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# **Philips CMS Patient Monitoring System**

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## **Service Guide**

# **PHILIPS**

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Printed September 2002

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## Overview

### Introduction

The Philips CMS Patient Monitoring System Service Guide is a reference guide featuring six chapters on how to test, troubleshoot, and repair the instrument.

The Philips CMS Patient Monitoring System and the Philips Anesthesia CMS Patient Monitoring System, as well as the Philips Neonatal CMS Patient Monitoring System will be referred to throughout this guide as the CMS.

### Target Audience

This reference guide is intended for hospital Biomedical Engineers and Technicians, Philips Customer Engineers, Response Center Engineers, and Installation Planning Specialists who have experience servicing Philips patient monitoring devices or similar products.

### Prerequisites

In addition to this guide we recommend you to complete the Philips *Patient Monitors – Concepts Guide* also contained in the Service Training Kit.

### Course Objectives

This guides objectives are:

- Identify the major units of CMS.
- Identify the controls and connectors of the major units of CMS.
- Identify the four operating modes of CMS.
- Connect the cabling of the CMS.
- Complete a Quick Check of the system.
- Perform Safety checks.
- Perform recommended maintenance.
- Perform a general inspection of the system.
- Clean the major units of the CMS.
- Perform Self-check procedures for CMS modules.
- Recognize a properly operating CMS.
- Identify symptoms of improper operation for the CMS.
- Use any symptoms or indications to identify a fault as being in the display module, computer module, or the plug-in parameter modules.
- Further isolate faults down to field-replaceable assemblies.
- Locate and understand the removal and replacement procedures for the CMS and ACMS.
- Provide a list of available parts for the CMS and ACMS.

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## In This Guide

**Chapter 1 - Introducing the CMS** provides a physical/functional overview of the monitor.

**Chapter 2 - Testing & Maintaining the CMS** describes how to test, maintain and check that the instrument operates in an optimum condition.

**Chapter 3 - Troubleshooting the CMS** provides troubleshooting and diagnostic procedures for the monitor.

**Chapter 4 - Troubleshooting the Plug-in Modules** provides troubleshooting and self-test procedures for the parameter modules.

**Chapter 5 - Repairing the CMS** includes removal and replacement procedures for field replaceable parts.

**Chapter 6 - Parts List for CMS** lists replacement and exchange part numbers for the instrument.

**Appendix A - Product Information** gives a listing of the options for the monitor.

**Appendix B - Conversion Charts** gives relative conversion information.

**Appendix C - Philips 15210B Calibration Unit** gives service and installation information for this instrument used in calibrating plug-in modules.

**Appendix D - CPC Programming Tool Manual**

**Glossary** gives relevant definitions for the system

**Index** gives an alphabetical listing the contents of the guide.

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## How to Use this Guide

Each chapter begins with a title which is followed by three sections: an opening statement, an objectives statement and a concepts listing. These three sections can be thought of as your guide to the chapter. They will tell you what you are going to find in the chapter, what you should take away from the chapter in the way of goals and terms, and concepts central to the chapter.

Chapters containing procedures will then proceed with a procedure overview table and the body of the chapter. The procedure overview table is your guide to the actual procedures in the chapter. It is designed to be used by an experienced user who needs a quick review of the procedure or a page number of a particular procedure.

The body of the chapter will cover all of the procedures associated with the task. In order to make the procedure easier to follow, we have kept the body of the text focused on the procedure at hand and pulled the extra information, which might be helpful to a new engineer, into the outside column. Here is a formatting example:

---

### Example: Inspect the System Hardware

No tools are required to perform this inspection.

- Step 1** Examine the exterior of the unit for cleanliness and general physical condition. Check that the plastic housings are intact, that all hardware is present and tight, and that there are no signs of spilled liquids or other serious abuse.
  - Step 2** Check fuse values and type against that marked on the chassis, and ensure that a spare is provided.
  - Step 3** Inspect connectors of the module rack and ensure that the plug-in modules are locked into place and do not slide out without first releasing the locking plate on the bottom of the module.
  - Step 4** Ensure all labeling is present and legible.
  - Step 5** Inspect all accessories external to the system such as transducers, referring to the manufacturer's documentation.
- 

*Inspecting the system on an annual basis will help you keep track of your system and identify potential parts that need to be replaced.*







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# Chapter 1    Introducing the CMS

This chapter gives a detailed description of the components and operating modes of the CMS, a modular patient monitor with networking and data management capabilities. The system can be upgraded with additional modules as needed, or you can interchange the modules between systems in your units.

This version of the CMS Service Guide introduces the new CMS Release C.0 range of monitors. The new options H03 or H04 (with version M1167A or M1177A) enable the use of an off-the-shelf XGA-compatible display as the main display. The new option H05 (M1167A/77A only) provides a touchscreen XGA display with an External Alarm Device and a RS232 Interface.

There are three versions of CMS corresponding to the three major types of application: CMS (for Critical and Cardiac Care), Anesthesia CMS (ACMS), and Neonatal CMS (NCMS).

The versions and models described by this guide are listed as follows (models indicated by asterisk were discontinued. (“S)” indicates a non-US-model):

CMS: M1165A/66A/67A	Models 54(S)*, 56(S), 64(S), 66(S) and 68(S)
CMS: M1175A/76A/77A	Models 54*, 56, 66 and 68
ACMS: M1165A/66A/67A	Models 74(S)*, 76(S), 84(S), 86(S) and 88(S)
ACMS: M1175A/76A/77A	Models 74*, 76, 86 and 88
NCMS: M1166A/67A	Models 34(S)*, 36(S)*, 44(S), 46(S)* and 48(S)
NCMS: M1176A/77A	Models 34*, 36*, 46* and 48

All of these systems run on fully compatible hardware and are hereafter commonly referred to as the *Monitor or CMS*.

---

## Objectives

In order to meet the chapter’s goals, you should be able to:

- Identify the major units of CMS.
- Identify the controls and connectors of the major units of CMS.
- Identify the operating modes of CMS.

