to the Service Menu.

Writing the Serial Number

You can write the serial number to the monitor only if you have replaced the CPU Board with an exchange board. The serial number can be written only **once** to the exchanged board. If you accidently enter the wrong serial number, you can reset it using an access code obtainable from your Philips Response Center or from the Philips Technical Marketing Intranet page, "Softserver."



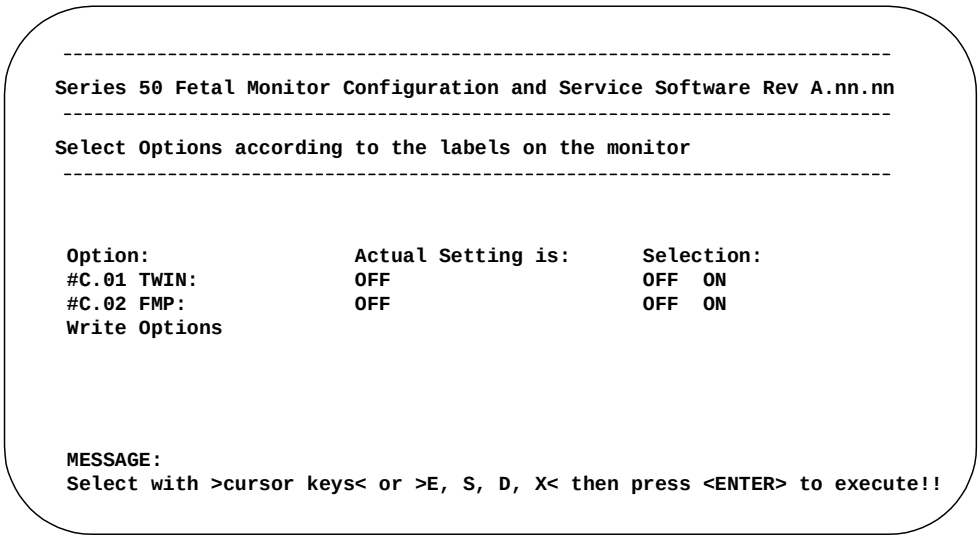
To write the serial number:

1. Using the keyboard, type in the serial number of the monitor. This is printed on the side and on the bottom of the monitor
2. Press Enter.

   A confirmation message asks if the serial number is correct:

   - Press **Y** if it is, OR
   - Press **N** and retype the serial number.

You then go to the Set Options Screen to reset the options for the monitor.



To select an option:

1. Using the appropriate keys, move the cursor to the selection you require.
2. Press Enter .

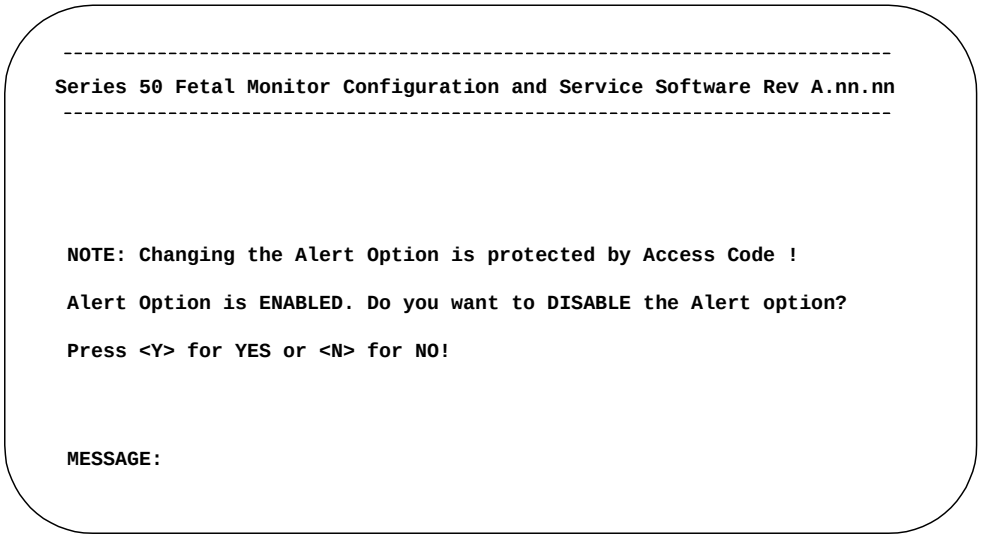
To write the options to the monitor and return to the Main Menu:

1. Move the cursor to **Write Options**.
2. Press Enter .

   A confirmation message asks if the selected options are correct.

Enabling/ Disabling FHR Alerting

This screen enables you to enable or disable the fetal heart rate alerting. To change this configuration you must enter an access code, which is available from your Philips Response Center or from the Technical Marketing "Softserver" page on the Philips Intranet. There are two different access codes, one enables the alerting, and the second disables alerting.



To enable or disable the alerting, enter the specific code to enable or disable the alerting.

4
Getting Started (Basic Considerations and Operation)

Setting the Time and Date

You can view and change the time, the date and the paper speed using the following keys:

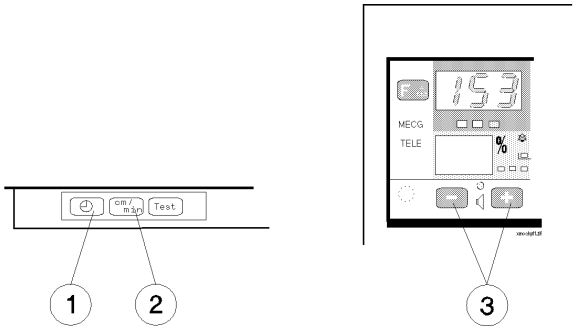


Figure 4-1 Setting the Time and Date

- **Clock key** displays the time (1).
- **Paper speed** displays the paper speed (2).
- **Volume keys** change the time, date and paper speed (3).

To set the time and date:

1. Press and release [clock] to display the current time. The Cardio 1/Combi display flashes to show that the hour can be changed.
2. Press [−] or [+] to set the hour. Press and hold the keys to change the setting more quickly.
3. Press and release [clock] and the Toco display flashes to show that the minutes can be changed.
4. Press [−] or [+] to set the minutes.
5. Repeat the procedure:
   - To set the month (in North America) or the day (in other countries).
   - To set the day (in North America) or the month (in other countries).
   - To set the year.
6. Press and release [clock] to return to the normal display.

You can also change the format of the time and date using the optional Barcode Reader and the feature setting barcodes supplied with it.

Changing the Time Format

To change from 12-hour to 24-hour format, enter **TIME FORMAT 24H (MILITARY)** from the feature setting sheet.

To change from 24-hour to 12-hour format, enter **TIME FORMAT AM/PM** from the feature setting sheet.

To change from Day.Month.Year to Month/Day/Year format, enter **DATE FORMAT NORTH AMERICAN** from the feature setting sheet.

To change from Month/Day/Year to Day.Month.Year format, enter **DATE FORMAT EUROPEAN** from the feature setting sheet.

If the batteries are not changed when they become low or empty of charge, the settings will return to their default values: the date is set to 04.04.44 and the time is set to either 00.00 (European Format) or 12:00A (US Format).

Setting Paper Speed and Scale

Setting the Paper Speed

The paper speed can be 1, 2 or 3 cm/min. The default for North America is 3 cm/min; the default for other countries is 2 cm/min. A change in paper speed will result in a change in the appearance of an FHR trace, care must be taken to ensure **ALL** monitors in your institution are consistently set at the same speed.

The ACOG technical bulletin on FHR monitoring states that “accurate pattern recognition is difficult if not impossible at 1 cm/min and that 1 cm/min is only recommended for more economic screening. When FHR abnormalities arise, the faster paper speeds will enhance FHR pattern recognition.”

Use the Paper Speed Key to display the current paper speed and to return to the normal display. You also return to the normal display automatically if you don't press any key for a few seconds. When you return to the normal display, the new paper speed is set, and the time, date, speed and monitoring modes are printed on the paper.

To set the paper speed:

1. Press and release [cm / min] to display the current speed.
2. Press [−] or [+] to set the speed.
3. Press and release [cm / min] to return to the normal display.

Setting the FHR Paper Scale

All chart paper available for the monitor is 2-channel chem/thermal paper, containing 150 numbered pages per pack. Each page is 100mm long and 151mm wide. Several configurations are available, each with a 0 - 100 labor scale.

Table 4-1 Types of Trace Paper Available

Product Number	FHR Scale	Color of Grid	FMR Filing System	Packs per Case	European KPa scale	Highlighted Three Lines
M1910A	30 - 240	Orange	No	40	No	Yes
M1911A	50 - 210	Green	No	40	Yes	No
M1913A	50 - 210	Green	No	40	No	Yes

Caution
Using recorder paper that is not approved by Philips can damage the monitor. This type of damage will not be covered by warranty.

Some monitor configurations come with a fetal monitoring record (FMR) management system. Included in the FMR system are labels that facilitate a total management system for organized storage and retrieval of patient records.

If you wish to use paper with a different FHR scale (for example, 50 - 210 bpm instead of 30 - 240 bpm) you can change the paper scale settings:

1. Using the service software (see “Using the Service Program” on page 30).
2. Using pushbuttons (see “Configuring the Monitor Using Pushbuttons” on page 21).

Switching Logic Off and On

The default setting for arrhythmia logic is on. To change the setting, do the following:

- Connect a DECG transducer to the Cardio 1/Combi or Cardio 2 socket.
- Press F.⚠ repeatedly until LOG is displayed.
- The Signal Quality Indicator shows:
  - RED if logic is OFF.
  - GREEN if logic is ON.
- Press − or + to change the setting.
- Press F.⚠ repeatedly to return to the normal display.

You also return to the normal display automatically if you do not press a key for a few seconds.

Separating FHR Traces ("Twins Offset")

Twin monitoring is an option.

To help with the interpretation of traces with similar baselines, you can separate them.

Using Keys

- Connect two fetal heart rate transducers to the Cardio 1/Combi and Cardio 2 sockets.
- Press F.⚠ repeatedly to display 20-.
- The Signal Quality Indicator shows:
  - RED if the traces are NOT SEPARATED.
  - GREEN if the traces are SEPARATED.
- Press − or + to change the setting.
- Press F.⚠ repeatedly to return to the normal display.

You also return to the normal display automatically if you do not press a key for a few seconds.

Using the Barcode Reader

Enter "Twins Offset" from the barcode sheet.

Switching FMP Off and On

FMP is an option.

The default setting for FMP is on.

Using Keys To change the setting, do the following:

- Connect a transducer to the Cardio 1/Combi socket.
- Press F.⚠ repeatedly until FMP is displayed.
- The Signal Quality Indicator shows:
  - RED if FMP is OFF.
  - GREEN if FMP is ON.
- Press − or + to change the setting.
- Press F.⚠ repeatedly to return to the normal display.

You also return to the normal display automatically if you do not press a key for a few seconds.

Using the Barcode Reader Enter **FMP Off** or **FMP On** from the barcode sheet.

5
System Interfaces

Monitor Rear Panel

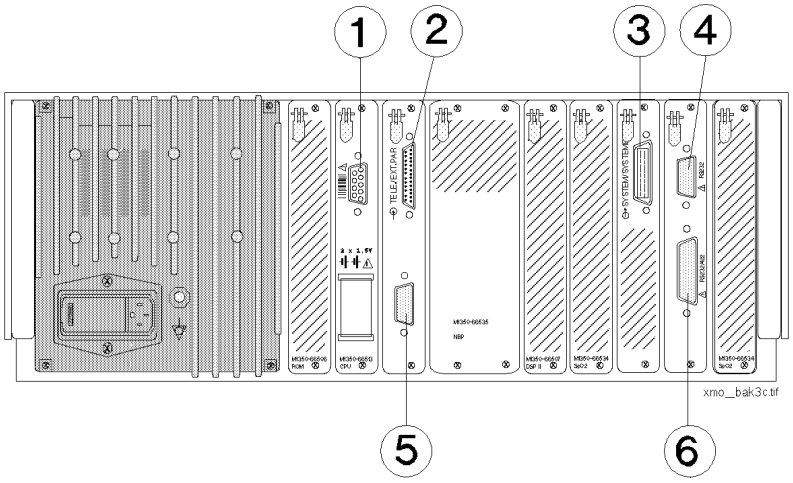


Figure 5-1 Sockets for Peripheral Devices

1. Interface for optional barcode reader.
2. Interface for Philips Avalon CTS Cordless Fetal Transducer System (M2720A) and Series 50 T Fetal Telemetry System (M1310A). See “Connecting External Devices” on page 56 and “Interface for Philips M2720A/M1310A” on page 46 for details.
3. System interface for connection to 80225A/80235A OBMS System and/or M1340A Fetal Trace Transmitter or M1370A ODIS System (optional). See “System Interface Option J12” on page 53 for details.
4. Serial RS232/RS422 system interface for connection of maternal monitors such as Philips CMS. See “RS232/RS422 Dual Serial Interface Option J13” on page 55 for details.
5. RS232 digital system interface for connection to a Philips OB **TraceVue** system or an IBM compatible PC. See the table “RS232 System Interface” on page 52 for details.
6. Serial RS232/RS422 system interface for connection of Nellcor N-200 maternal SpO_2 monitor (and N-400 fetal SpO_2 monitor for an M1350 XM without fetal SpO_2).

See “Rear Panel (Slot Positions)” on page 14 for a description of the board positions.

Interface for Philips M2720A/M1310A

The Telemetry interface allows connection to the Philips Fetal Telemetry Systems. Full functionality is provided by the Philips Avalon CTS Cordless Fetal Transducer System (M2720A) and Series 50 T Fetal Telemetry System (M1310A) with monitor software revision higher than A.04.00.

The pin allocations for the various signals are shown below.

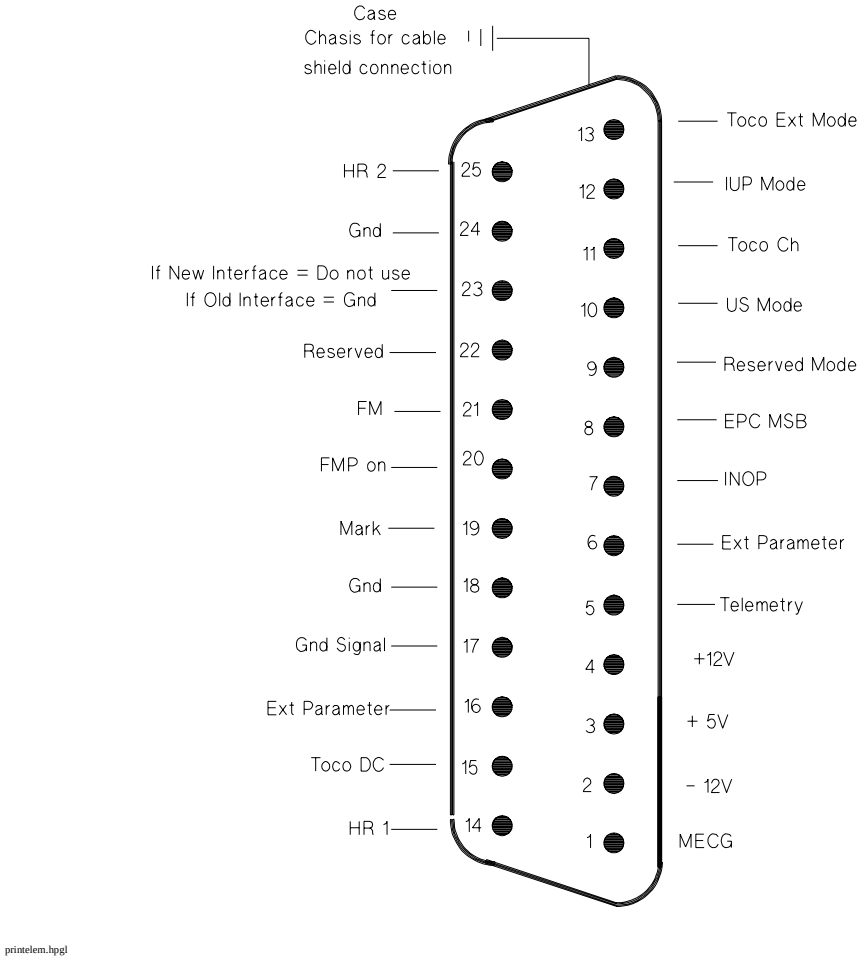


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Figure 5-2 Telemetry Input Signal Allocations

For details of which parameters are supported with each monitor/interface combination, refer to "Monitoring Using External Devices" in the *Instructions for Use*.

Table 5-1 Telemetry Interface: Pin Connections

Pin	Signal	Function 1 (Telemetry)	Function 2 (External Parameter)
1	HR2	HR-LF 2 MECG Analog: Input	
2	-12V	Max. 100mA: Output	
3	+5V	Max. 100mA: Output	
4	+12V	Max. 100mA: Output	
5	S1	Telemetry on (L)[1]:Input	
6	S2		Ext Par On (L)[1]: Input
	S3	DECG Inop (L)[1]	INOP (L)[1]: Input
8	S4	DECG Mode	Ext Par Code MSB (scaling): Input
9	S5	Reserved Mode	Ext Par Code LSB (scaling): Input
10	S6	US Mode (L)[1]: Input	Cardio Channel (L[1]): Input
11	S7		Toco Channel (L[1]): Input
12	S8	IUP Mode (L)[1]	
13	S9	Toco Ext Mode (L)[1] Input	
14	HR1 (HR-LF)	FHR low frequency 1	
15	Toco	Toco dc: Input	
16	Ext Par		Ext Par Analog: Input
17	Gnd Analog	Signal Gnd	Signal Gnd
18	Gnd		
19	Mark	Telemetry Marker on (L)[1]	
20	FMP on	Telemetry FMP on	
21	FM	Telemetry Fetal Movement event on	
22		reserved (L)[1]	
23	N.C. (if ID)	New Interface= Do not connect Old Interface= connect to Gnd	
24	Gnd		
25	S10	HR2 Mode = MECG Mode (L) [1]	

1. If pin 5 is high (telemetry is off) the other inputs have different functions. Tele On (pin 5=L) and Ext.para.on (pn 6=L) are not allowed at the same time.

HCMOS threshold:
L = Low = 0 to 1.5V
H = High = 3.5 to 5V

Ext. Par. Code		Recorder Toco scale		Recorder Philips scale (US) (EU)		
MSB	**LSB**	**Sensitivity**	**0..100**	**Sensitivity**	**30..240**	**50..210**
0	0	1V/100 units	0V 1V	1V/100bpm	0.0V 2.1V	0.0V 1.6V
0	1	1V/100 units	0V 1V	1V/100bpm	0.3V 2.4V	0.5V 2.1V
1	0	2V/100 units	-1V 1V	1V/100bpm	0.0V 2.1V	0.0V 1.6V
1	1	10V/100 unit	-5V 5V	1V/100bpm	0.0V 2.1V	0.0V 1.6V

Functions for External Parameter Input

Telemetry

Pin 1 HR 2--MECG Analog Input.
Analog Signal Specification:

- Ri > 10 kΩ
- U max = ±6 Vpp, min = 40 mVpp

MECG Mode (L) Input (pin 25) should be set to L (0V).

Pins 2, 3 and 4. Supplies for small peripheral instruments, earth connections through pins 18 and 24. Maximum current allowed 100mA.

Pin 5 (**S1**) **Telemetry on** (**L**). monitor goes to Telemetry Mode.

- Telemetry display field is lit.
- Transducer must be removed from the front panel connectors. If they are not removed,  appears in the display above the transducer socket.
- Status bits pin 7 (S3) to pin 13 (S9) and pin 25 (S10) are activated through the connection to ground (pins 18 to 24) and have function 1 (Telemetry).
- Pin 6 (S2) must be High, if not  appears in the display.
- Each transition of S1 starts a complete mode annotation at the recorder.

Pin 7 (**S3**) DECG inop.

Pin 8 (**S4**) DECG Mode.

Pin 9 (**S5**) Reserved Mode.

Pin 10 (**S6**). US-Heart rate mode programming for Telemetry input signal.

Pin 11 (**S7**). Not used with Telemetry.

Pin 12 (**S8**). IUP Mode (L).

Pin 13 (**S9**). Toco Ext Mode (L). Toco mode programming. Activated Toco mode will be displayed on the front panel.

Pin 14 HR 1 Fetal Heart Rate INPUT. Input signal depends upon the selected HR mode. The table below gives details of the input signals for each of the HR modes.

Fetal Heart Rate Mode	Input signal Pin 14
US (S6 Low level)	Doppler LF signal
	Ri > 10 kΩ
	Umax = ±3.5 Vpp
	min = 35 mVpp

Pin 15 TOCO - DC INPUT

Ri > 10 kΩ
Input range = -3 V to +2 V
Sensitivity = -1 V Full scale

Pin 17. Signal ground for pins 14 and 15.

Pin 18 - 24. Ground for supply and status bits S1 to S10 activation. System outputs will be controlled in the telemetry mode as in the front mode.

Pin 25. MECG - Mode. Input > (L). MECG mode programming. Activated MECG mode will be displayed on the front panel. The input signal from pin 1 (MECG Analog Input) will be processed by the instrument.

External Parameter

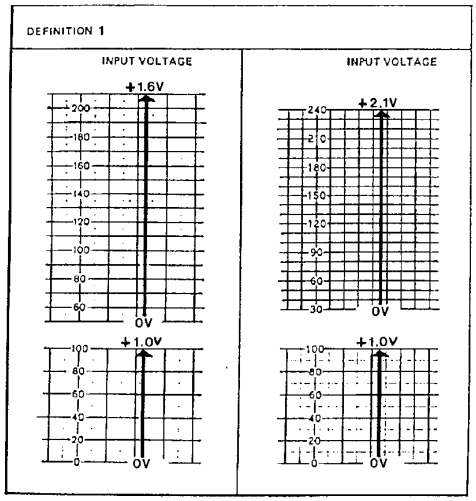
Pin 6 (S2) External Parameter ON (L). The external parameter is printed on the recorder in addition to the front mode information.

- Pin 5 (S1) must be High, if not  appears in the display.
- Status bits S3 to S7 have function 2.

Pin 7 (S3) INOP (L). Printer disabled for the external parameter.

Pin 8 (S4) MSB and Pin 9 (S5) LSB. External parameter code.

Ext. Par. Code		Definition
MSB	LSB	
0	0	1 (see Figure Definition 1)
0	1	2 (see Figure Definition 2)
1	0	3 (see Figure Definition 3)
1	1	4 (see Figure Definition 4)

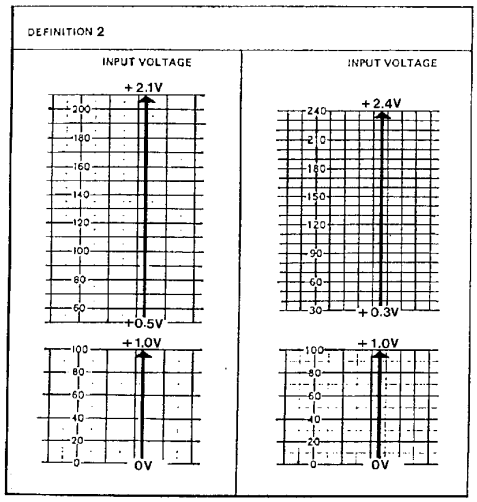


psm11sca.tif

Figure 5-3 External Parameter Definition 1

HR Channel: 1 V/100 bpm
TOCO Channel: 1 V/100 Toco units

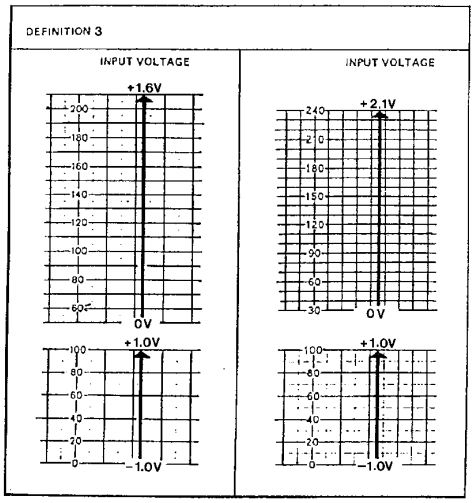
Positive input voltages only; when the paper scaling limits are exceeded the external parameter will no longer be recorded.



psm12sca.tif

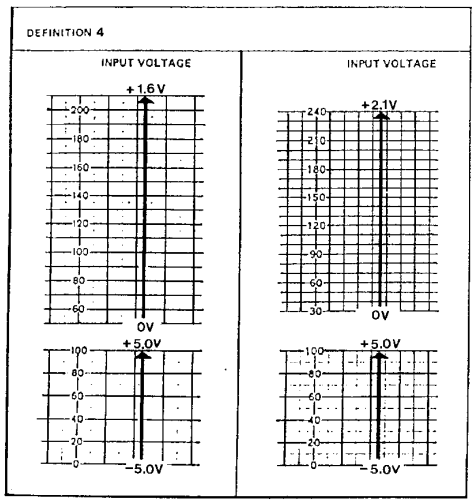
Figure 5-4 External Parameter Definition 2

HR Channel: 1 V/100 bpm
TOCO Channel: 1 V/100 units



psm13sca.tif

Figure 5-5 External Parameter Definition 3



psm13sca.tif

Figure 5-6 External Parameter Definition 4

When the paper scaling limits are exceeded the external parameter is recorded as a straight line on the limit.

Pin 10 (S6) Cardio Channel (L). External parameter will be printed on the Cardio Channel.

Pin 11 (S7) Toco Channel (L). External parameter will be printed on the Toco channel. One and only one of either S6 or S7 has to be selected otherwise E--/[]4 is displayed on the right hand Cardio 2 display.

Pin 16 External Parameter Input

Ri > 10 kΩ
Uin (max ±5 V)
See external parameter code definition (pin 8, pin 9).

The external parameter is recorded but does not appear at the display and system interface output. The digital serial interface can provide the external parameter signal.

Interface for Triplets Monitoring

Connect the M1360-61671 triplets cable to the 25 pin connector on the telemetry interface or telemetry system interface of the M1350A or M1350B/C, and to the system interface of either the 8040A or the 8041A. Refer to the *Instructions for Use* for details.

RS232 System Interface

The 9 pin RS232 Telemetry interface system connector provides a digital interface protocol to permit connection to a Philips Series 50 OB TraceVue system or an IBM compatible PC.

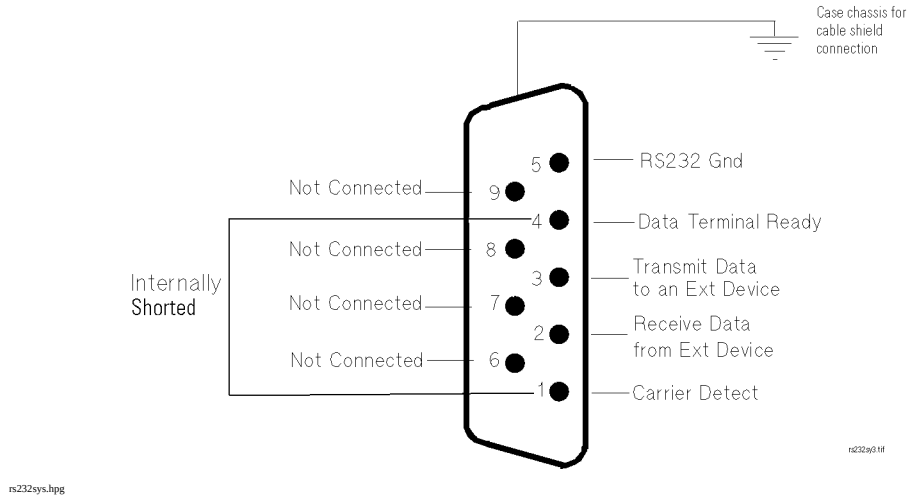


Figure 5-7 RS232 System Interface Connector

Note

If an OBMS Board (M1350-66532) is plugged in at the same time as the Combined Telemetry/ Digital System Interface Board (M1350-66536), the digital interface on the Telemetry Board is switched off as per default. See Chapter 5 for information on how to activate RS232.
If the Software Revision installed is earlier than **A.04.01** the RS232 system interface will remain inactive.

System Interface Option J12

The system interface is provided for connection to the Obstetrical Display Information System (ODIS), and the Obstetrical Information Management System (OBMS) Central Stations.

The pin allocations for the various signals are shown below.

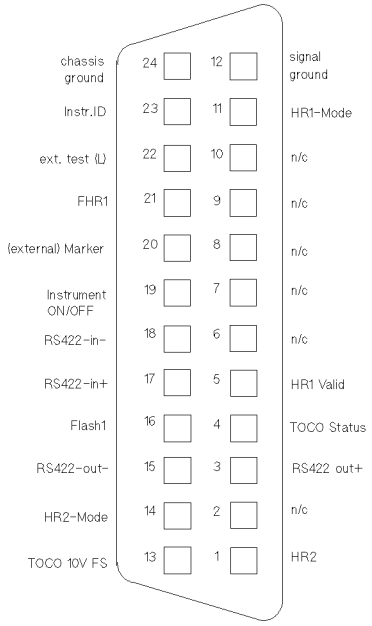


Figure 5-8 System Interface Connections

The following table lists the pin numbers, the signals at each pin and the signal details. If a Telemetry/System Interface M1350-66536 is connected at the same time, you should check the correct setting of C13. See Chapter 5 for the correct setting.

Table 5-2 System Interface: Pin Connections

Pin	Signal	Signal Details
1	HR2 Output	1 V/100 bpm ±40mV (0V if not valid) R_out = 100Ω
2		Not connected
3	RS422 Output +	Digital Serial Output
4	Toco Status Output	Toco external/No Toco (L) IUP (H) (Digital Signal)
5	HR1_valid Output	When heart rate is valid, output is high.
6		Not connected
7		Not connected
8		Not connected
9		Not connected
10		Not connected
11	HR1-Mode 10V Output	US=0.6V / AECG=5V / DECG=6.7V / INOP=8.5V
12	Ground Analog	Signal Ground
13	Toco 10V	1 V/10 Toco-units ±100mv R_out = 100Ω
14	HR2-Mode 10V Output	US=0.6V / MECG=5V / DECG=6.7V / INOP=8.5V
15	RS422 Output -	Digital Serial Output
16	Flash 1	Pulse (H) > 100ms (Digital Signal)
17	RS422 Input +	Digital Serial Input
18	RS422 Input -	Digital Serial Input
19	Instrument ON/OFF	Open PNP Collector R_i = 22kΩ; (ON=Conducting)
20	External Marker	0V=On (Output)
21[1]*	FHR1 Analog Output	1V/100bpm ±30mV R_out=100Ω
22	External Test Input	When input is low, external test is on. Internal Pullup 5kΩ
23	Instrument ID	2.5V Regulated R_i = 100Ω
24	Chassis Ground	Chassis ground

1. In the event of a “paper end” or an “FHR coincidence” condition, an analog signal is applied to Pin 21 FHR 1 output. This lasts approximately 600msec and is repeated every minute while the condition remains. The exact output voltage values are shown in the following table.

Table 5-3 Pin 21: Output Voltage Values

FHR Coincidence Bit	Paper End Bit	Reserve Bit	Voltage Range	Pin21 Output
0	0	0	3.500 - 3.650	3.575
0	0	1	3.650 - 3.800	3.725
0	1	0	3.800 - 3.950	3.875
0	1	1	3.950 - 4.100	4.025
1	0	0	4.100 - 4.250	4.175
1	0	1	4.250 - 4.400	4.325
1	1	0	4.400 - 4.550	4.475
1	1	1	4.550 - 4.700	4.625

RS232/RS422 Dual Serial Interface Option J13

The Dual Serial Interface board provides data communication between the Philips monitor and external devices. A model **8801** adapter is required from Critikon before the Dinamap 8100 can be connected to the interface socket on the Philips monitor. External parameters are transmitted/printed only if the monitor has no internal parameters installed.

Supported External Devices	External Maternal Parameters				Fetal
	NIBP	SpO_2	Temp	MHR[1]	$FSpO_2$
Philips M1165A/1166A/1175A/1176A CMS/ V24/V26	Yes[2]	Yes[2]	Yes[2]	Yes[2]	No
Philips 78352C/78354C Compact Configurable Monitor (CCM)	Yes[2]	Yes[2]	Yes[2]	Yes[2]	No
COLIN Press-Mate/Nippon Colin	Yes	No	No	Yes	No
Listmini Model BP-8800	Yes	No	No	Yes	No
Datascope Accutorr 3, 4	Yes	No	No	Yes	No
Dinamap 1846/8100 NIBP Monitor	Yes	No	No	Yes	No
Datascope Accutorr 3SAT, 4SAT	Yes	Yes	No	Yes	No
Nellcor Oxygen Saturation monitor (N-200)	No	Yes	No	Yes	No
Nellcor OxiFirst™ Fetal Oxygen Saturation monitor (N-400)	No	No	No	No	Yes

1. An MHR measurement is provided in conjunction with maternal NIBP or SpO_2 monitoring.

2. Only if this parameter is installed on the external device.

Measurement Priority Measurements made by internal maternal parameters (SpO_2, NIPB, and MHR) take precedence above the same measurements made by an externally connected device.

The MHR measurement obtained from the SpO_2 measurement has higher priority than the MHR obtained from the NIBP measurement.

Connecting External Devices

The supported external devices are connected to the monitor via the Dual Serial interface at the rear of the monitor. External devices connected to socket 1 that can monitor SpO_2 have priority over the Nellcor OxiFirst™ Oxygen Saturation monitor (N-200).

Warning
Before connecting an external device to the monitor, connect the equipotential grounding point (3) to earth potential. Use the grounding cable supplied with the monitor. The power cord of the external device must be plugged into a wall-mounted power outlet - not into an extension block.

The Dual Serial Interface has two sockets: see Figure 5-1.

1. Use socket **1** (9 pin) for connecting:
   - Philips M1165A/1166A/1175A/1176A CMS, all models
   - Philips 78352C/78354C Compact Configurable Monitor.
   - Dinamap 1846/8100 NIBP Monitor.
   - COLIN Press-Mate/Nippon Colin Listmini Model BP-8800.
   - Datascope Accutor 3, 4, 3SAT and 4SAT.
2. Use socket **2** (25 pin) for connecting:
   - Nellcor Maternal Oxygen Saturation monitor (N-200) and Nellcor OxiFirst™ Fetal Oxygen Saturation monitor (N-400).

Philips CMS, Philips 78352C/ 78354C, Dinamap 1846/ 8100, Datascope Accutorr Monitor

To connect either a Philips CMS, a Philips 78352C or 78354C, a Dinamap 1846/8100, or a Datascope Accutorr monitor follow the instructions below. The screws for the Philips CMS and Philips 78352C or 78354C are metric and should be tightened by hand only, and not with a screwdriver.

- Use interface cable M1350-61609.
- Connect the 9-pin end of the cable to the Philips Series 50 XM or XMO monitor.
- Connect the 25-pin end of the cable to the external device.
- Secure the interface cable by the screws at the cable connectors.

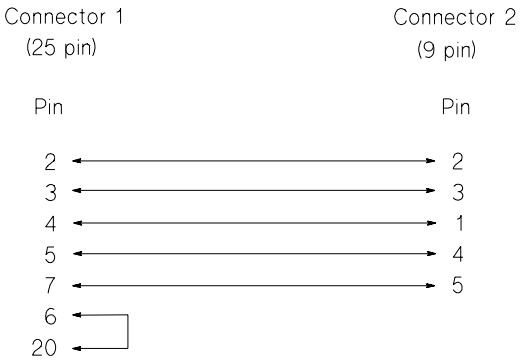


Figure 5-9 Interface Cable M1350-61609

COLIN BP-8800

To connect a COLIN BP-8800 Monitor to a Philips Series 50 XM or XMO monitor:

- Use the interface cable supplied by the COLIN Corporation with the NIBP monitor.
- Connect the 9-pin end of the cable to the Philips Series 50 XM or XMO monitor.
- Connect the 15-pin end of the cable to the COLIN.
- Secure the interface cable by the screws at the cable connectors.

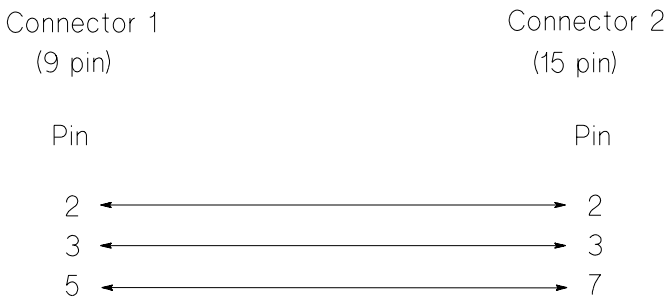


Figure 5-10 COLIN Interface Cable

Nellcor N-200 or N-400 Monitor

To connect a Nellcor N-200 or N-400 monitor to the Philips Series 50 XM or XMO monitor:

- Use the interface cable M1350-61609.
- Connect the 25-pin end of the cable to the Philips Series 50 XM or XMO monitor.
- Connect the 9-pin end of the cable to the Nellcor N-200 or N-400.
- Secure the interface cable by the screws at the cable connectors.
- Set the dip switches on the rear panel of the Nellcor N-400 fetal SpO_2 monitor to:
  - Up: 4, 8
  - Down: 3, 6, 7,

    This selects a baud rate of 2400 and an output format of "Conversation". The positions of the other dip switches do not matter.

The following tables list the pin numbers, the signal at each pin and the signal details.

Table 5-4 9-Pin Connector

Pin	Signal	Signal Details
1	-	Connected to pin 4
2	RxD (RS232)	Received data input
3	TxD (RS232)	Transmitted data output
4		Connected to pin 1
5	GND	Signal ground

Table 5-5 25- Pin Connector

Pin	Signal	Signal Details
2	TxD (RS232)	Transmitted data output
3	RxD (RS232)	Received data input
	RxD-1 (RS422)	Received differential data input +
7	GND	Signal ground
9	TxD-1 (RS422)	Transmitted differential data output +
10	TxD-2 (RS422)	Transmitted differential data output -
18	RxD-2 (RS422)	Received differential data input -

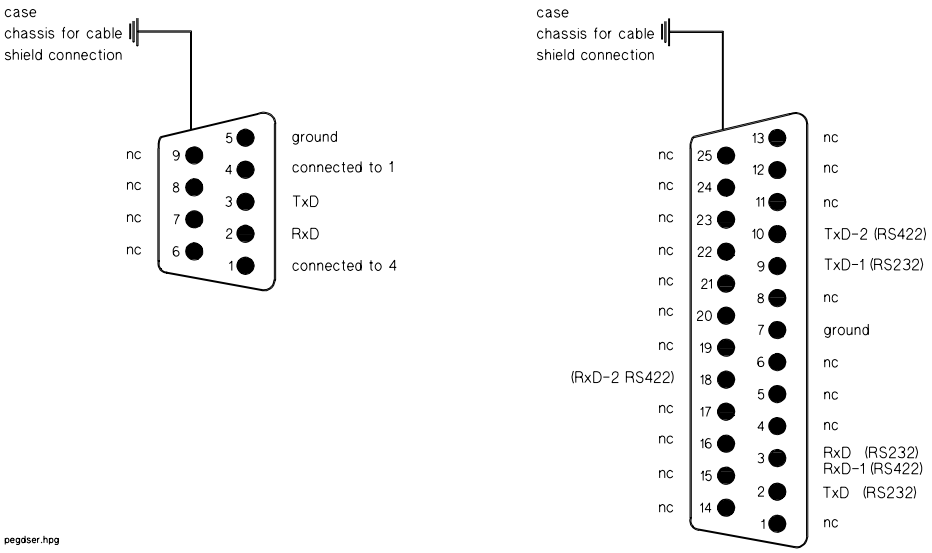
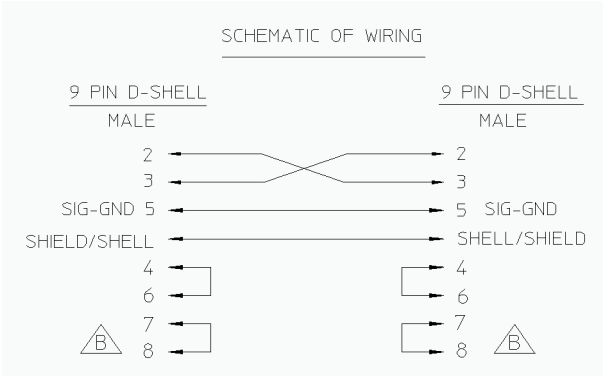


Figure 5-11 Dual Serial Interface: 9-Pin and 25-Pin

Philips V24/ V26

To connect a V24/V26 to the Philips Series 50 XM or XMO monitor:

- Use the interface cable M1353-61614.
- Secure the interface cable by the screws at the cable connectors.



External Device Baudrate Settings and Configurations

Philips CMS

Baudrate:	9600		
Startbit:	1	**Parity:**	None
Databits:	8	**TX/RX:**	High/Low
Stopbits:	1	**Computer:**	On
Cable:	M1350-61609 only		
Port:	Any port may be used, but ensure the above settings are stored to the Philips CMS in configuration mode.		

Philips 26/24

Baudrate:	9600		
Startbit:	1	**Parity:**	None
Databits:	8	**TX/RX:**	High/Low
Stopbits:	1	Computer	On
Cable:	M1353-61614		

Philips 78352C and Philips 78354C

Baudrate:	9600	**Switches:**	SW5 Open
Startbit:	1		SW6 Closed
Databits:	8	**Parity:**	None
Stopbits:	1		
Cable:	M1350-61609		
Port:	Only port B (sometimes referred to as port 2) can be used if the Philips 78352C or 78354C is configured to 9600 Baud.		

COLIN BP-8800

Baudrate:	4800		
Startbit:	1		
Databits:	8	**Parity:**	Even
Stopbits:	1		
Cable:	Supplied by the COLIN Corporation		

Dinamap 1846/ 8100

Baudrate:	600		
Startbit:	1		
Databits:	8	**Parity:**	None
Stopbits:	1		
Cable:	M1350-61609		

Datascope Accutorr

Baudrate:	9600		
Startbit:	1		
Databits:	8	**Parity:**	None
Stopbits:	1		
Cable:	M1350-61609		

Nellcor N-200 and N-400

Baudrate:	2400		
Startbit:	1		
Databits:	8	**Parity:**	None
Stopbits:	1		
Cable:	M1350-61609		

External Maternal Measurement on the FHR Trace

Annotations on the trace of measurements made by external devices are always prefixed with an asterisk, *. Maternal measurements made by the 50 XM/XMO monitor itself have higher priority than maternal measurements made by a device externally connected to it.

Table 5-6 External Maternal Measurement Frequency

Parameter	Measurement Printout Interval	
	Internal	External
SpO_2		5 minutes
NIBP		Each measurement[1]
MECG Waveform	On demand	Not available
Temperature	Not available	5 minutes

1. If you are using automatic mode to measure maternal blood pressure, with a short interval between repetitions, not all measurements will be recorded on the paper.

If you monitor maternal NIBP only, an MHR measurement is printed at the same time as the NIBP measurement. If you monitor SpO_2, an MHR measurement is printed at the same time as the maternal SpO_2 measurement, every 5 minutes.

If you set the NIBP monitor to automatic mode, you must leave a minimum time interval between each measurement. This time interval depends upon the paper speed setting.

Paper Speed	Minimum Time Interval
1 cm/min	3 minutes.
2 cm/min	2 minutes.
3cm/min	1 minute.

Troubleshooting

You can use the following tables for solving general application problems and product-specific problems that may occur. For solving general technical problems, refer to the troubleshooting flowcharts.

General		
Problem	**Possible Causes**	**Solutions**
Not all maternal NIBP measurements are printed on the trace and the NIBP Monitor is in automatic mode.	The time interval between each measurement is too short.	Set the minimum time interval according to paper speed. (See previous pages in this Chapter).
Incorrect SpO_2 or Temperature measurements.	The monitor has been switched on before the appropriate sensor was applied.	Apply sensor 5 minutes before the monitor is switched on.

Nellcor N-200 Maternal SpO_2 Monitor		
Problem	**Possible Causes**	**Solutions**
No maternal SpO_2 and no MHR measurements are printed on the trace.	The Nellcor monitor is powered by the internal battery. (Battery power symbol is lit.)	Switch on the AC power at the rear of the monitor. (Battery power symbol is not lit.) See also "FSpO2 Monitor" on page 164 for $FSpO_2$ troubleshooting instructions.
	Wrong DIP switch configuration of N-200 monitor.	Check DIP switch configuration of N-200 monitor (see page 58).

Nellcor N-400 Fetal SpO_2 Monitor		
Problem	**Possible Causes**	**Solutions**
No $FSpO_2$ annotation after Rec On in Toco grid.	Wrong DIP switch configuration of N-400 monitor.	Check DIP switches (see page 58).
	Wrong setting of C10.	Change C10 setting.
mat HR and mat SpO_2 appear as printout instead of trace.	No $FSpO_2$ transducer plugged in.	Connect transducer.
	Wrong C10 setting.	Change C10 > 10.

Philips CMS and Philips 26/24 Series		
Problem	**Possible Causes**	**Solutions**
No maternal measurements are printed on the trace.	The parameters are switched off. Incorrect interface cable. Incorrect Philips CMS software revision. Other RS232 external devices are blocking the communication to the Fetal Monitor. Incorrect configuration of the RS232 port.	Switch on the parameters in the Parameters On/Off menu. (See the *Operating Guide* supplied with the Component Monitoring System.) Ensure the interface cable M1350-61609 is used. (This number is printed on both ends of the cable.) Ensure the Philips CMS has Revision C (or higher) software. Disconnect all other RS232 external devices, except the fetal monitor from the Philips CMS and turn the power supply switch for the Philips CMS off. Wait at least 10 seconds, then turn the Philips CMS power supply switch on again. Check Philips CMS settings and refer to Philips CMS *Service Documentation*.
No MHR measurement is printed on the trace.	Incorrect parameter source.	If the SpO_2/PLETH module is plugged in, set the HR/PULSE source to PLETH.
No maternal temperature is printed on the trace.	TEMP1 is not labeled T1. Temperature sensor is not connected to module TEMP1.	Change TEMP1 label to T1. Check the cable connection of the temperature sensor.
Mat.HR 0 and Mat.SpO_2 0% values are printed on the trace.	The Nellcor and the Philips CMS are connected in parallel and the Nellcor front power supply switch is in the off position and the rear power supply switch is in the on position.	Ensure the Nellcor power supply switches (front and rear) are both on or both off. Alternatively, disconnect the Nellcor monitor completely (see also page 164).