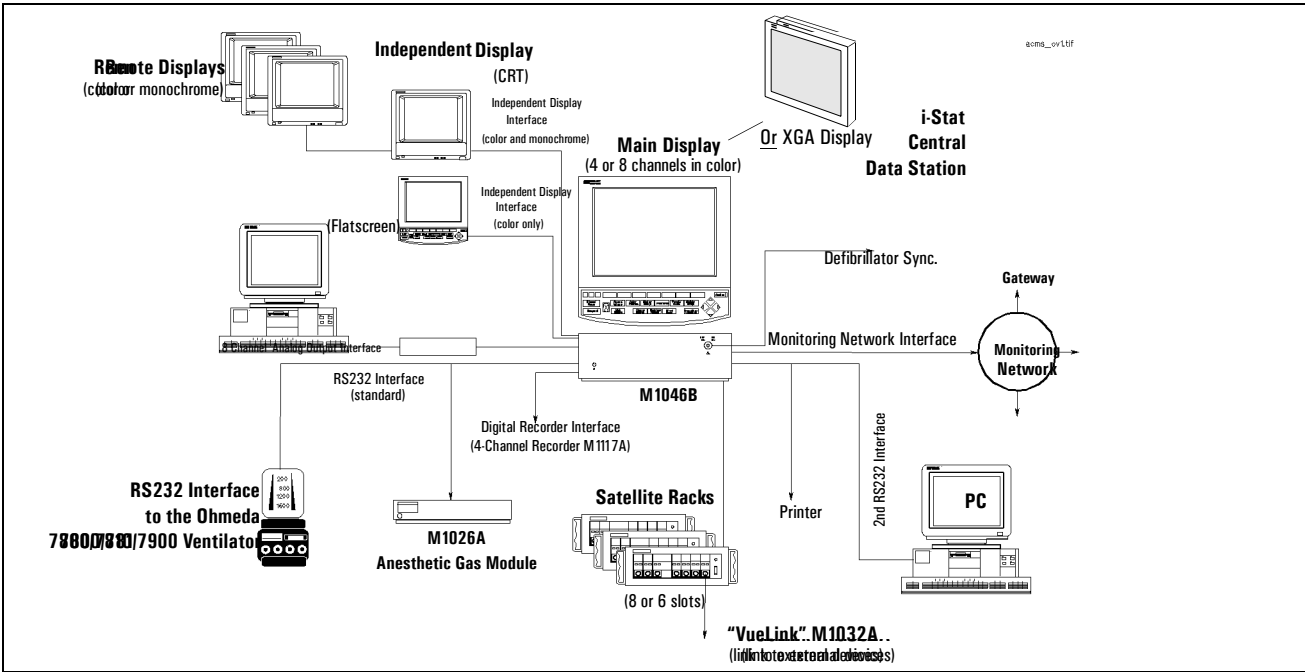
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## Concepts

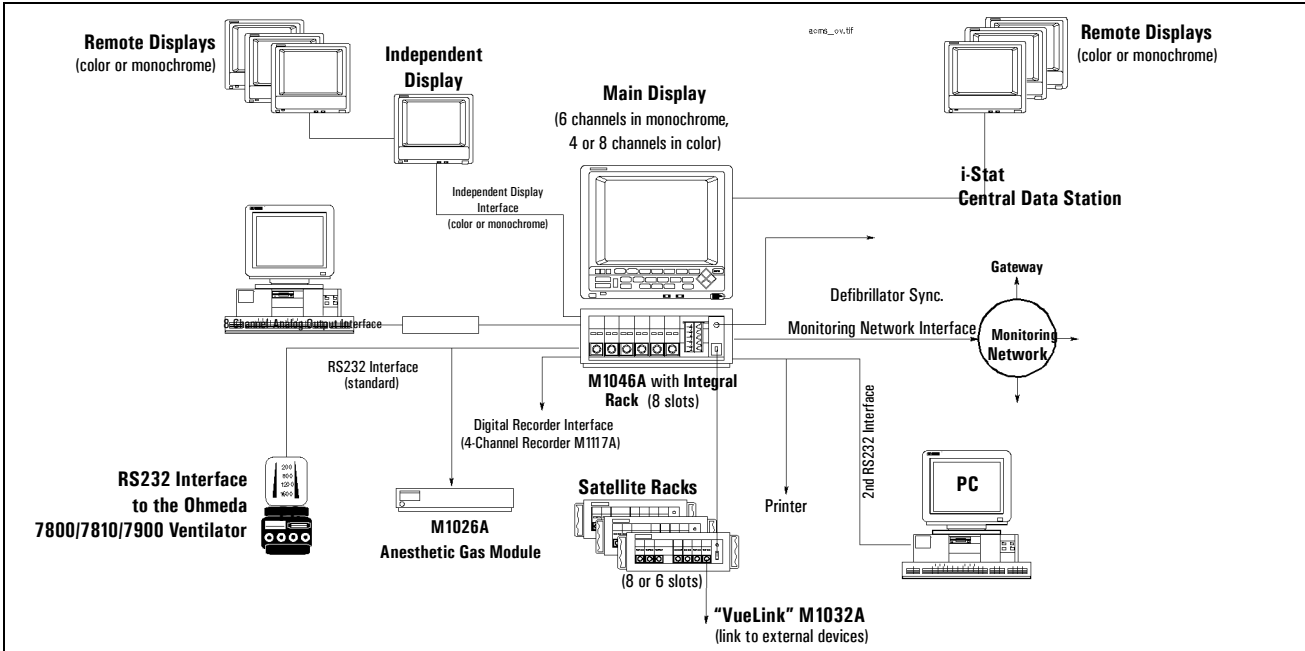
CMS Release C.0 contains the following major units:

- **Main Display Module** - Main Display Modules are 10.4" Flatscreen Color, 14" CRT Color, 14" CRT Mono, or an off-the-shelf XGA-compatible display. The first three have an integrated Control Panel for the human interface; the XGA display option has the External Alarm Device with the Handheld Keypad for the human interface. See page 1-4.
- **Independent Display Module** - Independent Display Modules can be: 10.4" Flatscreen Color; XGA-compatible display; 14" CRT Color or 14" CRT Mono or 21" CRT Color without Control Panels. These displays are connected to the Computer Module by their own display controller and may display different information than the Main Display Module under software control. See page 1-13.
- **Slave Display Module** - Slave Display Modules are 14" CRT Color or 14" CRT Mono or 21" CRT Color without Control Panels. These displays can be daisy-chained to any CRT and display the same information as the display they are connected to. See page 1-13.
- **Handheld Keypad** - The Handheld Keypad is an input device connected to the HIL connector on the Main Display and is used to interact with patient data management and drug calculator software. With the XGA-compatible display options, the **External Alarm Device** complements the Handheld Keypad to give a full set of user controls. See page 1-16.
- **Computer Module** - The Computer Module contains the hardware and software for the processing functions of the monitor. Most of the external connections of the monitor are in the rear of the Computer Module. See page 1-19.
- **Integral Power Supply** - The Integral Power Supply, located in the new Computer Module (M1046B) in CMS products M1167A and M1177A that have the M1095A flatscreen (or an XGA-compatible) as the main display, provides the power for the Flatscreen Display, Computer Module and satellite-mounted Plug-in Modules. See page 1-51.
- **Remote Power Supply** - The Remote Power Supply, used with CMS models that have a flatscreen as the Main Display Module and a M1046A Computer Module, provides the power for the Flatscreen Display Module, Computer Module and Plug-in Modules. See page 1-52.
- **Plug-in Module Rack** (Integral or Satellite) - The Plug-in Module Rack is the interface between the Plug-in Modules and the Computer Module. Plug-in Module Racks can be integrated in the M1046A Computer Module or remotely located in the patient vicinity. See page 1-55.
- **Plug-in Modules** - The Plug-in Modules are the interface between the patient cables and the Plug-in Module Rack. Each Plug-in Module is responsible for specific types of patient measurement (pressure, temp, and so on). These types of measurement are also known as Parameters. The number and type of Plug-in Modules used will depend on the monitoring situation. See page 1-58.

The CMS monitors can be networked on the Philips Network (also known as SDN). If your system is connected to such a network you can receive information from other Philips monitors or send information to the Philips Central Stations.



M1167A/77A  
CMS (Flatscreen) System Overview

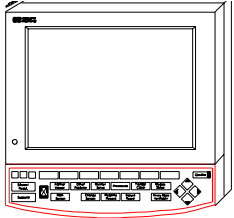


M1165A/66A/75A/76A  
CMS (CRT) System Overview

Figure 1-1 Philips CMS Patient Monitoring System

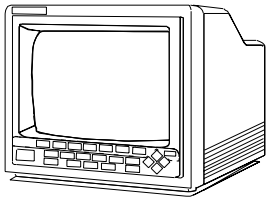
## Main Display Module

### Main Display Module



Flatscreen  
Main Display

The Main Display Module of the CMS can be a 10.4" Color flatscreen, a 14" CRT, or an off-the-shelf XGA-compatible display. CRT display-based CMSs can use either a Color CRT Display (M1094B or M1094A) or a Monochrome CRT Display (M1092A) as the Main Display Module. Slave CRT Displays can be daisy-chained from any other CRT displays. Additional independent displays, CRTs and flatscreens can be connected but they need their own display controller in the Computer Module allowing them to show different information than the main display under software control.



CRT Main Display

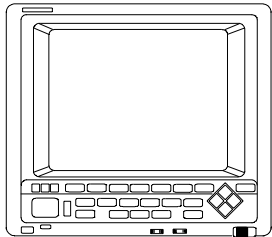
The main display (flatscreen or CRT) contains a consistent arrangement of indicators and keys on the Control Panel (human interface). There are two versions of the Control Panel and Handheld Keypad: Standard and Classic. The Classic is no longer available. The Standard Control Panel is available in supported local languages. Slave and independent displays have no Control Panel fitted.

### Objective

In order to meet this section's goals, you should be able to:

- Identify the controls and connectors of the Display Module.
- Be familiar with the function of the controls and connectors of the Display Module.

### Concepts



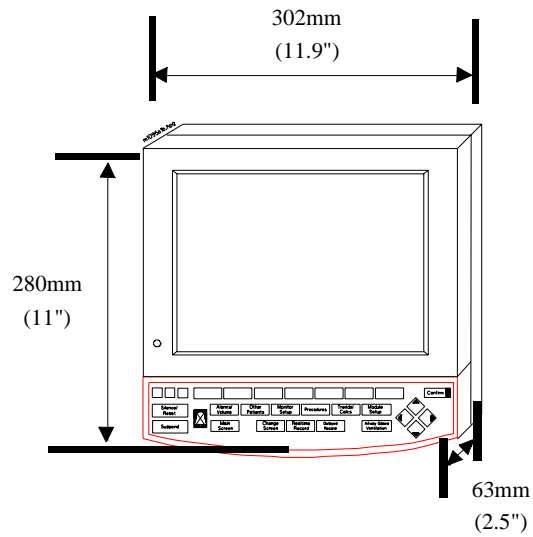
Front Panel of  
Display Module

With the exception of Options H03/4, the Main Display Module can be either a flatscreen or CRT with a Control Panel on the front panel or bezel. The bezel contains the Control Panel, as well as the main power switch and the adjustments for brightness and contrast. The rear of the display is referred to as the rear panel and contains the rest of the adjustment controls and all of the connectors. The HIL Connector on the CRT Display is on the lower right-hand corner of the front panel.

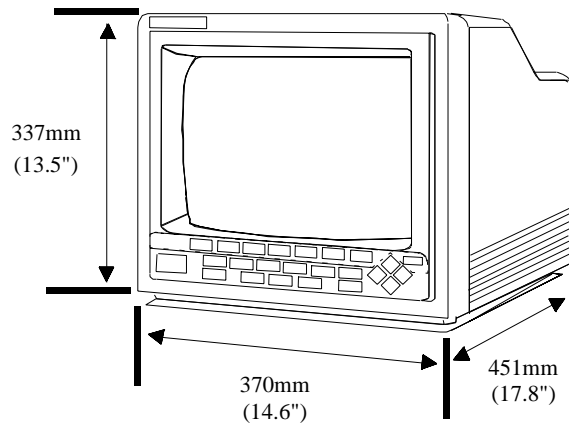
**Note:** With Options H03/4 the Main Display Module is an XGA-compatible display and the Control Panel is the Handheld Keypad with External Alarm Device.