6
Quick Installation Checks

Carrying Out the Checks

After you have installed the monitor, perform the following checks listed below:

1. Ensure you have loaded some paper and connected the power cord.
2. Turn the monitor on.
3. Check that the paper speed, and time and date are configured.
4. With no transducers connected, press Test .

   You should see the following:

   DISPLAY: All parts of the display are lit followed by all mode symbols. These will flash alternately for about 10 seconds.

   RECORDER: During the test the recorder speed will automatically set to 3cm/min and a test pattern will be printed on the recorder paper to verify the condition of the thermal print head and if the printer is correctly configured. See Figure 9-1. Recorder Test Pattern, for a sample recorder test pattern.
5. Perform the Parameter Test as described in “Parameter Test” on page 112.
6. Check the Barcode Reader is correctly connected as outlined in Chapter 3.

The previous checks should verify the operation of the monitor. More complete tests, such as transducer tests, are given later in this book.

7
Upgrades

Introduction

This chapter tells you how to upgrade the monitors, which options require which steps, and how to restore the monitor's original configuration. Many of the upgrade options (especially those whose option number begins with "C") require very similar steps to upgrade them, as you will see from the tables.

Overview of Upgrade Options

There are many different upgrades possible. The following table shows you the upgrade option numbers (upgrade option and part numbers are prefixed with M1360) and gives a brief description of their function.

add	Existing Configuration			
	Series 50 IX	Series 50 XM		Series 50 XMO without maternal parameters
		without maternal parameters	with maternal parameters	
Second US/Cardio channel	C01	C01	C01	C01
Fetal Movement Profile	C02	C02	C02	C02
Maternal parameters only	C04	C03	not applicable	C30
$FSpO_2$ only	C31	C34	C32	not applicable
$FSpO_2$ and maternal parameters	C33	C35	not applicable	not applicable
latest software release	S01	S01	S01	S01
RS232 Interface (for Philips OB TraceVue) or Telemetry Interface	J10	not applicable	not applicable	not applicable
Combined analog/digital system interface for OBMS and ODIS	J12	J12	J12	J12
Maternal parameter interface to connect external patient monitor	J13	J13	J13	J13

Work Instructions at a Glance

Each upgrade is described in a series of work instructions. Not all upgrades require all the work instructions. The following table shows you exactly which instructions you must follow for the upgrade you are performing.

	Work Instruction									
Upgrade option	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
C01	-	-	-	-	-	-	-	-	-	●
C02	-	-	-	-	-	-	-	-	-	●
C03	●	●	●	-	●	●	-	●	●	-
C04	●	●	●	●	-	-	-	-	●	-
C30	●	●	●	-	●	●	-	●	●	-
C31	●	●	●	●	-	-	-	-	●	-
C32	●	●	●	-	●	-	●	●	●	-
C33	●	●	●	●	-	-	-	-	●	-
C34	●	●	●	-	●	-	●	●	●	-
C35	●	●	●	-	●	●	●	●	●	-
S01	●	●	-	-	-	-	-	-	●	-
J10	●	●	-	-	-	-	-	-	●	-
J12	●	●	-	-	-	-	-	-	-	-
J13	●	●	-	-	-	-	-	-	●	-

Options at a Glance

The following table gives you an overview of what is involved in each upgrade option. All "Cxx" upgrades include a mandatory CPU firmware upgrade for the ROM board.

Option	Adds.....	Factory ships.....	You must.....
C01	second US/Cardio channel	• upgrade key	• upgrade and test the monitor
C02	Fetal Movement Profile		
C03	maternal parameters to an XM without maternal capability	• new display • NIBP board • SpO_2 board • new CPU firmware (4 EPROMs)	• use original base assembly • fit new display • connect NIBP and SpO_2 and fit both boards • upgrade ROM board with new CPU firmware • configure and test monitor
C04	maternal parameters to IX	• installed new base assembly • new CPU firmware (4 EPROMs)	• transfer original cover, recorder, power supply and ROM board to new base assembly • upgrade ROM board with new CPU firmware • configure and test monitor
C30	maternal parameters to an XMO without maternal capability	• new display • NIBP board • SpO_2 board • new CPU firmware (4 EPROMs)	• use original base assembly • fit new display • connect NIBP and SpO_2 and fit both boards • upgrade ROM board with new CPU firmware • configure and test monitor
C31	$FSpO_2$ only (no maternal parameters) to an IX	• installed new base assembly • new CPU firmware	• transfer original cover, recorder, power supply and ROM board to new base assembly • upgrade ROM board with new CPU firmware • configure and test monitor
C32	$FSpO_2$ to an XM that already has maternal capability	• new display • $FSpO_2$ board • new CPU firmware (4 EPROMs)	• use original base assembly • fit display assembly • Fit $FSpO_2$ board • upgrade ROM board with new CPU firmware • configure and test monitor
C33	maternal parameters and $FSpO_2$ to an IX	• installed new base assembly • new CPU firmware (4 EPROMs)	• transfer original cover, recorder, power supply and ROM board to new base assembly • upgrade ROM board with new CPU firmware • configure and test monitor
C34	$FSpO_2$ only to an XM without maternal capability	• $FSpO_2$-only display • $FSpO_2$ board • new CPU firmware (4 EPROMs)	• use original base assembly • fit $FSpO_2$ board • fit new display • upgrade ROM board with new CPU firmware • configure and test monitor
C35	$FSpO_2$ and maternal parameters to an XM without maternal capability	• new display • $FSpO_2$ board • NIBP board • SpO_2 board • new CPU firmware (4 EPROMs)	• use original base assembly • connect NIBP and SpO_2 and fit boards • fit $FSpO_2$ board • fit new display • upgrade ROM board with new CPU firmware • configure and test monitor
S01	latest software	• new CPU firmware (4 EPROMs) • new NIBP firmware	• upgrade ROM board with new CPU firmware • upgrade NIBP board with new firmware
J10	RS232 interface for OB TraceVue, or Telemetry interface	• RS232/Telemetry board • new CPU firmware (4 EPROMs)	• upgrade ROM board with new CPU firmware • Fit new board. Series 50 IX only.
J12	combined analog/digital system interface for OBMS and ODIS	• Analog/digital interface board	• Fit new board

Option	Adds.....	Factory ships.....	You must.....
J13	maternal parameter interface	• Interface Board • CPU firmware (4 EPROMs) • Cable to link monitor to external device	• Fit new interface board • upgrade ROM board with new CPU firmware

Initial Inspection

The upgrades are supplied packed in protective shipping cartons. Before unpacking, visually check the packaging and ensure there are no signs of mishandling or damage. Using the table above, ensure that you have received the correct components for the upgrade option number, check that the contents are complete and that you have the correct upgrade.

Claims for Damage

Follow the instructions in the section "Unpacking and Checking the Shipment" on page 3 if the shipping cartons show signs of damage.

What You Need

Upgrading a monitor requires simple tools:

- pozidrive screwdriver size 1
- safety test equipment
- PC for configuration
- Configuration software "pegserv.exe"
- Cable to link PC to fetal monitor

Before You Start

Warning
Disconnect the electrical power to the monitor before you remove any component. Follow the necessary electrostatic discharge (ESD) procedures throughout the upgrade process.

Instruction 1 Verifying Monitor for Upgrade

Before you start the upgrade process, ensure that you are upgrading the correct monitor and that it is working properly.

Options Requiring this Procedure													
C01	C02	C03	C04	C30	C31	C32	C33	C34	C35	S01	J10	J12	J13
-	-	●	●	●	●	●	●	●	●	●	●	●	●

1. Check the monitor's serial number as described in the section on "Instrument Identification" on page 5.

   When you have upgraded the monitor, remove the old serial number labels from the monitor and replace them with the new labels supplied in the upgrade pack.

2. Ensure that the monitor you are about to upgrade works correctly. Perform a Quick Test and a Parameter Test on the monitor. These are detailed in Chapter 9.

   If the monitor does not successfully complete its service tests, do not upgrade it. Make appropriate arrangements for its repair. It is more expensive in time and money to troubleshoot after an upgrade.

Instruction 2 Checking Current Configuration

The first step in the upgrade process for all upgrade options is checking the current configuration. You do this by printing the error log to provide you with a record of the current configuration. After you have finished upgrading the monitor, you will need this record to help you to restore the initial configuration. See page 24 for instructions on printing the error log.

Options Requiring this Procedure													
C01	C02	C03	C04	C30	C31	C32	C33	C34	C35	S01	J10	J12	J13
-	-	●	●	●	●	●	●	●	●	●	●	●	●

Instruction 3 Removing the Top Cover

See “Removing the Top Cover” on page 167 for instructions.

Options Requiring this Procedure													
C01	C02	C03	C04	C30	C31	C32	C33	C34	C35	S01	J10	J12	J13
-	-	●	●	●	●	●	●	●	●	-	-	-	-

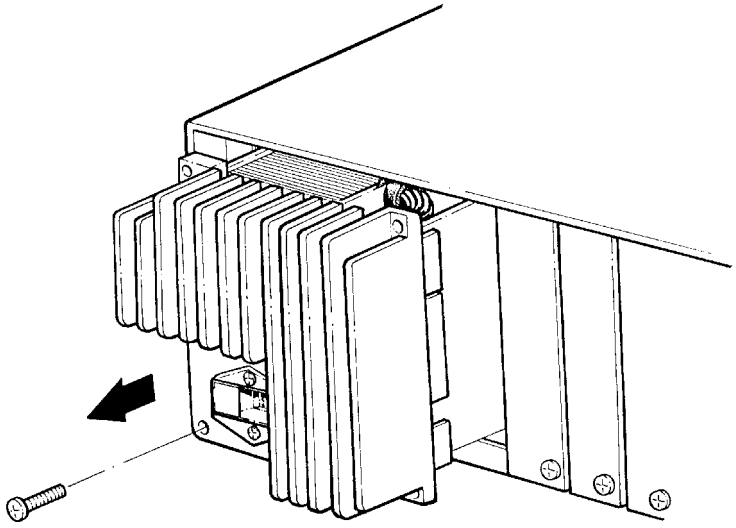
Instruction 4 Using the New Base Assembly

When you upgrade a Philips Series 50 IX monitor, you receive a new base unit that is fully fitted with the options that were ordered. All you have to do is transfer some components from the original monitor into the new base unit and perform a firmware upgrade. From the original monitor, you must reuse the cover, the power supply, the recorder and the ROM board.

Options Requiring this Procedure													
C01	C02	C03	C04	C30	C31	C32	C33	C34	C35	S01	J10	J12	J13
-	-	-	●	-	●	-	●	-	-	-	-	-	-

Reusing the Power Supply

To remove the power supply from the monitor:



psm20sca.tif

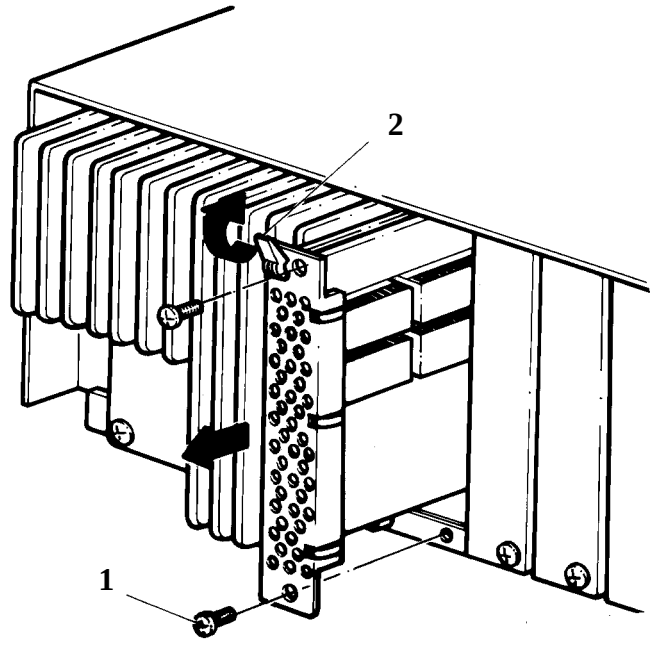
1. Undo the four screws at the rear of the power supply.
2. Pull the power supply out of the rear of the monitor.
3. Put the power supply into the new card cache of the upgrade kit. This is basically a reversal of the above procedure. Hold the ON/OFF switch (on the front of the monitor) as this can be dislodged while inserting the power supply. If you have trouble locating the power supply into the rear of the monitor, remove and check that the pins connecting the supply to the backplane are not bent. Reinsert the power supply (see page 14 for the correct location).

Reusing Boards

Depending on the configuration of the original monitor, you may have to swap up to three other boards from the original monitor into the new one. The technique for removal and replacement is the same for all of the boards. These boards are:

- Telemetry interface
- Dual serial interface
- OBMS interface

1. Undo screws (1) and (2) at the top and bottom of the board.
2. Move lever (2) upwards and pull the board out of the rear of the monitor.

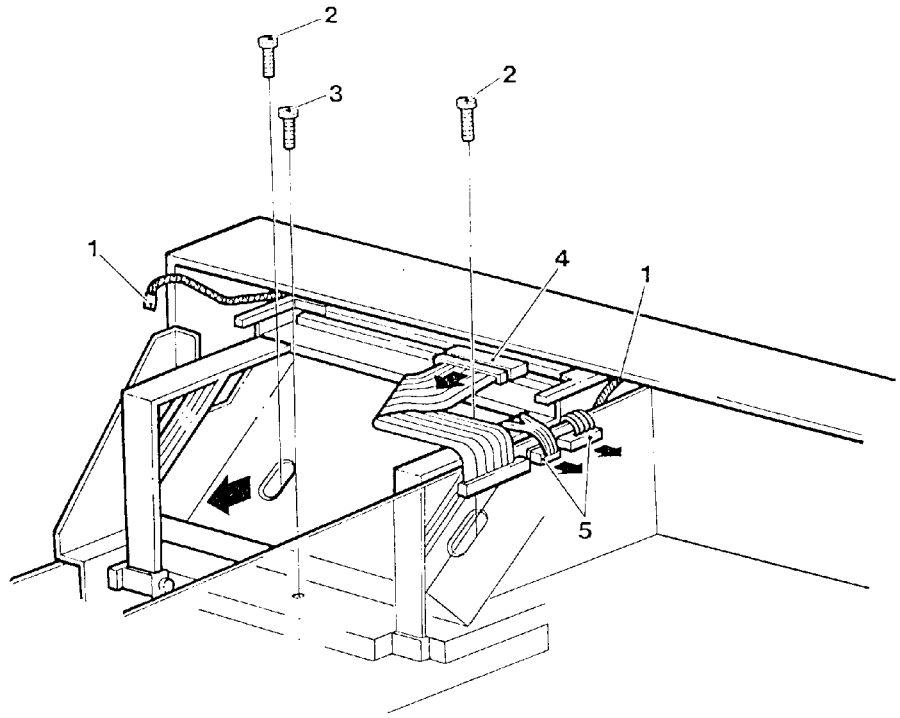


psm23sca.tif

3. Put the reused board(s) into the appropriate slot(s). See page 14 for details.
4. Replace and tighten the screws.

Using the Existing Recorder

To swap the existing recorder to a new unit, follow the instructions in the section on “Recorder Assembly” on page 174.



psm26sca.tif

Then replace the cover on the monitor, using the four screws you reserved earlier.

Labeling

1. Stick the option indicator label (which indicates whether the monitor has FMP and/or twin capability) beneath the remote event marker socket.
2. Place the upgrade serial number label on the righthand side of the cover so that it can be easily seen.

Instruction 5 Removing the Display Assembly

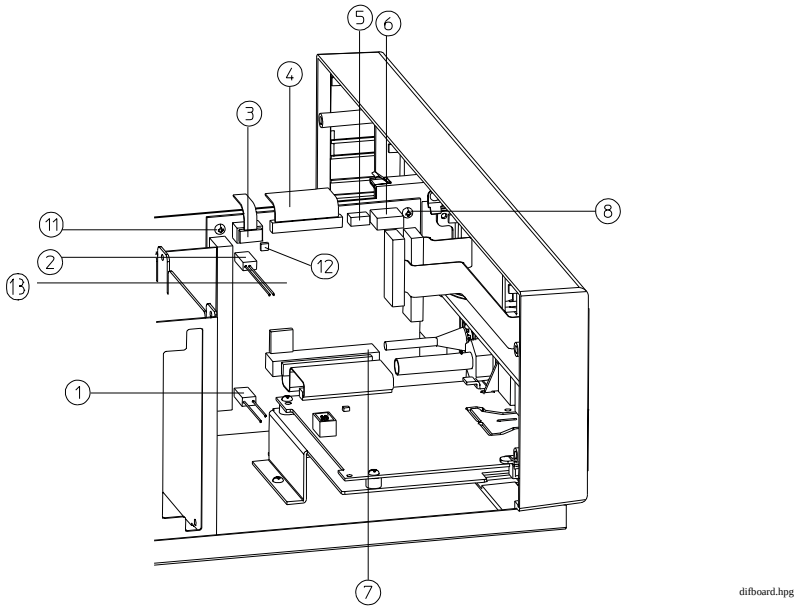
To remove the display panel you need first to remove the front end board, and then the digital interface board. This applies to upgrades to XM and XMO monitors.

Options Requiring this Procedure													
C01	C02	C03	C04	C30	C31	C32	C33	C34	C35	S01	J10	J12	J13
-	-	●	-	●	-	●	-	●	●	-	-	-	-

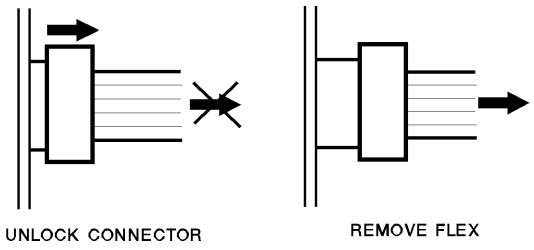
A Removing the Front End Board

See “Frontend Board” on page 176 for instructions on how to remove the frontend board.

B Removing the Digital Interface Board



1. Disconnect all the cables:
   - loudspeaker cable (1)
   - power LED connector (2)
   - recorder switch board connector (3)
   - recorder sensing board connector (5). Unlock the flex layer connector by pulling it slightly forwards.



- recorder stepper motor (6)
- frontend board connector (7)
- backplane flat cable (13)

2. Disconnect the recorder print head (4) from the recorder assembly.
3. Remove the two screws (8) and (11) that hold the board in place.
4. Slide the digital interface (DIF) board towards the rear of the monitor before lifting the board up, to give the marker connector a “chance”.
5. Remove the label from the front end connector area. Score carefully around the connectors in the area with a flat bladed knife. Do not allow any adhesive to remain on the front panel.

C Removing the Maternal Display Panel

See “Display Assembly” on page 180 for instructions on how to remove the maternal display panel.

Next Step

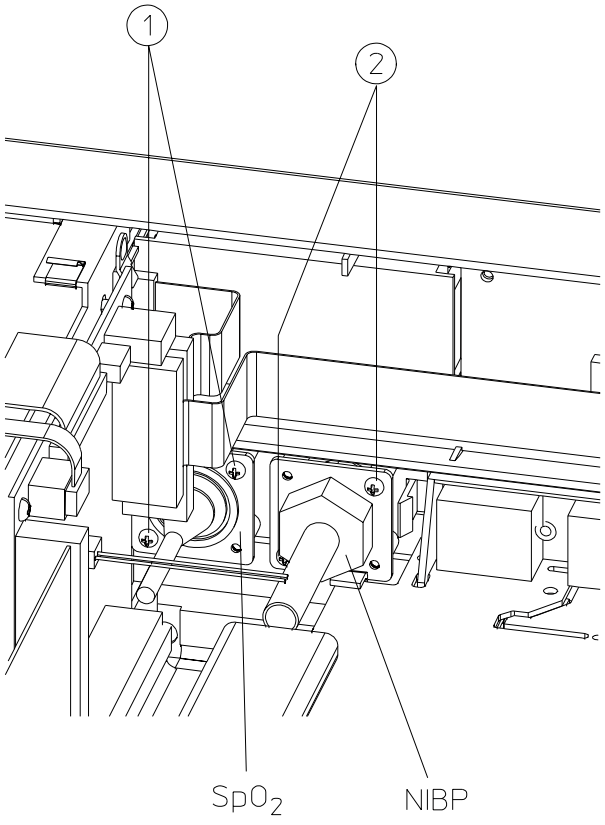
If your upgrade is Option C03, C30 or C35 go to “Adding SpO2 and NIBP Capability” on page 77.

If your upgrade is Option C32 or C34, now go to “Adding an FSpO2 Board” on page 79.

Instruction 6 Adding SpO_2 and NIBP Capability

This adds maternal pulse oximetry and blood pressure measurement capability.

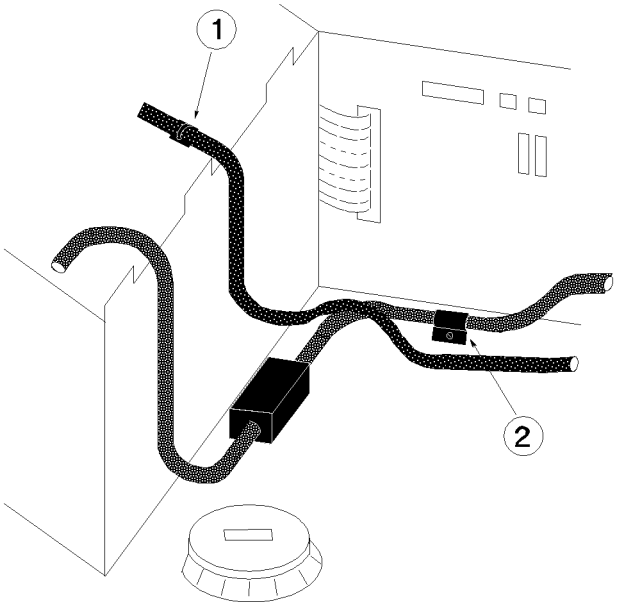
Options Requiring this Procedure													
C01	C02	C03	C04	C30	C31	C32	C33	C34	C35	S01	J10	J12	J13
-	-	●	-	●	-	-	-	-	●	-	-	-	-



matcable.hpg

1. Remove the two plastic parts that pad the two holes already prepared for the NIBP and SpO_2 connectors (screws 1 and 2).
2. Remove the three cover-blanks that cover slots 4 and 5 (NIPB) and 9 (SpO_2), from the rear of the monitor.
3. Fix the NIBP tubing and SpO_2 cabling, with their connectors, to the front panel. Do not force the screws drilled into the plastic on the front panel.

4. Replace the DIF board into the monitor, checking that the marker connector is raised through the front end. Reconnect all the cables.
5. Secure the earth connection mounting (2) to hold the SpO_2 cable in place and to ensure the correct shielding.
6. Place the SpO_2 cable and the NIBP tubing in wide soft curves from the front to the rear card cache and feed them through the appropriate slots.
7. Insert the SpO_2 and NIBP boards halfway into the appropriate slots at the rear of the monitor. Connect the tubing and the cable and then fully insert the boards. Screw the boards into position with the provided screws.
8. Attach the self-adhesive holders fixing cable and tubing (1) to the top of the card cache so that it allows any subsequent exchange of the boards without removing the top cover. Make sure that the cable and tubing lie in a soft curve without any crossover on top of the card cache.



spo2nib.tif

9. Put the frontend board back into the monitor, sliding it towards the front to click the connectors back into their clips. Ensure that all connectors are fully inserted (check this from the front) before you screw the board back in place.
10. Replace the top cover, ensuring that the cable and tubing are not squeezed.

Next Step

If your upgrade is Option C32, C34 or C35, go to “Adding an FSpO2 Board” on page 79.

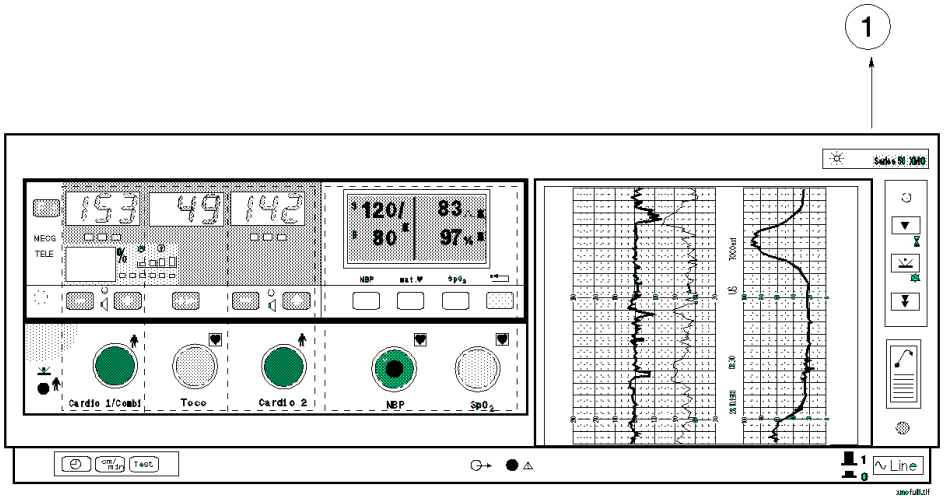
If your upgrade is C03, C30, or C34, go to “Upgrading ROM Board EPROMs” on page 80.

Instruction 7 Adding an $FSpO_2$ Board

This adds fetal pulse oximetry capability.

Options Requiring this Procedure													
C01	C02	C03	C04	C30	C31	C32	C33	C34	C35	S01	J10	J12	J13
-	-	-	-	-	●	●	●	●	●	-	-	-	-

1. Replace the DIF board into the monitor, checking that the marker connector is raised through the front end. Reconnect all the cables.
2. Put the frontend board back into the monitor, sliding it towards the front to click the connectors back into their clips. Ensure that all connectors are fully inserted (check this from the front) before you screw the board back in place.
3. Remove the cover blank from slot 9 at the rear of the monitor.
4. Insert the $FSpO_2$ board into the monitor. There is no tubing or cabling to connect.
5. Screw the board into position with the screws provided.
6. Carefully remove the existing product label from the front of the monitor. The existing label says either “Series 50 IX” or “Series 50 XM”. Replace this with the label that says “Series 50 XMO”(1).



xmolabel.gif

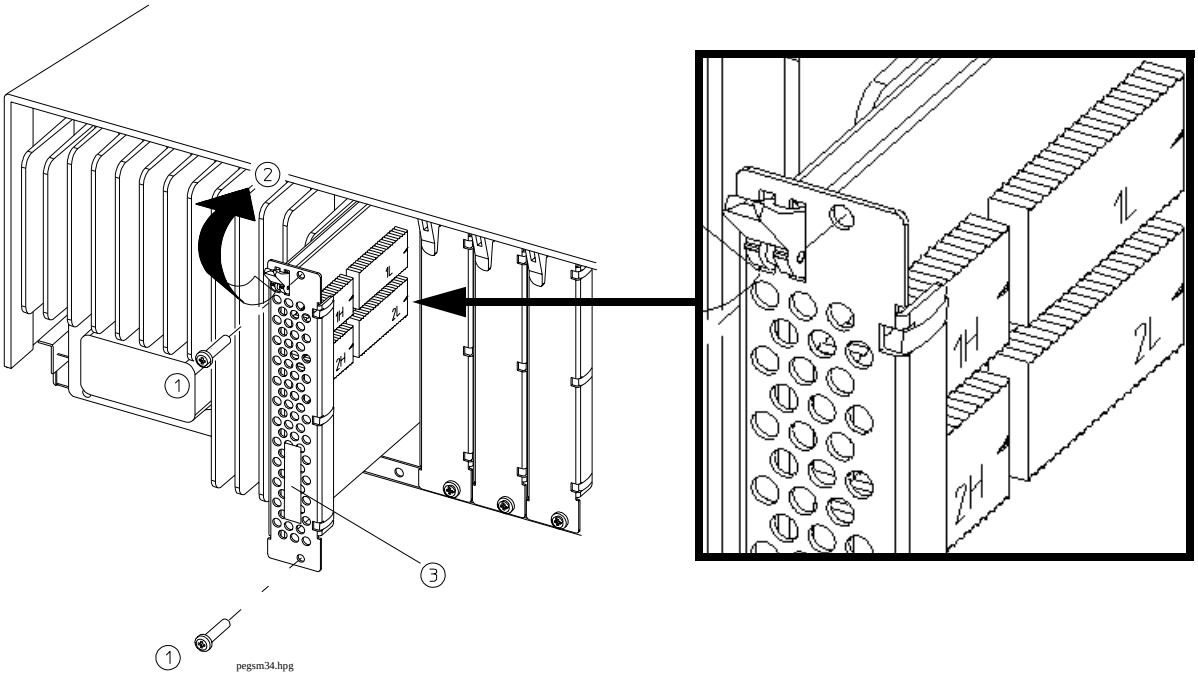
7. Go to “Upgrading ROM Board EPROMs” on page 80.

Instruction 8 Upgrading ROM Board EPROMs

Most upgrades require new EPROMS. You must fit them now and then reconfigure the monitor. For upgrade S01 this is the only procedure you need.

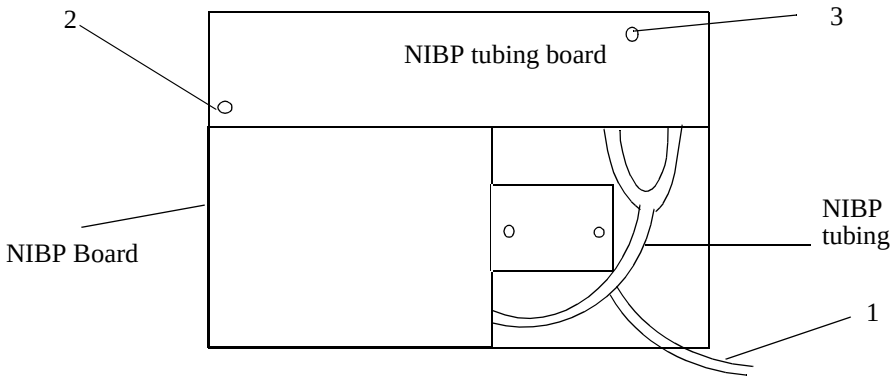
Options Requiring this Procedure														
Board	C01	C02	C03	C04	C30	C31	C32	C33	C34	C35	S01	J10	J12	J13
ROM Board	-	-	●	●	●	●	●	●	●	●	●	●	-	●
NIBP Board	-	-	-	-	-	-	-	-	-	-	●	-	-	-

1. Undo screws (1) at the top and bottom of the ROM Board.
2. Move lever (2) upwards and pull the board out of the rear of the monitor.
3. Using a flat-blade screwdriver, replace the EPROM set, according the diagram below.

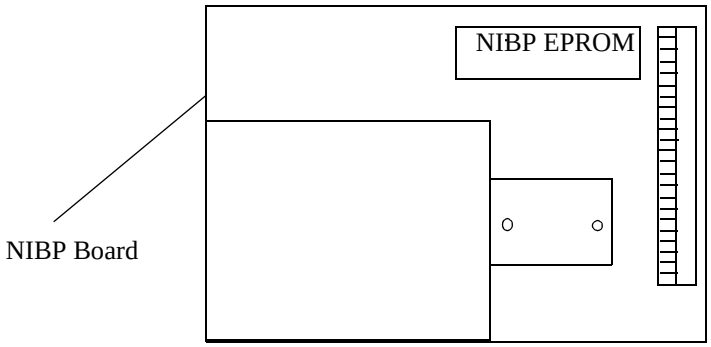


4. Push the board back into the slot inside the rear of the monitor.
5. Replace the screws and tighten securely.
6. Stick the label (3) provided with the new EPROMS onto the board as shown.
7. Perform the appropriate safety tests, and initiate the monitor's self test before allowing the monitor to be used on a patient.

8. Carefully attach the new label with the additional holes for the NIBP and SpO_2 connectors to the front panel.
9. If your S01 upgrade includes a new ROM for the NIBP board, follow these instructions:
   a. Remove the NIBP board from the monitor. There is no need to remove the cover.
   b. Undo the screws at the top and bottom of the NIBP board, which is in Slots 4 and 5 at the rear of the monitor.
   c. Move the lever upwards and pull the board out of the rear of the monitor.
   d. Disconnect the part of the NIBP tubing that leads to the display panel at the front of the monitor (1)
   e. Remove screws (2) and (3) from the NIBP tubing board and gently ease the board forwards so you can access the NIBP board beneath.



   f. Lever the NIBP EPROM gently off the board using a flat bladed screwdriver and replace it with the upgrade EPROM.



   g. Replace the NIBP tubing board and tighten the screws.
   h. Reconnect the NIBP tubing that leads to the display panel.
   i. Slide the NIBP board into the rear of the monitor and refasten the screws.

Instruction 9 Reconfiguring the Monitor

When you exchange EPROMs on the ROM board you must rewrite the new serial number and restore the original options configuration (Twins, FMP, Fetal Alerting).

Options Requiring this Procedure													
C01	C02	C03	C04	C30	C31	C32	C33	C34	C35	S01	J10	J12	J13
-	-	●	●	●	●	●	●	●	●	●	-	-	-

1. If you have not yet done so, print the error log (see “Printing and Clearing the Error Log” on page 24). This will serve as a useful record of the current monitor configuration.
2. Enter the new serial number from the serial number labels (included in this upgrade kit). This must be done using the service software: see “Writing the Serial Number” on page 36 for instructions. A serial number can be written only once to the exchanged board. If you accidentally confirm an incorrect serial number you can reset it using an access code obtainable from your Philips Response Center.
3. You will be prompted for the option configuration. You can set all the option settings using the pushbuttons, as described in “Writing the Serial Number” on page 36. Using the error log you printed previously, ensure that you restore only those options that the customer had before you commenced the upgrade.
4. Double check the settings carefully. If you accidentally confirm an incorrect serial number you can reset it using an access code obtainable from your Philips Response Center.
5. Step back to the main menu of the service program and select “Configuration Tasks” to set the paper speed, time format, and so forth, or perform the self tests, or read the error log. You will find detailed instructions for all these tasks in Chapter 3, “Configuring the Monitor.”

Restoring Service Settings Using Pushbuttons

Using the data from the error log you must now restore the customer’s original service settings. Of course, if you have added new functionality, you should ensure that default settings for the new parameter(s) are satisfactory for the customer and if not, change them. See “Configuring the Monitor Using Pushbuttons” on page 21 for instructions on changing the settings.

Instruction 10 Upgrade Key (Option Upgrades Only)

This section tells you how to use an upgrade key to add options (Twins, FMP, Fetal Alerting) to the Philips Series 50 XM and XMO fetal monitors.

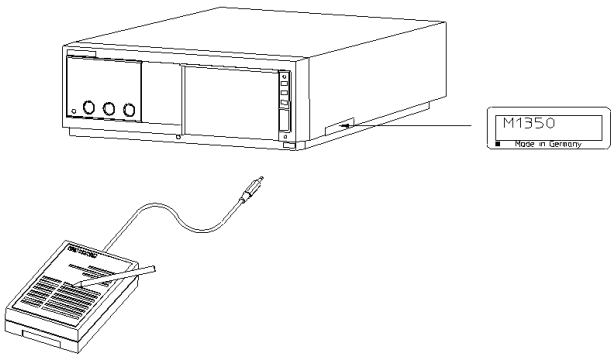
1. Disconnect all transducers (and telemetry) from the monitor.
2. Switch on the monitor.
3. Plug the upgrade key into the service socket (see Figure 1-1 on page 8) on your monitor (if applicable, first remove the little plastic cap on the service socket).

   The “start upgrade” tone sounds (two short beeps) when the upgrade begins.
4. At the end of the procedure (after about 45 seconds), you will hear the “upgrade successful” tone (a continuous beep lasting two seconds). Unplug the upgrade key from the monitor. If you don’t hear the “start upgrade” tone or you hear the “upgrade failed” tone (a series of short beeps lasting 2 seconds), there may be several reasons:
   - The battery in the upgrade key may be low. Replace the battery.
   - You may already have carried out the upgrades for the maximum number of monitors. The upgrade key is programmed to perform the ordered upgrades for up to a maximum of eight different monitors.

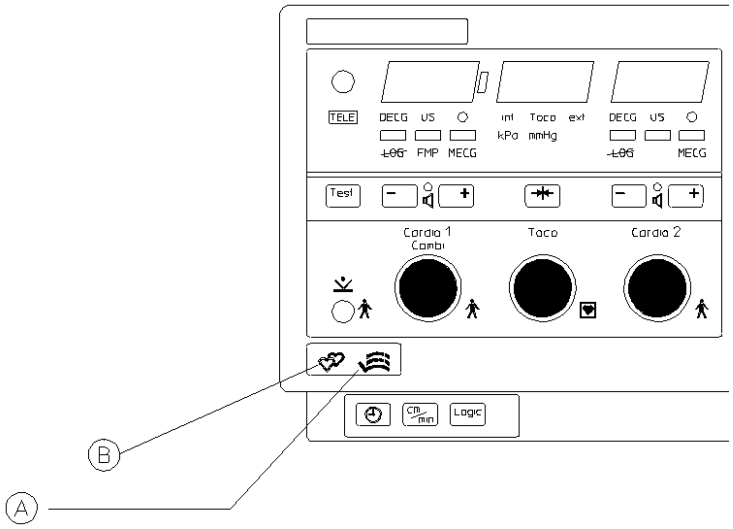
If you hear the upgrade failed tone, (a series of short beeps lasting 2 seconds), disconnect the upgrade key and try again from step 3 above.

If the upgrade still fails, carry out the quick test described in Chapter 9. If the response is not the same as that described in this manual, contact Philips Support Service.

5. Note down the serial number of the upgraded monitor so that you can keep a record of the monitors that have been upgraded.



6. Stick the feature label to the front of the monitor, as in the example below:
   A: Fetal Movement Profile
   B: Dual Ultrasound



7. Switch the monitor off and then on: it will perform the power-on self-test. If an error message is displayed, contact Philips. Perform performance assurance tests as described in Chapter 9.

Repeat steps 1 to 7 for each monitor to be upgraded.

When the upgrade key has performed as many upgrades as it was programmed to perform, return it to Philips for recycling. Please contact your nearest Philips Response Center for details.

Instruction 11 Test/Inspection and Safety Procedures

Whenever you upgrade a monitor there are some tests you must run before the upgrade is complete. Exactly which tests you must perform depend on the upgrade you are performing.

	Options Requiring this Procedure													
Test Type	C01	C02	C03	C04	C30	C31	C32	C33	C34	C35	S01	J10	J12	J13
1. Instrument Safety Test (see page 120)	-	-	●	●	●	●	●	●	●	●	-	-	-	-
2. Parameter Test (see page 112)	●[1]	●[2]	●	●	●	●	●	●	●	●	●	●	●	●
3. Quick Test (see page 114)	●	●	●	●	●	●	●	●	●	●	●	●	●	●
4. System Test (see page 120)	●	●	●	●	●	●	●	●	●	●	●	●	●	●

1. Perform parameter test with both Cardio1 and Cardio2 connected.
2. Plug in US transducer to either socket. Press Function key and check if FMP can be enabled.

8
Theory of Operation

Introduction

This chapter contains an overview of the system, boot sequence and system self tests as well as brief functional descriptions of individual boards. The following boards are described in this chapter.

Product Number	Name	Abbreviation
M1350-66502	Power Supply Board	PSU
M1350-66506	ROM Board	ROM
M1350-66513	Central Processor Unit Board	CPU
M1350-66515	Digital Interface Board	DIF
M1350-66517	Frontend Board	FE
M1350-66532	OBMS Interface Board	None
M1350-66533	Dual Serial Interface Board	None
M1350-66534	Maternal Pulse Oximetry Interface Board	SpO_2
M1350-66535	External Blood Pressure Interface Board	NIBP
M1350-66536	Telemetry/System Interface Board	None
M1350-66540	Fetal Pulse Oximetry Interface board	$FSpO_2$

The following boards are not described.

Product Number	Name	Abbreviation
M1350-60026	LCD Display Board	None
M1350-66501	Backplane	None
M1350-66521	Switch Board	None
M1350-66525 (XM) M1350-66527 (XMO)	Display Board	None

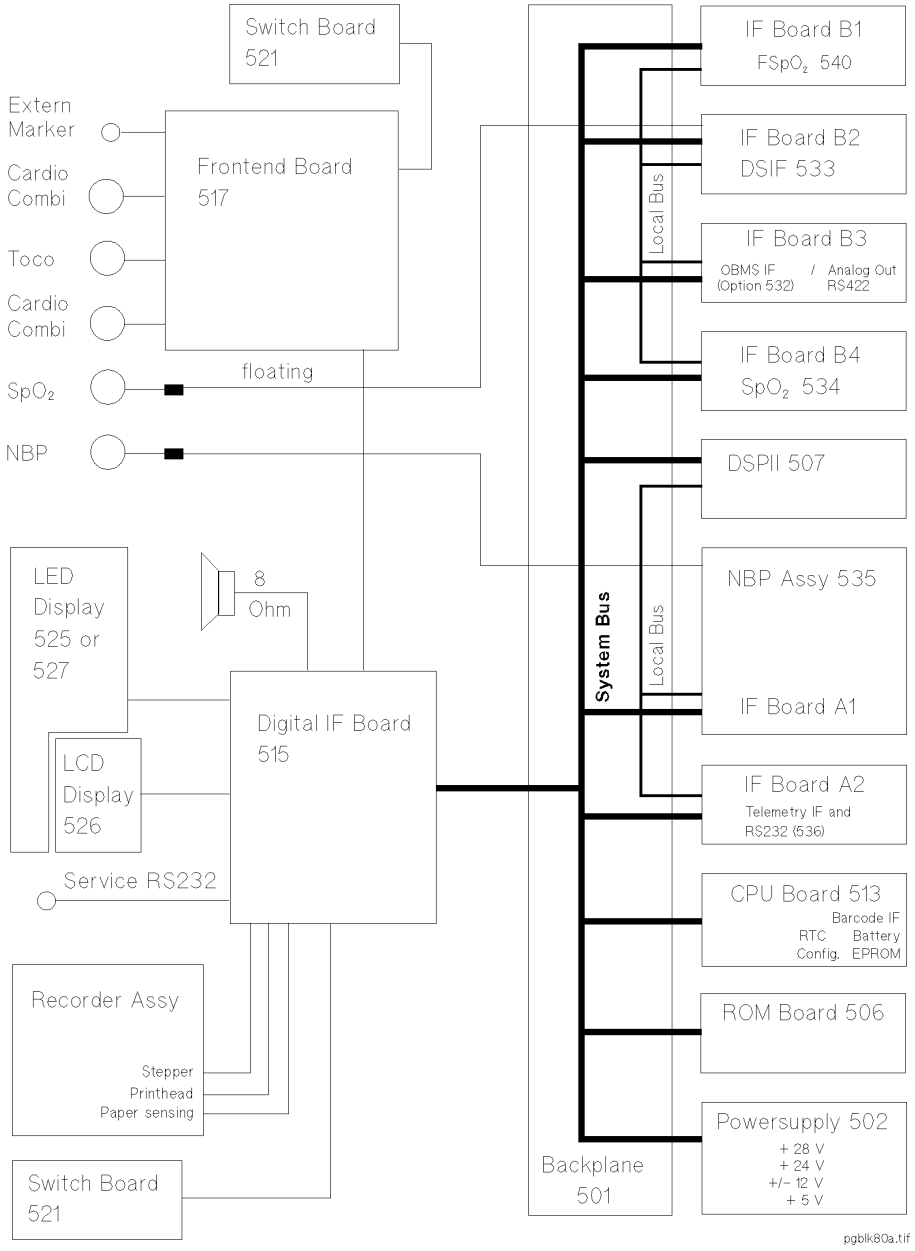


Figure 8-1 System Overview

8-1 shows the boards and their interconnections.

The CPU board, which has overall control of the entire system, is connected to the ROM board, which contains all the system software, by the system bus. The software for individual boards is loaded from ROM at startup.

The signals from the transducers receive some analog conditioning and are then digitized and loaded, via the DIF board, into the CPU board RAM. The CPU passes the data to the DSPII board which processes it in the two signal processors. Most data movement is by Direct Memory Access (DMA).

The maternal parameters NIBP and maternal SpO_2 and fetal SpO_2 are processed completely by their respective modules.

The results of the processing are transferred from the signal processors, via the DSPII, to the CPU board RAM and then distributed to the outputs, for example the recorder, “traffic lights” and interface boards.

The backplane is passive, all decoding and similar functions take place on the individual boards.

The CPU also handles data exchange between the maternal interface and the soft keys.

Booting and Self Test

The system tests itself when it is turned on. There are two types of check: programs that check the hardware on each board, and programs that perform checksums on the individual portions of code that are loaded from the ROM board. Boards with processors check themselves; boards without processors are checked by the CPU board. All error LEDs are lit at the start of the checks, and the boards are then checked in sequence. If a hardware error is detected on a board, its error LED stays lit, and the error code for the board is shown on the display (the error code is the last three digits of the board's part number). If any element in the display chain is not working, the errors may not be displayed. If a board passes its check, the LED is extinguished, and the next board in the sequence is checked.

The system also tests itself while it is running.