<b>Front Panel</b>	The plastic bezel on the front of the display that contains controls and connectors, including the Control Panel and display adjustments.
<b>Standard Control Panel</b>	The hardkeys, softkeys and alarm indicators of the Standard human interface (Release E or later). Includes Airway Gas/Ventilation key.
<b>Classic Control Panel</b>	The hardkeys, softkeys and alarm indicators of the Classic human interface. Available with and without the SUSPEND key (see Parts List). Includes HELP key. The Classic Control Panel is not supported from CMS Release B.0.
<b>HIL Connector</b>	The Human Interface Link (HIL) Connector on the Main Display is used to attach the Handheld Keypad and uses Philips HIL protocol to transfer data to the system. The HIL Connector on the CRT Display, which is on the lower right-hand corner of the front panel, can be covered with a plastic insert when not in use.
<b>Softkeys</b>	These are blank single-press keys used as selection controls to enter Task Windows. They correspond to the softkey labels displayed above them on the screen.
<b>Hardkeys</b>	These are single-press keys with labels used as selection controls. Typically, a hardkey accesses the Selection Window of its label.
<b>Rear Panel</b>	The panel on the rear of the display that contains display controls and connectors for power, HIL and video.

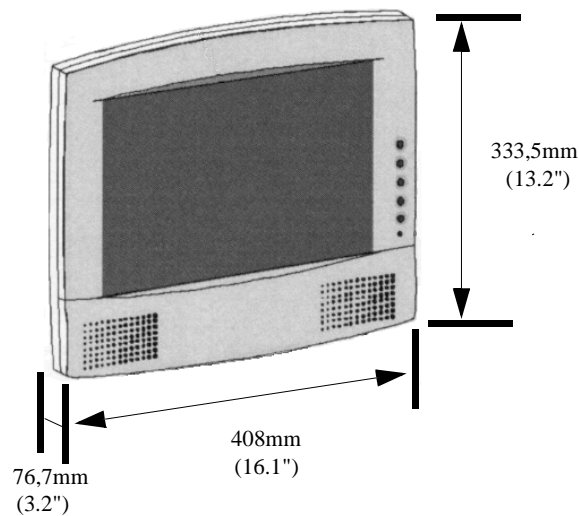
## Main Display Module



Flatscreen Main Display Module



CRT Main Display Module



XGA Flatscreen Display Module

Figure 1-2 Display Modules with Dimensions

Front Panel Controls and Connectors – CRT Display

The controls and connectors on the front panel of the Display Module are shown below:

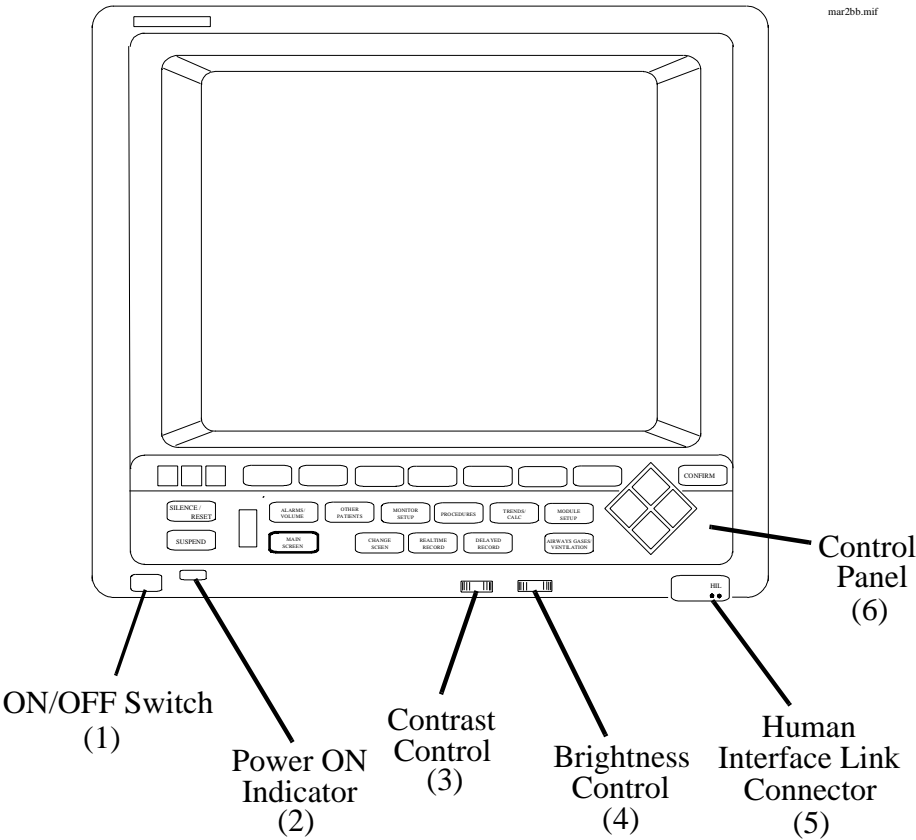


Figure 1-3 The Display Module Front Panel

Table 1-1 Display Module Front Panel Controls and Connectors

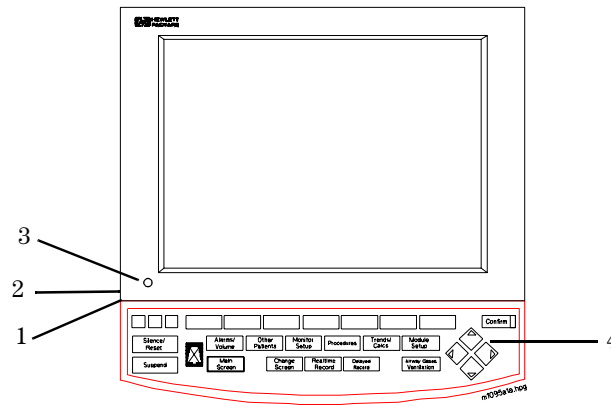
	Controls	Function
1	ON/OFF Switch	Used to turn the display On/ Off. This is the only power switch for the system and it must be pushed in for power ON.
2	Power ON indicator	Green LED, which is lit when the display is switched ON.
3	Contrast Control	Rotary control, used to vary the contrast of the display.
4	Brightness Control	Rotary control, used to vary the brightness of the display.

### Table 1-1 Display Module Front Panel Controls and Connectors

	Controls	Function
5	HIL Connector	Human Interface Link (HIL) connector is used to connect the Handheld Keypad. This connector may be covered by a plastic insert when not in use.
6	Control Panel	User interface of the Display Module.

## Front Panel Controls and Connectors – Flatscreen Display

The controls on the front panel of the Flatscreen Display are shown below:



### Figure 1-4 The Flatscreen Display Front Panel

### Table 1-2 Flatscreen Display Front Panel Controls and Connectors

	Controls	Function
1	ON/OFF Switch	Used to turn the display On/Off and used as the remote switch for either the M1047A Remote Power Supply or the M1046B Computer Module integral power supply.
2	Brightness Control	Rotary control, used to vary the brightness of the display.
3	Power ON indicator	Green LED which is lit when the display is switched ON.
4	Control Panel	User interface of the Display Module.



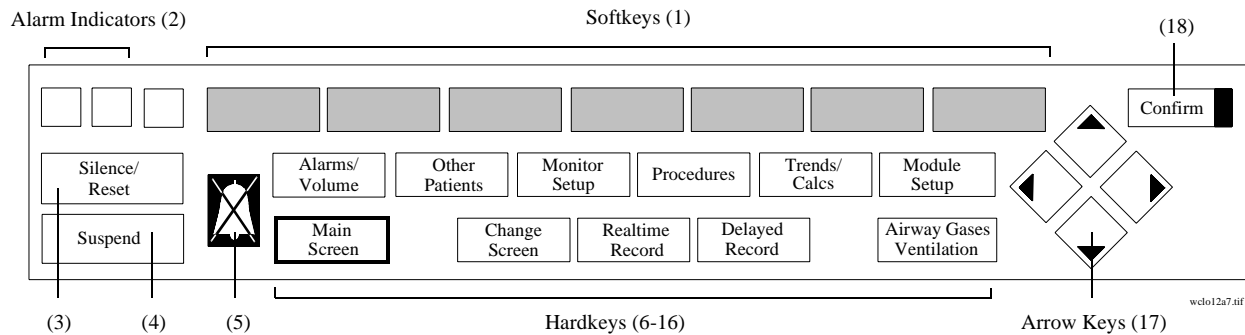
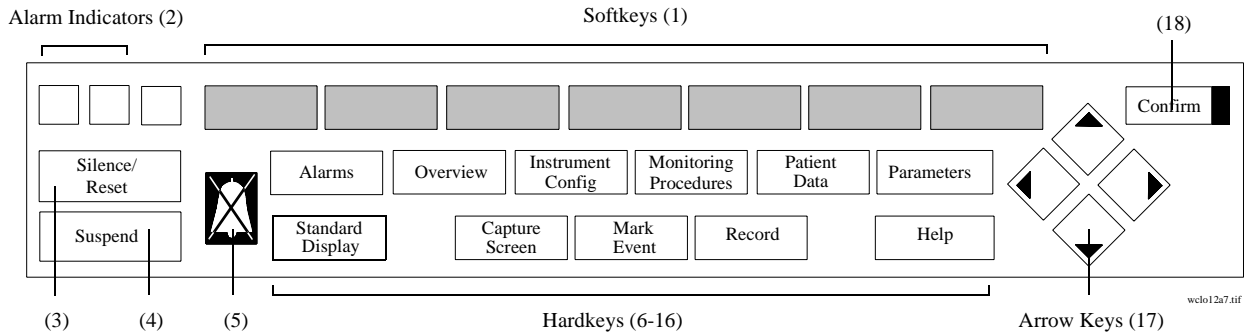


Table 1-3 Standard Control Panel Controls

Controls	Function
1 Softkey	Selection controls for the softkey labels displayed above them on the screen. Softkeys bring up Task Windows.
2 Alarm Indicators	Indicates the color of the alarm: RED and YELLOW.
3 <b>Silence/ Reset</b>	Used to silence an alarm and, if the cause has been eliminated, reset it.
4 <b>Suspend</b>	Used to switch all alarms on/off.
5 Alarms Off Indicator	Indicates that all alarms have been shut off.
6 <b>Alarms/Volume</b>	Used to turn all alarms off/on and individual alarms on/off, adjust alarm limits and volume, limits, show the alarm messages and go to standby mode.
7 <b>Other Patients</b>	Used to view data and alarms between beds.
8 <b>Monitor Setup</b>	Used to change settings such as screen displays and patient type, setup OxyCRG (Standard CMS only) and recording and make general configuration changes.
9 <b>Procedures</b>	Used to perform Cardiac Output and Wedge Pressure measurements, make ST segment monitoring adjustments, review ST wave segments, admit and discharge patients, or end particular patient case and transfer patient data.
10 <b>Trends Calc</b>	Used to view data in graphs and tables, do physiological calculations in graphs, print reports and mark events to view in graphs.
11 <b>Module Setup</b>	Used to set up and change settings for all modules that are plugged into the CMS.
12 <b>Main Screen</b>	Used to return the standard monitoring screen.
13 <b>Change Screen</b>	Used to freeze waves on the screen and change between screen layouts.
14 <b>Realtime Record</b>	Used to start a realtime preset recording or a realtime selected recording.
15 <b>Delayed Record</b>	Used to start a delayed recording.
16 <b>Airway Gases Ventilation</b>	Used to measure airway gases or show ventilator data.
17 Arrow Keys	Used to move highlighting and make selections in the Task Windows - only active when lit.
18 <b>Confirm</b>	Used to confirm that the user input is correct - only active when lit.