When the system is turned on, the initial reset generated by the power supply is fed to the CPU board, where it is latched and passed to the other boards. Each board latches the reset, to light its error LED. The LED can only be turned off by the CPU board de-latching it.

The processor on the CPU board runs a small self-test program from the ROM board. The program tests certain functions of the CPU and ROM boards. If the tests are successful, the LEDs on the two boards are extinguished. If either board fails its test, the LED is left on, and the appropriate error code is displayed.

The current limits of the outputs of the PSU board are then checked. If any are out of limits, the board's error code is displayed. This error doesn't necessarily mean that the PSU board is faulty. For example, a short on the system bus or one of the other cards could be drawing too much current.

If the PSU board passes its checks, the CPU board takes away the reset to the other boards (which leaves the LEDs lit).

The boards are tested in the order shown below:

- The DIF Board
- The MUX and AD sections of the Frontend Board
- The Telemetry Interface Board
- The OBMS Interface Board
- NIBP Interface Board
- SpO_2 Interface Board
- $FSpO_2$ Interface Board
- Any other interface board
- The DSPII Board
- LCD Board
- LED Board
- FE Board

If any board fails its test, its LED stays lit and the error code is displayed.

The CPU board boots a test program from the ROM board to the DSPII program RAM, and the

DSPII board runs it. The program tests the DSP-CPU 68000 and its associated components and writes the results to the DSP-CPU 68000 RAM. The CPU board reads the RAM to find out the exit status of the tests. If it fails the tests, the LED stays lit and the error code is displayed. If it passes the tests, the CPU board boots a start up program from the ROM board into the DSP-CPU 68000 program RAM. The program tests the DSP-CPU board. If it fails, the appropriate error code is displayed.

The signal processing software is stored as programs which perform discrete functions (for example, depth selection or auto-correlation). The DSP-CPU generates a list of programs it wants, and passes the name of the first program to the CPU board which transfers the program to the DSPII program RAM by DMA. The DSP-CPU 68000 transfers the program from its 68000 RAM to the program RAM of the appropriate signal processor. The DSP-CPU deletes the program name from the list when it receives the program. When the list is empty, the CPU board passes control to the DSP-CPU 68000 which starts normal processing.

The ARCHIMEDES signal processors receive latched resets from the DSP-CPU 68000 to allow the system to start tidily.

When the system boots, the US processing software is loaded by default. If an ECG transducer is connected, the change in transducer is detected, and DECG software is booted from ROM to replace the US software.

Operational Checks

The following self tests are performed while the system is running.

The DSP-CPU checksums the signal processing software approximately every minute, and the CPU board checksums the ROM board at approximately the same interval. If the checks fail, the system is reset and rebooted.

An ASIC is fed patterns by the CPU board 68000 every 300 ms. If it doesn't receive a pattern, it resets the system.

Hardware

This section contains brief functional descriptions of some of the boards in the system. Most of the signal processing is digital and makes use of ASICs. As the boards contain mainly surface-mounted components and are not repairable, details of the hardware are not covered.

PSU (M1350-66502)

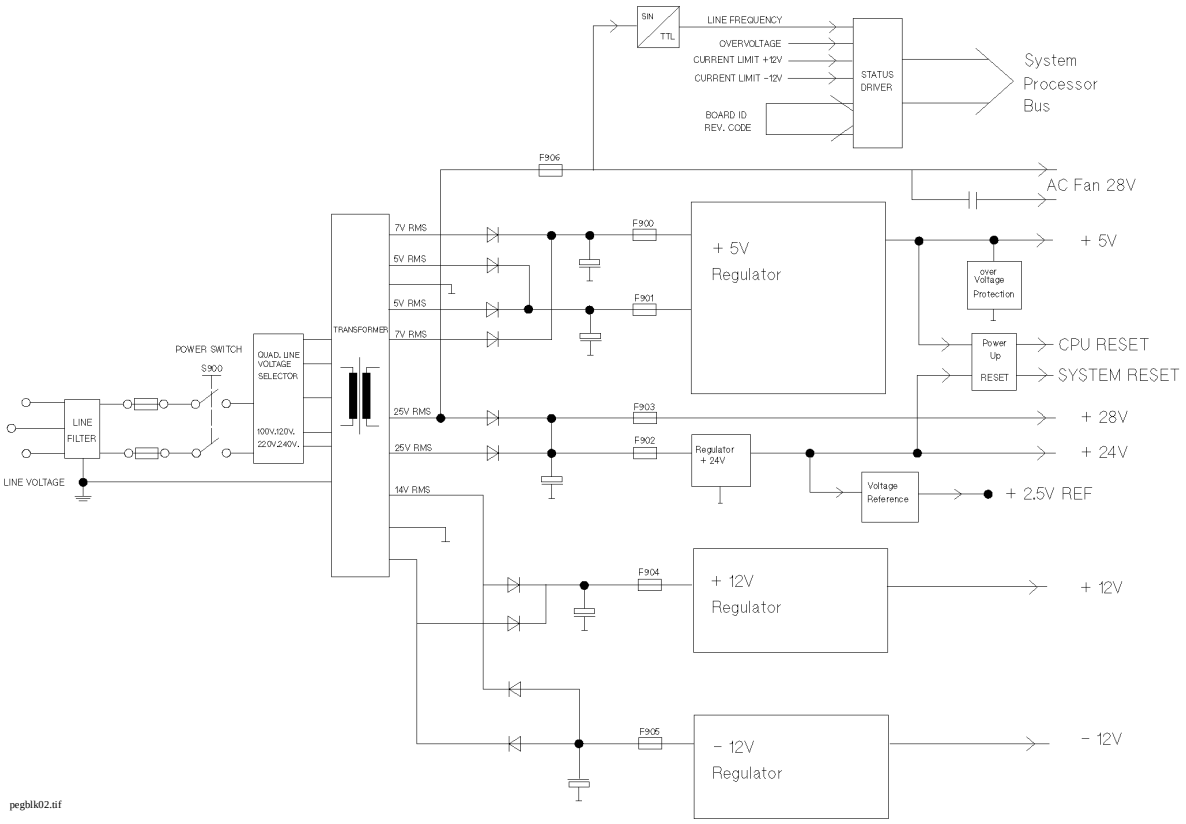


Figure 8-2 Power Supply Board (PSU)

The Power Supply (PSU) board operates as a linear regulated power supply with rectifier, capacitor and regulator. It generates the following voltages:

Regulated DC	±12 V, +5 V and +24 V
Unregulated DC	28 to 35 V
AC	28 V

The regulated voltages have an electronic short circuit current limit.

The +24 V DC regulator works independently from the others. The internal +2.5 V reference voltage is generated from the +24 V, so if the 24 V section is inoperative, the rest of the power supply won't work. The -12 V regulator also needs the regulated +5 V to work correctly.

The two resets (open collector outputs) are active low, when either the +5V is lower than +4.6 V or the +24 V is lower than +14.8 V. The CPU reads the PSU board ID and its four status bits. The status bits are:

- Line frequency clock to differentiate 50 and 60 Hz.
- +5 V over voltage protection bit (PSU error).
- +12 V current limit bit (overload of +12 V or PSU error).
- -12 V current limit bit (overload of -12 V or PSU error).

CPU (M1350-66513)

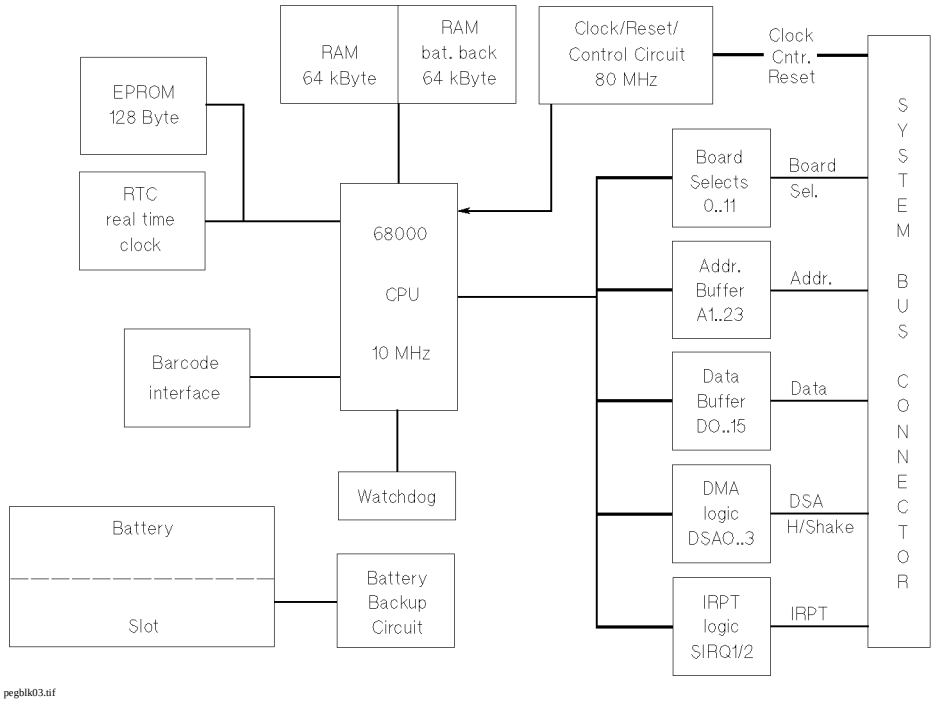


Figure 8-3 CPU Board

The Central Processor Unit (CPU) board is the heart of the system and, as master of the system bus, it controls most other boards. The 68000 microprocessor and associated support ICs provide system functions, interface control ICs support the Barcode Reader Interface and the bus control section controls the system bus. The card is directly connected to the ROM board, which contains all the system software.

The board includes the following sections:

- Microprocessor section
  - 68000 microprocessor.
  - CMOS RAM memory, partially backed by a battery to store short time device settings etc.
  - A non-volatile EEPROM memory for permanent device and user settings.
  - A real-time clock, battery-backed and power-fail protected. The processor has access to all clock registers.
  - The Watchdog ASIC monitors the operation of the microprocessor and restarts the system if it is not served at a constant rate.
- Outside interface section
  - The CPU M1350-66513 interfaces barcode readers which use a RS232 connector.
  - A battery drawer which contains two batteries of type IEC LR1, size N.
  - Battery control and test circuit to provide battery voltage when the power line is switched off and to detect battery low condition.
- Bus control section
  - Address and data bus control chips.
  - Board select logic to access all system boards.
  - DMA circuits to allow DMA access via the system bus.
  - Interrupt logic to provide for local and system wide interrupts with different priority levels.
  - A crystal quartz oscillator and related circuitry provide several local and bus clock frequencies.

DSPII (M1350-66507)

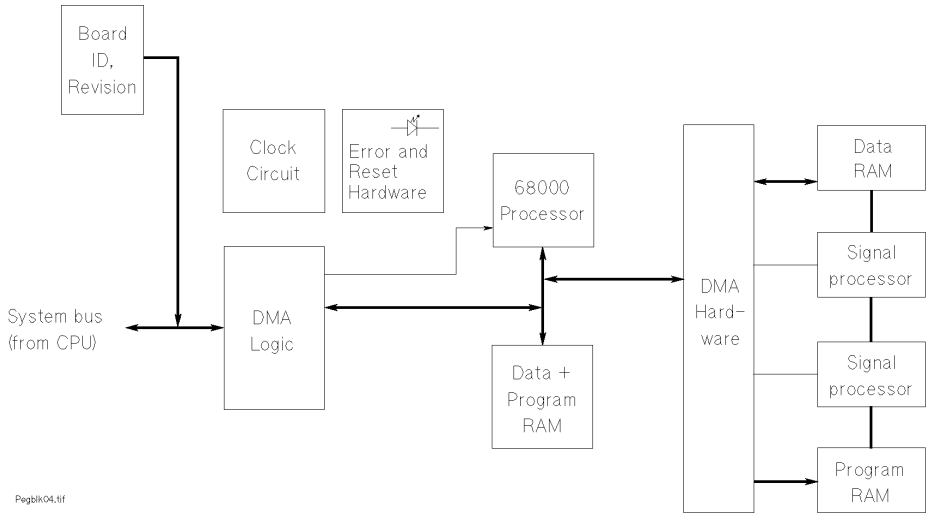


Figure 8-4 DSPII Board

The Digital Signal Processor (DSPII) board contains the following main functional elements:

- 68000 CPU and RAM
- 2 signal processors and RAM
- DMA control logic and hardware
- Clock circuits

The 68000 CPU has overall control of system signal processing. It controls the on-board signal processors. The majority of the signal processing takes place in the ARCHIMEDES (proprietary Philips signal processors). Two ARCHIMEDES are used. One processes DECG1, MECG1, US1 and fetal movement detection. The second processes DECG2/MECG2 or US2 depending on the software loaded. Maternal SpO_2, fetal SpO_2 and NIPB measurements are all processed completely on their corresponding PC board.

The signal processing software is booted from the ROM board into the 68000 program RAM by DMA: the process is initiated by the CPU board. The DSP-CPU signal processor software is booted into its program RAM by the DSP-CPU 68000. Communication between the signal processor and the 68000 is by DMA, controlled by handshake flags, data exchange is via the data RAM by DMA. The DMA is controlled by on-board logic and hardware.

The clock circuit generates all clocks of the 40 Mhz backplane master clock.

ROM (M1350-66506)

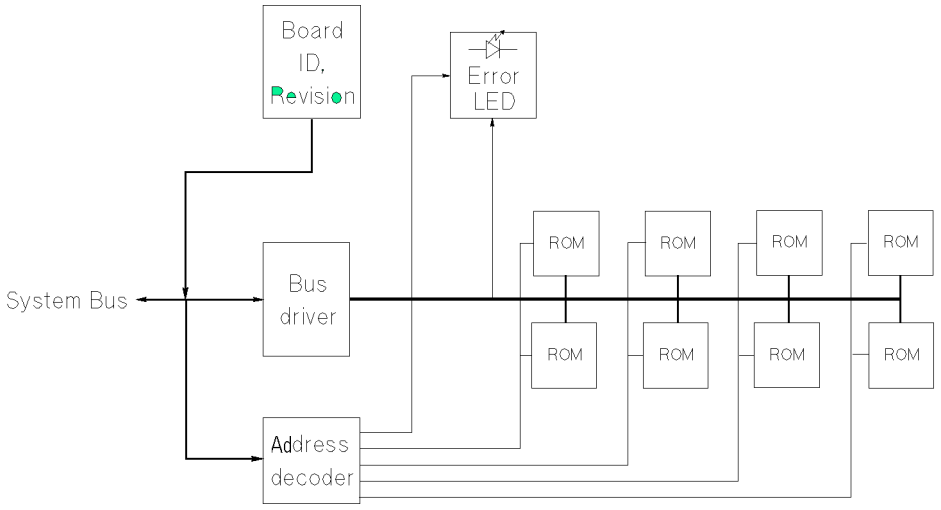


Figure 8-5 ROM Board

The ROM board contains the sockets for four 1 Mbit ROM pairs, The ROM board contains all the system software, except NIBP and SpO_2 software which is loaded into the corresponding boards.

DIF (M1350-66515)

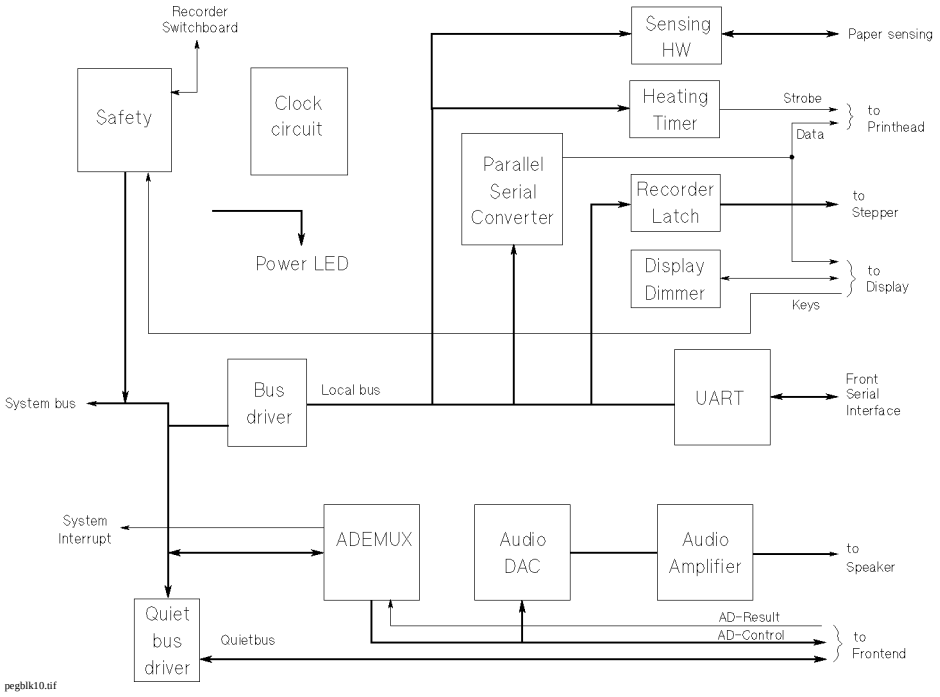


Figure 8-6 DIF Board

The Digital Interface (DIF) board provides the interfaces to recorder, display, speaker, Frontend board and external service computer.

After system startup, the CPU starts the A/D control chip ADEMUX (a proprietary Philips IC), which divides the signal from the clock circuit and generates an interrupt every 2.5 ms.

The 68000 on the CPU board then programs the ADEMUX to select the analog channels for A/D conversion: the analog/digital conversion of up to eight channels is done by ADEMUX without further intervention by the CPU. A/D conversion is by successive approximation. After the next interrupt, the CPU reads the results stored in registers within ADEMUX. ADEMUX also receives values from the CPU for audio output.

The quiet bus is only enabled during CPU access to the Frontend board to minimize noise on the analog amplifiers on the Frontend.

Address and data bus drivers decrease the load on the system bus.

The recorder interface consists of:

- The parallel/serial converter for the thermal array data.
- A heating timer to control the heating pulse for the thermal array. The voltage from a thermistor on the thermal array is A/D converted and the CPU programs the heating timer with a value which compensates the ambient temperature.
- The recorder sensing hardware consists of two reflective light sensors, one detecting that the recorder is open, the other detecting the black marks on the paper and paper out.

The display interface uses the same parallel/serial converter as the recorder. The complete display is blanked frequently, for a longer or shorter period, depending on the signal from the light sensor on

the display board. The digital functions of this recorder serial interface (RSI) are integrated in the RESI ASIC.

An RS232 serial interface is provided for use during production and service. Connection is via a stereo phone on the front panel.

The board also contains test hardware which is not shown in the diagram.

The serial data communication to and from the LCD display is controlled by the DUPLO ASIC. This ASIC also controls the LCD contrast voltage and the LCD backlight voltage.

Frontend Board (M1350-66517)

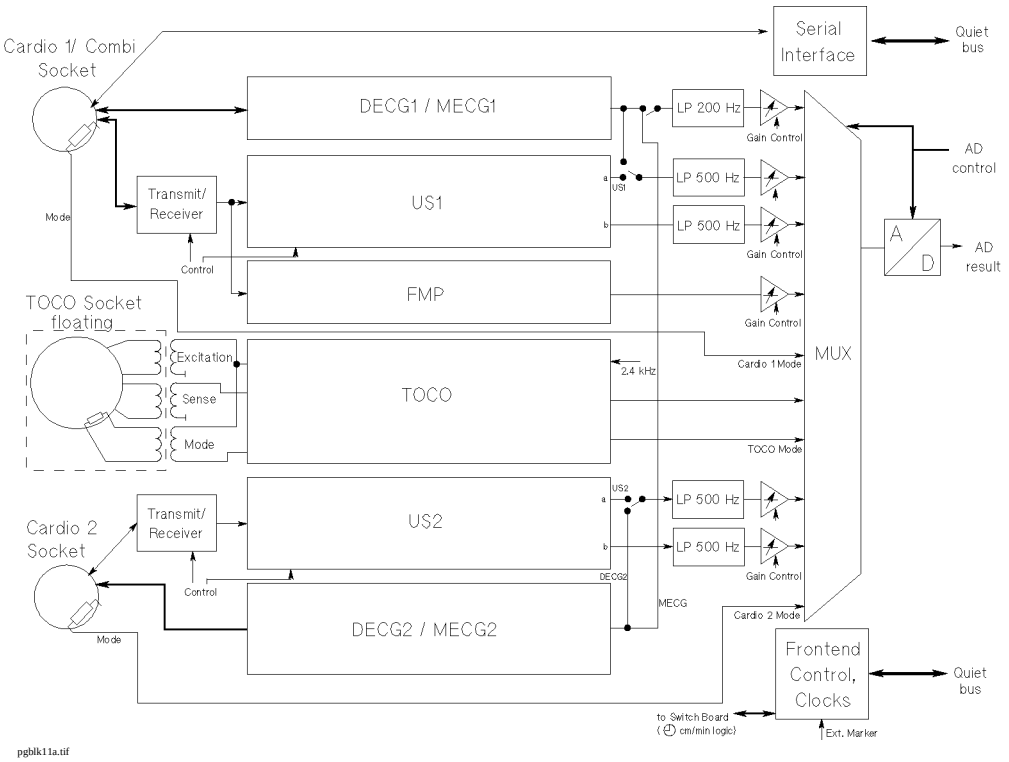


Figure 8-7 Frontend Board

The Frontend board contains the analog circuitry for measuring all the possible fetal parameters of the monitor. It includes the control circuit interface to the DIF board (M1350-66515). The FOCUS ASIC on the board provides the US timing and window control, and controls the ECG.

Each type of transducer has a specific mode resistor which is recognized by the monitor when the transducer is connected to an input socket. In this way, different types of transducer can be used without having to recalibrate the system.

ECG The FOCUS IC divides the 4 MHz system clock to generate a 181 kHz clock. A power stage generates the power clock for the ECG transducers. The ECG signal modulates the supply current of the transducer. The modulated current is detected, amplified and bandpass filtered (1 - 250 Hz).

US The US transducer transmits 998.4 kHz ultrasound bursts which are generated by the FOCUS IC. The burst widths are controlled by software. The transmitter amplifier supplies 5 V_{pp} at the Cardio sockets. The repetition rate is 3.2 kHz.

The received 998 kHz signal is amplified by a high frequency amplifier with a gain of 120 and then split to provide a reference path **a** and a compare path **b**. The two demodulators **a** and **b** are independently controlled by software in their receive windows by the FOCUS IC. The demodulated LF signals are bandpass filtered (100 - 500 Hz) and amplified by a software controlled gain of 180 to 1860 in eight steps. The **FMP-LF** path is independently demodulated, bandpass filtered and amplified by a factor of 18.

TOCO The pins of the TOCO/IUP socket are electrically isolated, connected by three transformers (excitation, sense and mode).

The excitation voltage is a 2.4 kHz square wave with an amplitude of 3.5 V_{RMS}. The frequency is generated in the control chip by dividing the 4 MHz system clock.

The sense input signal is amplified by 93.75 (40µV/V/mmHg) or 750 (5µV/V/mmHg), rectified with a synchronous detector and lowpass filtered with a cutoff frequency of 7.5 Hz.

All LF signals are multiplexed, sampled at either 1600 or 800 Hz, and A/D converted with 12-bit resolution.

The marker cable and the switch board are also connected to the Frontend board.

Maternal Pulse Oximetry (SpO_2) Board (M1350-66534)

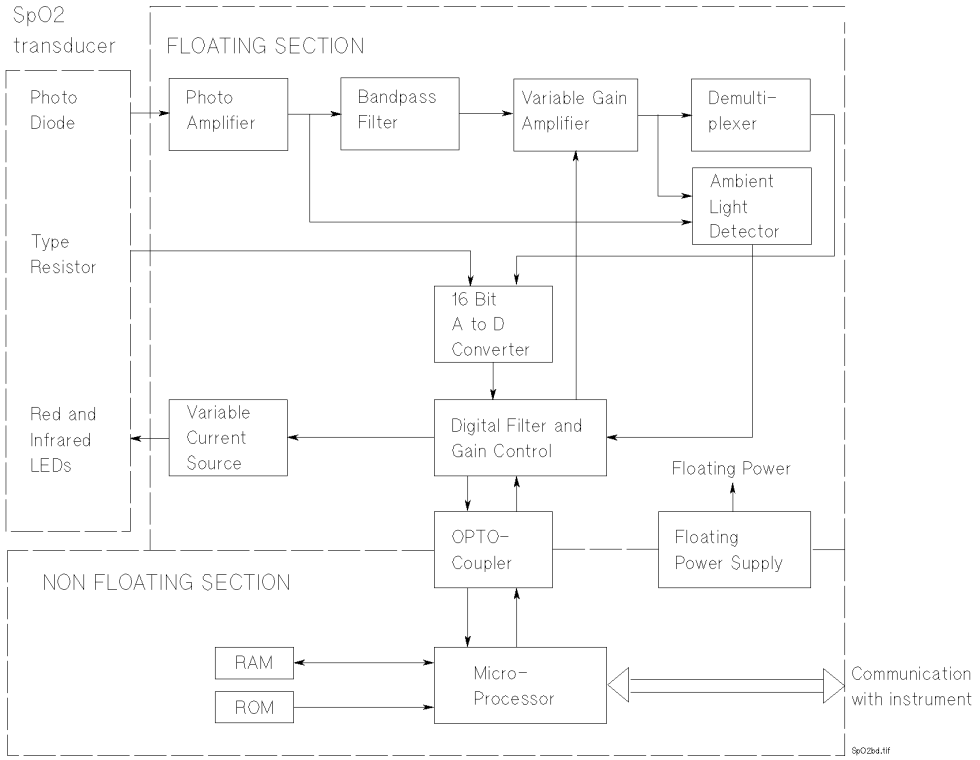


Figure 8-8 Maternal SpO_2 Board

The maternal oxygen saturation (SpO_2) parameter is based on the principle of pulse oximetry, in which arterial blood flow through tissue is detected optically. An adaptor holds two LEDs against one side of the patient's finger or ear. One LED emits red light, the other infra-red light. Against the other side the adaptor holds a photo diode. The device can register small changes in the conductivity of light in response to patient pulse. By isolating the pulsatile component of the signal, the maternal SpO_2 board eliminates the effects of absorption from tissue, bone and venous blood.

The more heavily blood is oxygenated, the brighter red it becomes. Hence an algorithm comparing the conductivity of red and infra-red light, thereby measuring the color of the blood, can also offer an indication of oxygen saturation.

The maternal SpO_2 board is divided into two distinct areas - floating and grounded. These are connected by two high voltage optocouplers for data transfer, together with the power transformer for power transfer.

Floating Section

The sampling of signals from the photo diode is in four discrete phases.

1. Dark Phase. Neither red nor infra-red LEDs are lit. Only ambient light is measured.
2. Red Phase. The red LED is lit, and the light conductivity measured.
3. Infra-Red Phase. The infra-red LED is lit, and conductivity measured.
4. Pleth Phase. Infra-red LED is lit and conductivity measured.

Consecutive frames composed of these four phases are repeated 375 times per second. Both the lighting of the LEDs and the sampling of the signal from the photo diode is sequenced by a time multiplexor governed by the microprocessor.

The function of the floating section of the board is twofold:

1. To enable accurate reading of light conductivity by removing noise and compensating for ambient light in the pulse train.
2. To drive the two LEDs.

The outstream from the photo diode is amplified by variable amplifier. This is software controlled and monitored by comparator, which checks for wave clipping. A series of switched low pass filters is used to separate the four phases within each frame of the pulse train and compensate for the effects of ambient light and for noise rejection.

The Transducer

As well as the connections to the transducer relating to the LEDs and photo diode, two more wires are used to check the transducer itself. These are connected to resistor R2 (within the transducer) and enable monitoring to show:

- That the transducer is properly connected.
- Transducer type.

LEDs

The LEDs are driven by controlled current source. Two demands must be met:

- LEDs must be lit in their correct sequence, to produce the four phases of the pulse frame.
- LEDs must be lit to an ideal intensity. This is dependent upon the light absorption at the transducer site.

The grounded section of the maternal SpO_2 board is completely digital. It is essentially a dedicated microcomputer, and amongst other tasks, performs the following:

- Calculation of the maternal SpO_2 saturation percentage.
- Control of the user-determined alarms.
- Control of the “NOP” alarms.

Input is via the optocoupler, shared with the floating section of the board.

The board has its own RAM as working area and its own EPROM holding the software.

External Blood Pressure (NIBP) Board (M1350-66535)

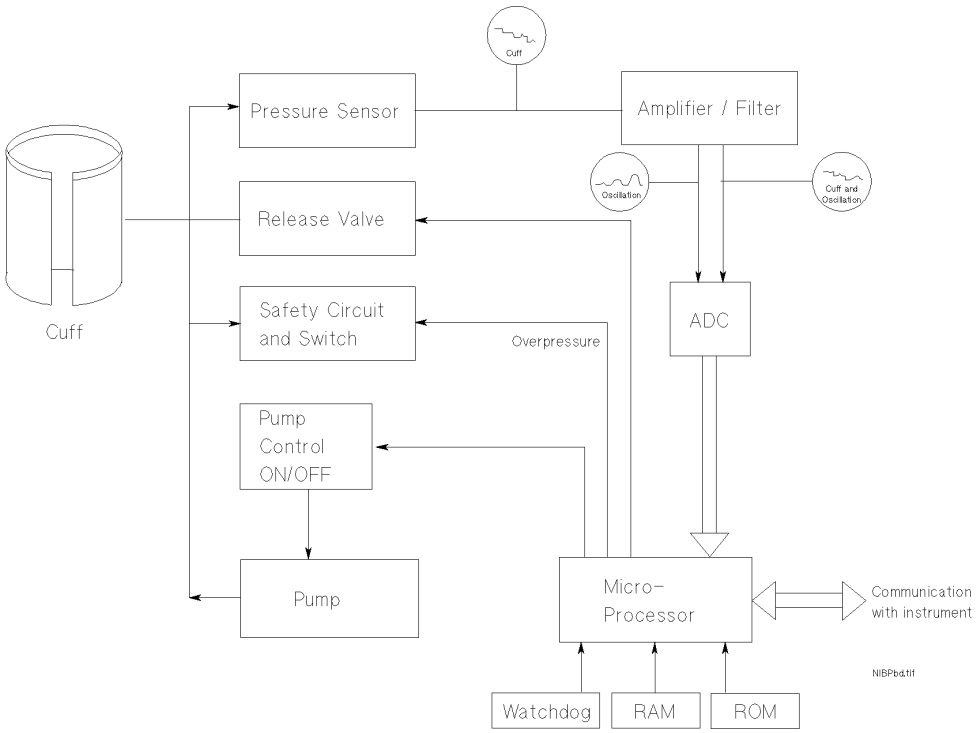


Figure 8-9 External Blood Pressure Board

The measurement of the blood pressure is based on the oscillometric method in which an inflated cuff around the patient's limb partially occludes the artery. The pulsatile arterial flow causes oscillations superimposed on the cuff pressure, the amplitude of which can be analyzed to obtain the systolic and diastolic pressure values. The procedure is microprocessor controlled.

The board offers three methods of obtaining the external blood pressure measurement:

- **Manual:** This method takes one measurement of systolic and diastolic on each request.
- **Auto**: This method takes repeated blood pressure measurements of systolic and diastolic at specific user-selected time intervals.
- **Stat**: This method immediately takes repeated blood pressure measurements of systolic and diastolic over a period of five minutes. This method uses a faster measurement procedure than the other two.

The cuff around the patient's limb is connected to the board via a single tube. The cuff is inflated by the pressure pump once or repeatedly (depending on the measurement method used) to a cuff pressure above the patient's systolic pressure.

For the first measurement, the cuff inflates to approximately 165 mmHg. For further measurements the cuff inflates to approximately 20 mmHg above the previously measured systolic pressure. The pressure transducer detects both the cuff baseline pressure and pressure oscillation. These signals are amplified and filtered to separate the cuff baseline pressure and the pressure oscillations. The microprocessor compares successive pressure oscillation magnitudes until it detects two oscillations of similar amplitude. By checking two subsequent oscillations it is possible to reject artifacts due to patient movement. The baseline cuff pressure and oscillation magnitudes

are stored in the memory and the cuff pressure is further decremented. Subsequent oscillation magnitudes will show decreases until no significant oscillations are seen.

The microprocessor displays the arterial mean pressure together with the systolic and diastolic pressures. The pressure in the cuff is automatically released by the deflation system on the board. The cuff is completely deflated and, depending on the selected cycle time, is inflated when the next measurement is to be made.

The board has the following maximum limits which ensure the safety of the patient:

1. A maximum measurement time of 120 seconds.
2. A maximum time of 120 seconds for a cuff pressure greater than 15 mmHg.
3. An overpressure system with a limit of 330 mmHg maximum, or 300 mmHg for 2 seconds.

The NIBP board contains its own RAM as working area and ROM containing the software and a microprocessor supervised additionally by a watchdog timer.

Fetal Oxygen Saturation ($FSpO_2$) Board (M1350-66540)

An Intel 80C186 CPU in the PLCC68 package performs the fetal SpO_2 processing. It runs with a 20MHz clock. Beside the ROM and normal RAM, there is a 1 kByte Dual Port RAM for the communication with the M1350C main processor (a Motorola 68HC000).

The communication time frame is 17.5 msec, a multiple of 2.5 msec (the main tick of the M1350C operating system)

The following diagram shows the functional blocks of the fetal SpO_2 processing board:

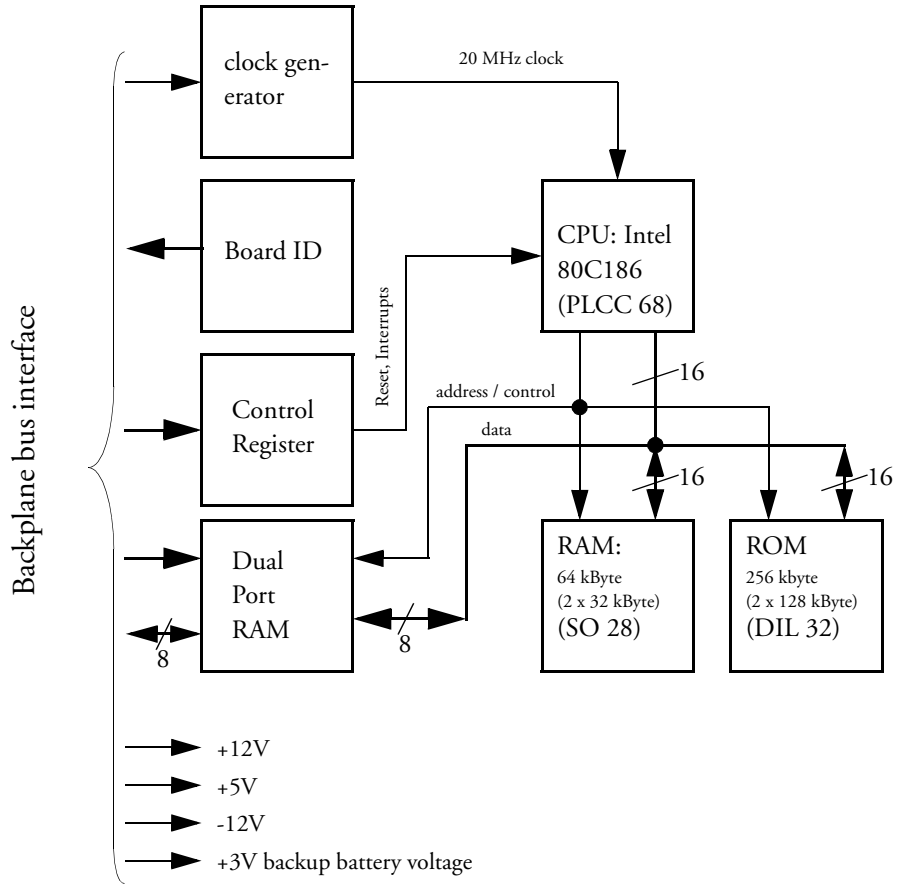


Figure 8-10 Fetal SpO_2 Board

Telemetry/ System Interface (M1350-66536)

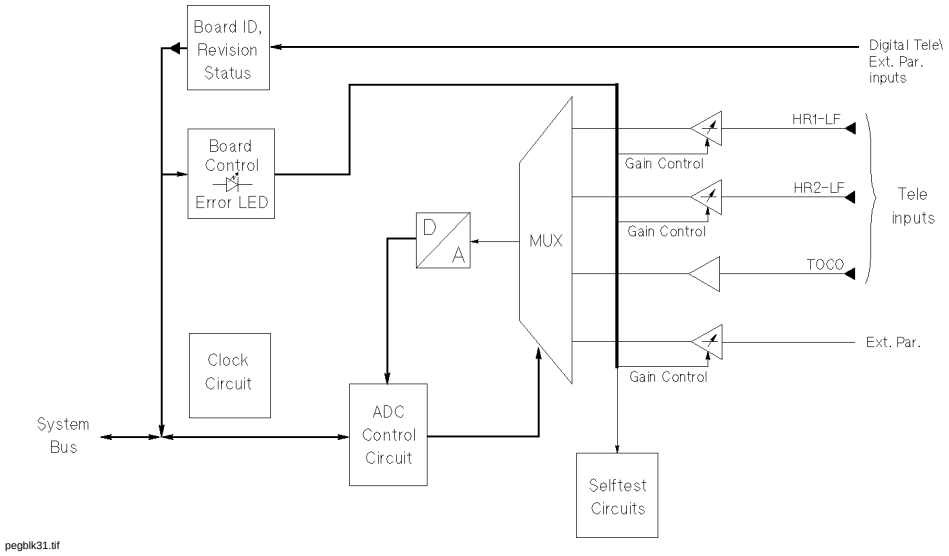


Figure 8-11 Telemetry / System Interface

The Telemetry Interface board processes analog input signals from Philips telemetry systems, for example the M1310A. Alternatively, an external analog parameter can be input to be recorded by the fetal/maternal monitor. The board contains an analog signal filter section, an analog to digital conversion section, digital clock and control circuits and a section for calibration and self test.

The features of the Telemetry Interface board are:

- Analog Signal Filter Section
  - An analog input for FHR, US LF or DECG, with low pass filter and variable gain amplifier.
  - An analog input for maternal heart rate, MECG, with low pass filter and variable gain amplifier.
  - An analog input for TOCO/IUP with low pass filter.
  - An analog input for an external parameter with low pass filter and variable gain amplifier.
- Analog to Digital Conversion Section
  - A 12 bit digital to analog converter with build in voltage reference.
  - An ADEMUX conversion controller chip.
  - An analog four channel input multiplexer.
  - A sample and hold circuit.
  - A precision comparator.
- Digital Clock and Control Sections
  - Board ID latch.
  - Status input lines.
  - Control latch.
  - Bus control and clock circuits.

- Calibration and Self Test Section
  - Calibration and reference circuits.
  - System controlled test signal generation.
  - Analog switches to apply reference voltages and test signals to the telemetry inputs.
- RS232 Socket

Note If an OBMS board (M1350-66532) is connected at the same time as the M1350-66536, the RS232 facility is switched off as default. You can overwrite this setting. See Chapter 5.

OBMS Interface Board (M1350-66532)

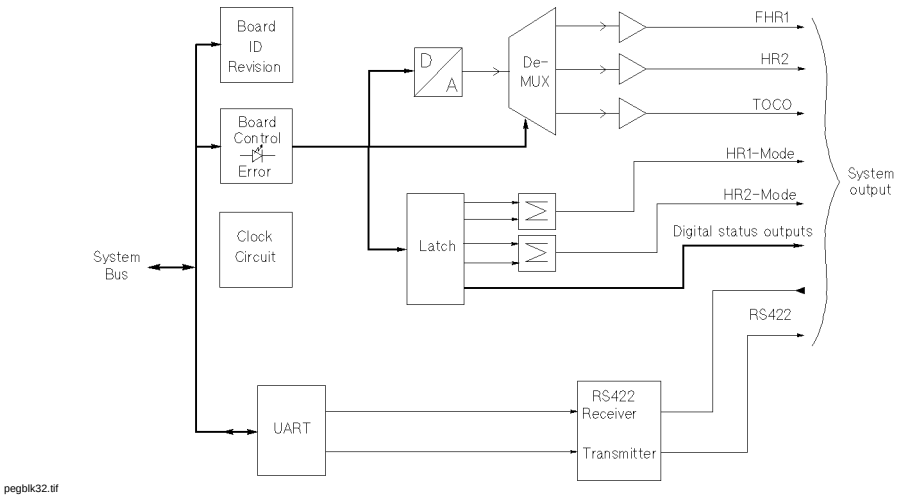


Figure 8-12 OBMS Interface Board

The OBMS Interface board sends heart rate, TOCO, mode and status information to systems such as M1370A, 80225A, 80235A and M1340A (FTTS).

The status bit is set if an external test from an OBMS is requested. The clock circuit divides the system clock.

The Board Control section interfaces the fast processor bus with the local board bus. An LED is set if a hardware error is detected.

The analog voltages heart rate 1, heart rate 2 and TOCO are generated by a DAC which feeds three sample and hold buffers via a multiplexer.

The latch stores mode and status information. Status information is passed to the output as a logic signal. Mode information is a sum of logic signals and appears as an analog voltage at the output.

The UART and RS422 receiver/transmitter form a I-directional RS422 interface for system notes.

Note If a Telemetry/System board (M1350-66536) is connected at the same time, either the RS422 on the M1350-66532 or the RS232 on the M1350-66536 is active. See Chapter 3 for information about setting configuration options.

Dual Serial Interface Board (M1350-66533)

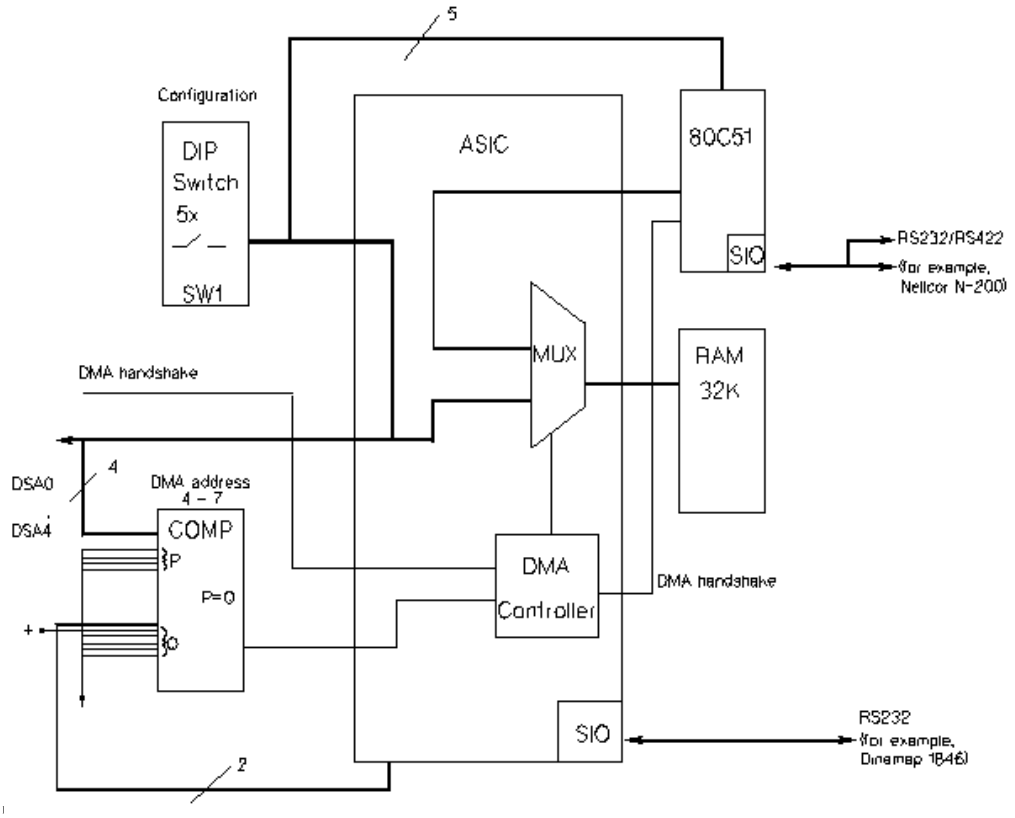


Figure 8-13 Dual Serial Interface Board

The RS232/RS422 dual serial interface board uses both RS232 and RS422 standard voltage levels to interface between the monitor and external devices. Currently, the monitor supports communication with the following external devices:

- Philips M1165A/1166A/1175A/1176A CMS with appropriate options (abbreviated to Philips CMS).
- Philips 78352C and Philips 78354C Compact Configurable monitors with appropriate options.
- Philips 26/24 monitors.
- Dinamap 1846 and 8100 NIBP monitors.
- Datascope Accutorr 3, and Accutorr 4 NIBP monitors.
- Datascope Accutorr 3SAT, 4SAT NIBP and SpO_2 monitors.
- Press-Mate Listmini Model BP-8800 (abbreviated to BP-8800).
- Nellcor OxiFirst™ Oxygen Saturation monitor (N-200).
- Nellcor OxiFirst™ Fetal Oxygen Saturation monitor (N-400).

The interface board has two independent ports - one 9-pin connector and one 25-pin connector. The 9-pin port can be used for RS232 data transmission and the 25-pin port for both RS232 and RS422 data transmission. The RS232 standard is suitable for distances up to 15m (50 feet) and the RS422 standard for up to 300 m (1000 feet).