## Main Display Module



**Table 1-4 Classic Control Panel Controls**

	Controls	Function
1	Softkey	Selection controls for the softkey labels displayed above them on the screen. Softkeys bring up Task Windows.
2	Alarm Indicators	Indicates the color of the alarm: RED and YELLOW.
3	<b>Silence/ Reset</b>	Used to silence an alarm and, if the cause has been eliminated, reset it.
4	<b>Suspend</b>	used to switch all alarms on/off.
5	Alarms Off Indicator	Indicates that all alarms have been shut off.
6	<b>Alarms</b>	Used to turn all alarms off/on and individual alarms on/off, adjust alarm limits, show the alarm messages and go to standby mode.
7	<b>Overview</b>	Used to view data and alarms between beds.
8	<b>Instrument Config</b>	Used to setup OxyCRG and recording, change between main screens and combinations of OxyCRG or Split Screen Trending, or to make general configuration changes.
9	<b>Monitoring Procedures</b>	Used to perform Cardiac Output and Wedge Pressure measurements, review ST wave segments, admit and discharge patients, or transfer patient data.
10	<b>Patient Data</b>	Used to view data in graphs and tables, do physiological calculations in graphs and print reports.
11	<b>Parameters</b>	Used to setup and change settings for all modules that are plugged into the CMS.
12	<b>Standard Display</b>	Used to return to the standard monitoring screen.
13	<b>Capture Screen</b>	Used to freeze the screen.
14	<b>Mark Event</b>	Used to display softkeys to mark events you can view in graphs and softkeys for cal signals.
15	<b>Record</b>	Used to display softkeys to make delayed recordings or realtime recordings.
16	<b>Help</b>	Used to provide information about tasks. NOTE: HELP below softkey label on screen points to item you will get help for.
17	Arrow Keys	Used to move highlighting and make selections in the Task Windows - only active when lit.
18	<b>Confirm</b>	Used to confirm that the user input is correct - only active when lit.

Rear Panel Controls and Connectors

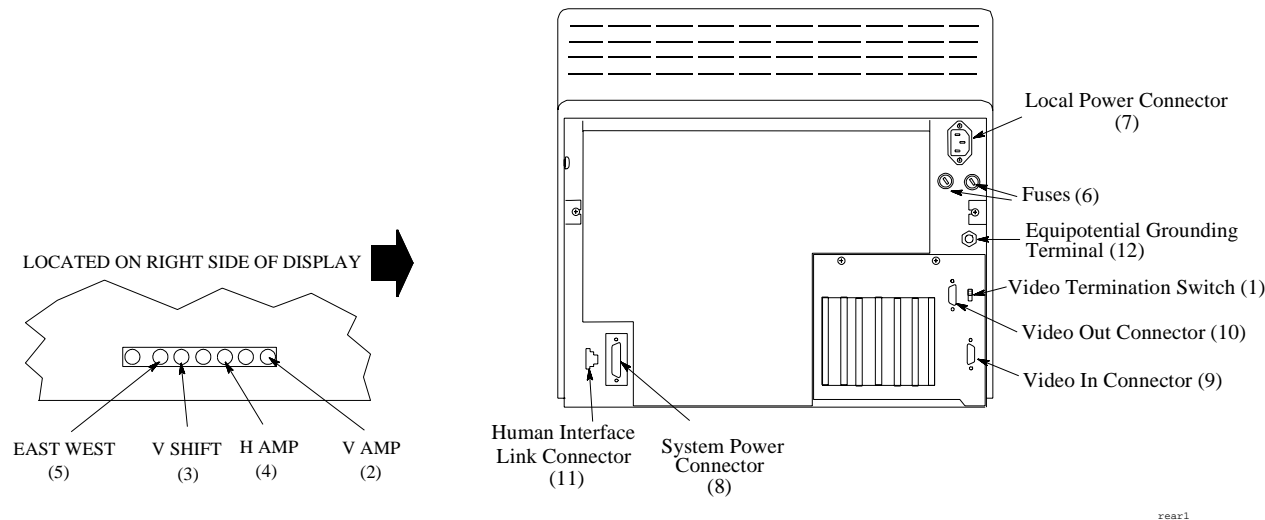


Figure 1-5 Rear Panel of the M1094B Display Module

Table 1-5 Main CRT Display Rear Panel Control and Connectors

Controls and Connectors	Function
1 Video Termination Switch	Used to terminate the video signal at this display. This must be switched to the <b>75Ω</b> position if only a main display is used. When a remote display is connected, the video termination switch on the main display must be switched to <b>High Imp.</b>
2 V AMP	Vertical amplitude control, used to adjust the height of the displayed video.
3 V SHIFT	Vertical shift control, used to adjust the vertical position of the displayed video.
4 H AMP	Horizontal amplitude control, used to adjust the width of the displayed video.
5 EAST WEST	Used to adjust the pin-cushion effect of the displayed video.
6 Fuse Holders	Two fuse holders for the line protection fuses, one for the higher operating voltage range and one for the lower operating voltage range.
7 Local Power Connector	3-pin connector, used to input the local line voltage.
8 System Power Connector	15-pin "D" type connector, used to output the 60V dc supply to a similar connector on the DC/DC converter in the rear of the Computer Module.
9 Video In Connector	9-pin "D" type connector, used to input the video signal to be displayed from the display controller in the Computer Module (DSPC for monochrome or CDSPC-Video for color).
10 Video Out Connector	9-pin "D" type connector, used to output the video signal to be displayed on a slave display.

Main Display Module

Table 1-5 Main CRT Display Rear Panel Control and Connectors

Controls and Connectors	Function
11 Human Interface Link Connector	Human Interface Link (HIL) connector, used to output the information from the Control Panel and the Handheld Keypad to the Utility CPU function card in the Computer Module.
12 Equipotential Grounding Terminal	Grounding stud connector, used to connect the Display Module to an equipotential grounding system, if required. The overall system is normally grounded at the grounding terminal on the Computer Module.