The RS232/RS422 interface board consists of the following major components:

- 80C51 Microcontroller (U1)
- ASIC Chip (U2):
  - Multiplexer
  - DMA Controller
  - Signal Input/Output (SIO)
- 32KB SRAM (U3)
- Comparator (U4)
- Switchblock (SW1)

The available baud rates are:

9-pin	9600 Baud (Philips CMS)
	9600 Baud (Philips 7835xC)
	600 Baud (Dinamap 1846/8100)
	9600 Baud (Accutorr)
	4800 Baud (BP-8800)
25-pin	2400 Baud (Nellcor N-200, N-400)

9
Safety, Maintenance, and Calibration

Introduction

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

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

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

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

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

Recommended Frequency of Testing

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

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

Cleaning the Monitor

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

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

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

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

Performance Assurance Tests

Self Test

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

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

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

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

Parameter Test

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

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

- Press Test.

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

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

Table 9-1 Parameter Test

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

Quick Test

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

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

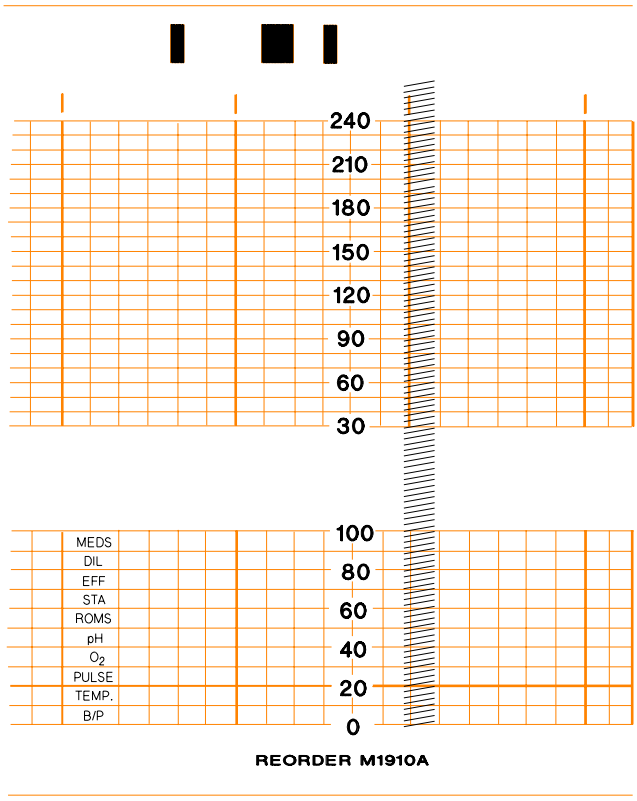


Figure 9-1 Recorder Test Pattern

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

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

If any of these conditions occur, replace the printhead.

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

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

Performance Assurance: NIBP

When to perform:

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

Accuracy Test

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

Leakage Test

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

Linearity Test

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

Service Tests

Cyclic Test

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

Permanent Test

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

To start the permanent test:

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

The permanent test runs until you release the marker button.

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

Safety Tests

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

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

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

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

Safety Test Procedures

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

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

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

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

When to Perform Safety Tests

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

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

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

How to Carry Out the Safety Tests

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

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

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

Instrument Safety Test

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

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

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

System Test

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

What is a Medical Electrical System?

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

General Requirements for a System

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

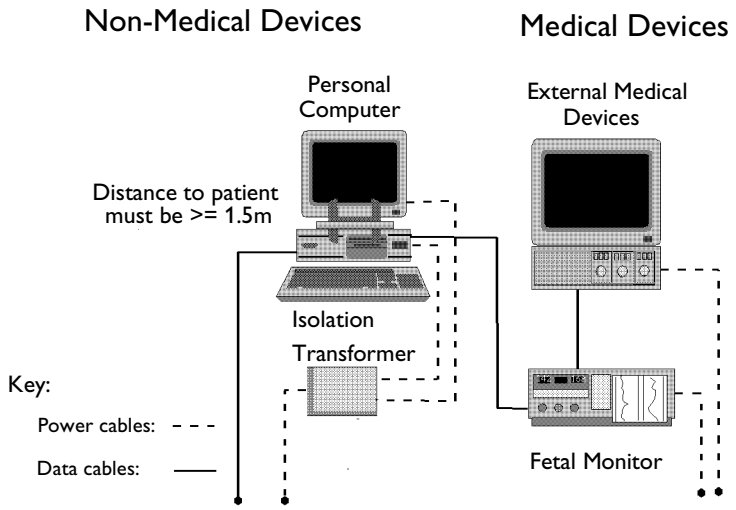
Note— **Medical electrical equipment must comply with the requirements of the general standard IEC/EN 60601-1, its relevant particular standards and specific national deviations.**

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

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

System Example

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



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

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

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

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

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

Safety Test (1): Protective Earth Test

Test to perform:

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

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

Test to perform:

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

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

Test to perform:

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

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

Test to perform:

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

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

Test to perform:

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

Abbreviations

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

Regular Maintenance

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

Mechanical Inspection

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

Recorder Maintenance

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

Clean the assemblies as follows:

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

Ultrasound Transducer

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

Visual Check

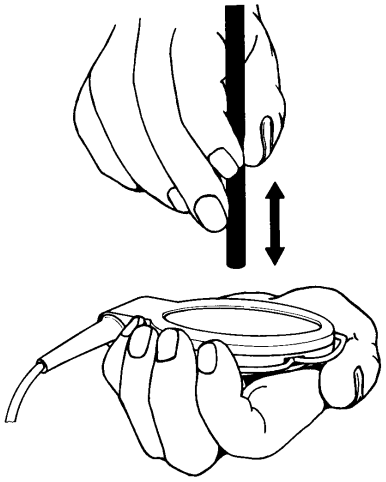
Ensure there are no cracks in the transducer dome, that the cable is not cracked or broken, and that there are no cracks on the connector plug.

Electrical Check

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

   Ensure that:

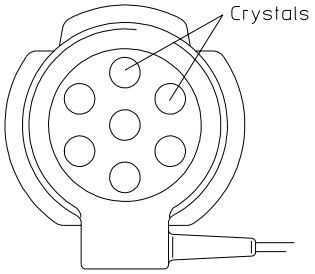
   - The signal quality indicator is red
   - The FHR numerical display is blank
   - When the recorder is switched on, the date, time, mode and paper speed are printed on the recorder trace.
2. Turn the loudspeaker volume up to an audible level.
3. The ultrasound transducer contains seven piezoelectric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



psm18sca.tif

Figure 9-2 Testing an Ultrasound Transducer using a Pen

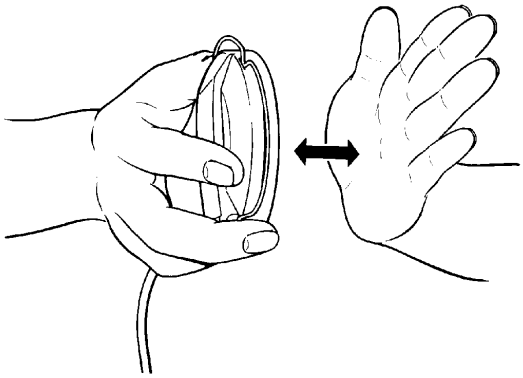
A sound should be heard for each crystal tested. The pen should be held 2 to 3 cm from the transducer surface when the test is carried out.



ustrancs.hpg

Figure 9-3 Position of Crystals in an Ultrasound Transducer

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



pop21sca.tif

Figure 9-4 Checking an Ultrasound Transducer

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

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

TOCO Transducer

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

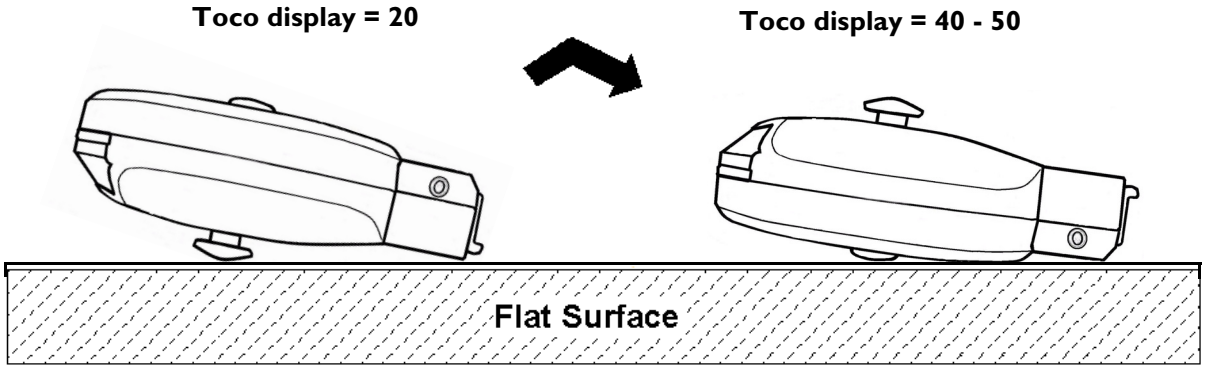
Electrical Check

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

   Ensure that:

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

   The Toco display should read between 40 to 50 units.



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

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

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

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

IUP Transducer

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

Electrical Check

1. Connect the transducer to the Toco socket.

   Ensure that:

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

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

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

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

Maternal SpO_2 Transducer

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

Electrical Check

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

   Ensure that:

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

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

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

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

ECG: M1364A Patient Module

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

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

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

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

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

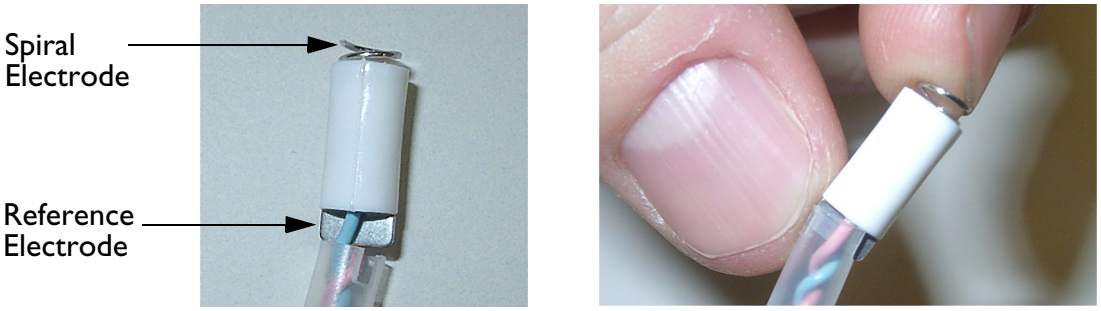
2. Connect the M1362B or M1363A adapter cable to the M1364A Patient Module. With open connections (i.e. no connection to electrode(s) on patient), the fetal monitor’s signal quality indicator should be red, and either no numeric in the display, or "nop".

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

Testing DECG Mode:

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

Caution
Take care not to injure your fingers.



Result: NOP should disappear.

OR

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

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

Result: "NOP" should disappear.

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

Testing MECG Mode

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

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

   OR

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

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

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

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

ECG: M1365A Patient Module

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

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

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

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

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

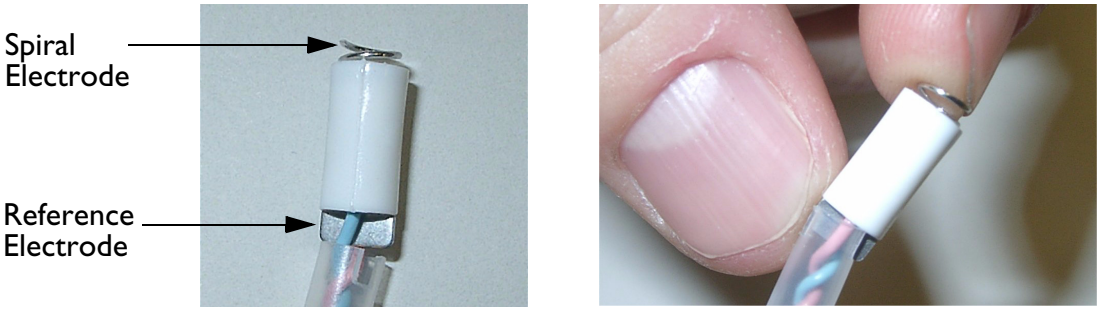
Note—The position of the M1365A and the M1362B or M1363A cable relative to each other can influence the displayed result, e.g. an antenna may be unintentionally created, receiving spurious signals.

Testing DECG Mode

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

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

Caution
Take care not to injure your fingers.



Result: NOP should disappear.

OR

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

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

Result: NOP should disappear.

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

Testing MECG Mode

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

   EITHER

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

   OR

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

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

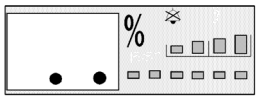
Result: You should see MECG values displayed on the maternal LCD display and annotated on the recorder trace.

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

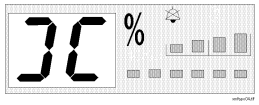
Testing with Fetal SpO_2 Sensor

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

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



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



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

NIBP Calibration

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

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

To enter NIBP calibration mode

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

To calibrate NIBP

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

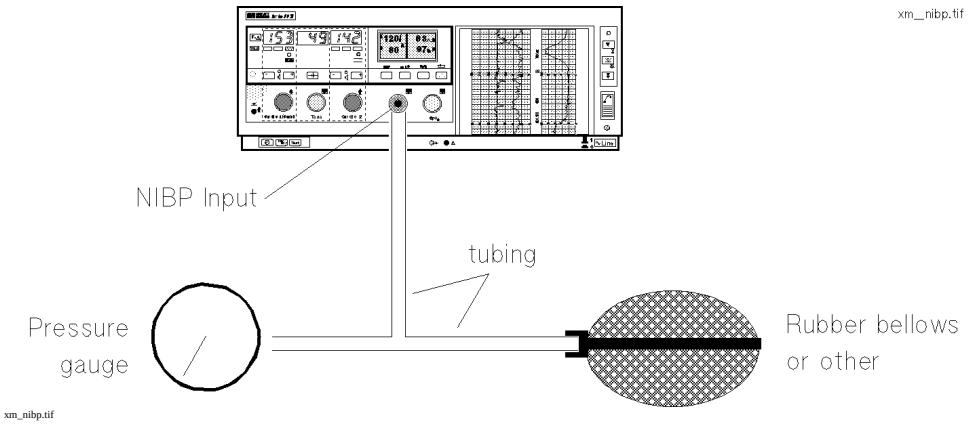


Figure 9-5 Connecting the Pressure Gauge

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

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

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

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

NIBP Overpressure Test

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

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

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

10
Troubleshooting

Introduction

The foundation for troubleshooting is the interpretation of error messages written on the display and in the systems error log, which you can print. For details of how to do this, and of how to clear the contents of the error log, see “Printing and Clearing the Error Log” on page 24.

If no error message occurs you may need to look at the troubleshooting flowchart for the system in Figure 10-1. This directs you towards the problem in a schematic approach.

Also explained are the procedures to be followed when the Parameter Test and Quick Test are not as described in Chapter 9, “Safety, Maintenance, and Calibration” on page 111.

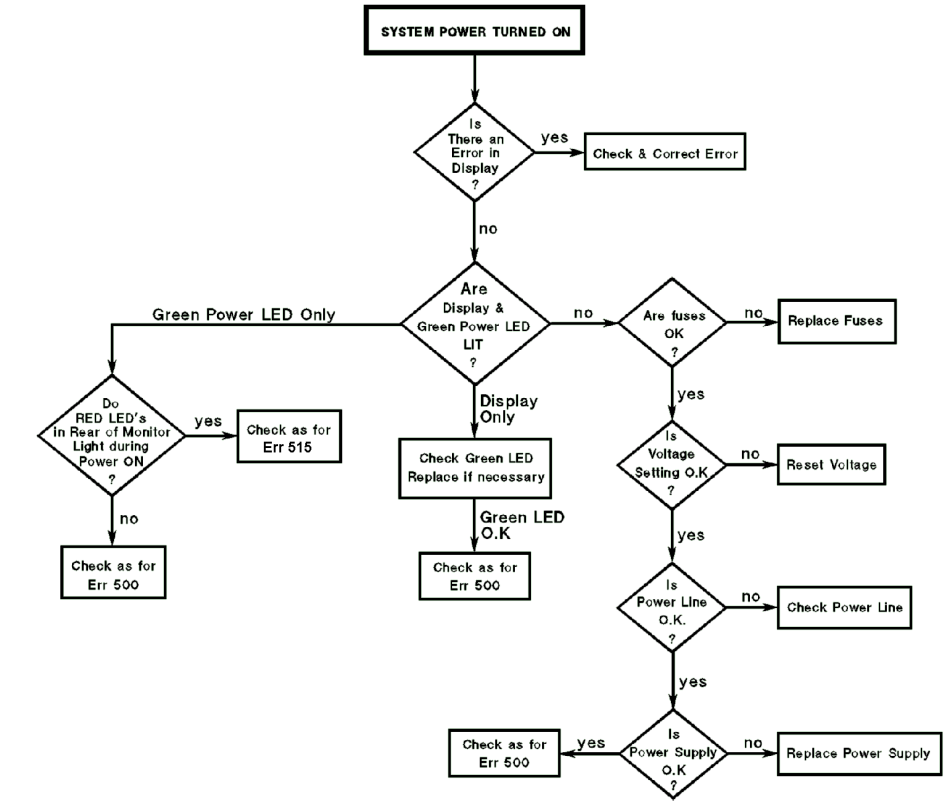


Figure 10-1 Troubleshooting Flowchart for the System

When troubleshooting some of the error messages, you will have to check LEDs that are situated on the boards. The following two diagrams show the locations of the LEDs.

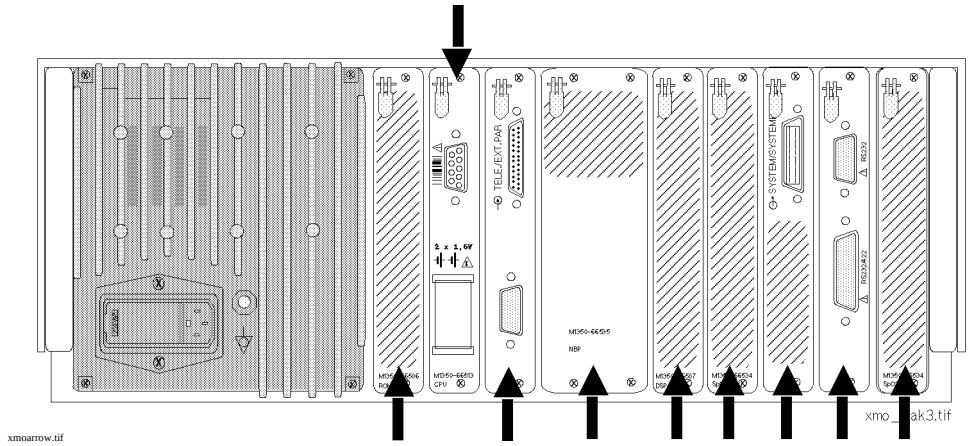


Figure 10-2 LEDs in the Rear Panel

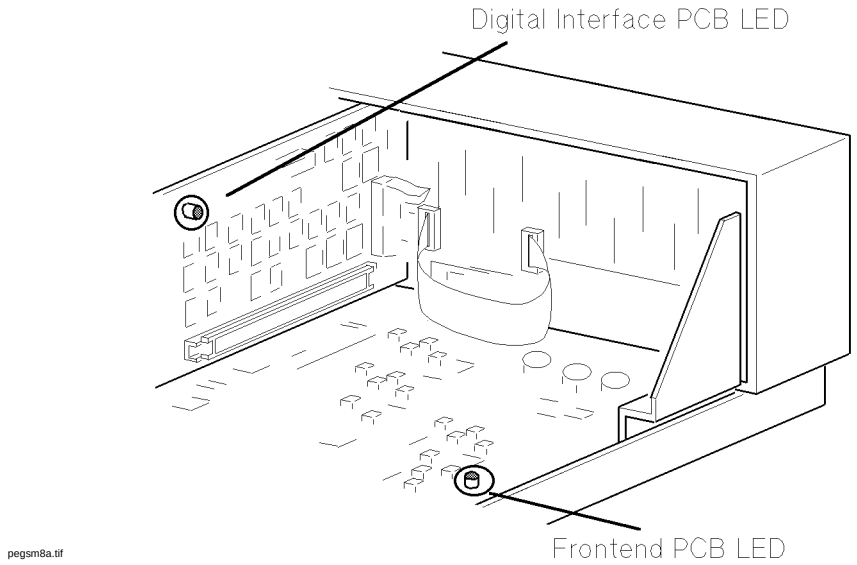


Figure 10-3 LEDs on the DIF and Frontend Boards

Operator Error Messages

Error	LED Display	Cause	Solution
Err 1	Cardio 1	Wrong transducer in Cardio 1/Combi socket.	Connect correct transducer.
Err 1	Cardio 2	Wrong transducer in Cardio 2 socket.	Connect correct transducer.
Err 2	Toco	Wrong transducer in Toco socket.	Connect correct transducer.
Err 4	Cardio 2	US/MECG Combi transducer not allowed in this socket.	Only 1 x MECG and 1 x DECG are permitted in combination. Remove transducer.
Err 6	Cardio 1 Cardio 2	Wrong pairing of US/MECG Combi transducer, MECG transducer and DECG transducer.	Remove one of the transducers.
	Cardio 1	M1365A combined patient module being used to measure $FSpO_2$ and MECG.	Measure $FSpO_2$ and DECG
	Cardio 2	M1364A combined patient module being used to measure DECG.	Measure MECG
Err 8	Cardio 1 Cardio 2	Dual Ultrasound Twins option is not fitted.	Remove one of the transducers.
Err 9	Cardio 1 Cardio 2	Invalid telemetry mode.	Check the cable from the telemetry receiver and if, necessary, replace it.
Err 14	Cardio 2	2 FHR transducers are being used with single FHR option (Invalid “Ext. parameter” status on Tele IF).	Remove one of the transducers.
Err 15	Cardio 1 Cardio 2	2 FHR transducers are being used with single FHR option (Invalid “Ext. parameter” status on Tele IF).	Remove one of the transducers.
Err 16	Cardio 1 Toco Cardio 2	Wrong pairing of telemetry and transducers.	Either disconnect the transducers or switch off the telemetry receiver.
Err 18	none	Use of paper designed for HP 8040 monitor.	Use correct paper for this monitor.
Err 19		Battery low or empty of charge.	Change the batteries as soon as possible. If you do not change the batteries, your specific settings will return to their default values when the monitor is switched on. (For example, the date is set to 4.4.44.)
Err 101	Cardio 1	$FSpO_2$ patient module defective.	Replace patient module.
Err 102	Cardio 1	Communication error - no connection between $FSpO_2$ patient module and monitor.	Replace patient module.
Err 103	Cardio 1	$FSpO_2$ sensor defective.	Use a new sensor.
nop	Cardio 1 Cardio 2	No contact, or poor contact, between reference electrode and mother.	Use a new spiral electrode.

Error Messages on Trace	Cause	Solution
Err bAt[1]  [2]	Battery low or empty of charge	Change the batteries as soon as possible. If you do not change the batteries, your specific settings will return to their default values when the monitor is switched on. (For example, the date is set to 4.4.44.)
Err PAP 30-240  [3]	Incorrect type of paper loaded.	Load paper with 50-210 scale or change the monitor's paper format setting (see the section "Setting Paper Speed and Scale" on page 40).
Err PAP 50-210  [3]	Incorrect type of paper loaded.	Load paper with 30-240 scale or change the monitor's paper format setting (see) the section "Setting Paper Speed and Scale" on page 40).
Err xxx  [3]	xxx is between 500 and 600. This indicates a technical failure diagnosed by the monitor's self test program.	Contact a Philips Service Engineer or Response Center.
Error 601  [3]	Paper speed.	Check that correct paper is used. Check the speed by timing how long it takes for the paper to advance 1cm: 60 seconds = 1cm/min 30 seconds = 2cm/min 20 seconds = 3cm/min Contact a Philips Service Engineer or Response Center if the speed is incorrect.
Error 602  [3]	Incorrect type of paper loaded.	Load with appropriate scale paper or change monitor's paper format setting.

1. Displayed for ten seconds when the monitor is first switched on.
2. Printed every 10 minutes.
3. Printed every three pages.

LCD Display Warning Messages

Table 10-1 Noninvasive Blood Pressure

Warning Message	Situation	Audible Indication	Action Required
 overpressure	Cuff pressure increases above 330mmHg or remains above 300mmHg for 2 sec.	Yes (cannot be switched off)	Check to see if cuff is being pressed manually (perhaps by patient movement) and restart the measurement. Cuff deflates automatically.
 artifacts	Patient is moving.	Yes (if alarming is on)	Restrain patient movement and restart the measurement.
 cuff tubing	Inflation/deflation takes too long.	Yes (if alarming is on)	Check that all tubes are connected properly, not blocked, leaking or defective. Ensure that the correct cuff is being used. Restart the measurement
 NBP error	Tubing obstructed, or hardware problem.	Yes (if alarming is on)	Check tubing. Switch monitor off and try measurement again. If problem persists, call service personnel.

Table 10-2 Pulse Oximetry

Warning Message	Parameter Display	Audible Indication	Possible Cause	What to Do
None	--%	No	Transducer or adapter cable disconnected	Connect transducer or cable.
SpO_2 no pulse	NOP	Yes (if alarming is on)	Pulsation too weak or no pulsation detectable. Transducer incorrectly positioned	Check patient's pulse. Reposition transducer. Ensure transducer is not on same limb as NIBP cuff.
			Patient wearing colored nail polish.	Remove nail polish.
SpO_2 low signal	Normal display	No	Weak signal, SpO_2 less accurate.	Reposition transducer or try a different site.
			Wrong transducer selected	Use correct transducer.
			Transducer incorrectly applied.	Reapply transducer.
			Photodetector not opposite light emitter.	Reposition transducer.
			Patient wearing colored nail polish.	Remove nail polish.
SpO_2 light interference	-?-	No	A light source is so high that the SpO_2 transducer cannot measure SpO_2 or HR.	Remove strong light source, or cover transducer with opaque material.
SpO_2 artifacts	-0-	No	Irregular pulse patterns detected, possibly arising from patient movement.	Restrain patient.

Service Errors

If one of these service error message appears on the display, consult the appropriate page in this manual for the procedure you should follow.

Table 10-3 Service Error Messages

Error Message	Error Location
Err 500	Not known (bus error)
Err 502	Power supply board
Err 504	DSP-CPU
Err 505	DSP-CoP
Err 506	ROM Board
Err 507	DSPII Board
Err 513	CPU Board (Smartwand)
Err 515	Dig If Board
Err 516 or 517	Frontend Board
Err 525 and Err 527	LED Board
Err 526	LCD Board
Err 531	Telemetry Board
Err 532	OBMS Interface Board
Err 533	DSIF Board
Err 534	Maternal SpO_2 Board
Err 535	NBP Assembly
Err 536	Combined Telemetry/System Board
Err 540	Fetal SpO_2 Board
Err 601	Recorder Paper Feed
Err 602	Incorrect Type of Paper

Error 500: General Failure

Warning
The following task requires that the power be on while the cover is removed. Proceed with extreme caution. Failure to do so can result in serious injury.

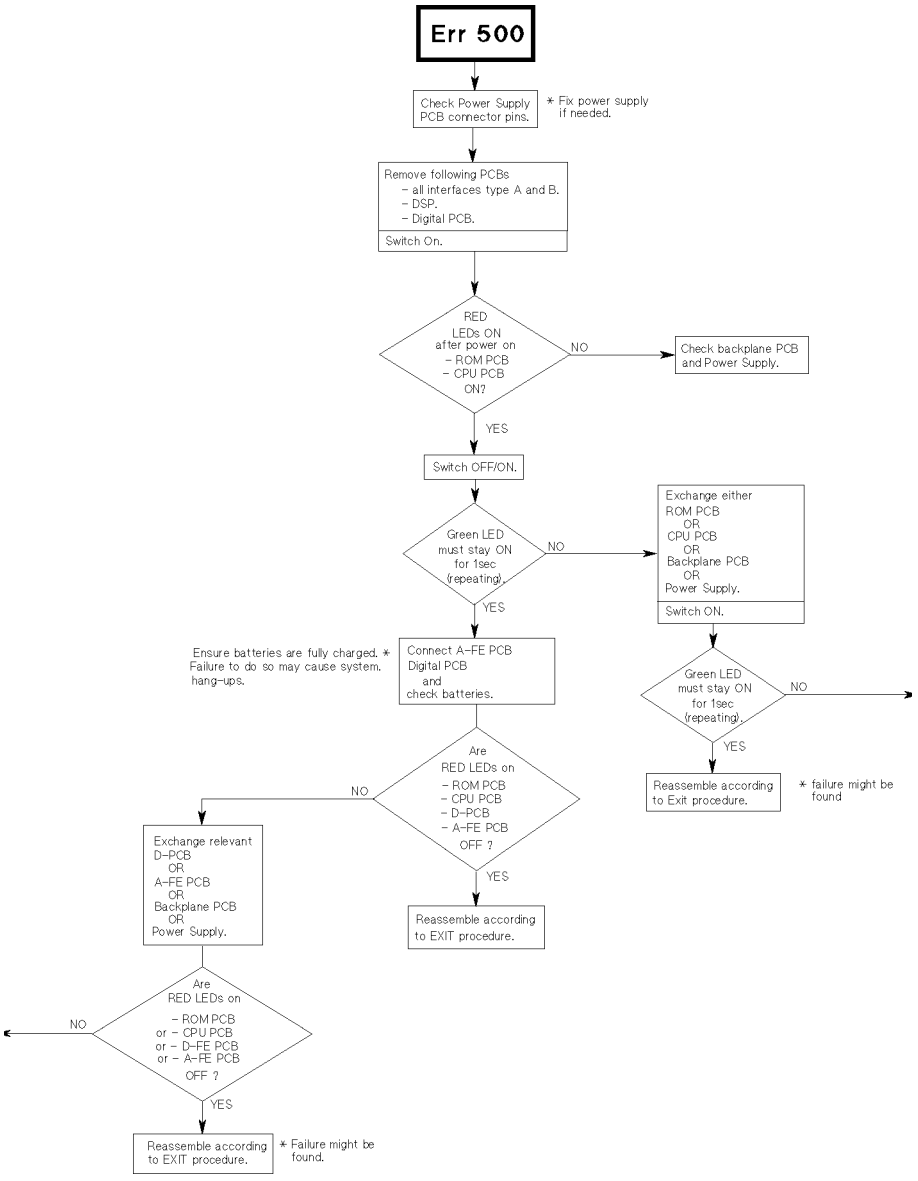


Figure 10-4 Troubleshooting: Error 500

Error 502: PowerSupply

Warning
The following task requires that the power be on while the cover is removed. Proceed with extreme caution. Failure to do so can result in serious injury.

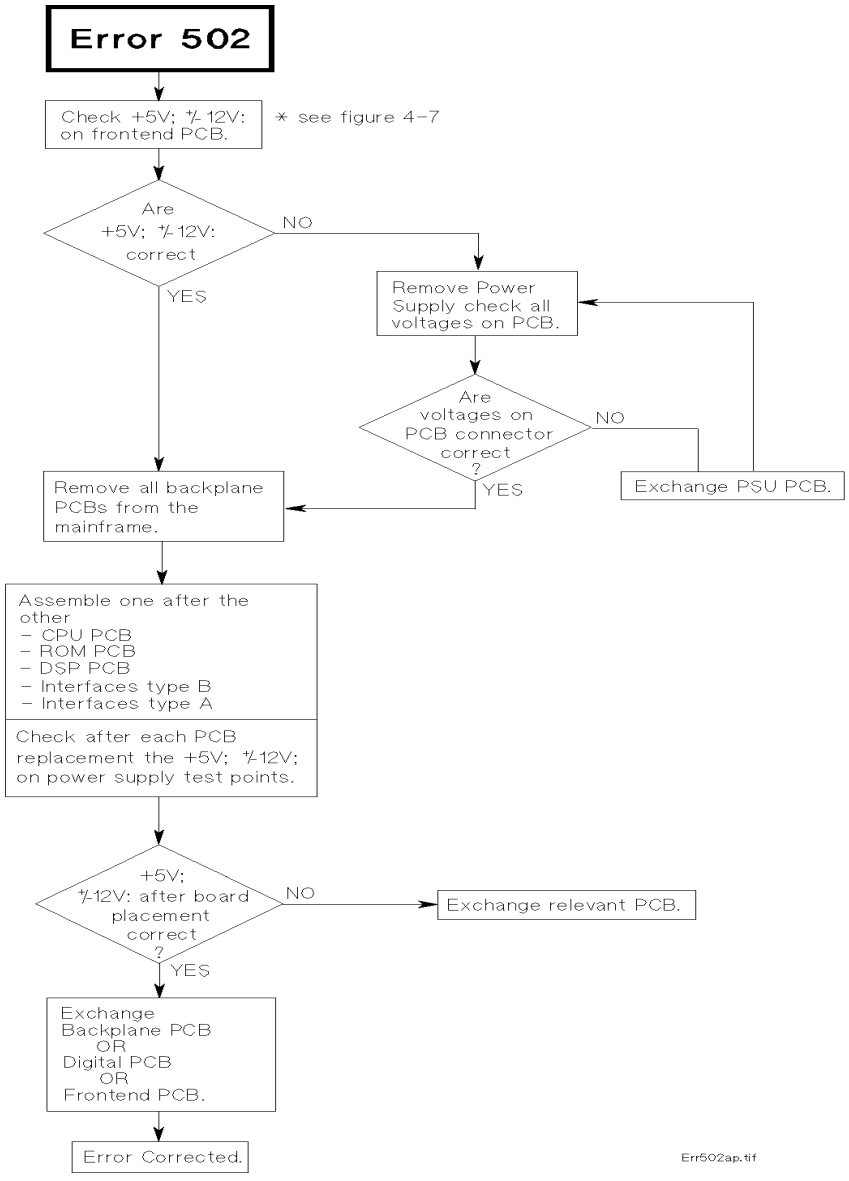


Figure 10-5 Troubleshooting: Error 502

Warning
Electrical current is dangerous. You must use extreme caution when performing the two following procedures.

Checking Output from the Frontend Board

1. Remove the monitor top cover (see "Removing the Top Cover" on page 167).
2. Connect the monitor to line voltage and switch on.

Checking Output from the Power Supply Board

1. Remove the power supply from the monitor (see "Rear Assembly" on page 168).
2. Connect the monitor to line voltage and switch on.
3. Using a DVM meter, check the voltage output from the pins as shown in Figure 10-5, and in Figure 10-6.

It is recommended to use the rear of the board to check the voltages.

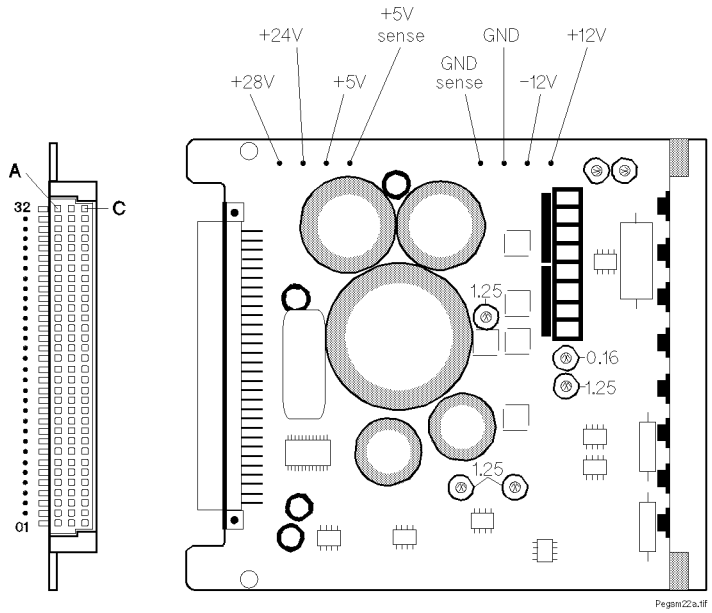


Figure 10-6 Power Supply Board

Table 10-4 Power Supply Board: Output from Connector Pins

Column	Pin No.	Output
A	32	24V AC (27 to 36V rms)
A	31	24V AC (27 to 36V rms)
C	32	+28V (< 50V)
C	31	+24V (22.3 to 25.7V)
A/B/C	24	+4.9 to 5.1V
C	03	-11.8 to -12.8V
C	02	+11.8 to +12.8V

4. If the output is not as shown, replace the board (see "Power Supply Board" on page 168).

Error 506: ROM Board

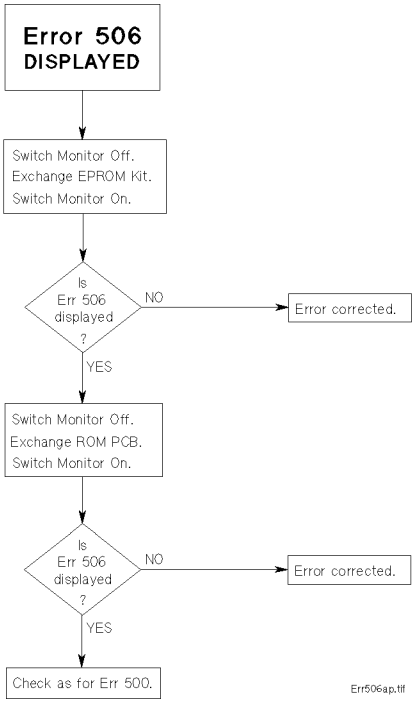


Figure 10-7 Troubleshooting: Error 506

Error 507: DSPII Board

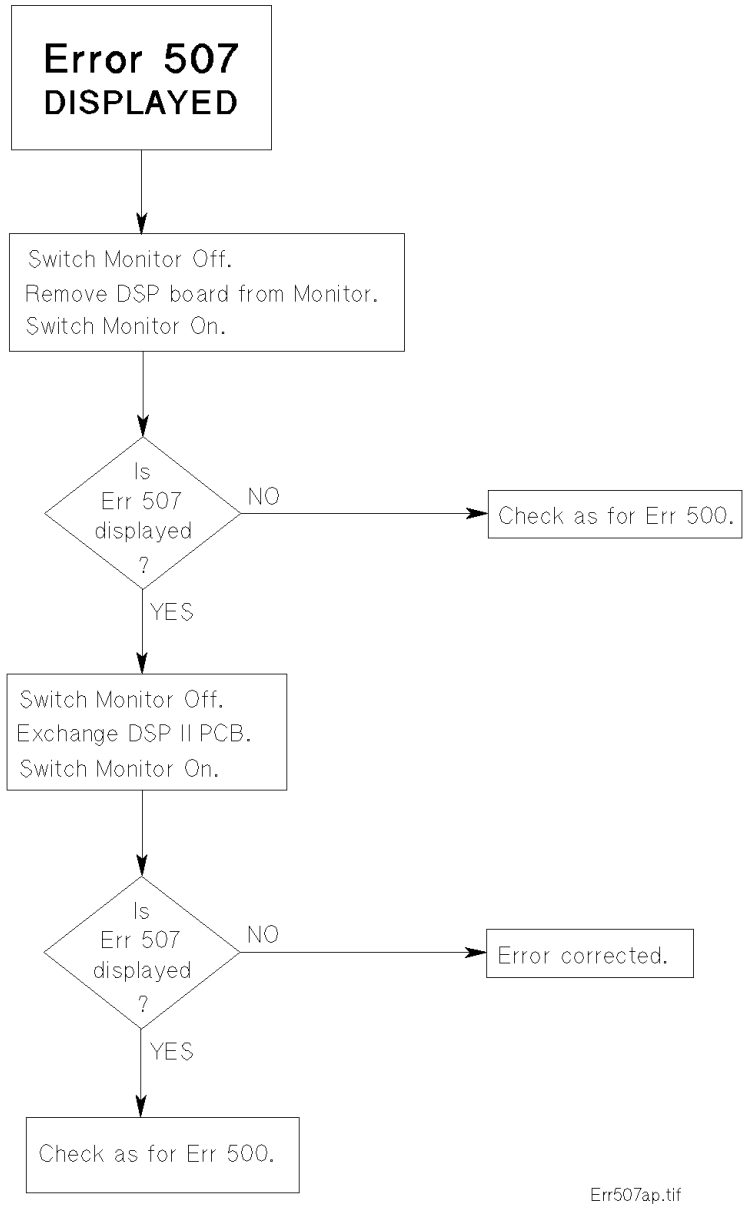


Figure 10-8 Troubleshooting: Error 507

Error 513: CPU Board

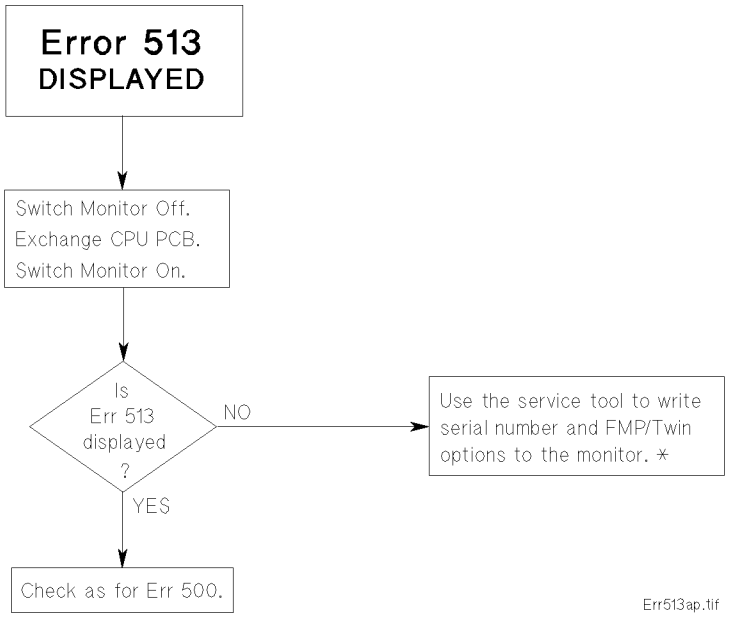


Figure 10-9 Troubleshooting: Error 513

Warning
The serial number and feature settings can only be written once.