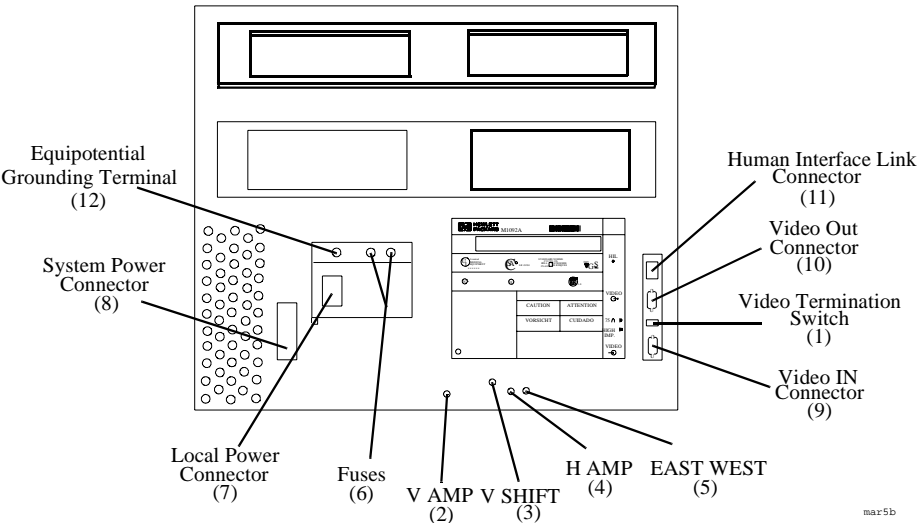


Figure 1-6 Rear Panel of the M1092A & M1094A Main Display Modules

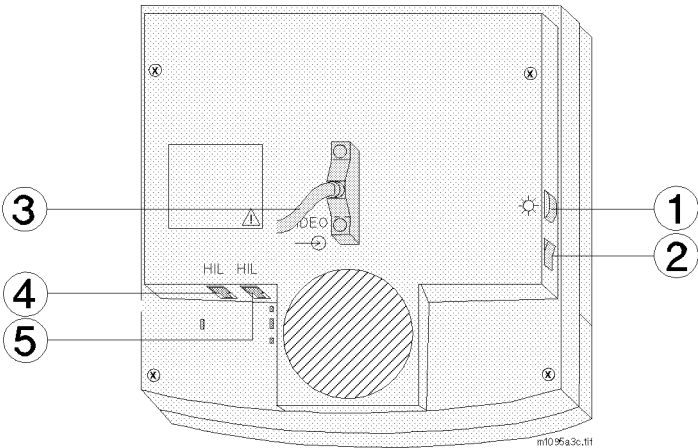


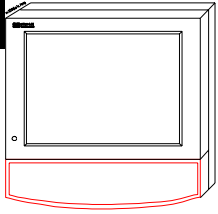
Figure 1-7 Rear Panel of the M1095A Main Display Module

# Slave Display Module

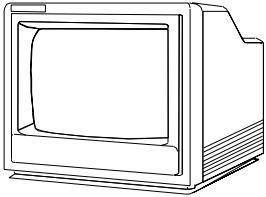
Table 1-6 Flatscreen Rear Panel Controls and Connectors

Controls and Connectors		Function
1	Brightness Control	Adjusts the brightness of the display.
2	ON/OFF Switch	Used to turn the display On/Off and used as the remote switch for either the M1047A Remote Power Supply or the M1046B Computer Module integral power supply.
3	Combined Video In / Power Connector	This is a male SCSI connector with 25 pin pairs used to input the video signal and the 60 V DC line voltage.
4	Human Interface Link Connector In	This Human Interface Link (HIL) connector is used to connect the handheld keypad.
5	Human Interface Link Connector Out	This Human Interface Link (HIL) connector is used to output the information from the handheld keypad and control panel to the Utility CPU function card in the computer module.

## Slave Display Module



Independent  
Flatscreen Display  
without Control Panel



Independent / Slave  
CRT Display  
without Control Panel

The CMS supports additional displays as either CRT Slave or Flatscreen and CRT Independent Display Modules. CRT Slave Displays connect directly to any CRT and display the same information as the CRT they are connected to. Independent Displays have their own display controller in the Computer Module and may display different information than the Main Display under software control. Slave and Independent Displays are intended as a visual reference and do not have a Control Panel. The information on the 21" slave display can be found in its accompanying manual. See also the Appendix, "Remote 21" Displays".