Error 515: DIF Board

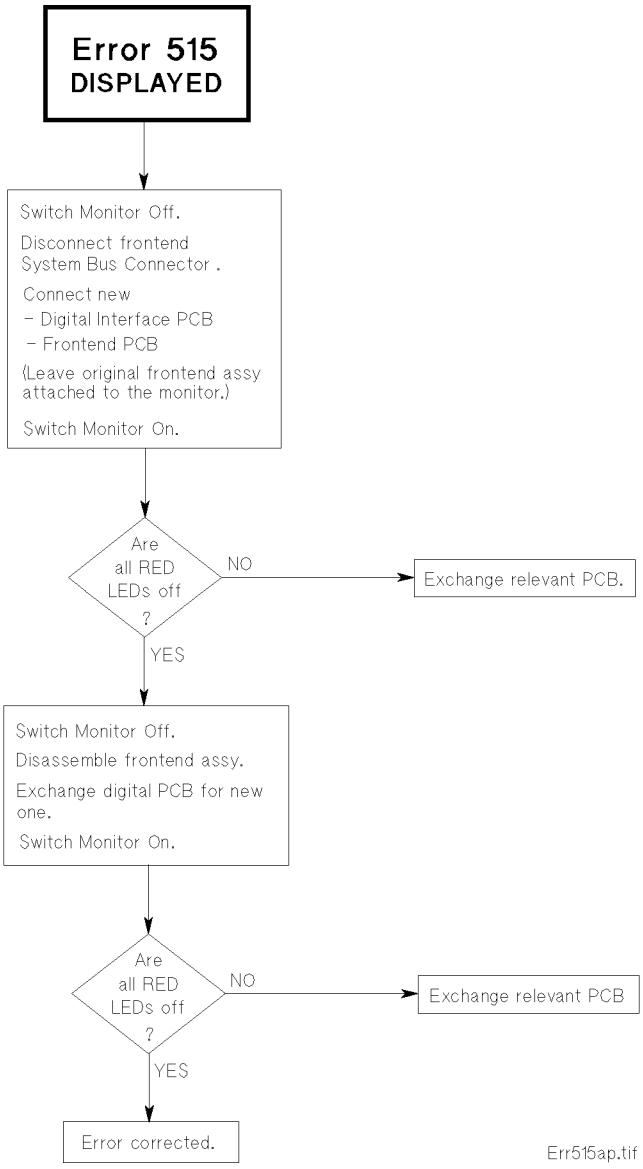


Figure 10-10 Troubleshooting: Error 515

Error 516 or 517: Frontend Board

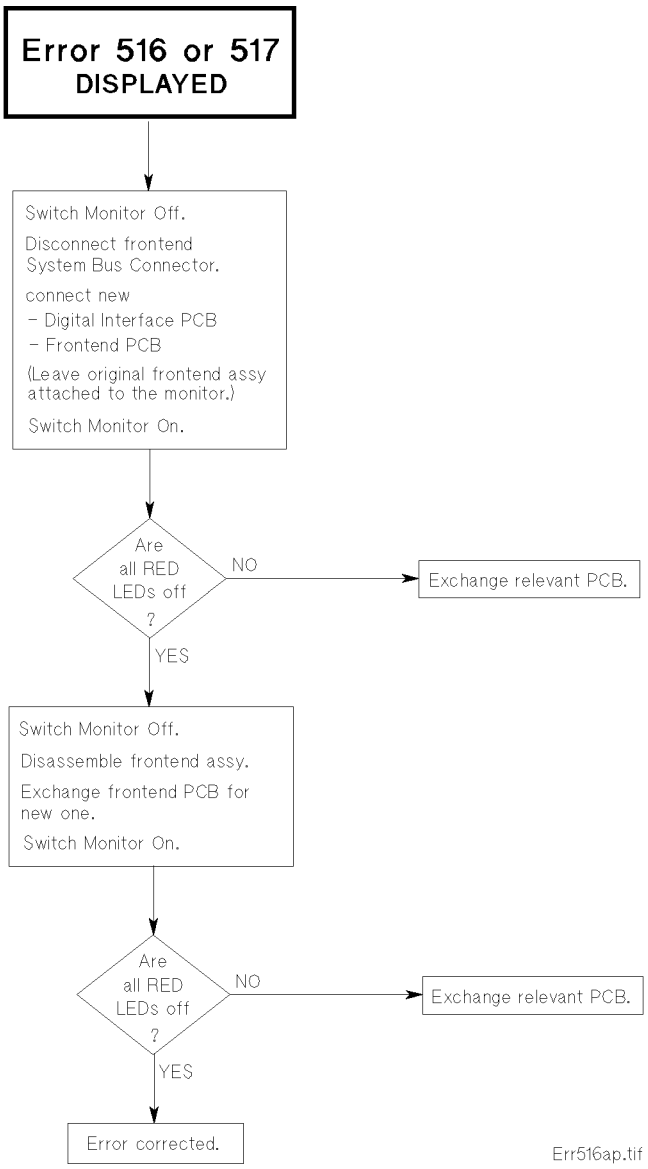


Figure 10-11 Troubleshooting: Error 516 or 517

Error 525 or 527: LED Display Board

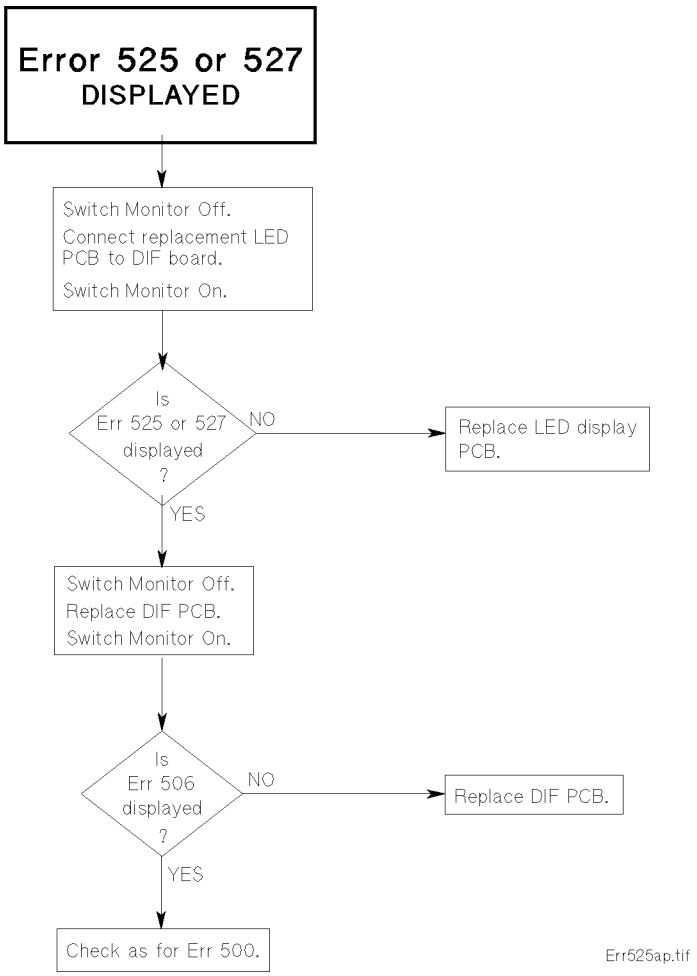


Figure 10-12 Troubleshooting: Error 525 or 527

Error 526: LCD Display Board

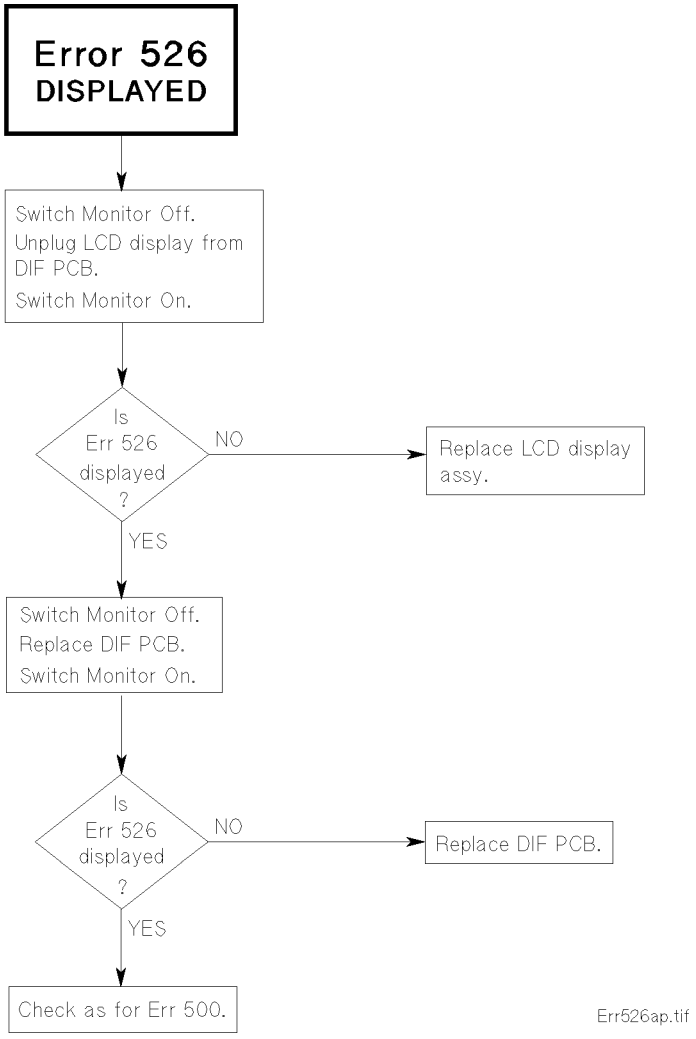


Figure 10-13 Troubleshooting: Error 526

Error 532: System Interface Board

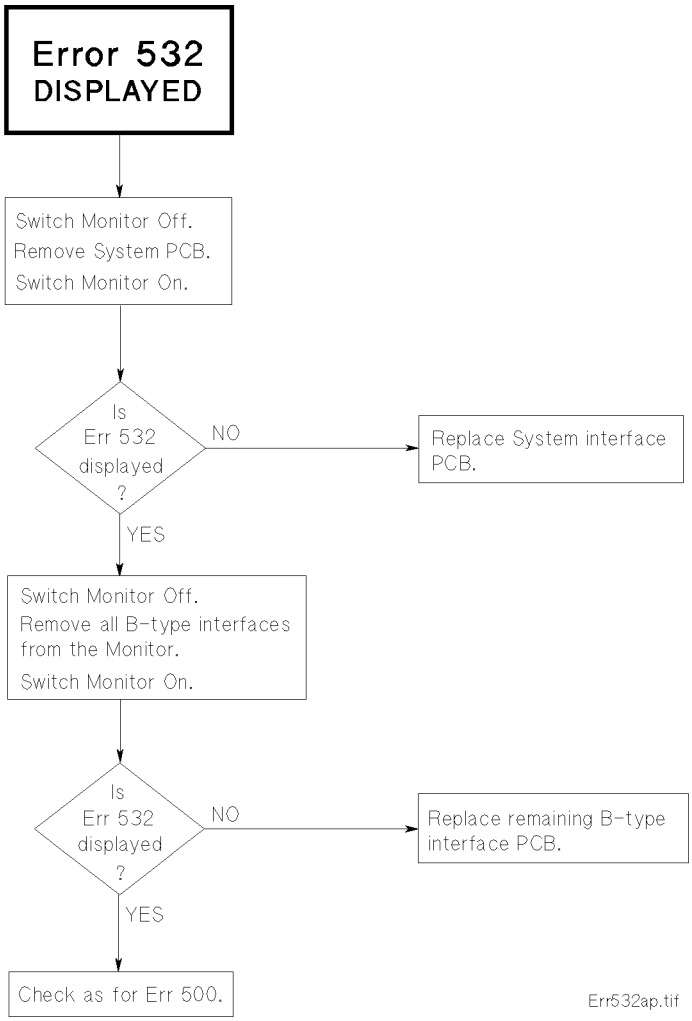


Figure 10-14 Troubleshooting: Error 532

Note — If Philips M1350-66536 is connected at the same time, check the correct setting of C13 (see Chapter 5).

Error 533: Dual Serial Interface Board

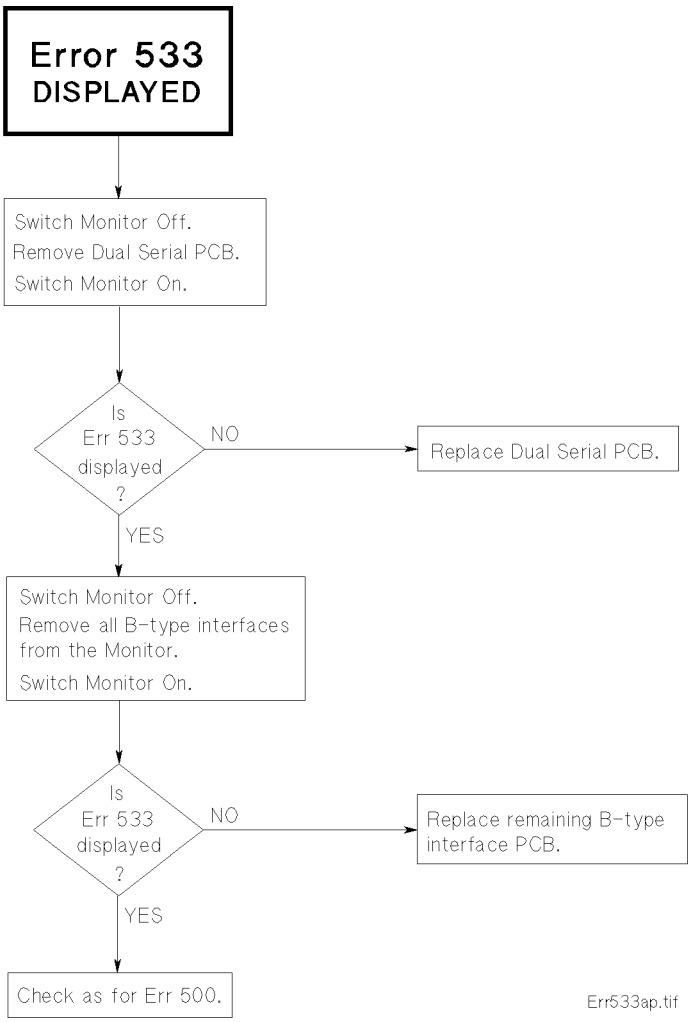


Figure 10-15 Troubleshooting: Error 533

Error 534: Maternal SpO_2 Board

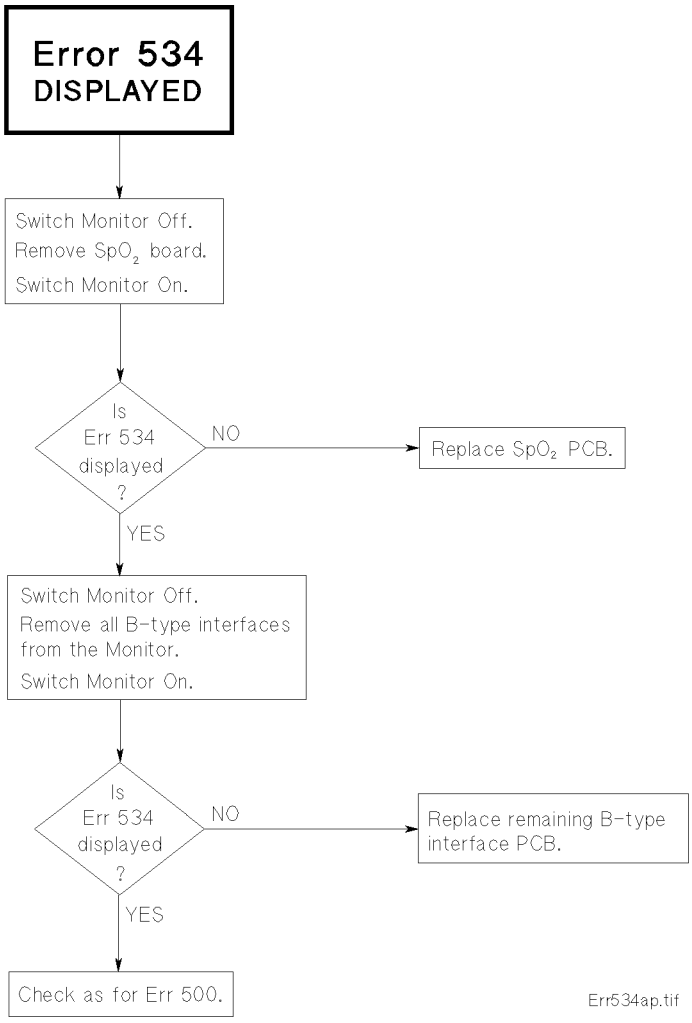


Figure 10-16 Troubleshooting: Error 534

Error 535: NIPB Board

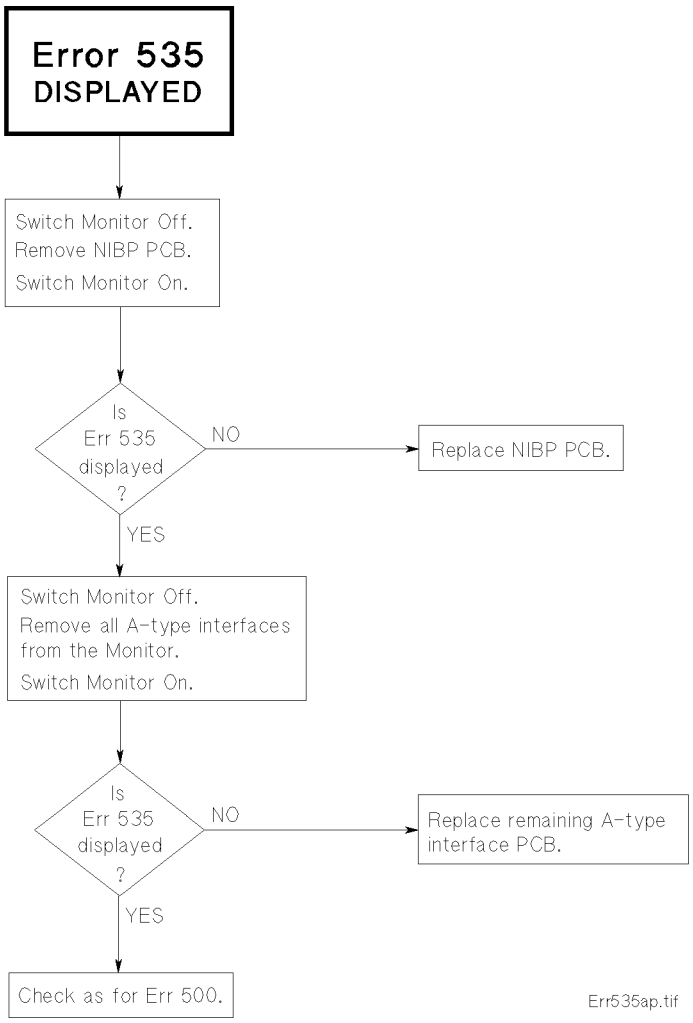


Figure 10-17 Troubleshooting: Error 535

Error 536: Telemetry Interface Board

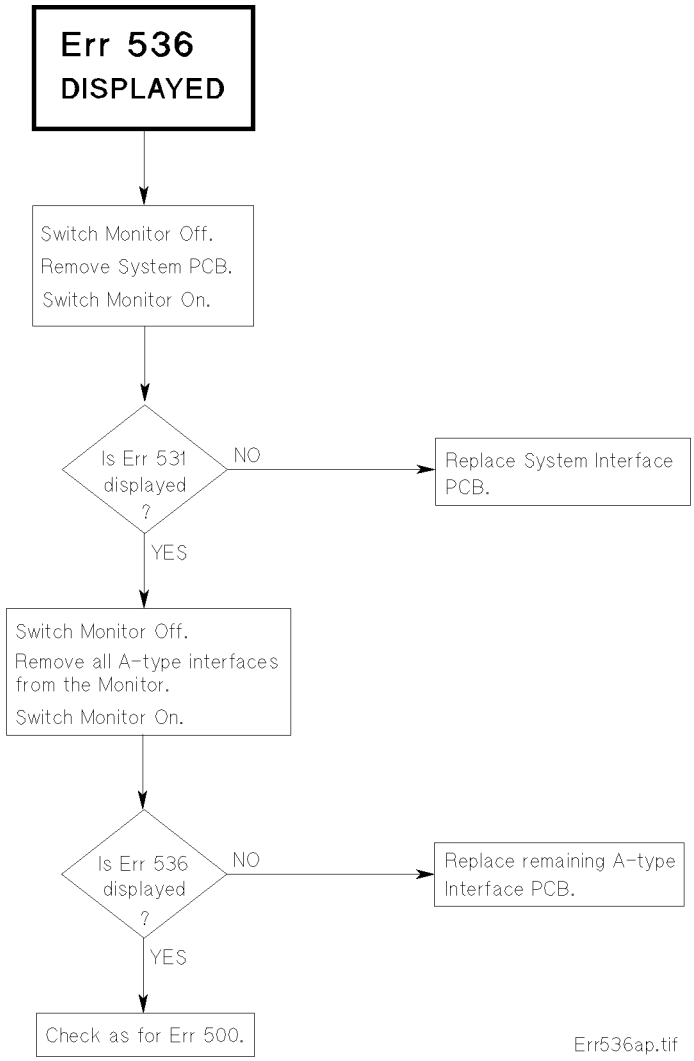


Figure 10-18 Troubleshooting: Error 536

Note — If the OBMS (M1350-66532) board is connected to the Fetal Monitor at the same time, check the C13 setting (see Chapter 5).

Error 540: Fetal SpO_2 Board

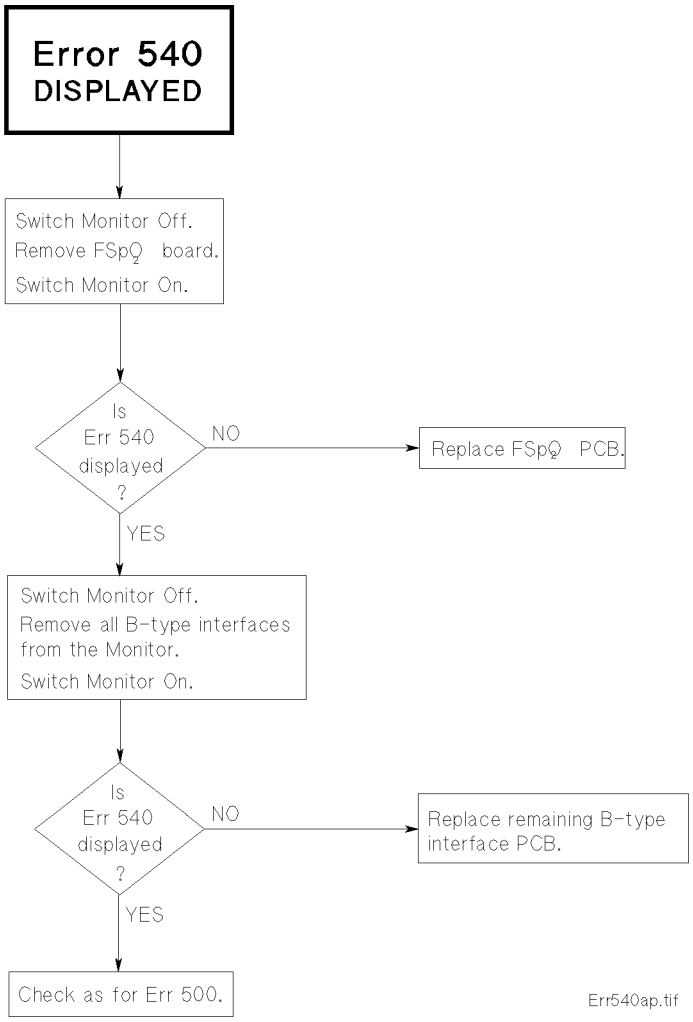


Figure 10-19 Troubleshooting: Error 540

Error 601: Recorder Paperfeed

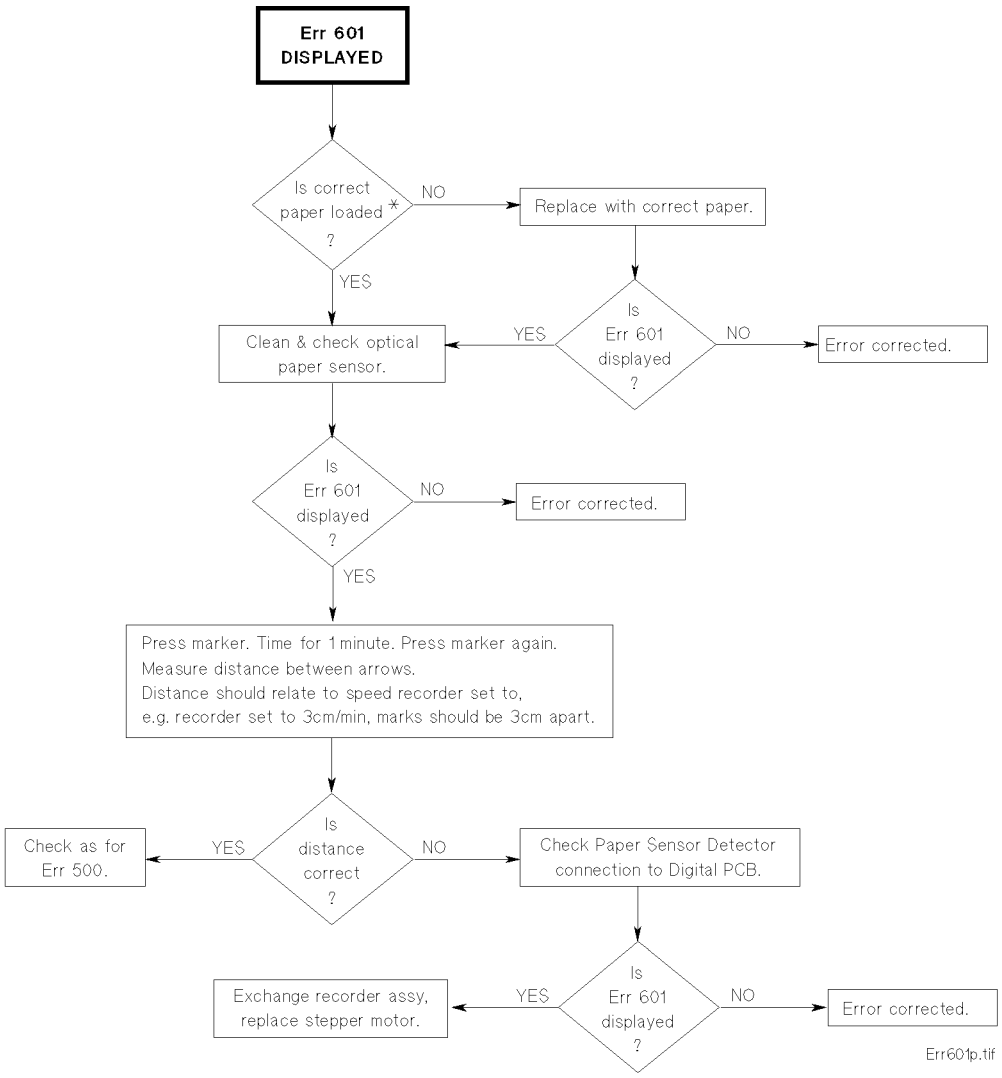


Figure 10-20 Troubleshooting: Error 601

Caution
The use of recorder paper that is not approved by Philips can damage the monitor. This type of damage will not be covered by warranty.

Error 602: Incorrect Type of Paper

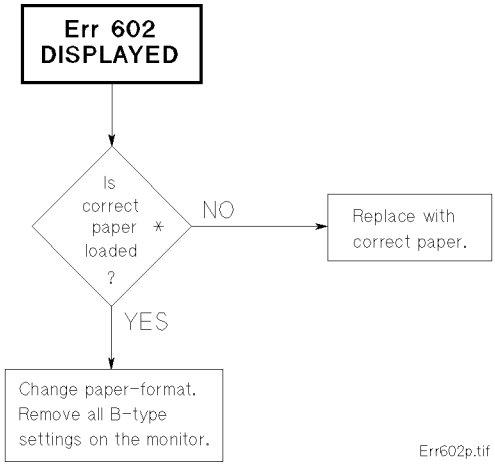


Figure 10-21 Troubleshooting: Error 602

Caution
The use of recorder paper that is not approved by Philips can damage the monitor. This type of damage will not be covered by warranty.

Ultrasound Parameter Test

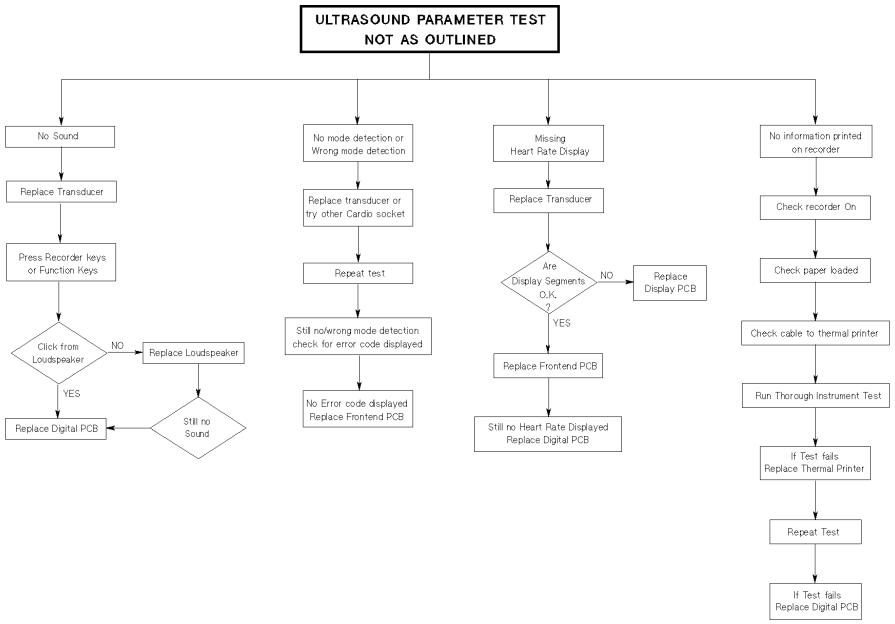


Figure 10-22 Troubleshooting: Ultrasound Parameter Test

Direct ECG Parameter Test

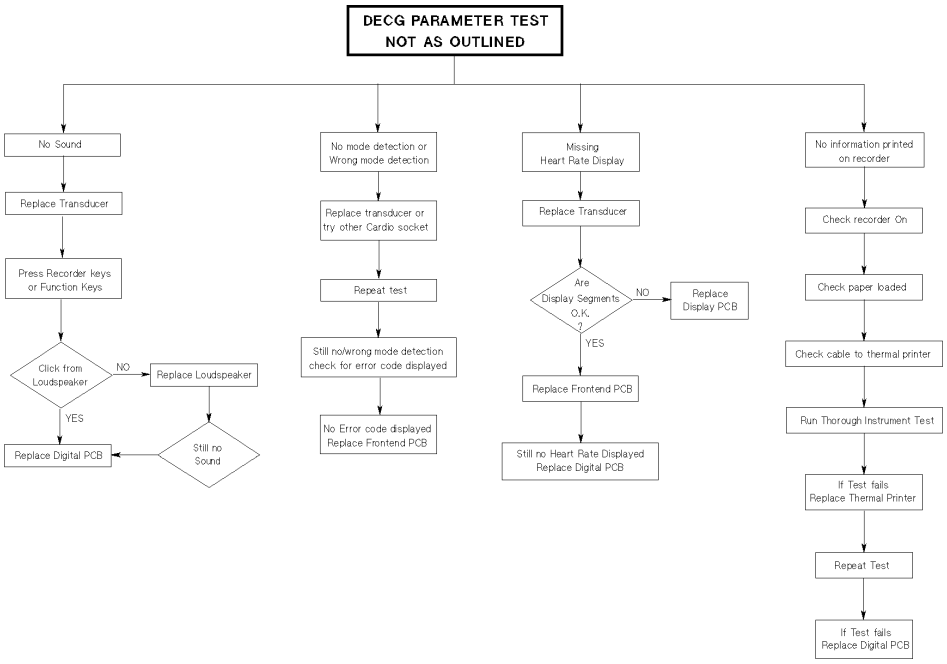


Figure 10-23 Troubleshooting: Direct ECG Parameter Test

Maternal ECG Parameter Test

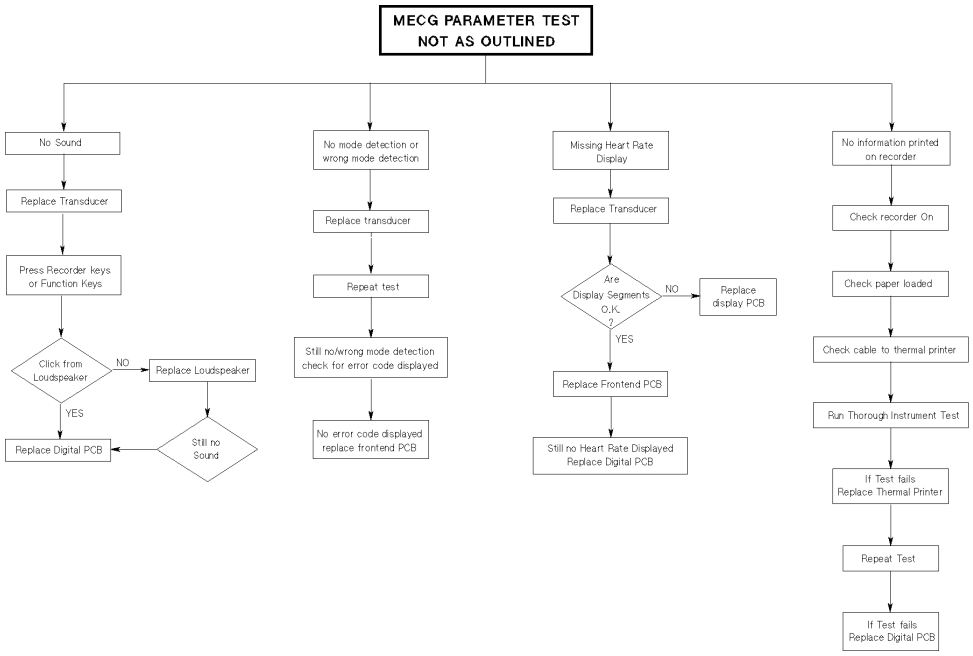


Figure 10-24 Troubleshooting: Maternal ECG Parameter Test

Toco Parameter Test

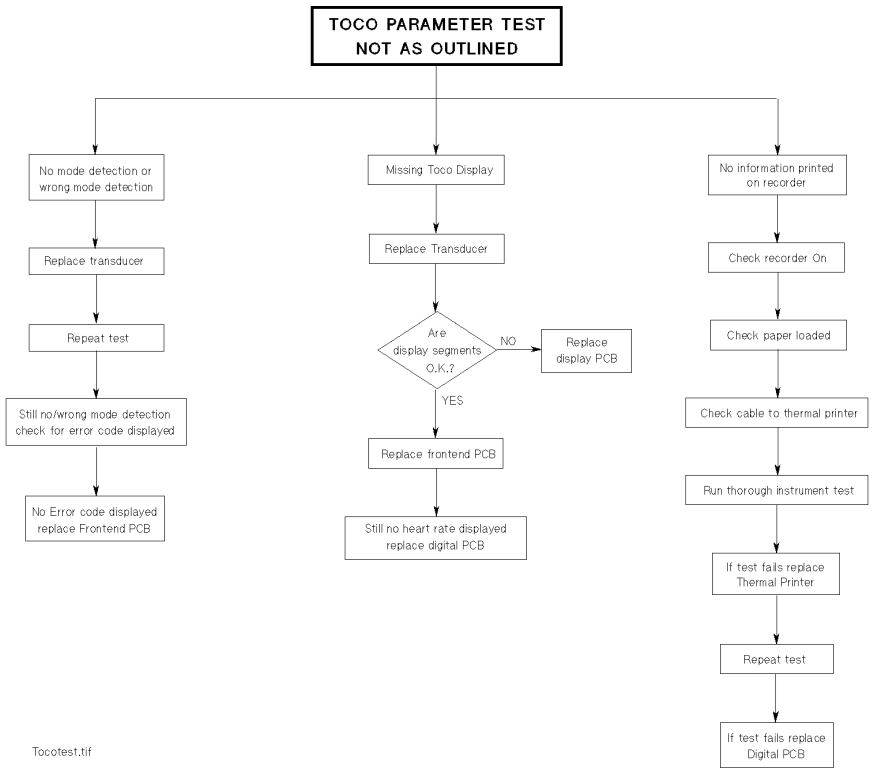


Figure 10-25 Troubleshooting: Toco Parameter Test

Maternal SpO_2 Parameter Test

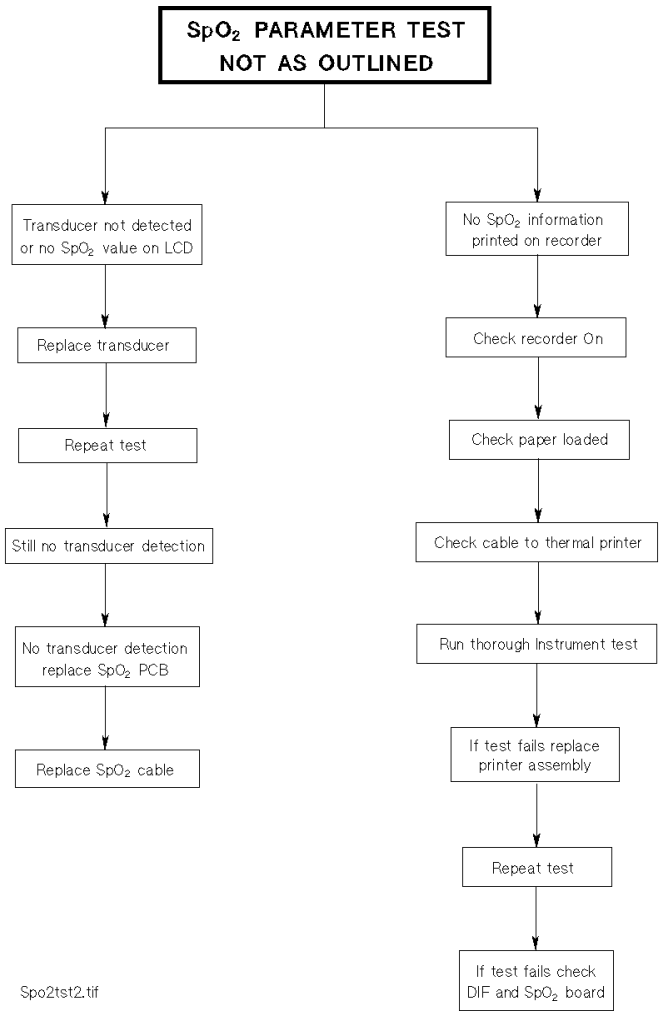


Figure 10-26 Troubleshooting: Maternal SpO_2 Parameter Test

Internal maternal parameters contained within the monitor override external maternal parameters.

Fetal SpO_2 Parameter Test

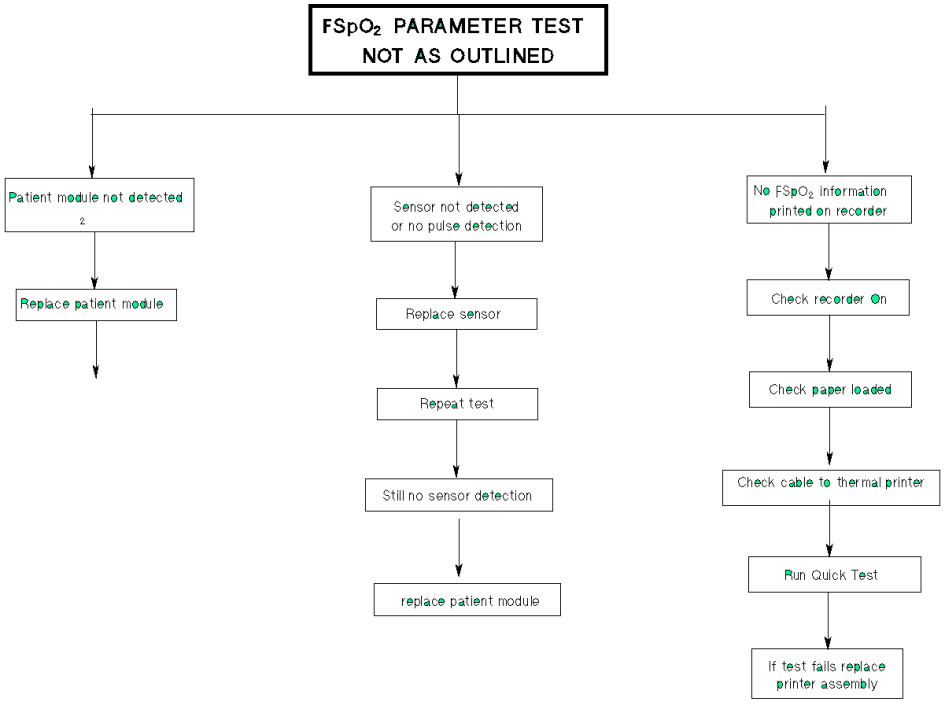


Figure 10-27 Troubleshooting: Fetal SpO_2 Parameter Test

NIBP Parameter Test

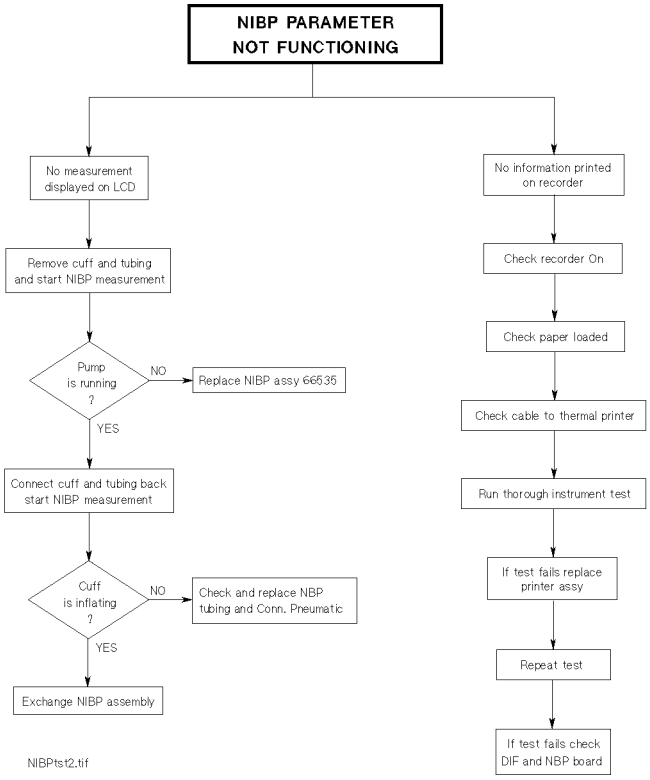


Figure 10-28 Troubleshooting: NIBP Parameter Test

Internal maternal parameters contained within the monitor override external maternal parameters.

External Maternal Parameters

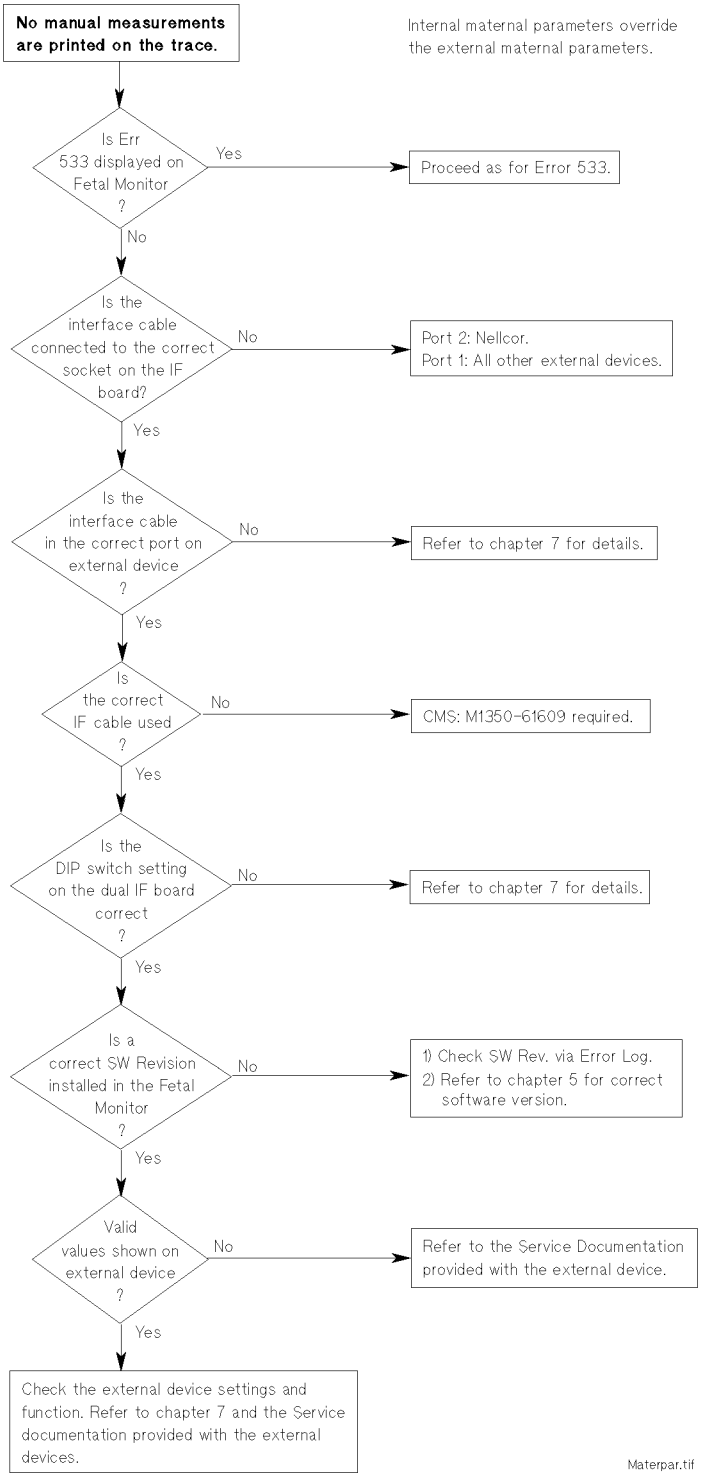


Figure 10-29 Troubleshooting: External Maternal Parameters

Recorder PaperSensing

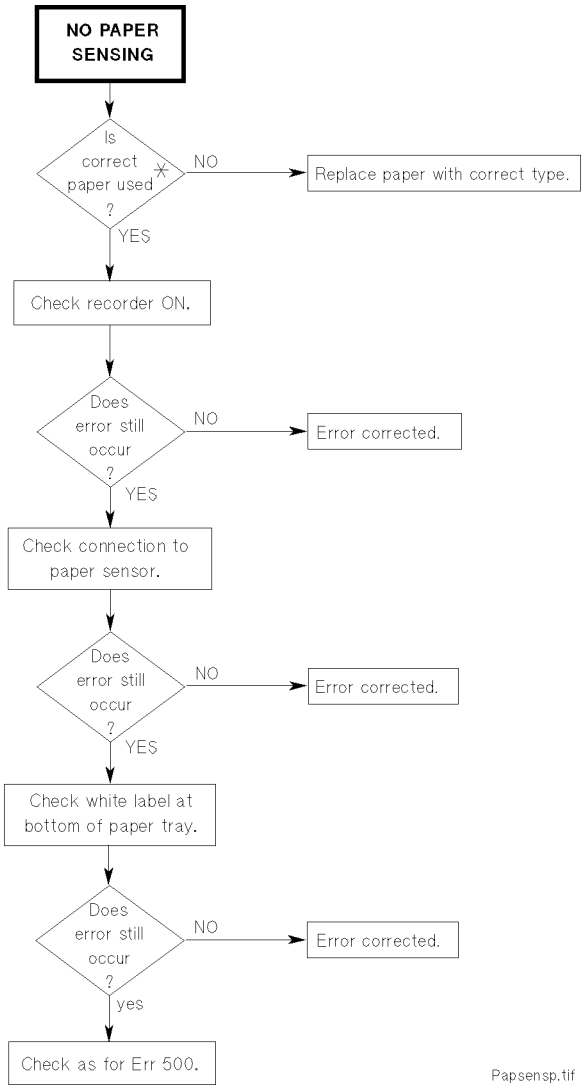


Figure 10-30 Troubleshooting: Recorder Paper Sensing

Caution
The use of recorder paper that is not approved by Philips can damage the Monitor. This type of damage will not be covered by warranty.

$FSpO_2$ Monitor

If the Nellcor $FSpO_2$ monitor has two power switches (a mains switch at the rear of the unit and a standby switch at the front of the unit), take care to switch them off and on in the correct order. Failure to follow this prescribed sequence can cause the unit to appear to malfunction by displaying data erratically or not at all.

Switching Off

1. Turn front switch (on/standby mode) to standby.
2. Turn rear switch (mains power switch) to off.

Switching On

1. Turn rear switch (mains power) to on.
2. Turn front switch (on/standby mode) to on.

If the unit behaves erratically, switch it off, exactly as detailed above, wait for five seconds, then switch it on again.

When using the $FSpO_2$ monitor regularly, it is recommended to keep the rear switch in the "on" position and use the front switch to change from on to standby mode.

11
Removal and Replacement Procedures

Introduction

This section provides detailed information on the removal and replacement of components, but it is not necessary to do this for most service tasks. You should only disassemble the monitor as far as you need to replace an item.

In order to help with the descriptions, the monitor is divided into three sections. These are:

1. The Rear Assembly:
    - Power Supply
    - Boards
    - Backplane
    - Batteries
2. The Recorder Assembly
3. The Front Assembly:
    - Front Cover
    - Frontend Board
    - Loudspeaker
    - Digital Interface Board
    - Display Board
    - Function Switches
    - Recorder Keys
    - LCD Display Board
    - Tilt Mechanism
    - Display Assembly

As no components on the boards are replaceable, the removal procedures will only go down as far as removal and replacement of the boards themselves.

Test/Inspection and Safety Procedures

It is very important to perform the test, inspection and safety tests detailed in Chapter 9, “Safety, Maintenance, and Calibration,” whenever you connect a monitor to an OB system, or have worked on individual monitor components.

Tools

The following tools are needed to dismantle the monitor:

- pozidrive screwdriver size 1
- safety test equipment
- PC for configuration
- Configuration software “pegserv.exe”
- Cable to link PC to fetal monitor

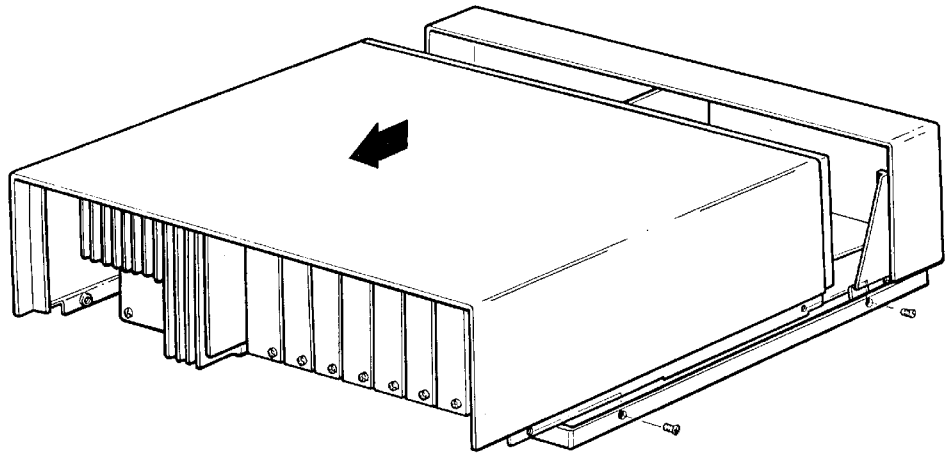
Removing the Top Cover

Warning
Electrical power is dangerous. Prior to attempting to remove any component from the system the power to the system must be disconnected.

Access to most of the items within the monitor is only possible with the top cover of the monitor removed.

To remove the top cover:

1. Turn the system off and disconnect the power cable.
2. Undo the four screws situated on the sides of the monitor.
3. Slide the cover towards the rear of the monitor and lift it off.



psm19sca.tif

Figure 11-1 Removing the Top Cover

Replacement of the cover is a reversal of the above procedure.

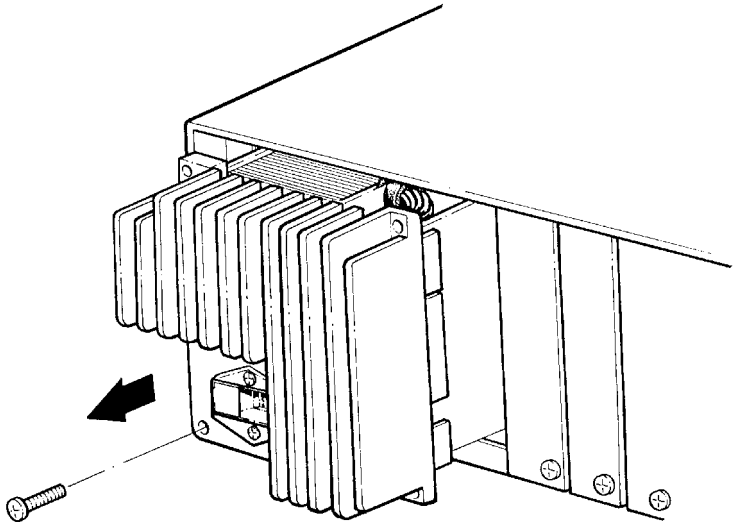
Note

The boards and power supply can be removed from the rear of the monitor without removing the top cover. If you do remove the top cover, take care when you slide it back that the RFI spring does not fall into the Fetal Monitor. This could damage the components.

Rear Assembly

Removing the Power Supply Assembly

1. Turn the system off and disconnect the power cable.
2. Remove the top cover (see page 167).
3. Remove the ON/OFF button by pulling it forwards. You hear a click as the end of the buttons's extension arm comes forward one notch from the switch unit located in the power supply. Release the end of the extension arm with the aid of a flat-bladed screwdriver. Turn the button/arm 90 degrees counter-clockwise, then pull it straight out.
4. Undo the four screws from the rear of the power supply assembly.
5. Pull the power supply assembly out of the rear of the monitor.



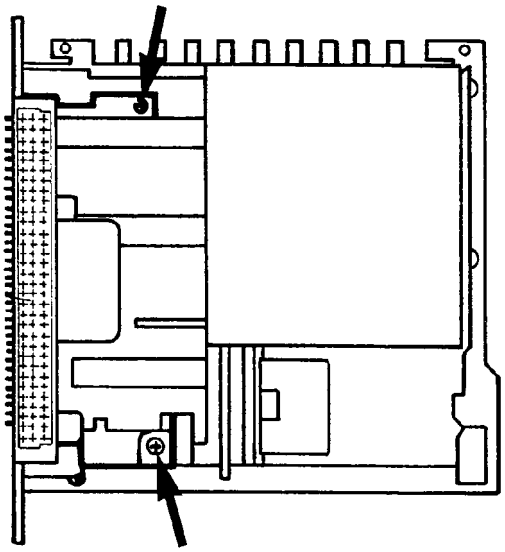
psm20sca.tif

Figure 11-2 Removing the Power Supply Assembly

6. If you are exchanging the power supply assembly, remove the power supply board for later refitting to the new power supply assembly.

Removing the Power Supply Board

1. Remove the power supply assembly as described on page 168.
2. Turn the power supply over and remove the two screws holding the board in place.



psm15sca.tif

3. Remove the power supply board.

Figure 11-3 Removing the Power Supply Board

Replacing the Power Supply Board

Replacement of the Power Supply board is a reversal of the above procedure.

Replacing the Power Supply Assembly

1. If you are exchanging the power supply assembly, first fit the power supply board to the new power supply.
2. Replacement of the power supply assembly is the reversal of the removal procedure (see "Removing the Power Supply Assembly" on page 168.

Note— DO NOT **force the power supply assembly into the rear of the monitor. If it will not locate, remove and check that the pins connecting the supply to the Backplane are not bent. Reinsert the power supply assembly.**

3. Replacement of the ON/OFF button is a reversal of the removal procedure (see step 4 on page 168). You should hear two clicks as the end of the button's extension arm locates on the notches on the switch unit in the power supply.
4. Perform the Instrument Safety Test (see page 120) after you have worked on the power supply.

Fuses

1. Remove the power supply board as previously described.
2. The location of the fuses is shown below.

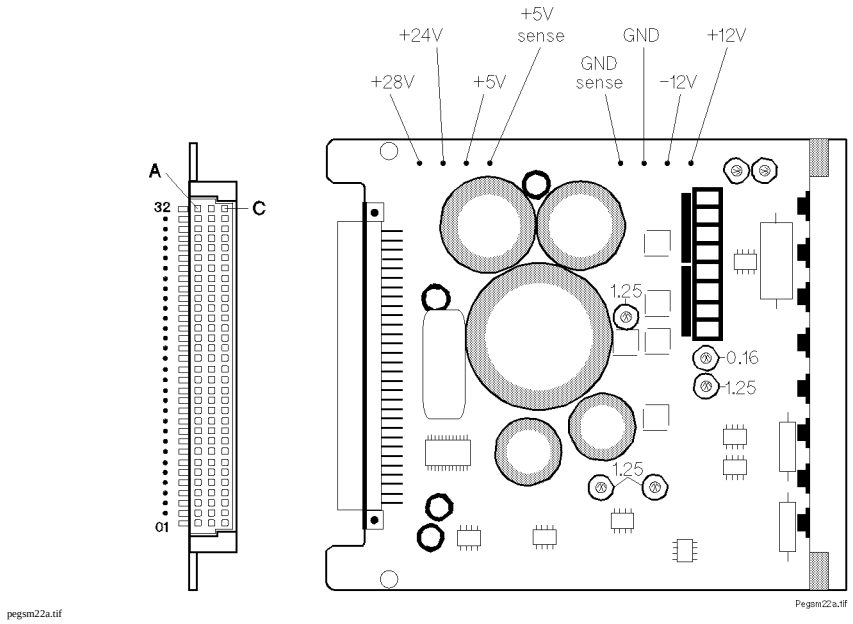


Figure 11-4 Output Voltage from Power Supply Board

3. To remove the fuses, pull them out.

Table 11-1 Fuses

Philips part number	Description	Qty
2110-0830	bipin fuse 1.25A	4
2110-0833	bipin fuse 0.16A	1

Boards

To remove a board from the monitor:

1. Turn the system off and disconnect the power cable.
2. Undo screws **1** at the top and bottom of the board you want to remove.
3. Move lever **2** upwards of the monitor.

   NIPB and SPO_2 Boards Only

   Slide the board out for a few centimeters, until you can easily disconnect the NIPB tubing, or SpO_2 cable.

   Detach the connection.
4. Remove the board from the monitor.

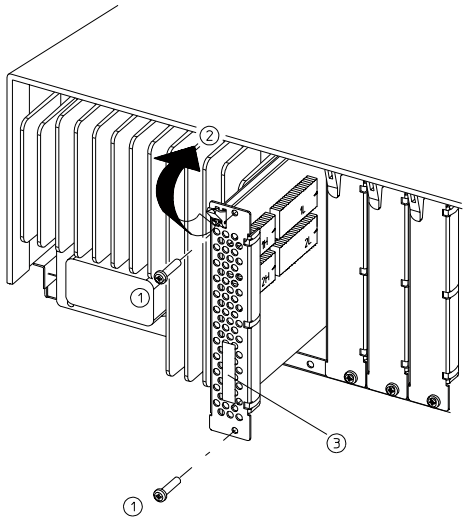


Figure 11-5 Replacing a Board

To replace a board:

1. Push the board into the appropriate slot inside the rear of the monitor. You cannot insert the board in the wrong compartment.
2. Replace the screws and tighten securely.

If the CPU board has been replaced, you must write the serial number (3) and feature settings of the monitor to the EPROMS on this board and reload the functionality with the PC software. (See Chapter 3, “Configuring the Monitor” for details.) **The serial number and feature setting can only be written once.**

When you replace either the SpO_2 or the NIBP boards, you must disconnect the SpO_2 cable, or NIBP tubing as appropriate before completely removing the boards.

Perform the Instrument Safety Test as described in page 120 after you have worked on the maternal SpO_2 board.

Backplane

To remove the Backplane proceed as follows:

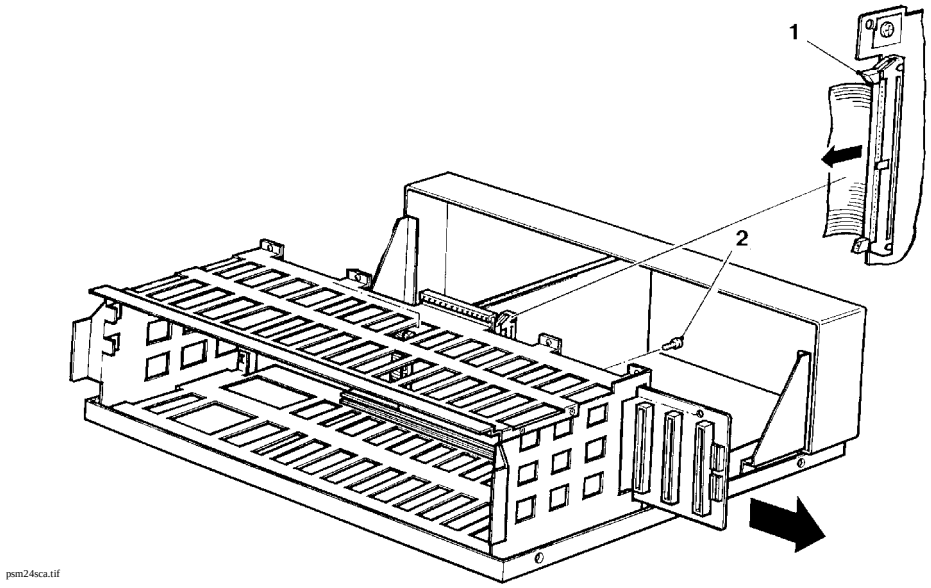


Figure 11-6 Removing the Backplane

1. Turn the system off and disconnect the power cable.
2. Remove the Monitor Top Cover.
3. Remove all boards from the rear of the monitor.
4. Remove the system power supply.
5. Disconnect the system bus connector **1** from the Digital Interface board.
6. Remove the three screws **2** connecting the Backplane to the monitor chassis.
7. Gently pull the Backplane out of the side of the monitor.

Replacement is a reversal of the above procedure.

Batteries

The monitor's clock is powered by two batteries located in the rear panel of the monitor. The average life span of these batteries is one year. When the battery charge is low, the message E-F bAt is displayed, and ⊠ is printed on the recorder trace. When this happens, the batteries should be changed as soon as possible.

If the batteries are not changed, the specific settings will return to their default values and will have to be reset each time the monitor is switched on. (For example, the date is set to 4.4.44)

Replace the batteries with two alkaline 1.5 Volt size N batteries (recommended type: MN9100.

To replace the batteries:

1. Switch off the monitor. If you don't, ⊠ will continue to be printed on the recorder trace.

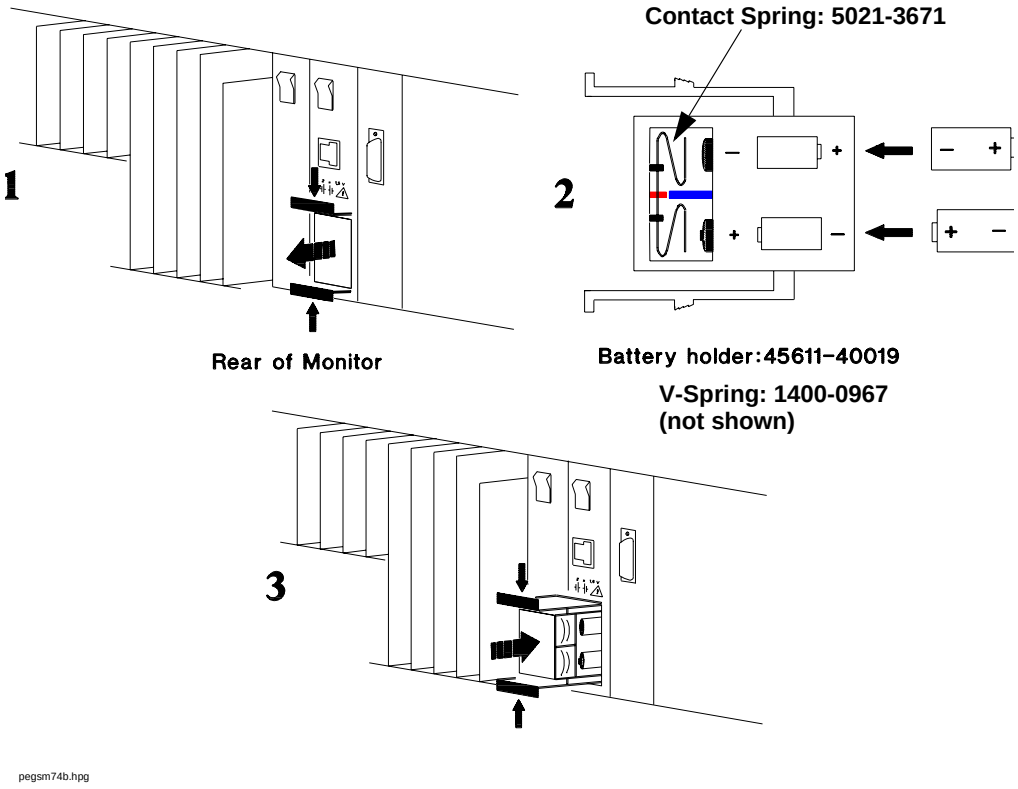


Figure 11-7 Replacing the Batteries

2. Replace the batteries (see Figure 11-7).
3. Switch on the monitor.
4. Reset the time and date (see "Chapter 4. Getting Started (Basic Considerations and Operation)" on page 39). If you don't, the wrong time and date will be printed on the recorder trace.

Recorder Assembly

To remove the Recorder Assembly proceed as follows:

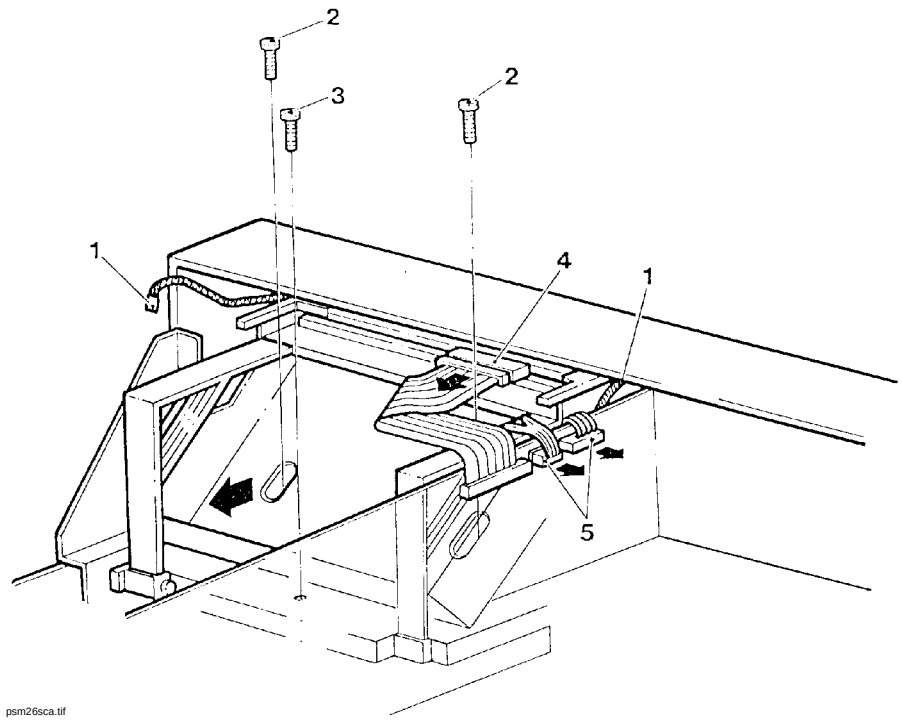
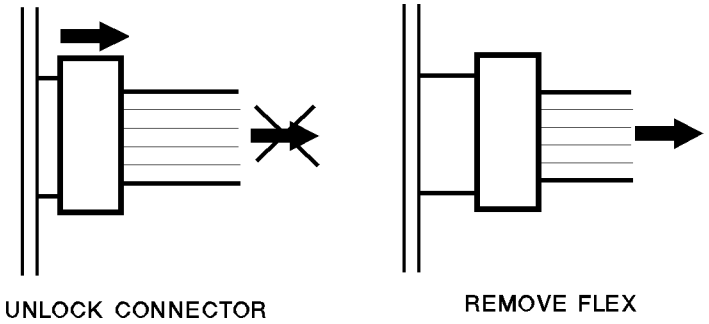


Figure 11-8 Removing the Recorder Assembly

1. Turn the system off and disconnect the power cable.
2. Remove the recorder paper.
3. Remove the monitor top cover.
4. Disconnect the two earth straps **1** from the front assembly.
5. Loosen screws **2 and 3**. Screws 2 are accessible via holes in the paper tray.
6. Disconnect the cables 4 and 5 between the Digital Interface board and the recorder. Remove screw **3**.

7. Unlock the flex layer by pulling it slightly forward.



8. Lift the recorder assembly out of the monitor casing
9. Place it in the new base assembly, reversing the above procedure. Take care that the paper eject lever fits back into the paper eject knob.

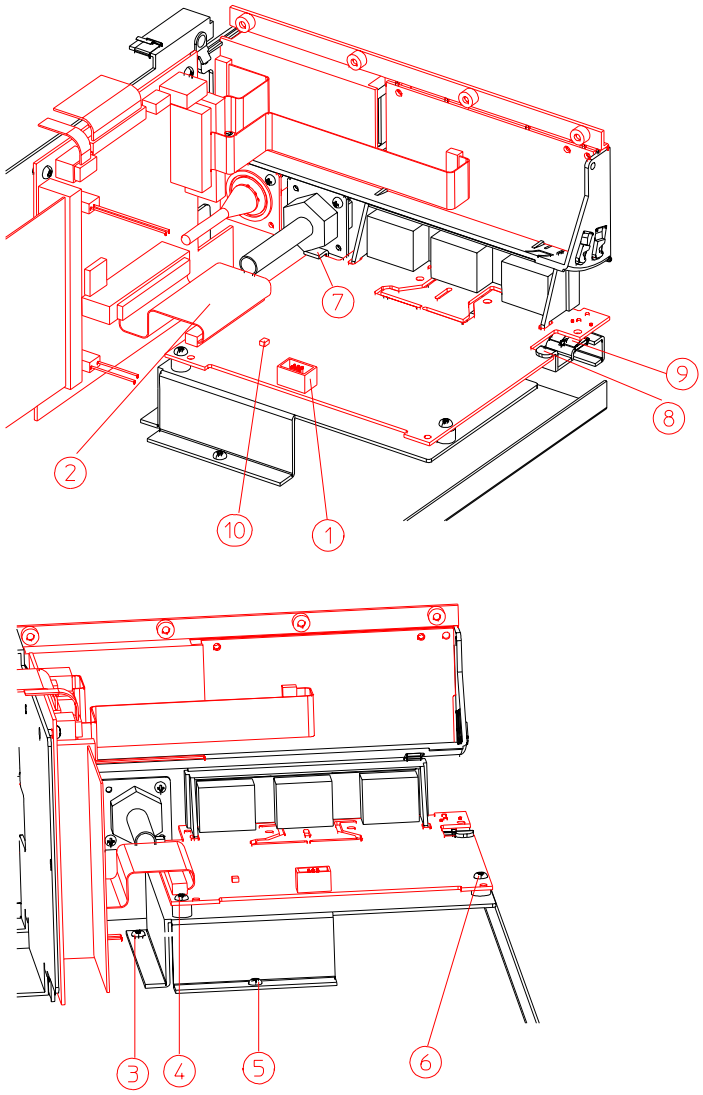
Note — Take care not to lose the small O-rings when you have removed screws **2** and **3**.

Replacing the Recorder Assembly is a reversal of the above procedure.

Caution
The use of recorder paper that is not approved by Philips can damage the monitor. This type of damage will not be covered by warranty.

Frontend Board

To remove the Frontend board proceed as follows:



serv6_10.hpg

Figure 11-9 Removing the Frontend Board

1. Turn the system off, disconnect the power cable and all transducers.
2. Remove the monitor top cover.

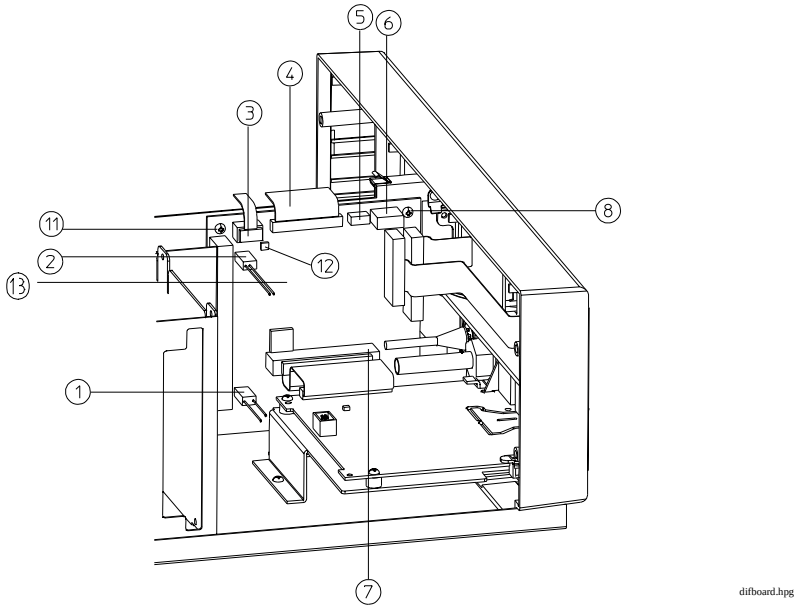
3. Disconnect the switch board cable (1).
4. Disconnect the cable (2) from the connector on the DIF board.
5. Remove screws (3) and (5) and release the clips on either side of the transducer connectors.
6. Remove the Frontend board, with its metal holder, from the monitor.
7. Slide the Frontend board carefully to the rear of the monitor and lift it up out of the unit.
8. Remove screws (4) and (6) to remove the Frontend board from the metal part.

Replacement of Frontend Board

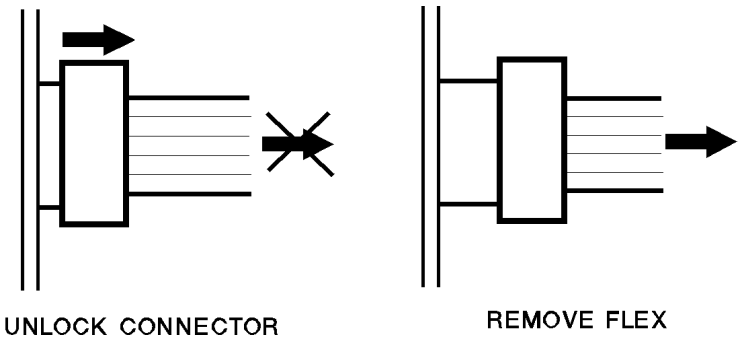
To replace the Frontend board, reverse the above procedure. Ensure that you position the board under the two metal holders (7) and (8) and the ground clips (9) are still in place. Now fix the board to the metal holder with screws (4) and (6). Put the assembly back into the unit and slide the complete assembly towards the front to click the connectors back into their clips. Ensure that all connectors are fully inserted (check this from the front) before you fix the board back in place using the two screws (3) and (5).

Perform the Instrument Safety Check (see page 120) after working on the Frontend board.

Digital Interface Board



1. If this is not already done, turn the system off. Disconnect the power cable and all transducers and remove the monitor top cover.
2. Disconnect all the cables:
   - loudspeaker cable (1)
   - power LED connector (2)
   - recorder switch board connector (3)
   - recorder sensing board connector (5). Unlock the flex layer connector by pulling it slightly forwards



   - recorder stepper motor (6)
   - frontend board connector (7)
   - backplane flat cable (13).

3. Disconnect the recorder print head (4) from the recorder assembly.
4. Remove the two screws (8) and (11) that hold the board in place.
5. Slide the digital interface (DIF) board towards the rear of the monitor before lifting the board up, to give the marker connector a “chance”.
6. Remove the label from the front end connector area. Score carefully around the connectors in the area with a flat bladed knife. Do not allow any adhesive to remain on the front panel.

Item 12 shows the error LED, which is red until the monitor successfully passes its self test.

Replacement is a reversal of the above procedure.

Display Assembly

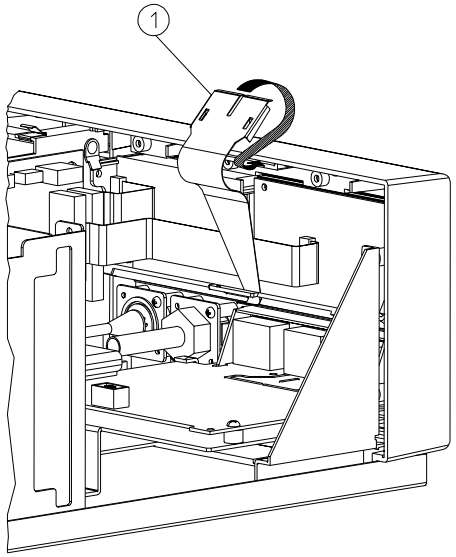
To remove the display assembly you must first remove the frontend board, and then the digital interface board.

Removing and Replacing the Maternal Display Panel

Monitors with serial numbers greater than 3545G01115 have a factory fitted-clip that secures the tiltable maternal display panel. Monitors with numbers below have no factory-fitted securing device. However, it is possible that a “spring and spacer” arrangement may have been fitted by a Customer Engineer.

Before removing the display assembly, you must first remove the clip or spring and spacer.

Removing the Clip

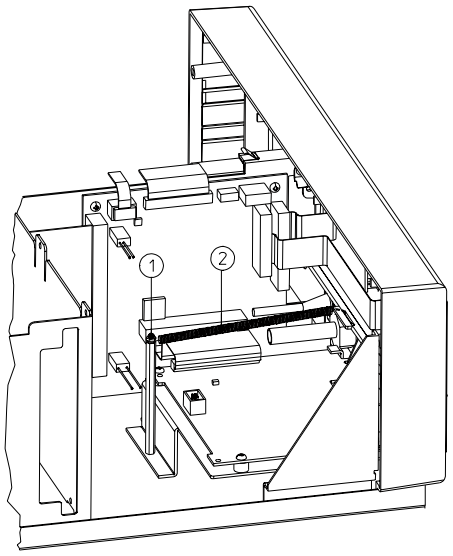


clip.hpg

1. Gently slide the top of the clip from the slot located at the top and middle of the display panel (1). Take care not to bend the clip so far that it does not spring back to its original shape.
2. Remove the smaller end of the clip from the slot in the protruding tab on the edge of the display assembly.

Reverse this procedure to replace the clip.

Removing the Spring and Spacer



spring1.hpg

1. Make sure that the display panel is shut.
2. Unscrew the spacer (1) from the frontend board as shown in the diagram.
3. Remove the end of the spring from the small hole on the protruding tab of the edge of the display assembly.
4. Move the other end of the spring from the groove in the spacer.

Reverse this procedure to replace the spring and spacer.

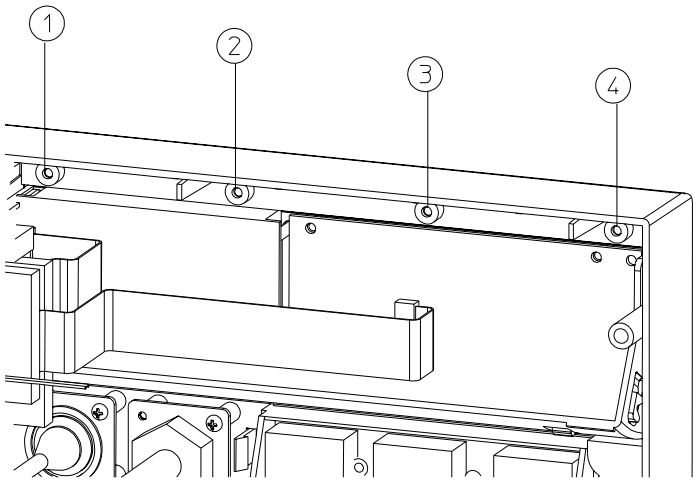


Figure 11-10 Removing the Display Assembly

To remove the complete display assembly with the tilt mechanism:

1. If you have not done this already, turn the system off, disconnect the power cable and all transducers.
2. Remove the monitor top cover.
3. Remove screws (1), (2), (3) and (4).
4. Disconnect the cables from their connections on the DIF board.
5. Slide the entire display assembly a small way through the front panel.
6. Remove the ground cable and then remove the assembly completely.

Replacement is a reversal of the above procedure. Insert all four screws to center the (closed) display assembly before you tighten the screws.

Caution
Ensure that you use the correct screws. Exert a minimum of pressure when tightening the screws. Excess force can damage the display assembly.

Exchanging the Display Assembly Housing

1. Remove the maternal display panel as described under "Removing and Replacing the Maternal Display Panel" on page 180.

There are two versions of the display housing: one with an LCD display, and one without.

2. a. If your display assembly contains an LCD display, first remove this. Remove the two screws on the right side of the rear of the LCD display assembly using a Phillips Screwdriver size 0 (Zero) and take out the LCD display. DO NOT TOUCH THE LCD DISPLAY SCREEN.
   Take out the LCD window glass and try to avoid fingerprints or dust/dirt on it.

   b. If your display assembly has no LCD display, it contains a plastic blanking cover. Remove this for later reuse.

3. Remove the earth strap by removing the screw and nut. Ensure that you retain the fixings, including the washer, for later reassembly.
4. Remove the remaining screws from the frontend display/switch board.
5. Lift the edge of the display/switch board, pull the board forward, at the same time making sure to free the switches from the housing, and remove the board.
6. Take the new plastic display assembly and fit the LCD display board or blanking cover, as appropriate, to the display assembly, following the reverse of the above procedure. (Note: You may need to apply mild force when re-seating the switches.)
7. a. If your display assembly contains an LCD display, make sure the matt side of the display window faces outside. Try to avoid any fingerprints and dust on the LCD window glass and LCD display.

   b. If your display assembly has no LCD display, refit the plastic blanking cover.

8. Use the Overlay Label Kit and stick the labels on the new display assembly.
9. Fit the new display assembly to the monitor front panel as described above (see "Removing and Replacing the Maternal Display Panel" on page 180).

SpO_2 Cable and NIBP Connector Tubing

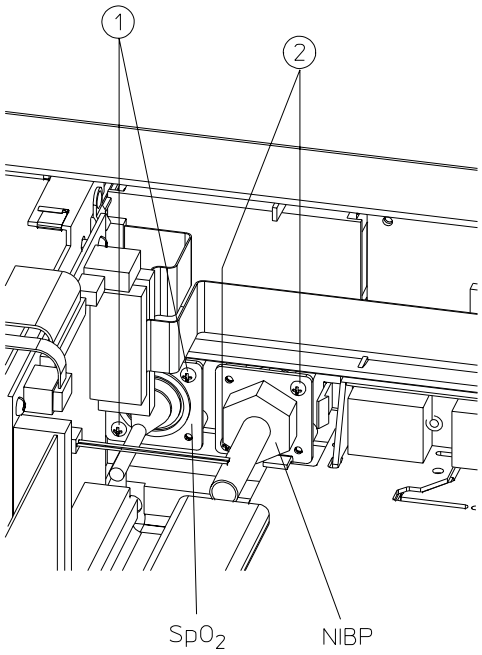


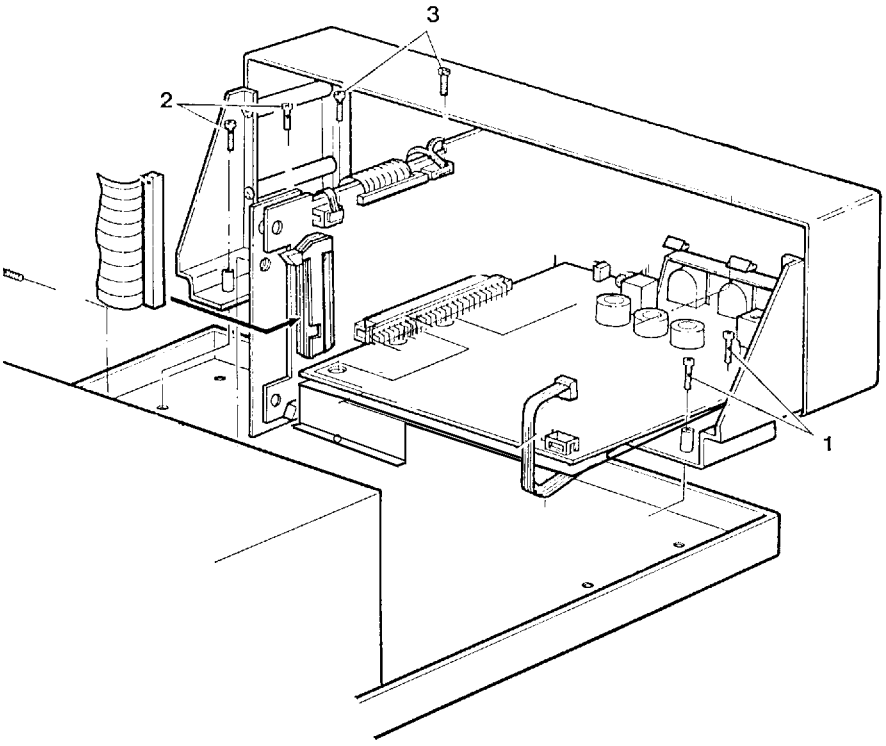
Figure 11-11 Removing the SpO_2 Cable and NIBP Connector Tubing

1. Turn the system off, disconnect the power cable and all transducers.
2. Remove the monitor top cover.
3. Remove screws (1) and (2) from the SpO_2 and/or NIBP connector.
4. Slide the NIBP board and/or SpO_2 board slightly out of the unit. Do not remove them completely.
5. Disconnect the NIBP tubing and/or SpO_2 cable from the boards.
6. Release the cable and tubing from where it is fixed to the metal chassis.

Replacement is a reversal of the above procedure.

Perform the Instrument Safety Test (see page 120) after working on the maternal SpO_2 board.

Front Panel Assembly



remfesca.tif

Figure 11-12 Removing the Front Panel Assembly

1. Turn the system off, disconnect the power cable and all transducers.
2. Remove the Monitor top cover.
3. Remove the Recorder Assembly as described in “Recorder Assembly” on page 174.
4. Remove the FE board as described in “Frontend Board” on page 176.
5. Remove the DIF board as described in “Digital Interface Board” on page 178.
6. Remove the power switch extension jig.
7. Remove the screws (1), (2) and (3) to release the holder from the bottom plate.
8. Slide the front panel backwards and remove it.
9. Release the three metal front panel holders from the front panel.

Replacement is a reversal of the above procedure.

Switch Boards

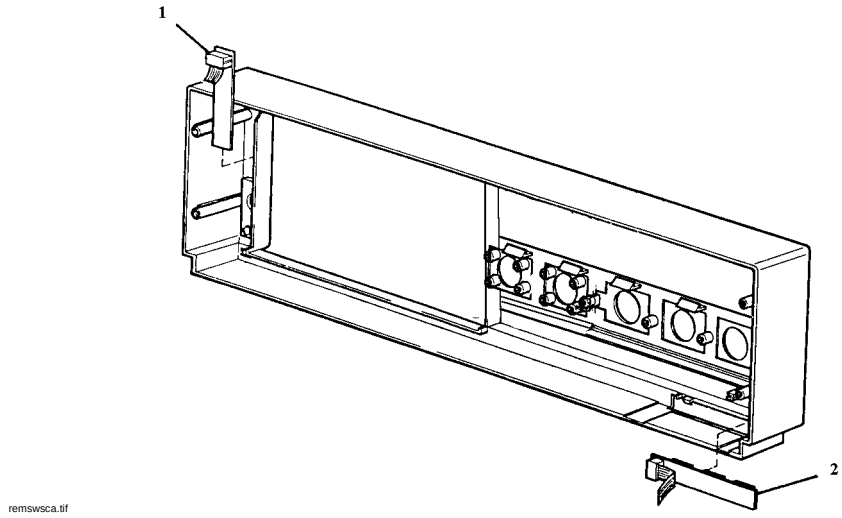


Figure 11-13 Removing the Switch Board

You can remove the recorder keys board without removing the Monitor's front cover.

Recorder Keys Board

- Uncap the Recorder Keys board (1) and lift it clear of the front cover.

Replacement is a reversal of the above procedure.

Function Switches Board

- Remove the Front Assembly and Front Cover from the monitor.
- Unclip the Function Keys board (2) and putt the board clear of the Front Cover.

Replacement is a reversal of the above procedure.

Loudspeaker

- Remove the loudspeaker cable going to the DIF board.
- Remove the four screws holding the loudspeaker in place.

Caution
The strong magnet will pull your screwdriver towards the membrane. Be careful not to damage the membrane.

Replacement is a reversal of the above procedure.

12
Parts Lists

Introduction

This section contains information for identifying, locating and ordering replacement parts.

Ordering Information

Occasionally, electronic items in the replacement parts list will be found to carry standard commercial identification numbers, and also to be indicated as being manufactured by Philips. These components have been selected to meet specific operational criteria. The use of these components purchased through normal commercial channels may result in degradation of the operation performance or reliability of the unit.

To order a replacement part, address your order or inquiry to the local Philips Sales/Service Office, giving the Philips part number of the item from the list.

To order a part not listed in a table, provide the following information:

1. Model number of the instrument.
2. Complete serial number of the instrument.
3. Description of the part including function and location.

Table 12-1 Parts List Index

Description	Reference
Parts List	Table 12-2 for Parts and Exchange Parts Numbers
Exploded System View	Figure 12-1
Recorder	See Chapter 13
Transducers	See Chapter 15
Board Positions and type	See “Rear Panel (Slot Positions)” on page 14

Replacement Parts

Table 12-2 Replacement Parts List

Description	New Part Number		Exchange Part Number		Qty
	Old Identifier	New Identifier	Old Identifier	New Identifier	
Philips Series 50 XM/XMO Monitor					
Drive Belt (recorder)	1500-0822	453563059501			1
Thermal Print Head (recorder)	1810-1421	453563064931			1
Stepper Motor (recorder)	3140-0847	453563085101			1
Spring Thermal Print Head (recorder)	M1350-29151	453563272581			2
Spring (recorder)	M1350-29152	453563272591			1
Flex Layer Assembly	M1350-46551	453563272831			1
Backplane Board	M1350-66501	453563273121			1
PSU- Board	M1350-66502	453563273131			1
CPU Board	M1350-66513	453563273211	M1350-69513	453563273671	1
DSPII Board	M1350-66507	453563273181	M1350-69507	453563273641	1
DIP Board	M1350-66515	453563273221	M1350-69515	453563273681	1
Frontend Board	M1350-66517	453563273241	M1350-69517	453563273701	1
Cardio Transducer Input Connector	1252-3461	453563050771			2
Toco Transducer Input Connector	1252-3462	453563050781			1
Conn Pneumatic	M1350-60007	453563272861			1
Cable Assembly SpO_2	M1350-61610	453563273061			1
Switch Board	M1350-66521	453563273261			1
Telemetry/System Interface Board	M1350-66536	453563273331			1
NIBP Assembly	M1350-66535	453563273321	M1350-69535	453563273721	1
Maternal SpO_2 Assembly	M1350-66534	453563273311	M1350-69534	453563273711	1
Fetal SpO_2 Board	M1350-66540	453563273341	M1350-69540	453563273731	1
System Interface Board	M1350-66532	453563273291			1
Dual Serial Interface Board	M1350-66533	453563273301			1
Recorder Assembly (complete)	M1350-60602	453563272951	M1350-69602	453563273751	1
Overlay Kit (multi language) XM	M1350-60606	453563272991			1
Overlay Kit (multi language) XMO	M1350-60607	453563273001			1
Primary Line Assembly	M1350-61605	453563273021			1
Blank ROM Board	M1350-66506	453563273171			1
Power Supply Assembly	M1350-69501	451261005021	M1350-68501	451261005011	1

Table 12-2 Replacement Parts List

Description	New Part Number		Exchange Part Number		Qty
	Old Identifier	New Identifier	Old Identifier	New Identifier	
Firmware					
EPROM Kit - Rom Board, Firmware Rev C 01.03	M1350-6802x[1]	453563463801			1
EPROM Kit - NIBP Board	M1350-6835x[1]	453563273531			1
EPROM Kit - $FSp0_2$ Board	M1350-6840x[1]	451261001671			1
Transducers					
Toco Transducer (complete, 2.5m/8ft 2in cable)	M1355-60011	453563277131	M1355-69011	453563277171	1
Toco Transducer (complete, 70 cm/ 28in cable)	M1355-60013	453563277141	M1355-69013	453563277181	1
US Transducer (complete, 2.5m/8ft 2in cable)	M1356-60011	453563277241	M1356-69011	453563277271	1
US Transducer (complete, 70 cm/28in cable)	M1356-60013	453563277281	M1356-69013	453563277281	1
US/MECG Combi Transducer (US)	M1358-60011	453563277331	M1358-69011	453563277351	1
US/MECG Combi Transducer (MECG)	M1358-60002	453563277321			1
Patient Modules and cables					
$FSpO_2$/ECG Combined Patient Module	M1365-60001	453563277491	M1365-69001	453563277501	1
DECG Patient Module (2.5m/8ft 2in cable)	M1364-60001	453563277411	M1364-69001	453563277471	1
DECG Patient Module (70 cm/28in cable)	M1364-60003	453563277421			
MECG cable	M1363A	989803103561			1
DECG Legplate adapter cable	M1362B	989803103551			1
DECG adapter	M1347A	989803103401			1

1. Where "x" changes with the latest software revision. See the CPL for the latest revision. For upgrading order M1360B/C option #S01 to receive the latest software together with the appropriate documentation.

Table 12-3 Display Assembly

Model	Parameters	Part Number		Qty
		Old Identifier	New Identifier	
M1350B	Fetal with maternal	M1350-69201	453563273571	1
M1350B	Fetal only	M1350-69203	453563273581	1
M1350C	Fetal with $FSpO_2$	M1350-69206	453563273601	1
M1350C	Fetal and maternal and $FSpO_2$	M1350-69205	453563273591	1

Caution
Use the replacement transducer cables listed below to repair BROWN transducers ONLY.

All **blue** M1355A, M1356A and M1358A transducers are sealed, watertight units and are **NOT** repairable. Replacing the cable of a **blue** transducer, or modifying the transducer in any way, will void any warranty, including the guarantee of watertightness.

Table 12-4 Replacement Parts: Transducer Cable Assemblies

Transducer Model	Description	Part Number		Qty
		Old Identifier	New Identifier	
M1355A	Cable Assembly (Toco) 2.5m / 8.2ft	M1355-61652	453563277161	1
M1356A	Cable Assembly (US) 2.5m / 8.2ft	M1356-61661	453563277261	1
M1358A	Combi Cable Assembly (US/MECG)	M1358-61681	453563277341	1

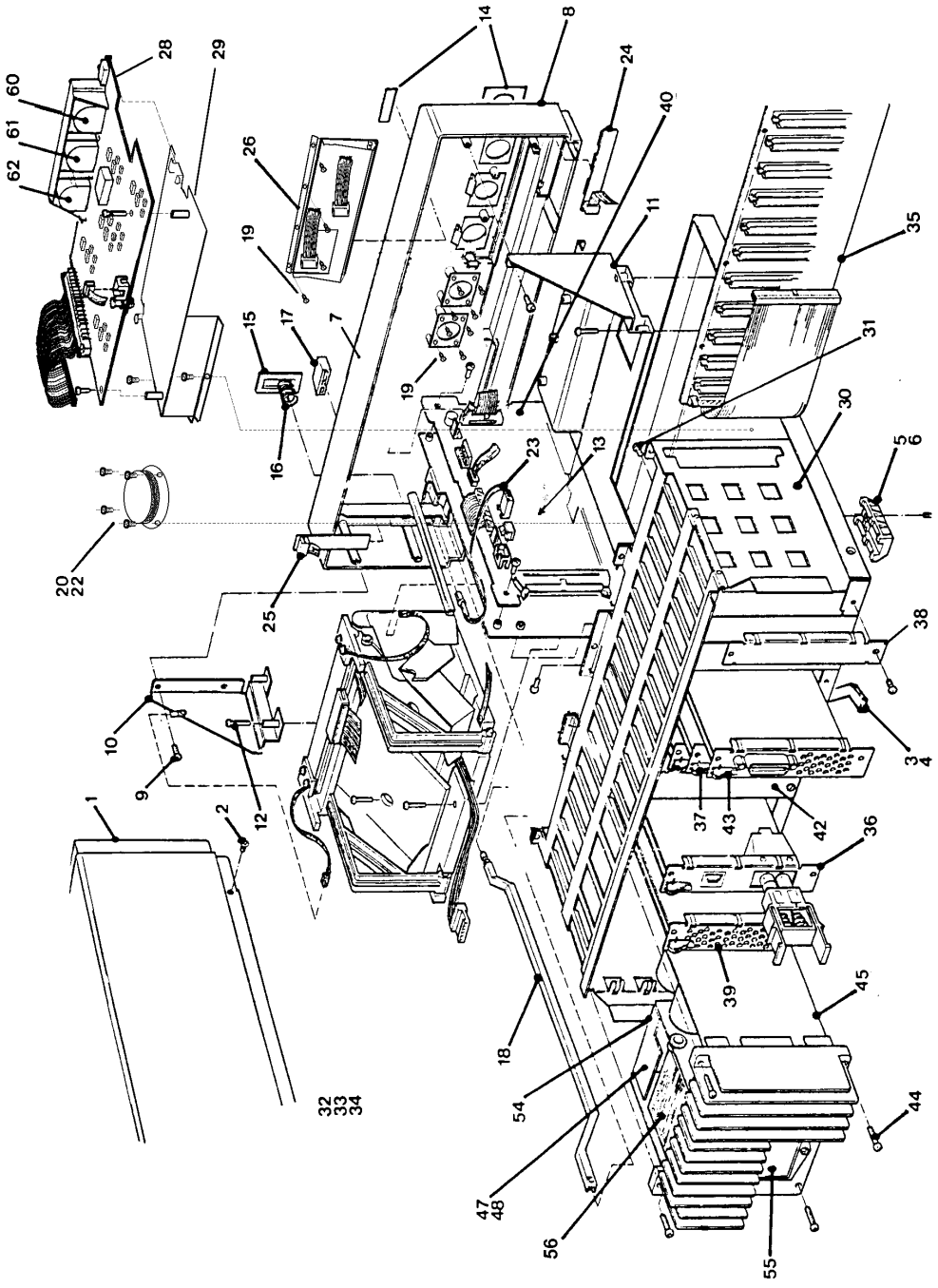


Figure 12-1 Parts Diagram

Table 12-5 Part Numbers

Item	Description	Part Number		Qty
		Old Identifier	New Identifier	
1	Monitor Top Cover	M1350-05202	453563272471	1
2	Screws - Top Cover M3 x 6	0515-0890P	453563480701	4
3	Mounting Cam	5041-4284	453563100001	1
4	Mounting Screw - Cam M3 x 8	0515-0897P	453563023841	1
5	Foot	5041-4264	453563099941	4
6	Mounting Screw - Foot M3 x 8	0515-0897P	453563023841	4
7	Front Panel (without label)	M1350-40202	453563272621	1
8	Mounting Screws - Front Panel M3 x 4	0515-1508P	453563024121	4
10	Holder Front Panel - Left	M1350-02311	453563272621	1
13	Chassis DIF Board	M1350-02315	453563272391	1
11	Holder Front Panel - Right	M1350-02312	453563272401	1
11	Mounting Screws - Holder Front Panel M3 x 16	0515-1111	451261001581	4
12	Mounting Screws - DIF Board Support M3 x 4	0515-1508P	453563024121	2
14	Front Panel Label Kit XM Front Panel Label Kit XMO	M1350-60606 M1350-60607	453563272991 453563273001	1 1
29	Chassis FE Board	M1350-02314	453563272411	1
15	Paper Eject Key	M1350-47402	453563272851	1
16	Spring - Paper Eject Key	1460-2250	453563058411	1
17	Power ON/OFF Key	5041-1203	453563099581	1
18	Power ON/OFF Shaft	5040-9317P	453563099491	1
20	Loudspeaker Assembly	9164-0710	453563202961	1
23	LED Assembly - Power	M1350-61607	453563273031	1
24	Function Key Switch Assembly	M1350-66521	453563273261	1
25	Recorder Key Switch Assembly	M1350-66521	453563273261	1
26	Display Assembly Fetal/Maternal	M1350-69201	453563273571	1
26	Display Assembly Fetal only	M1350-69203	453563273581	1

Table 12-5 Part Numbers

Item	Description	Part Number		Qty
		Old Identifier	New Identifier	
26	Display Assembly Fetal with $FSpO_2$	M1350-69206	453563273601	1
26	Display Assembly Fetal and maternal with $FSpO_2$	M1350-69205	453563273591	1
19	Display Assembly Mounting Screws	0515-2795	453563024361	1
27	Mounting Screws - DIF Board M3 x 6	0515-0886	453563480691	2
-	Mounting Screws - Frontend Board M3 x 6	0515-0886	453563023771	2
30	Complete Chassis Assembly	M1350-60102	453563272891	1
31	Backplane Mounting Screws M3 x 4	0515-1508P	453563024121	3
Boards				
-	Fetal SpO_2 Board	M1350-66540	453563273341	1
35	Backplane Board	M1350-66501	453563273121	1
36	CPU Board	M1350-69513	453563273671	1
37	DSPII Board	M1350-69507	453563273641	1
39	ROM Board	M1350-69506	453563273631	1
40	DIF Board	M1350-69515	453563273681	1
28	Frontend Board	M1350-69517	453563273701	1
-	NIBP Assembly	M1350-69535	453563273721	1
-	Maternal SpO_2 Assembly	M1350-69534	453563273711	1
42	Telemetry Interface Board	M1350-66536	453563273331	1
43	System Interface Board	M1350-66532	453563273291	1
-	Dual Serial Interface Board	M1350-66533	453563273301	1
38	Rear Blank Cover	M1350-04106	453563272431	
Power Supply				
44	Mounting Screws - Power Supply M3 x 12	0515-1110P	453563023971	4
45	PSU Board	M1350-66502	453563273131	1
46	Mounting Screws - PSU Board M3 x 8	0515-0897P	453563023841	2
47	Shield - Transformer	M1350-00601	453563272331	1
48	Mounting Screws - Shield M3 x 8	0515-0897P	453563023841	4

Table 12-5 Part Numbers

Item	Description	Part Number		Qty
		Old Identifier	New Identifier	
-	Transformer	9100-4810	453563202341	1
-	Mounting Screws - Transformer M3.5 x 55	0515-2125	453563023971	4
-	Insulator - Transformer	0340-0458	451261001561	4
-	Primary Line Assembly	M1350-61605	453563273021	1
54	Inlet Cover	M1350-44101	453563272691	1
55	Heat Sink - Power Supply	M1350-21104	453563272521	1
-	Mounting Screw - Transformer Earth Lead M3 x 4	0515-1508	453563024121	1
-	Washer - Transformer Earth Lead	2190-0921	453563077231	1
56	Power Supply Assembly, complete, exchange part	M1350-68501	451261005011	
56	Power Supply Assembly, complete, new part	M1350-69501	451261005021	1
Front Input Connectors				
60, 62	Cardio (red) Input Connector	1252-3461	453563050771	1
61	Toco (brown) Input Connector	1252-3462	453563050781	1
-	SpO_2 Cable Assembly	M1350-61610	453563273061	1
-	NIBP Connector with tubing	M1350-60007	453563272861	1
19	Plastic screw	0515-2795	453563024361	1
-	Marker Input Connector	1252-2702	453563050531	1
-	Paper Take-up Tray	M1350-00452	453563272321	1
-	Spring Holder Battery	1400-0967	451261001631	1
-	1.5V Battery	1420-0255	453563483901	1
-	Battery Holder	45611-40019	453563093991	1
-	Spring Battery Contact	5021-3671	453563098841	1
Fuses (Two types dependent upon the voltage selected)				
-	.5A 250V Fuse	2110-0458P	453563471191	2
-	1A 250V Fuse	2110-0007P	453563071451	2
NIBP Assembly				
-	Pump Assembly	M1008-60003	453563226771	1

Table 12-5 Part Numbers

Item	Description	Part Number		Qty
		Old Identifier	New Identifier	
Recorder				
-	Recorder, new part (see Chapter 13)	M1350-60602	453563272951	1
-	Recorder, exchange (see Chapter 13)	M1350-69602	453563273751	1

13
Recorder Assembly and Disassembly

Introduction

This chapter is split into three sections:

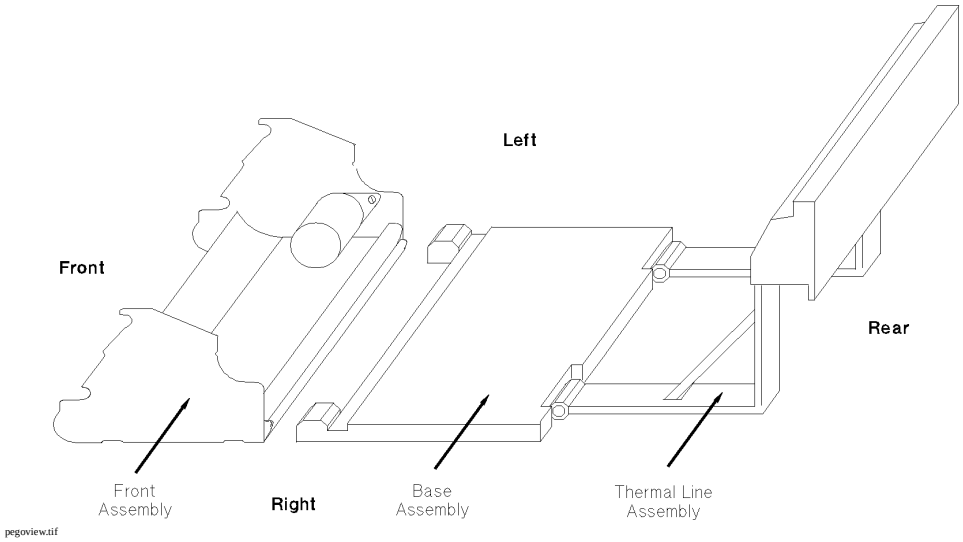
- Replacing specific items
- Disassembling and reassembling the entire recorder
- Parts list

This chapter provides detailed information on the complete disassembly of the recorder, but it is not necessary to do this for most service tasks. You should only disassemble the recorder as far as you need to replace an item.

Caution
The use of recorder paper that is not approved by Philips can damage the monitor. This type of damage will not be covered by warranty.

Warning
Do not grease or oil any axle or bearing in the recorder system.

Most of the time, it is easier to work from the rear of the recorder, and even easier with the rear of the base plate held in a vice. However, these instructions always describe the recorder as viewed from the front. For example, "right" refers to the right side when the recorder is viewed from the front. The following figure illustrates this, and also shows the three major assemblies referred to. Some items, such as the paper box, have not been shown.



The instructions refer to Figures 9-2, 9-3, 9-4 and 9-5. Figure 13-1 is an exploded drawing of the recorder with some parts named. The callouts in the figures are referred to by **bold** numbers in the instructions. For example, "... spring **3**...".

Tools

The following tools are needed to service the recorder:

- Small crosshead screwdriver
- Large crosshead screwdriver
- Medium slothead screwdriver
- Spring tool

The following tools are useful but not essential:

- Universal vice to hold the base plate
- Small pincers or tweezers

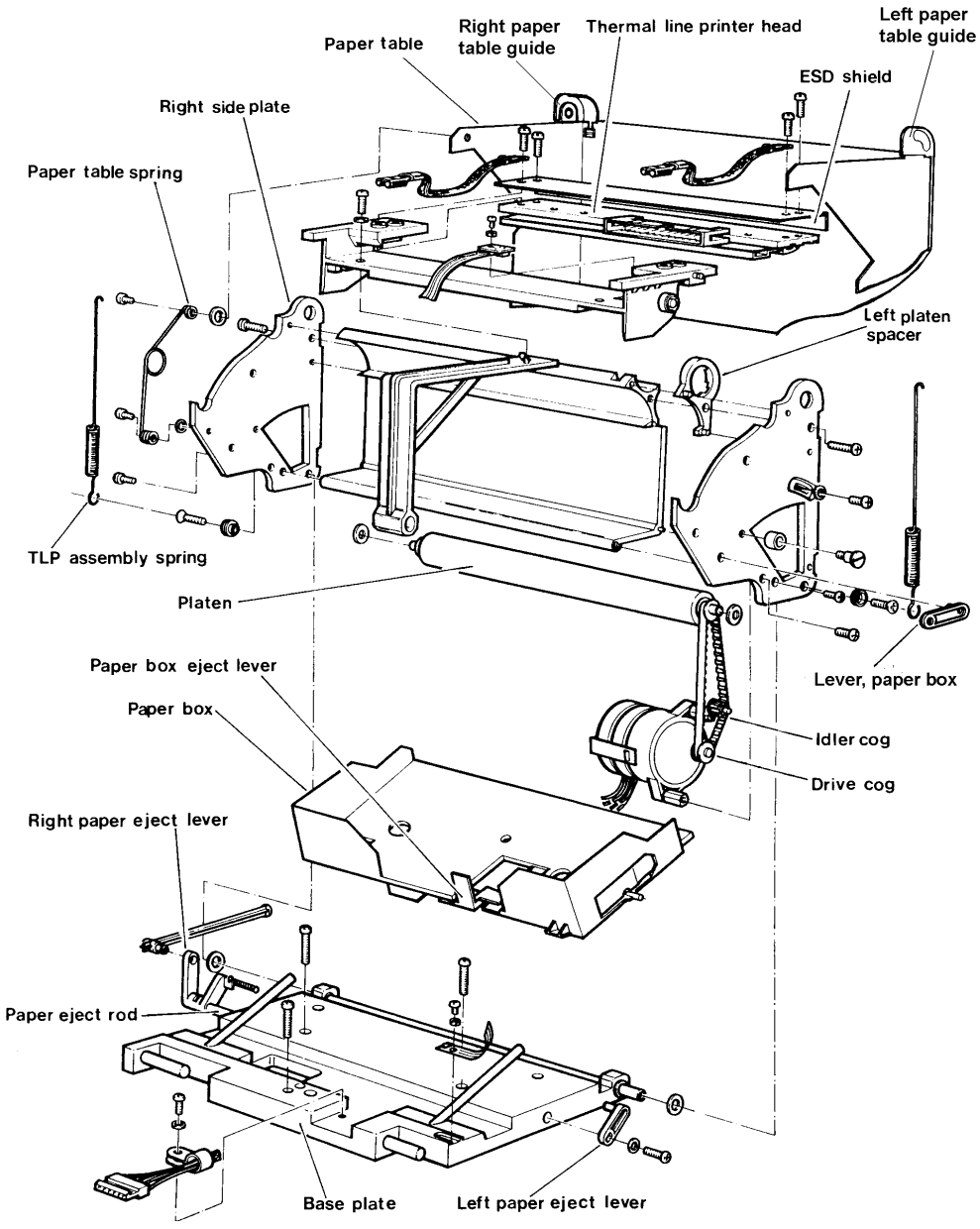


Figure 13-1 Component Names

Replacing Specific Items

Thermal Line Printer Head

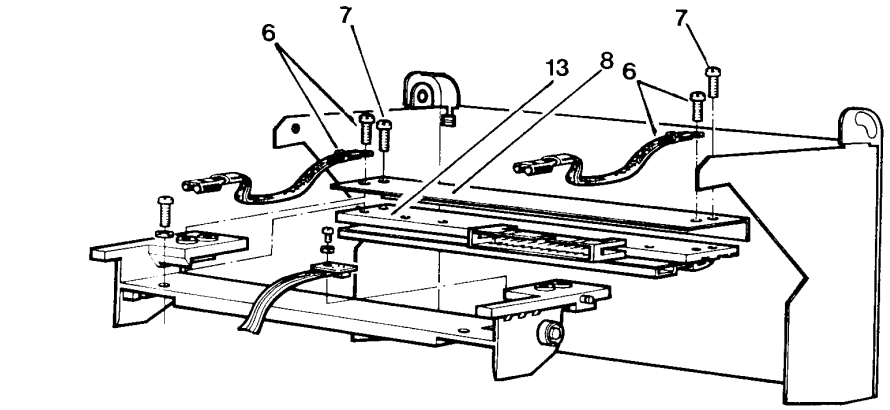


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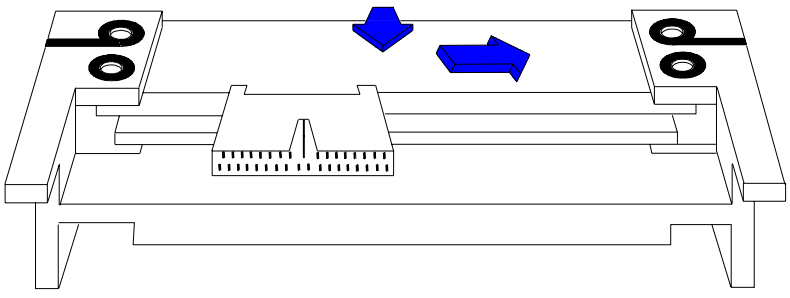
Figure 13-2 Replacing the Thermal Line Printer Head

It is not necessary to disassemble the recorder to replace the Thermal Line Printer (TLP) head.

1. Pull the front assembly forward, as though you were changing the paper.
2. Remove the two screws and ESD earth straps **6**.
3. Remove the two screws 7 and the ESD shield **8**.
4. Slide the TLP Head forward.
5. Slide the new TLP Head into position.
6. Place the ESD shield **8** in position and loosely attach screws 7.
7. Loosely attach the ESD earth straps with screws **6**.

Push the TLP Head as far back as it will go, then as far to the right as it will go (right is the side with the paper eject levers). See the following figure.



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8. Hold it in position and tighten the screws.

Full Disassembly

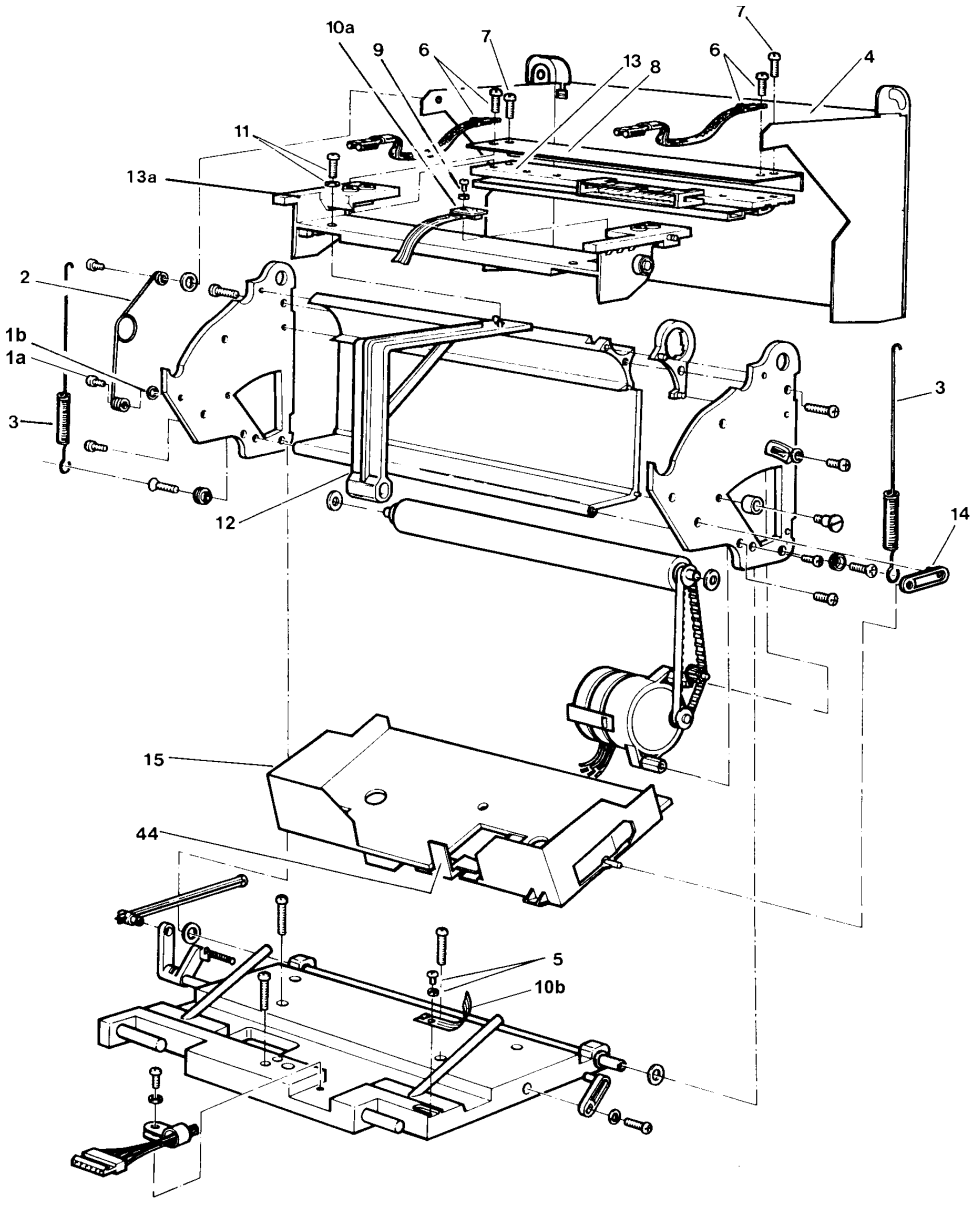


Figure 13-3 Paper Table and Thermal Line Printer Assembly

Paper Table

See Figure 13-3.

1. Remove screw and washer **1a** and **1b** to disconnect the bottom end of the paper table spring **2**.
2. The paper table, **4** is located on pins on the end of the bearing casing on the side plate. Pull the table away from the pins to release it.

Thermal Line Printer Assembly (TLP)

See Figure 13-3. But if you are changing only the TLP Head, see "Replacing Specific Items" on page 200.

1. Remove the two TLP retaining springs **3** to free the front of the assembly. Use a spring hook to avoid damaging the springs.
2. Pivot the TLP assembly backwards.

The TLP assembly can be left like this if it is not to be worked on. Proceed as follows to disassemble it, taking care not to damage the flex layer if you remove the thermal line assembly without disconnecting the sensors.

1. Free the base plate end of the flex layer by removing screw and washer **5**. Take care not to lose the washer. It is easier to use a magnetic screwdriver.
2. Remove the TLP assembly. The assembly must be rotated slightly to get it off the pins on the base plate.
3. Remove the two ESD shield screws and earthing straps **6**.
4. Remove the two ESD shield screws **7**.
5. Remove the electrostatic discharge (ESD) shield **8**.
6. Remove the thermal line unit **13**.
7. Remove the screw and washer **9** to free the flex layer and optical sensor assembly **10a**. It is easier to use a magnetic screwdriver.
8. Remove the two TLP bracket screws and washers (only one shown, **11**). The brackets can be removed (only one shown, **12**).

Paper Tray

See Figure 13-3.

1. Pivot the front assembly forward.
2. Remove the paper box links (only one shown, **14**).
3. Slide the paper box **15** forward off the slides.
4. Turn the paper box upside down.
5. Lift the free end of the paper eject lever **44** slightly to get it over the lip on the paper box, and rotate it 90 degrees anti-clockwise to remove it.

It is best to remove the motor next, though it can be left on the side plate if it isn't to be worked on.

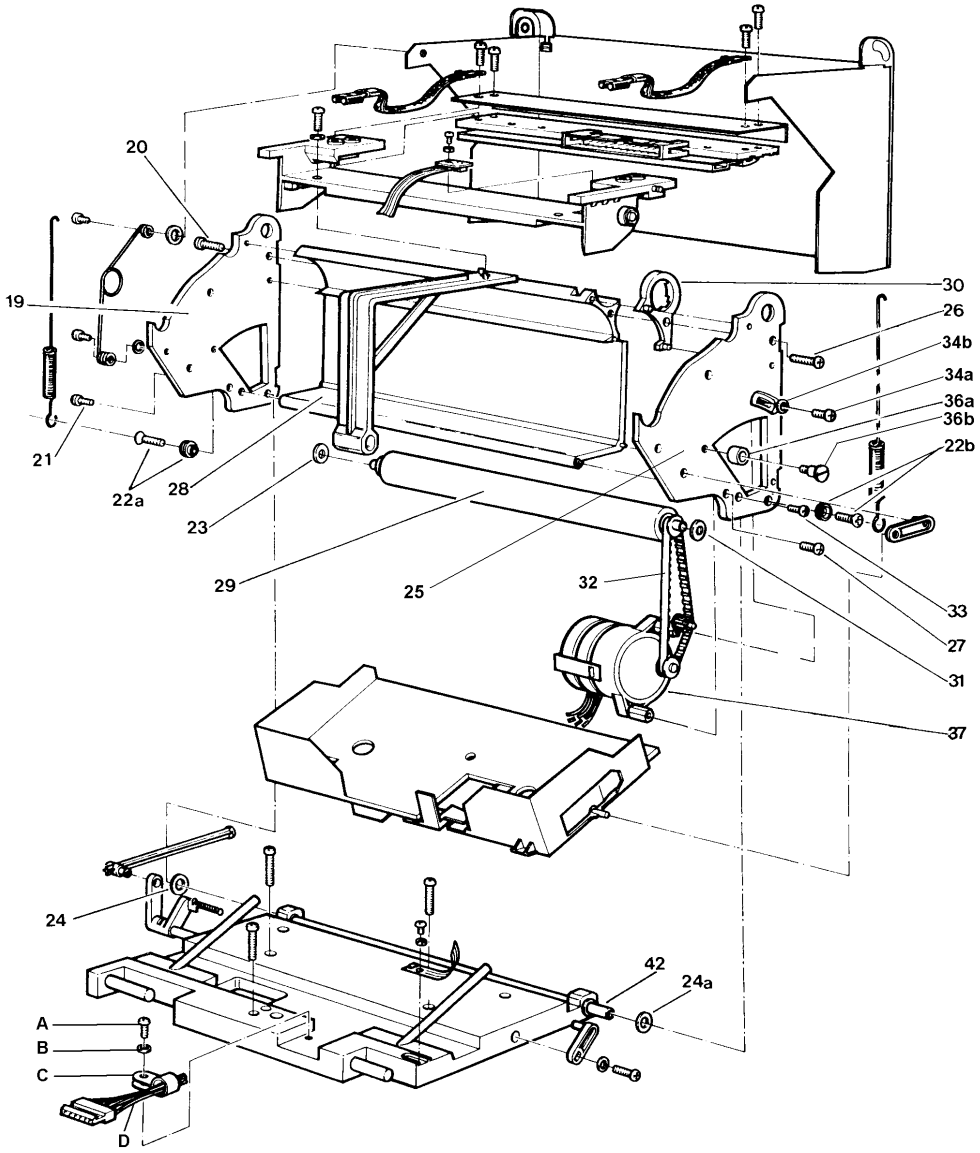


Figure 13-4 Motor and Side Plates

Motor

See Figure 13-4.

1. Depending on the version of your recorder, free the connector cable **D**:
   Either
   a. By removing screw and washer **A** and **B**, and cable clip **C** from the base plate.
   Or
   b. By removing the cable from the integrated cable guide on the base plate (not shown).

2. Remove screw **33** and screw and washer **34a** and **34b** from the left side plate.
3. Lift the motor **37** away from the side plate. The idler cog shown in the figure is fixed to the left side plate and is not removable.

Right Side Plate

See Figure 13-4.

1. Remove screws **20** and **21** from the right side plate.
2. Remove the screw and spring adapter **22a** from the right side plate.
3. Pull the right side plate **19** away from the assembly. Be careful of the platen washer **23** and washer **24**.
4. Slide the front assembly off the rod.

Left Side Plate

See Figure 13-4.

1. Remove the screw and rubber stop **36a** and **36b** from the left side plate for ease of working.
2. Remove the screw and spring adapter **22b** from the left side plate, the shaft **42** can now be removed. Be careful of washer **24a**.
3. Remove screws **26** and **27** from the left side plate.
4. Put the left side plate face down on the bench and slide the black extrusion **28** away from it.
5. Remove the platen **29** and the left platen spacer **30**. Be careful of platen washer **31**.

Eject Mechanism and Base Assembly

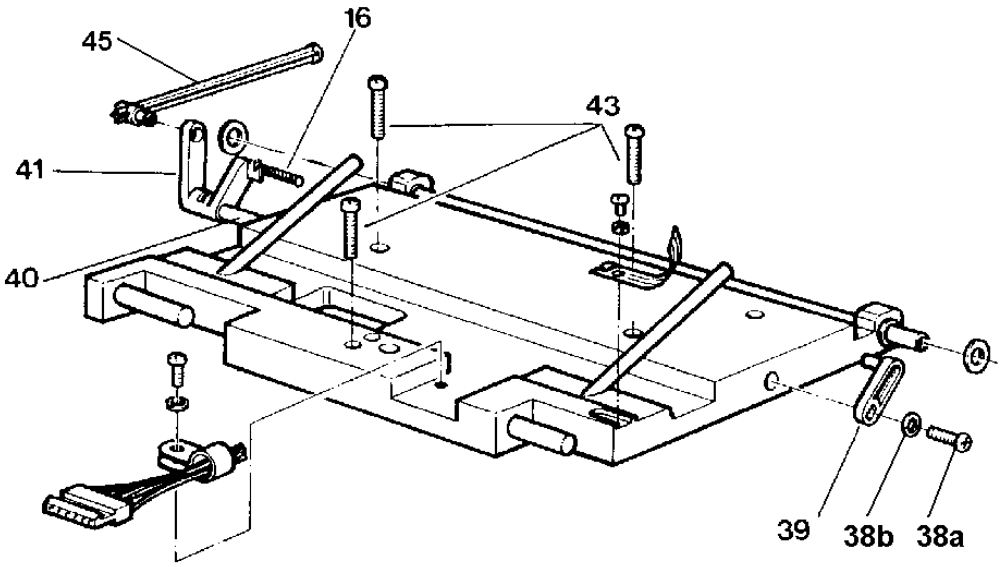


Figure 13-5 Eject Mechanism and Base Assembly

See Figure 13-5.

1. Disconnect spring **16** from the eject lever.
2. Remove the screw and washer **38a** and **38b** from the end of the paper eject rod.
3. Remove the left eject lever **39**.
4. Slide out rod **40**.
5. *Only perform this step if the right eject lever is damaged and has to be replaced.*

   Remove the right paper eject lever **41** by carefully levering the built in clip. *Be careful*, the clip is fragile and may break.
6. *Only perform this step if it is necessary.* Remove the three base plate screws **43**.

   The screws have rubber retaining O-rings (not shown), take care when removing the screws.

Full Re-assembly

Paper Eject Mechanism and Base Assembly

See Figure 13-5.

1. The right eject lever fits on the end of the eject rod with the longer machining. Make sure the lever is the right way round before fitting.
2. Fit the right eject lever **41** on to the rod **40**, being careful not to break or weaken the built-in retaining clip.
3. Slide the eject rod **40** into the base plate.
4. Fit the left eject lever **39** onto the free end of the eject rod.
5. Replace the screw and washer **38a** and **38b** on the end of the eject rod.
6. Replace the spring **16** using a spring hook.
7. Fit the three base plate screws **43** and the rubber O-rings (not shown).
8. It is easier to attach the flex layer **10b** to the base plate before the paper box is fitted. However, this can make it more difficult to assemble the TLP assembly later.

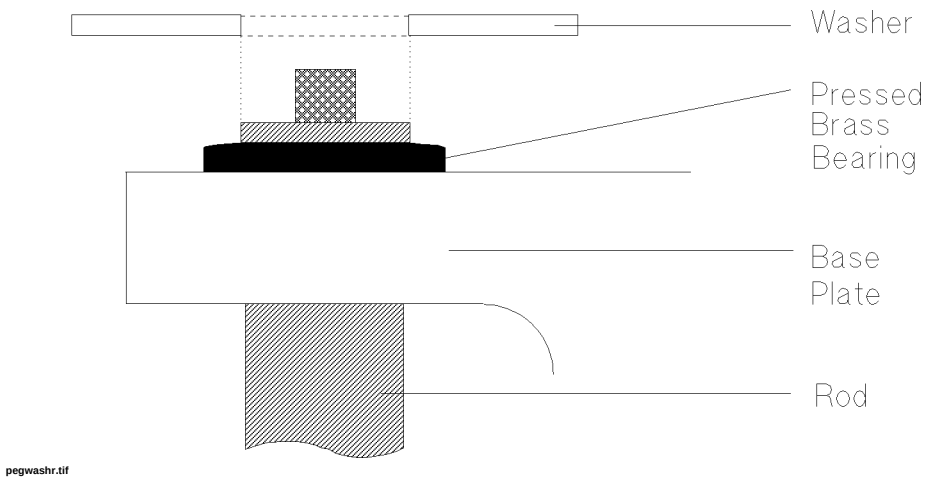
   Attach the flex layer **10b** to the base plate with screw and washer **5**, if you want to do so at this stage. Be careful with the flex layer, as it is easily torn at the junction of the **Y**. It is easier to use a magnetic screwdriver.

Left Side Plate and Platen

See Figure 13-4.

1. Put the left side plate face down on the bench.
2. Fit shaft **42** and attach screw and spring adapter **22b**.
3. Locate the left platen spacer onto the left side plate.
4. Position the washer **31** over the hole in the platen bearing. It is essential that the correct washer is used (0.15 mm thick, 8 mm external diameter, hardened).
5. Fit the drive belt **32** on the cog on the right end of the platen and locate the pin of the platen in the hole in the pressed bearing. Make sure the drive belt goes through the two slots in the right hand platen spacer.
6. Hold the platen in position, and slide the black extrusion **28** into place.
7. Turn the assembly over, holding the components together, and fit screws **26** and **27** to secure the side plate to the extrusion.
8. Slide the shaft **42** into the base plate.
9. Fit the right platen spacer **30**, making sure washer **31** is in place between the end of the platen and the side plate. It is essential that the correct washer is used (0.15 mm thick, 8 am external diameter, hardened).
10. Slide washer **24** onto the end of the shaft **42**. It is essential that the correct washer is used (0.2 mm thick, 12 mm external diameter, hardened).
11. Put washer **23** on the free end of the platen drive shaft.

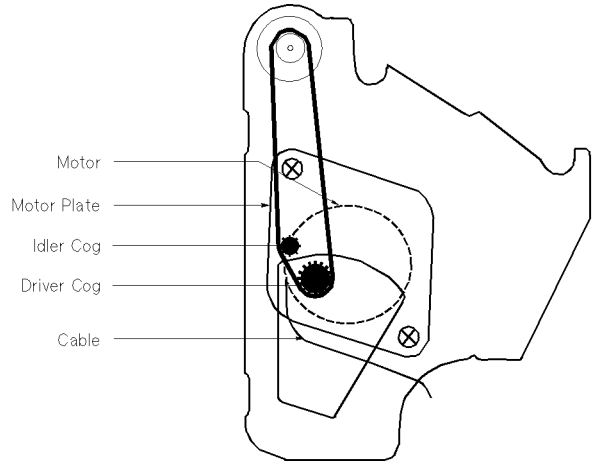
12. Fit the right side plate making sure the washer **24** is correctly seated.



13. Fit screw and spring adapter **22a** and screws **20** and **21** to secure the right side plate.
14. Check the assemblies pivot freely. If they don't, washer **24** is probably not seated correctly.
15. Attach rubber stop and screw **36**.

Motor

It is important that the motor is correctly positioned. The drive cog should be fully visible through the cut-out in the plate as shown in the following figure, with the cables out towards the bottom (narrowest end) of the panel.



pegdbelt.tif

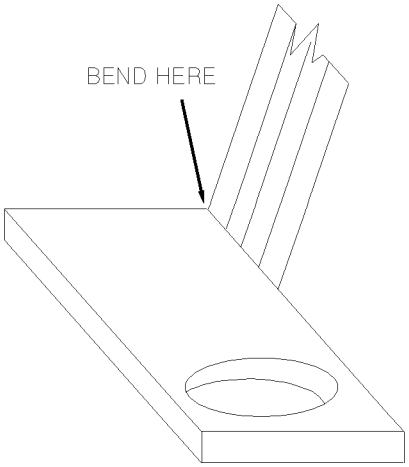
See Figure 13-3.

1. Locate the motor **37** on the left side plate, making sure the idler cog is visible through the cut-out.
2. Attach screw **33**, and screw and washer **34a and 34b**.
3. Adjust the belt tension and tighten the motor retaining screws.

Thermal Line Assembly

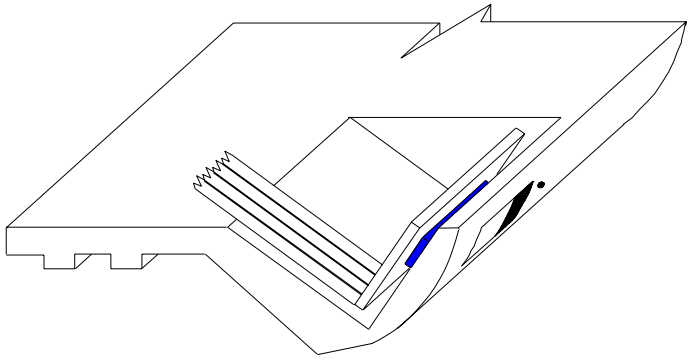
See Figure 13-2.

1. Attach the flex layer and optical sensor assembly **10a** to the TLP assembly using screw and washer **9**. It is easier to use a magnetic screwdriver. If you are using a new flex layer, it should be folded at its junction with the PCB holding the optical device to make it easier to insert, as shown below:



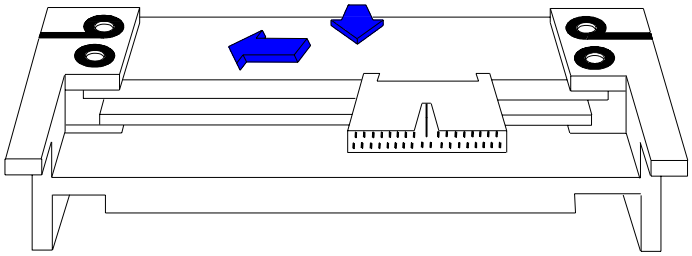
pegflex.tif

The following figure shows the location of the sensor in the TLP assembly:



pegflex2.hpg

2. Fix the TLP brackets **12** using the screws and washers **11**.
3. Fit the TLP Head **13** and the ESD shield **8**, and attach with the screws 7 (front of assembly). The thermal line unit must be pushed to the right and to the rear before the screws are tightened.

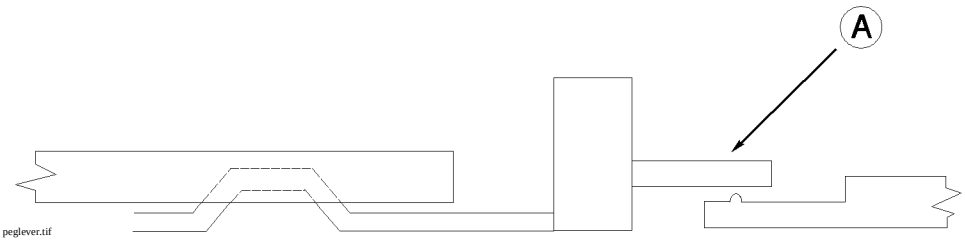


pegtlp2.hpg

4. Attach the two screws and earthing straps **6** (rear of assembly).
5. Slide the assembly onto the pins at the rear of the base plate. The assembly must be rotated slightly to get the right bracket over its pin.

Paper Box

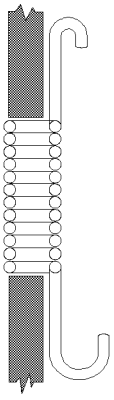
1. Position the paper eject lever so that the hole locates over the mounting pin (the lever will protrude from the paper box at 90 degrees to it.
2. Rotate the lever clockwise through 90 degrees, lifting the free end slightly to get it over the lip on the paper box. Make sure the end of the lever, **A** in the figure, is correctly positioned.



peglever.tif

Final Stages

1. Attach the flex layer **10b** to the base plate with screw and washer **5**, if you have not already done so. Be careful of the flex layer, as it is easily torn at the junction of the **Y**.
2. Slide the paper box onto the slides on the base plate. Be careful of the eject lever when fitting the tray.
3. Pivot the paper drive and feed assembly upwards.
4. Attach the paper box links **14**.
5. Pivot the thermal line assembly upwards.
6. Attach the TLP retaining springs **3** and **4** (springs TLPH). Make sure the body of the spring fits inside the cut out. If the springs are not mounted correctly, the paper table will rub against them.


pegsprng.tif

7. Fit the paper table pins into the holes in the bearing casings on the side plates.
8. Fit washer **1** over the pillar on the side panel, and fit the end of the paper table spring **2** over the pillar. Attach screw **1**.
9. Attach eject adapter **46**.

Recorder Settings

When you have re-assembled the recorder and installed it into the monitor, it may be necessary to adjust the recorder print offset and/or the recorder thermal head for trace density.

Before doing this, it is recommended that you first connect one of the transducers and perform a Parameter Test (see “Parameter Test” on page 112). This will enable you to check the offset of the printed test trace and the density of the print as described in “Quick Test” on page 114.

Replaceable Parts

The item numbers refer to the callouts in Figures 13-2, 13-4 and 13-5. Screws and washers which go together are listed together.

Table 13-1 Replaceable Parts

Item	Figure ref.	Description	Size	Part Number		Qty.
				Old Identifier	New Identifier	
Thermal Line Printer (TLP) Assembly						
-	-	Recorder Assembly, New, complete		M1350-60602	453563272951	1
-	-	Recorder Assembly, Exchange, complete		M1350-69602	453563273751	1
8	13-3	ESD shield / TLP cover		M1350-04151	453563272451	1
6, 7		ESD cover screws	M3 x 8	0515-0897P	453563023841	4
13		Thermal Line Print Head		1810-1421	453563064931	1
13a		TLP body		M1350-67751	453563273351	1
12		TLP arm		M1350-45051	453563272781	2
11		Arm screw	M3 x 12	0515-1110	453563023971	2
11		Arm washer		3050-0891	453563480721	2
3		Springs TLP Head		M1350-29151	453563272581	2
Front Assembly						
19	13-4	Right side plate		M1350-64151	453563273071	1
25		Left side plate		M1350-64152	453563273081	1
28		Paper de-fold center		M1350-23252	453563272531	1
20, 21, 26, 27		Side plate screws	M3 x 12	0515-1110	453563023971	4
22a, 22b		Spring adapter screw	M3 x 10 c/sunk	0515-1005	451261001571	2
22a, 22b		Spring adapter		M1350-23253	453563272541	2
23, 31		Platen bearing washer		M1350-28851	453563272561	2
24, 24a		Shaft bearing washer		M1350-28852	453563272571	2
-	-	Right platen spacer		M1350-44752	453563272771	1

Table 13-1 Replaceable Parts

Item	Figure ref.	Description	Size	Part Number		Qty.
				Old Identifier	New Identifier	
30	13-4	Left platen spacer		M1350-44751	453563272761	1
29		Platen		1530-2223	453563062431	1
32		Drive belt		1500-0822	453563059501	1
37		Stepper Motor		3140-0847	453563085101	1
34, 33		Motor screw	M3 x 6	0515-0886	453563480691	2
34		Motor washer		3050-0891	453563480721	1
Base Plate Assembly						
-	13-5	Base plate assembly		M1350-67752	453563273361	1
43		Base plate screws	M3 x 16	0515-1111	451261001581	3
-	-	O-ring		0900-0010	451261001611	3
39	13-5	Left eject lever		M1350-45052	453563272791	1
38a		Eject lever screw	M3 x 4	0515-1508	453563024121	1
38b		Eject lever washer		3050-0891	453563480721	1
41		Right eject lever		M1350-45053	453563272801	1
16		Eject lever spring		1460-2260	453563490661	1
40		Eject distance rod		M1350-23752	453563272551	1
45		Eject key adapter		M1350-43251	453563272681	1
Paper Tray						
15	13-3	Paper tray		M1350-65551	453563273101	1
44		Paper box eject lever		M1350-45055	453563272821	1
14		Lever, paper box		M1350-45054	453563272811	2
Paper Table						
4	13-3	Paper table		M1350-07752	453563272491	1
-	13-1	Right paper table guide		M1350-43157	453563272671	1
-		Left paper table guide		M1350-43156	453563272661	1
2	13-3	Paper table spring		M1350-29152	453563272591	1

Table 13-1 Replaceable Parts

Item	Figure ref.	Description	Size	Part Number		Qty.
				Old Identifier	New Identifier	
-	-	Spring screw - table end	M3 x 4	0515-1508	453563024121	1
-	-	Washer		3050-0681	451261001651	1
36	13-3	Tube-Flex		0890-1767	451261001601	2
36		Screw-Shldr		0515-2524	451261001591	2
1a		Spring screw - side plate	M3 x 4	0515-1508	453563024121	1
1b		Washer		3050-0681	451261001651	1
Flex Layer						
10a, 10b	13-3	Flex layer		M1350-46551	453563272831	1
5, 9		Screw	M2 x 4	0515-0977	453563023871	2
5, 9		Washer		3050-1283	451261001661	2
Paper take-up tray (not shown)				M1350-00452	453563272321	1

14
Transducers and Patient Modules

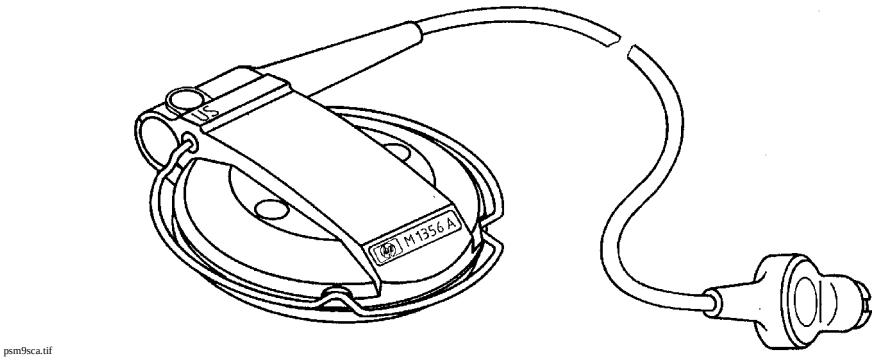
Introduction

This section deals with troubleshooting, specifications, dismantling and assembly and parts listing of the transducers used on the monitor.

- The **Blue** transducers can only be immersed in water while monitoring when they are used with the Philips Series 50 T Telemetry System. The telemetry transmitter must **NEVER** be immersed in water.
- The blue ultrasound and Toco transducers are protected against the effects of continuous immersion in water according to IEC 529 IP 68.

Warning
NEVER immerse any transducer in water when it is connected to the Fetal Monitor.

Ultrasound Transducer (M1356A)



psm9sca.tif

Figure 14-1 Ultrasound Transducer

Description

The M1356A Ultrasound Transducer detects fetal heart movements by directing a low-energy pulsed Doppler ultrasound beam towards the fetal heart. The transducer contains seven crystals which transmit the ultrasound signal and receive the reflected signal from the fetal heart. The

frequency shift caused by fetal heart movement is converted into an electrical signal from which the fetal heart rate is derived. **Blue** Ultrasound transducers are sealed units and are **NOT** repairable.

Specifications

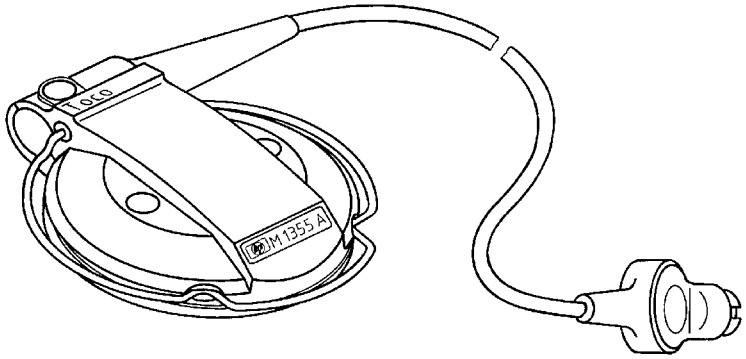
M1356A Specifications		
System		Pulsed Doppler
Oscillator Frequency		998.4 kHz
Ultrasound Intensity	Peak-negative acoustic pressure	$p_{\_}$ = (28.0 ± 4.7) kPa
	Output beam intensity (= temporal-average power/area)	I_{ob} = (2.53 ± 0.69) mW/cm2
	Spatial-peak temporal-average intensity	I_{spta} = (7.7 ± 2.6) mW/cm2
Dimensions	Diameter	75mm / 2.95in
	Depth	21.5mm / 0.85in
Transducer Weight with Cable		185 grams / 6.5 ounces
Cable Length		2.5m / 8ft 2in
Watertightness		To a depth of 0.5m / 1.64 ft
Temperature Storage Range		-40°C to +60°C / -40°F to +140°F

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

Troubleshooting

Ultrasound transducer tests and troubleshooting are described in “Ultrasound Transducer” on page 123.

Toco Transducer (M1355A)



psm10sca.tif

Figure 14-2 Toco Transducer

Description

The M1355A Toco Transducer detects relative measurement of uterine activity. **Blue** Toco transducers are sealed units and are **NOT** repairable.

Specifications Toco Transducer

System: Passive Strain Gauge

Sensitivity: 0 to 12N/overload protected

Dimensions: 75mm / 2.95in diameter, 25mm / 0.98in depth

Transducer Weight with Cable: 180 gram / 6.3 ounces

Cable Length: 2.5m/8ft 2in

Watertight: to a depth of 0.5m / 1.64 ft

Temperature Storage Range: -40°C to +60°C / -40°F to +140°F

Troubleshooting

See "TOCO Transducer" on page 125 for a description of the functional tests which can be carried out with a Toco transducer.

DECG Transducer (M1357A)

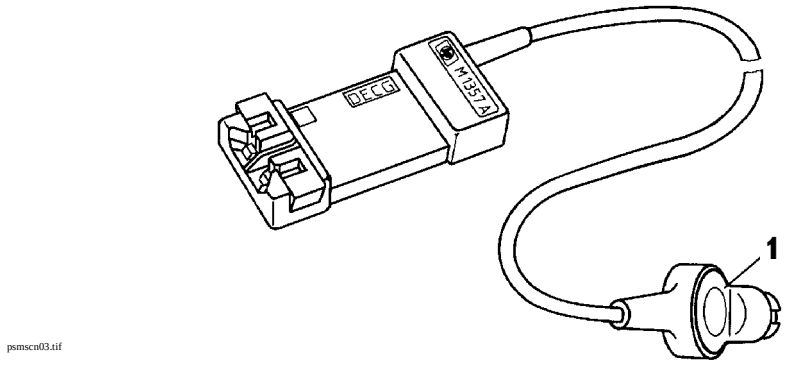


Figure 14-3 DECG Transducer

Description

The M1357A Direct ECG Transducer has two spring loaded clamp type connectors for connection to the 15133D (EU) or 15133E (USA) spiral scalp electrodes.

Specifications

Input Impedance: > 10MΩ

CMRR: with patient cable, 51.5kΩ/0.047μF imbalance at line frequency > 110dB

Noise: (referred to input with 25kΩ) < 4μVp

Contact Potential Difference: ±500mV

Input Voltage Range: 20μVp to 3mVp

Patient Leakage Current: 120V at 60Hz, 10μA rms

Patient Auxiliary Current: < 0.1μA (dc)

Dielectric strength: 1500Vrms spark gap protected

Transducer Weight with Cable: 185 grams / 6.5 ounces

Cable Length: 2.5m/8ft 2in

Parts List

See “DECG/MECG Patient Module Parts List” on page 227.

Cable Connections

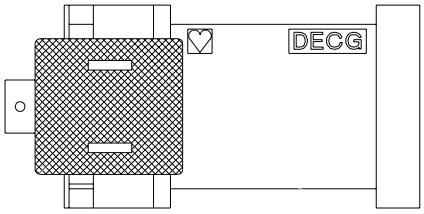
Table 14-1 Cable Connections

Pin	Wire Color
2	Red
5	Brown
1+6	Bridged by Code Resistor 4.53 kΩ (± 1%)
1	Shield

Troubleshooting

The functional checks that can be carried out on the M1357A DECG Transducer are those outlined in Chapter 9, “Safety, Maintenance, and Calibration.”

DECG Legplate Adapter (M1347A)



M1347A **M1357A**

Description

DECG Legplate Adapter clips onto a DECG legplate transducer (M1357A) for use with the DECG Adapter Cable (M1362B) to monitor fetal DECG.

MECG Transducer (M1359A)

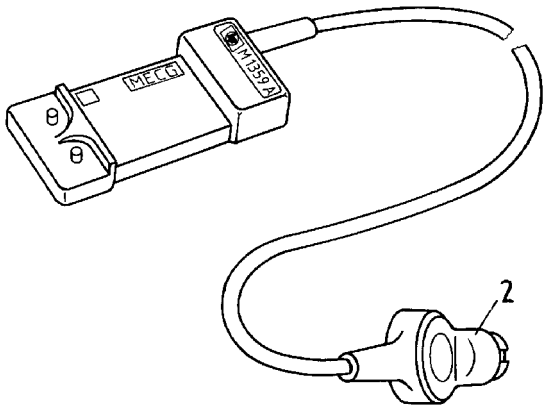


Figure 14-4 MECG Transducer

Description

The M1359A MECG Transducer has two press fit type connectors that allow connection of two electrode cables from the maternal ECG electrodes.

Specifications

Input Impedance: > 10MΩ

CMRR: with patient cable, 51.5kΩ/0.047μF imbalance at line frequency > 90dB

Noise: (referred to input with 25kΩ) < 4μVp

Contact Potential Difference: ±500mV

Input Voltage Range: 80μVp to 4mVp

Patient Leakage Current: 120V at 60Hz, 10μA rms

Patient Auxiliary Current: < 0.1μA (dc)

Dielectric strength: 1500Vrms spark gap protected

Transducer Weight with Cable: 175 grams / 6.2 ounces

Cable Length: 2.5m/8ft 2in

Parts List

See “DECG/MECG Patient Module Parts List” on page 227.

Cable Connections

Table 14-2 Cable Connections

Pin	Wire Color
2	Red
5	Brown
1+6	Bridged by Code Resistor 12.4 kΩ (± 1%)
1	Shield

Troubleshooting

The only functional checks that can be carried out on the M1359A MECG Transducer are those outlined in Chapter 9, “Safety, Maintenance, and Calibration.”

US/MECG Combi Transducer (M1358A)

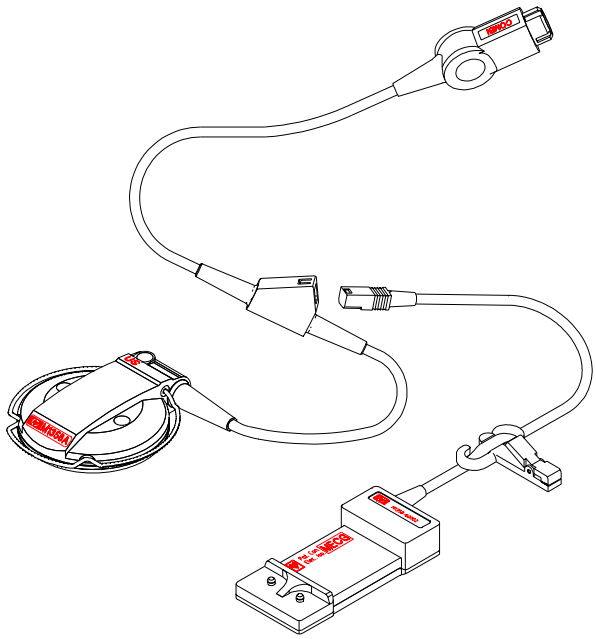


Figure 14-5 US/MECG Combi Transducer

Description

The M1358A US/MECG Combi Transducer gives the end user the possibility to monitor both the FHR and MHR using one transducer. The Ultrasound transducer operates in exactly the same way as the standard Ultrasound transducer The MECG transducer has two press fit type connectors that allow connection of two electrode cables (M1531B) from the maternal ECG electrodes (40493D).

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

Specifications

Ultrasound Transducer

System: Pulsed Doppler

Oscillator Frequency: 998.4 kHz

Ultrasound Intensity: < 1.5mW/cm^2

Dimensions: 75mm diameter, 21.5mm depth

Transducer weight with Cable: 185 grams / 6.5 ounces

Cable Length: 2.5m/8.2ft

Temperature Storage Range: -40°C to +60°C / -40°F to +140°F

Watertight: to a depth of 0.5m / 1.64 ft

MECG Transducer

Input Impedance: > 10MΩ

CMRR: with patient cable, 51.5kΩ/0.047µF imbalance at line frequency > 90dB

Noise: (referred to input with 25kΩ) < 4µVp

Contact Potential Difference: ±500mV

Input Voltage Range: 80µVp to 4mVp

Patient Leakage Current: 120V at 60Hz, 10µA rms

Patient Auxiliary Current: < 0.1µA (dc)

Dielectric strength: 1500Vrms spark gap protected

Transducer Weight with Cable: 175 grams / 6.2 ounces

Cable Length: 2.5m/8ft 2in

Parts List

Table 14-3 US/MECG Transducer: Cable Connections

Pin	Wire Color
4	Brown
8	Red
5	Green
2	Yellow
6	Red
1+6	Bridged by Code Resistor 665Ω (± 1%)
1	Shield

Table 14-4 US/MECG Combi Transducer Parts List

Description	New Part Number		Exchange Part Number		Qty
	Old Identifier	New Identifier	Old Identifier	New Identifier	
Combi Transducer (US)	M1358-60011	453563277331	M1358-69011	453563277351	1
Combi Transducer (MECG)	M1358-60002	453563277321	-	-	1
Combi Cable Assy (US)	M1358-61681	453563277341	-	-	1

Troubleshooting

Troubleshooting for the US/MECG Combi Transducer is the same as described for the Ultrasound Transducer and the MECG Transducer.

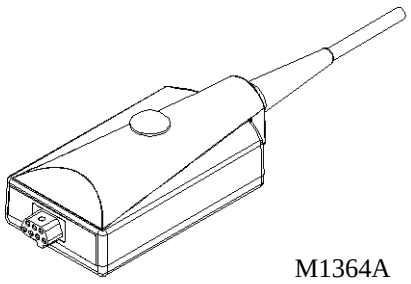
IUP Pressure Transducer (CPJ840J5)

Description

IUP pressure transducer, supplied with transducer holder CPJ84046. Use with sterile disposable domes CPJ84022.

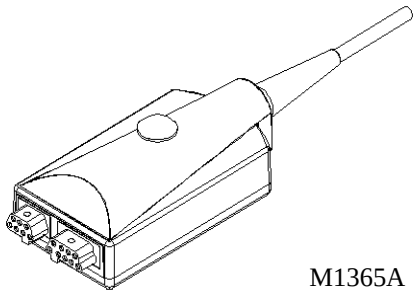
Pressure range:	-20 to + 300 mm Hg
Max. overpressure:	10,000 mm Hg
Sensitivity:	5µV/V/mm Hg
Resonance frequency:	300 Hz typical (transducer and dome)
Max. electrical excitation:	15 V DC or AC
Bridge resistance:	1000 Ohms (input and output)
Non-linearity and hysteresis:	max. 0.5% of full scale
Zero balance:	max. 0.15 mm Hg/°C
Operating temperature range:	+10 to +50°C / +50°F to +122°F
Storage temperature range:	-20 to +70°C / -4°F to 158°F
Isolation resistance:	min. 1000 MOhms
Leakage current:	max.1.5µA at 250V, 50 Hz
Weight:	24 grams / 0.85 ounces (without cable)
Connector:	Equipment specified
Immersion:	See the User Documentation that is supplied with the transducer.
Cleaning:	See the User Documentation that is supplied with the transducer.
Sterilization:	See the User Documentation that is supplied with the transducer.
Mounting:	Wrist strap provided for mounting on patient arm; transducer holder available as accessory for IV pole mounting.

Patient Modules (M1364A and M1365A)



M1364A

ecg_only.tif



M1365A

combimod.tif

Description

Both patient modules have a 7-pin ECG connector into which you can plug either DECG cable (M1362A) or MECG cable (M1363A). The $FSpO_2$ combined patient module also has a 9-pin connector for the fetal oxygen sensor.

Specifications

M1364A Patient Module

Overall length: 2706mm (+30, -100mm) / 106.5in (+1.2, -3.9in)

Length of free cable: 2618mm (+30, -100mm) / 103.1in (+1.2, -3.9in)

Weight: 120 grams / 4.2 ounces

Size: 88x42x30mm / 3.5x1.7x1.2in

Red Socket: DECG or MECG connection

M1365A Patient Module

Overall length: 2706mm (+30, -100mm) / 106.5in (+1.2, -3.9in)

Length of free cable: 2618mm (+30, -100mm) / 103.1in (+1.2, -3.9in)

Weight: 145 grams / 5.1 ounces

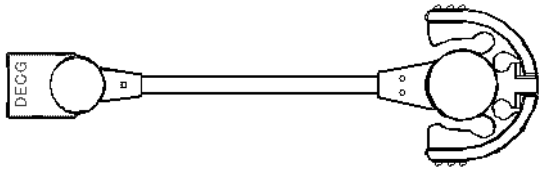
Size: 88x42x30mm / 3.5x1.7x1.2in

Blue Socket: $FSpO_2$ connection

Red Socket: DECG or MECG connection

DECG Cable (M1362A)

For connecting to red ECGconnector on M1365A and M1364A patient modules

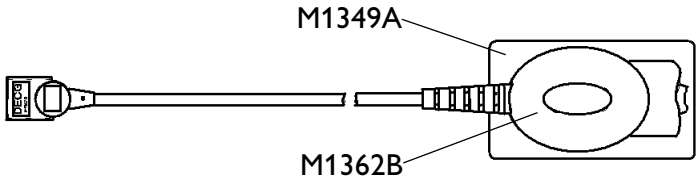


Cable weight: 22 grams / 0.8 ounces

Cable Length: 666mm +/- 30mm / 26.2in +/- 1.2in

DECG Adapter Cable (M1362B)

For connecting to red ECG connector on M1365A and M1364A patient modules.

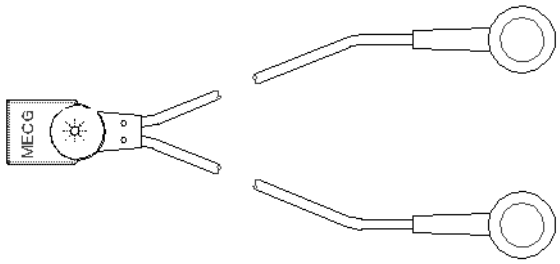


Cable weight: 35 grams / 1.2 ounces (approx.)

Cable Length: 770mm / 30.3in (approx.)

MECG Cable (M1363A)

For red connector on M1365A and M1364A patient modules



Cable weight: 16 grams / 0.56 ounces

Cable Length: 606mm +/-30mm / 23.9in +/- 1.2in

M1364A/M1365A With DECG Cable M1362A or M1362B

Patient Leakage Current: 120V at 60Hz, 10µA rms

Patient Auxiliary Current: < 0.1µA (dc)

Dielectric strength: 1500Vrms spark gap protected

Input Impedance: > 10MΩ

CMRR: with patient cable, 51.5kΩ/0.047µF imbalance at line frequency > 110dB

Noise: (referred to input with 25kΩ) < 4µVp

Contact Potential Difference: ±500mV

Input Voltage Range: 20µVp to 3mVp

M1364A/M1365A With MECG Cable M1363A

Patient Leakage Current: 120V at 60Hz, 10µA rms

Patient Auxiliary Current: < 0.1µA (dc)

Dielectric strength: 1500Vrms spark gap protected

Input Impedance: > 10MΩ

CMRR: with patient cable, 51.5kΩ/0.047µF imbalance at line frequency > 80dB

Noise: (referred to input with 25kΩ) < 4µVp

Contact Potential Difference: ±500mV

Input Voltage Range: 80µVp to 4mVp

Parts List

Table 14-5 DECG/MECG Patient Module Parts List

Description	Exchange Part Number		New Part Number		Qty
	Old Identifier	New Identifier	Old Identifier	New Identifier	
Combined Patient Module	M1365-69001	453563277501	M1365-60001	453563277491	1
ECG-only Patient Module	M1364-69001	453563277471	M1364-60001	453563277411	1
DECG Cable	-	-	M1362B	989803103551	1
MECG Cable	-	-	M1363A	989803103561	1

Troubleshooting

The only functional checks that can be carried out on the patient modules and cables are those

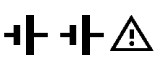
outlined in Chapter 9, “Safety, Maintenance, and Calibration.”

A
Safety

General Safety Information

The monitor is designed to comply with the general safety standard IEC 60601-1/EN 60601-1, its national deviations, such as UL 2601-1 and CSA-C22.2 No 601.1-M90, collateral standards such as the system standard IEC/EN 60601-1-1, and all applicable particular and other referenced standards.

The system software incorporates data integrity checks (for example, watchdogs, error and semaphore checking) to minimize the possibility of hazards arising from software errors.

	This symbol indicates that you should consult the *Instructions For Use*, and particularly any warning messages.
	**Equipotential Terminal** This symbol identifies terminals which are connected together, bringing various equipment or parts of a system to the same potential. This is not necessarily earth potential. The value of potentials of earth may be indicated adjacent to the symbol.
	**Protective Earth Terminal** This symbol identifies the terminal for connection to an external protective earth system.
2 x 1.5 V 	**Battery 2 x 1.5V** This symbol identifies the battery holder containing two 1.5 V batteries. For further information see Appendix B.

The Series 50 XMO and the Series 50 XM are not “ECG-Monitors”, are not defibrillator-protected, and are not designed for direct cardiac application. None of the ECG modes are electrosurgery proof.

ESU, MRI and Defibrillation

Warning
Remove all transducers, patient modules, sensors and accessories before performing electrical surgery, defibrillation, MRI and so forth. High frequency current can flow through the equipment and burn the skin.

The equipment has not been tested with defibrillators.

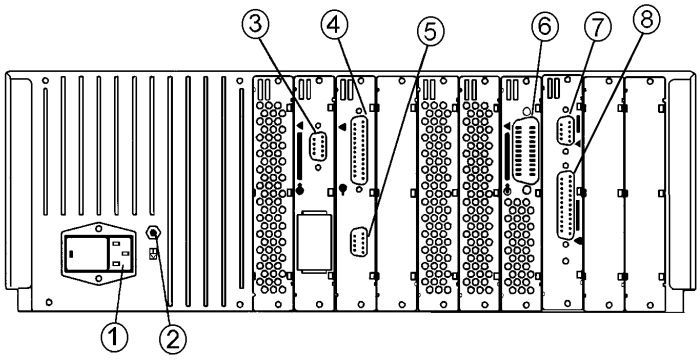
Leakage Current

Leakage current can be hazardous to the patient. Leakage current can increase if:

- the monitor is connected directly to other equipment, such as an additional patient monitor.
- a second monitor is applied directly to the mother.

Maximum Input/Output Voltages

The following diagram shows the sockets for peripheral devices.



PEGEH4.TIF

1. Mains Socket.
2. Equipotential Grounding Point.

   To use the monitor with other equipment in an operating room environment, connect the equipotential grounding point (2) to earth potential. Use the grounding cable supplied with

the monitor.

3. +5V input socket for the HBSW8200 Barcode Reader.
4. Socket for the Philips Avalon CTS Cordless Fetal Transducer System (M2720A) and Series 50 T Fetal Telemetry System (M1310A). All +5V input **except for**:

   Pins 1, 14, 15 and 16: ± 12V input
   Pin 2 -12V output
   Pin 3 +5V output
   Pin 4 ±12V output

5. RS232 Digital System Interface (for example, for OB TraceVue):

   Pin2 ±12V input
   Pin 3 ±12V output

6. Socket for one of the following:
   - 80225A or 80235A/B Obstetrical Information Management System (OBMS).
   - M1370A Obstetrical Display Information System (ODIS).
   - ±12V except for Pins 17, 18 and 22 which are +5V input.
7. Socket (9-pin) for an external device:

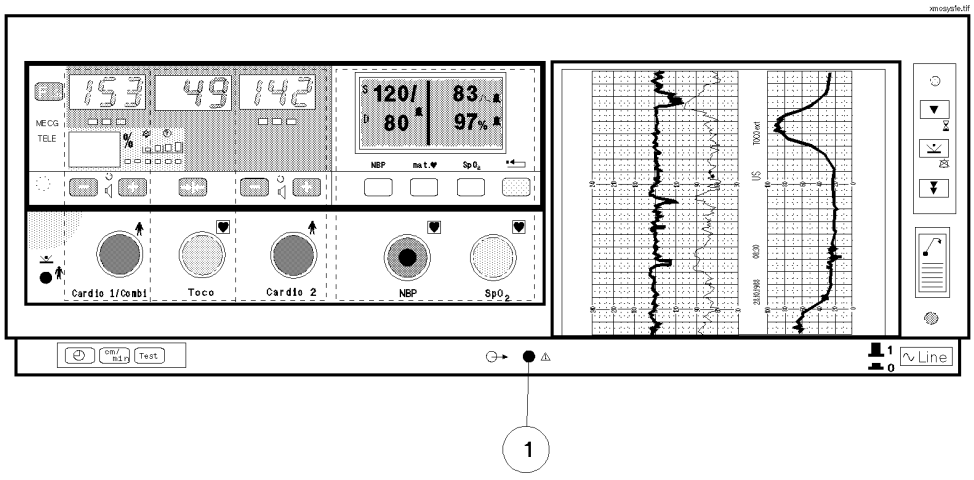
   Pin 3 ±12V

8. Socket (25-pin) for an external device:

   Pin 2 ±12V
   Pins 9 and 10 +5 Volt

Service Socket

The Service Engineer can connect a compatible laptop, Palmtop or PC to this socket (1) to carry out extended configuration and service functions.



xmosys1e.tif

Maximum voltage of ±12V.

Protective Earth

To protect hospital personnel and the patient, the monitor's casing must be grounded. Accordingly, the monitor has a 3-wire power cable that grounds it to the power line ground when plugged into an appropriate 3-wire receptacle. Do not use a 3-wire to 2-wire adapter with the monitor. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in serious personal injury.

Whenever it is likely that the protection has been impaired, the monitor must be made inoperative and be secured against any unintended operation.

Warning
Check each time before use that the monitor is in perfect working order and properly grounded.

Position the patient cable so that it does not come into contact with any other electrical equipment. The cable connecting the patient to the monitor must be free of electrolyte.

Make sure that during operation, the monitor is free from condensation. This can form when equipment is moved from one building to another, and is exposed to moisture and differences in temperature.

Warning
Possible explosion hazard if used in the presence of flammable anaesthetics.

Environment

Use the monitor in an environment that is reasonably free from vibration, dust, corrosive or explosive gases, flammable agents, extremes of temperature, humidity and so forth. It operates within specifications at ambient temperatures between 0 and 55°C. Ambient temperatures that exceed these limits can affect the accuracy of the monitor and cause damage to the components and circuits. Only products that fulfil the necessary safety and electrical standards should be used in conjunction with the monitor (contact your local response center for details).

Allow at least 5cm (2in) clearance around the monitor for proper air circulation. If the monitor is mounted in a cabinet, allow sufficient space at the front for operation and at the rear for servicing with the cabinet door open.

Spillage

When the maternal display is in a tilted position, take additional care to prevent spillage of liquid. If liquid enters the monitor through the maternal display recess, you must cease using the monitor immediately. Contact an authorized engineer for a safety inspection.

Electromagnetic Compatibility (EMC)

The Electromagnatic Compatibility (EMC) specifications in this chapter supplement those given in the *Instructions for Use*.

This device is an EMC Group 1, Class B device according to EN/IEC60601-1-2.

Emissions and Immunity

The product is designed and evaluated to comply with the emissions and immunity requirements of international and national EMC standards.

The EMC standards state that manufacturers of patient-coupled equipment must specify immunity levels for their systems. See Tables 4-9, 4-10 and 4-11 for this detailed immunity information. See Table 4-12 for recommended minimum separation distances between portable and mobile communications equipment and the product.

Immunity is defined in the standard as the ability of a system to perform without degradation in the presence of an electromagnetic disturbance.

Caution should be exercised in comparing immunity levels between different devices. The criteria used for degradation are not always specified by the standard and can therefore vary with the manufacturer.

Electromagnetic Emissions

Table 14-6 Electromagnetic Emissions

Emissions test	Compliance
Radio Frequency (RF) emissions in accordance with CISPR 11	Group 1
RF emissions in accordance with CISPR 11	Class B
Harmonic emissions IEC 61000-3-2	Class A
Voltage fluctuations and flicker IEC 61000-3-3	Complies

Electromagnetic Immunity

The M1350B/C (referred to in the following sections as the 'device') is suitable for use in the specified electromagnetic environment. The user must ensure that it is used in the appropriate environment as described below.

Table 14-7 Electromagnetic Immunity

Immunity Test	IEC 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment Guidance
Electrostatic discharge (ESD) IEC 61000-4-2	± 6 kV contact ± 8kV air	± 6 kV contact ± 2kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	± 2 kV for power supply lines (240 V AC)	± 0.5 kV for power supply lines (240 V AC)	Mains power quality should be that of a typical commercial and/or hospital environment
	± 2 kV for power supply lines (100 V AC)	± 0.4 kV for power supply lines (100 V AC)	
	± 1 kV for input/output lines	input/output lines not tested as these are less than 3m in length	
Surge IEC 61000-4-5	± 1 kV differential mode ± 2 kV common mode	± 1 kV differential mode ± 2 kV common mode	Mains power quality should be that of a typical commercial and/or hospital environment
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5% U_T (> 95% dip in U_T) for 0.5 cycles 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles < 5% U_T (> 95% dip in U_T) for 5 sec	0% U_T (100% dip in U_T) for 0.5 cycles 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles 0% U_T (100% dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial and/or hospital environment. If the user of the device requires continued operation during power mains interruptions, it is recommended that the device is powered from an uninterruptible power supply.

Table 14-7 Electromagnetic Immunity

Immunity Test	IEC 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment Guidance
Power frequency (50/ 60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at the levels characteristic of a typical location in a typical commercial and/or hospital environment

In this table, U_T is the a.c. mains voltage prior to application of the test level.

Finding Recommended Separation Distances

In the following table, ***P*** is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer, and ***d*** is the recommended separation distance in meters (m).

Portable and mobile RF communications equipment should be used no closer to any part of the device, including cables, than the recommended separation distance calculated from the equation appropriate for the frequency of the transmitter.

Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, should be less than the compliance level in each frequency range.

Interference may occur in the vicinity of equipment marked with this symbol:

Table 14-8 Conducted RF Immunity

Conducted RF Immunity Test EN/IEC 61000-4-6				
IEC 60601-1-2 Test Level over 150 kHz to 80 MHz	**Frequency Range (where Immunity Level is below IEC 60601-1-2 Test Level at certain frequencies)**	**Known RF Sources within Frequency Range**	**Worst Case Immunity Level within Frequency Range**	**Electromagnetic Environment Guidance: Recommended Separation Distance (*d*) (in Meters, at Frequency Range Tested) for Ultrasound and ECG Measurements**
Note: The device meets the compliance level of 3.0 V_{RMS} according to IEC 60601-1-2 for most of the specified test frequency range. However, within the frequency ranges specified in this table, there are some frequencies at which the immunity level is below the IEC 60601-1-2 test level. Within each frequency range, the worst case immunity level is given. Over the frequency range 150 kHz to 80 MHz, the recommended separation distance in meters (*d*) is found by the following equation: $d = \left(\frac{3,5}{V1}\right)\sqrt{P}$ For a compliance level of 3.0 V_{RMS}: $d = 1,2\sqrt{P}$				
3.0 V	0.5 MHz - 1.6 MHz	Medium Wave (AM) radio stations	0.1 V @ 0.908 MHz	$d = 35,0\sqrt{P}$
3.0 V	1.6 MHz - 3.0 MHz	Commercial radio stations, marine radio service, marine navigation, amateur radio, aircraft radio	0.3 V @ 2.998 MHz	$d = 11,7\sqrt{P}$
3.0 V	27.0 MHz 29.6 MHz	CB radio (in UK), amateur radio	0.2 V @ 28.693 MHz, 28.980 MHz, and 29.562 MHz	$d = 1,8\sqrt{P}$
3.0 V	29.6 MHz - 38.0 MHz	Commercial radio service (transportation, public safety, industrial), wireless microphones, radio remote controls	0.9 V @ 34.664 MHz, 35.011 MHz, and 35.361 MHz	$d = 3,9\sqrt{P}$

Key:

d = Recommended separation distance in meters (m)

P = maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer

*V*1 = Tested compliance level (in Volts) for the Conducted RF Immunity test IEC 61000-4-6

Table 14-9 Radiated RF Immunity

Radiated RF Immunity Test EN/IEC 61000-4-3			
IEC 60601-1-2 Test Level and Specified Test Frequency Range	**Compliance Level**	**Immunity Level**	**Electromagnetic Environment Guidance: Recommended Separation Distance (*d*) (in Meters, at Frequency Range Tested) for Ultrasound and ECG Measurements**
Note: The device meets the compliance level of 3.0 V/m according to IEC 60601-1-2 for the specified test frequency range. Over the frequency range 80 MHz to 800 MHz, the recommended separation distance in meters (*d*) is found by the following equation: $\left(\frac{3,5}{E1}\right)\sqrt{P}$ For a compliance level of 3.0 V/m: $d = 1,2\sqrt{P}$ Note: Over the frequency range 800 MHz to 2.5 GHz, the recommended separation distance in meters (*d*) is found by the following equation: $\left(\frac{7,0}{E1}\right)\sqrt{P}$ For a compliance level of 3.0 V/m: $d = 2,3\sqrt{P}$			
3 V/m 80 MHz to 800 MHz	3.0 V/m	3.0 V/m	$d = 1,2\sqrt{P}$
3 V/m 800 MHz to 2.5 GHz	3.0 V/m	3.0 V/m	$d = 2,3\sqrt{P}$
Key: *d* = Recommended separation distance in meters (m) *P* = maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer *E*1 = Tested compliance level (in Volts/meter) for the Radiated RF Immunity test IEC 61000-4-3			

Field strengths from fixed transmitters, such as base stations or radio (cellular, cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the device is used exceeds the applicable RF compliance level above, it should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the device.

These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

If you require further information or assistance, please contact Philips Support.

Recommended Separation Distances from Portable and Mobile RF Communication Equipment

The device is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or user of the device can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment and the device as recommended below, according to the maximum output power of the communications equipment.

Table 14-10Separation Distance

Rated Maximum Output Power (*P*) of Transmitter (in Watts)	Separation Distance (*d*) in Meters According to Frequency of Transmitter at IEC 60601-1-2 Test Compliance Level (Figures in brackets show worst-case separation distances where tested values fall below the compliance level at certain frequencies. See previous table.)		
	150 kHz to 80 MHz $d = \left(\frac{3,5}{V1}\right)\sqrt{P}$	**80 MHz to 800 MHz** $d = \left(\frac{3,5}{E1}\right)\sqrt{P}$	**800 MHz to 2.5 GHz** $d = \left(\frac{7,0}{E1}\right)\sqrt{P}$
0.01	0.1 (3.5)	0.1	0.23
0.1	0.4 (11.0)	0.4	0.7
1	1.2 (35.0)	1.2	2.3
10	3.8 (110.7)	3.8	7.3
100	12.0 (350.0)	12.0	23.0

B
Manufacturer's Information

Manufacturer's Responsibility

Philips only considers itself responsible for any effects on safety, reliability and performance of the equipment if:

- assembly operations, extensions, re-adjustments, modifications or repairs are carried out by persons authorized by Philips, and
- the electrical installation of the relevant room complies with national standards
- and the instrument is used in accordance with the instructions for use.

Manufacturers of Interfacing Monitors

This book refers to monitors made by manufacturers other than Philips. These are:

- Dinamap monitors are products of Critikon Incorporated.
- Press-Mate monitors are products of COLIN Corporation.
- Datascope monitors are products of Datascope Corporation.
- NELLCOR monitors are products of Tyco Healthcare.

USA Law

United States federal law restricts this device to sale by or on the order of a physician.

Specifications

The following section gives the manufacturer's specification for the monitor.

Patient Safety

Parameter	Monitor Input Connector	Resulting Isolation with transducer/ patient module
IUP, TOCO, NIBP, SpO2	CF	CF
US (M1356A)	B	BF
DECG (M1357A)	B	CF
MECG (M1359A)	B	CF
DECG **or** MECG via M1364A	B	CF
FSpO2 and **either** MECG **or** DECG via M1365A	B	CF
Remote event marker (15249A)	B	BF

None of the ECG modes are electrosurgery proof.

Operating and Environmental

Power Requirements	Operating Voltage	100 - 120 V (± 10%) 220 - 240 V (±10%)
	Line Frequency	50 to 60 Hz
	Power Consumption	60 VA max
Environment	Operating Temperature	0°C to + 55°C
	Storage Temperature[1]	-40°C to + 75°C
	Relative Humidity	5% to 95%°
Dimensions and Weight without transducers	Height	147 mm (5.8in)
	Width	422mm (16.6in)
	Depth	392mm (15.4in)
	Weight	14.6kg (31.96lb)

1. Transducers can be stored at temperatures of -40°C to + 60°C

Fetal Display

Fetal Display Specifications		
Heart Rate Range	US	50 to 240 bpm
	DECG	30 to 240 bpm
	MHR	30 to 240 bpm (not displayed)
External Toco Range		0 to +127 relative units
IUP Range		-99 to +127 mmHg
Fetal SpO_2 Range	0 - 99%	
Fetal Heart Rate Alarm Limits	Bradycardia Alert Range	60 to 120 bpm adjustable in 10 bpm steps Default: 110 bpm
	Tachycardia Alert Range	150 to 210 bpm adjustable in 10 bpm stems Default: 150 bpm
Fetal Heart Rate Alarm Delay (Lower limit also applies to signal loss alarm)	Bradycardia Alert Delay	10 to 300 sec adjustable in 10 sec steps Default: 60 sec
	Tachycardia Alert Delay	10 to 300 sec adjustable in 10 sec steps Default: 60 sec

Maternal External Blood Pressure

Complies with IEC 60601-2-30:1999/EN60601-2-30:2000

Maternal Non-invasive Blood Pressure Performance Specifications		
Pressure Transducer Accuracy	15°C to 25°C	±3 mmHg
	10°C to 35°C	±3 mmHg (±0.6% of reading)
	0°C to 55°C	±3 mmHg (±1.7% of reading)
Measurement Ranges	Systolic	30 to 270 mmHg
	Diastolic	10 to 245 mmHg
Cuff Inflation Time	Typically less than 10 seconds	
Auto Mode Repetition Time	2, 5, 10, 15, 30, 60 minutes	
Stat Mode Duration	5 minutes	
Cycle Time (Typical at HR over 60 bpm)	Auto/manual	35 seconds
	Stat	17 seconds
	Maximum	120 seconds
Limit Alarms	Adjustment	5mmHg steps
	Diastolic	10 to 245mmHg
	Systolic	30 to 270mmHg
	Overpressure Safety Limit	300 mmHg for more than 2 seconds or 330mmHg immediately
Pulse Rate Range	Measurable within heart rate range of 30 to 240 bpm, averaged during NIBP measurement.	

Maternal Pulse Oximetry (SpO_2)

Complies with EN 865:1997/ISO9919:1992

Measurement Validation: The SpO_2 accuracy has been validated in human studies against arterial blood sample reference measured with a co-oximeter.

SpO_2 Performance Specifications			
Percentage Range	0 to 100%		
BPM Range	30 to 300 bpm		
Accuracy	± 1%		
Resolution	1 bpm		
Pulse Rate Limit Alarms	Range	70% - 96%	
	Adjustment	1% steps	
Accuracy at 1 standard deviation	Philips Reusable Transducers:	M1191A, M1191T, M1192A, M1192T	70 to 100% ± 2.5%
		M1194A	70 to 100% ± 4%
	Disposable Transducers:	Philips: M1904B, M1903B Nellcor®: OxiMax Max-A, Max-P Oxisensor D-25, D-20	70 to 100% ± 3%
Transducers	Wavelength Range:	600 to 1000 nm	
	Emitted Light Energy:	≤ 5mW	
Pulse Oximeter Calibration Range	70 to 100%		
Display Update Period	Typical: <2 seconds; Maximum: 15 seconds (for example, with signal loss)		

Fetal Pulse Oximetry ($FSpO_2$)

Complies with EN 865:1997/ISO9919:1992

Measurement Validation: Controlled hypoxia studies in a piglet model[1]. The calibration was validated in an independent animal study of a different group of piglets and in a multi-center human study comparing monitor readings to simultaneous laboratory arterial blood saturation values obtained on severely cyanotic human infants and children.

$FSpO_2$ Performance Specifications		
Display Range	0 to 99%	
Saturation Limit Alarms	Range	25% - 45%
	Adjustment	1% steps
Alarm Delay	0.5 to 9.5 minutes in 0.5 minute steps	
Accuracy at 1 standard deviation[1]	4.7%.	
Transducers	Wavelength Range:	735 nm and 890 nm
	Emitted Light Energy:	≤ 80 mW
Pulse Oximeter Calibration Range	15 to 80%	
Display Update Period	≤ 1 second	

1. For a more detailed discussion of accuracy, refer to the Nellcor OxiFirst™ Oxygen Saturation Monitor (N-400): Technical Issues (Application Note 5990-0505EN), reprinted by Philips from Nellcor's Perinatal Reference Note 1.

Maternal ECG and Heart Rate

Maternal ECG and Heart Rate Specifications		
Heart rate Measurement	Range	30 to 240 bpm
	Accuracy	±1 bpm
	Resolution	Recorder: 0.25 bpm
		Display: 1 bpm
Heart rate Alarm Limits (excluding NIBP)	Range	30 to 250 bpm
	Adjustment	5 bpm steps

Maternal Display Section

Numerical Display

Two heart rate displays (orange) and one uterine activity display (green).
Type: (10mm) 7 segment LEDs.

Maternal Display

The maternal display shows:

- systolic measurement
- diastolic measurement
- SpO_2 level
- maternal heart rate (if derived from MECG), pulse rate (if derived from pulse oximetry) or average pulse rate (if derived from NIBP)
- Alarm status for each parameter (except NIBP pulse rate)
- Warning message (if any)

Instrument Displays

Mode Display

Mode display for MECG and Telemetry. (Telemetry mode will be displayed when a M2720A Avalon CTS Cordless Fetal Transducer System or 80240A or M1310A Telemetry System is connected and powered up.)

Two signal quality indicators (cardio channels only): green, yellow and red show signal quality. Acceptance lamps flash with valid heart rate measurement (M1350B only).

Ultrasound, External and Internal Toco

Ultrasound, External and Internal Toco Specifications			
Ultrasound Mode	System		Pulsed Doppler oscillator
	Frequency		998.4kHz
	Repetition Rate		3.2kHz
	Ultrasound Intensity	Peak-negative acoustic pressure	p_- = (28.0 ± 4.7) kPa
		Output beam intensity (= temporal average power/area)	I_{ob} = (2.53 ± 0.69) mW/cm2
		Spatial-peak temporal average intensity	I_{spta} = (7.7 ± 2.6) mW/cm2
External Labor	Signal Range		0 to 100 units
	Offset Compensation		±200 units
Intrauterine Pressure	Signal Range		-99 to +127mmHg
	Patient Leakage Current		10µA. Displayed pressure unit mmHg.
	Sensitivity		Automatically selectable between 40µV/V/mmHg (M1348A) and 5µV/V/mmHg (M1334A and CPJ840J5)

Recorder

Recorder mechanism: 5 channel, high resolution (8 dots per mm, 200 dots per inch) thermal array recorder, paper end detection. Paper speeds 1, 2 and 3cm/min.

Annotation: time of day and date (automatic annotation every 10 minutes), paper sensing mode (annotated with each alteration of parameter).

Paper advance speed: 24cm/min. Automatic stop at perforation line.

FHR (Cardio) Scales

	Scale A	Scale B	Uterine activity (Toco) scale
Vertical Scale Size	7cm	8cm	4 cm
Vertical Scale Sensitivity	30 bpm/cm	20 bpm/cm	25 units/cm
Range	30 to 240 bpm	50 to 210 bpm	0 to 100 units

Z-fold paper with numbered pages

Recording times per pack:

8h 20min at 3cm/min

12h 30min at 2cm/min

25h at 1cm/min

Fetal Movement Profile (FMP) recording:

2 mm high bars on upper Toco scale

Testing Facilities

Test button: With no front end connections to the instrument a thorough instrument test is performed including a display and recorder test. With the appropriate transducer connected the respective mode can be tested. See Chapter 10, “Troubleshooting.”

Carts

You can mount the Series 50 XM and the Series 50 XMO fetal/maternal monitors on the Philips CL, CM or CX carts. Cleaning instructions for the carts and safety details are provided in the Carts Equipment Note delivered with your cart.

Table 14-11Philips Carts: Specifications

Specifications	Carts		
	CL (M1323A)	CM (M1324A)	CX (M1325A)
Width (mm)	514	614	614
Depth (mm)	625	625	625
Height (mm)	805	989	1117
Weight (kg)	24.2	50.6	63.4

Table 14-12Philips Carts Replacement Parts

Replacement Parts	Part numbers	Cart CL (M1323A)	Cart CM (M1324A)	Cart CX (M1325A)
Wheels	M1324-42100	-	●	●
	M1323-42075	●	-	-
Drawers	M1324-68500	-	●	●
	M1323-68450	●	-	-
CAM Mounting Arm Kit	5061-8340	●	●	●
Mounting Kit IUP Pole	80310-68701	●	●	●
Infusion Pole Mount	5061-8364	●	●	●
Mounting Rail Kit	5061-8365	●	●	●

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