### 14" Slave Display Front Panel Controls

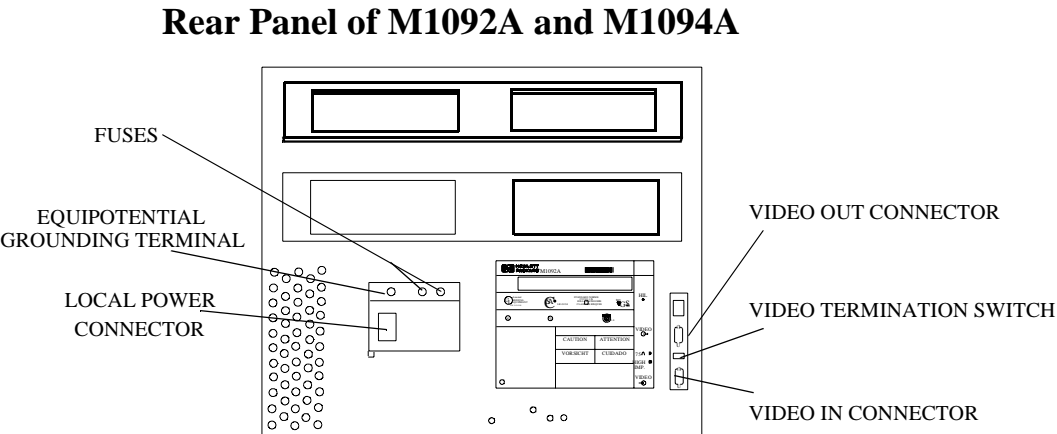
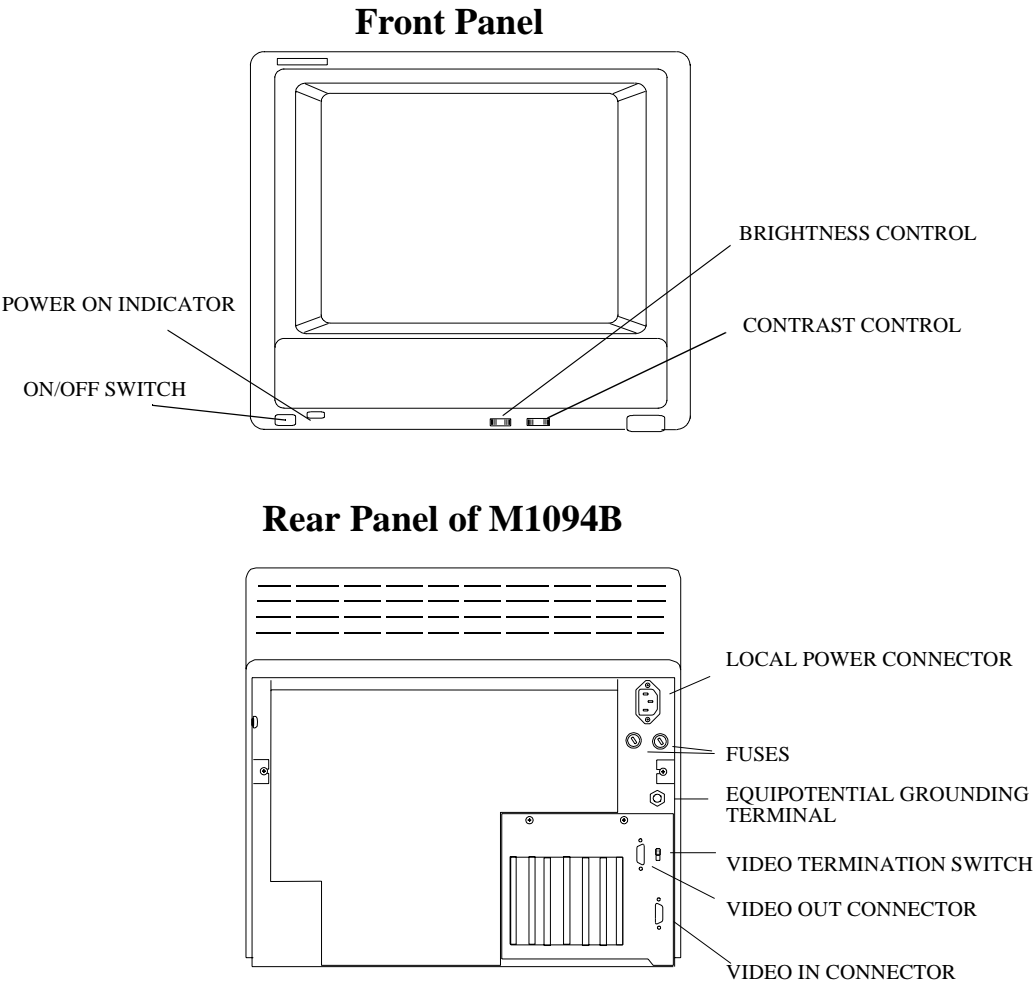
**Table 1-7 Slave Display Front Panel Controls**

Controls	Function
ON/OFF Switch	Push button switch, used to turn the slave display ON and OFF. This must be pushed in for power ON.
Power ON indicator	Green LED which is lit when the display is switched ON.
Brightness Control	Rotary control, used to vary the brightness of the display.
Contrast Control	Rotary control, used to vary the contrast of the display.

### 14" Slave Display Rear Panel Controls and Connectors

**Table 1-8 Slave Display Rear Panel Controls and Connectors**

Controls and Connectors	Function
Video Termination Switch	Push button switch, used to terminate the video signal at this display. This switch must be ON (in) or <b>75Ω</b> if the slave display is the last in the chain. Otherwise the switch must be OFF (out) or <b>High Imp.</b>
Fuse Holders	Holders for the line protection fuses.
Local Power Connector	3-pin connector, used to input the local line voltage.
Video In Connector	Male 9-pin "D" type connector, used to input the video signal to be displayed from the main Display Module.
Video Out Connector	9-pin "D" type connector, used to output the video signal to be displayed on another Slave Display Module.
Equipotential Grounding Terminal	Grounding stud connector, used to connect the system to an equipotential grounding system.

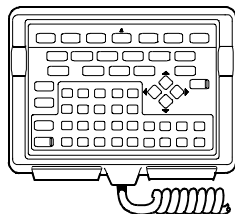


mar 5b

Figure 1-8 Slave Display Controls and Connectors

## Handheld Keypad

## Handheld Keypad



Handheld Keypad

The Handheld Keypad of the CMS is an external device used for inputting patient information and working with the drug calculator that is a part of the monitor. There are three released versions of the Handheld Keypad. The first release (M1106A) is called the Classic Handheld Keypad. The second release (M1106B) added the SUSPEND hardkey to the Classic Handheld Keypad. The current release (M1106C) is called the Standard Handheld Keypad and it contains the same number of keys as the M1106B but improves on the hardkey key labels and functionality to make them more user-friendly.

**Note:** Only the Standard Handheld Keypad (M1106C) is supported with Release B.0. The Classic Handheld Keypad (M1106A or M1106B) is not supported for use with Release B.0.

### Objective

In order to meet this section's goals, you should be able to:

- Identify the controls and connectors of the Handheld Keypad.
- Be familiar with the function of the controls and connectors of the Handheld Keypad.

### Concepts

The Handheld Keypad provides remote access to all monitoring tasks. There are 55 domed buttons on the membrane keyboard which provides a fluid seal to make cleaning easier. A coiled cable is used to connect the keypad to the master or main display, or to the External Alarm Device.

<b>Membrane Keypad</b>	The plastic bezel on the front of the Handheld Keypad that contains the controls and connectors, including the Control Panel and alphanumeric keypad.
<b>Standard Control Panel</b>	The hardkeys, softkeys and alarm indicators of the Standard user interface (Release E or later).
<b>Classic Control Panel</b>	The hardkeys, softkeys and alarm indicators of the Classic user interface. Available with and without the SUSPEND key (see Parts List).
<b>HIL Connector</b>	Human Interface Link (HIL) Connector is used to connect the Handheld Keypad to the Main Display, or to the External Alarm Device. Information is transferred to the system using Philips HIL protocol.
<b>Alphanumeric Keys</b>	These are single-press keys used to input patient information and drug calculations into the monitor.



Handheld Keypad Membrane Keyboard

All of the softkeys and hardkeys on the Display Module are also found on the Handheld Keypad. See Table 1-3 and Table 1-4 and for descriptions of these keys. In addition, the Philips Handheld Keypad has keys for alphanumeric data entry.

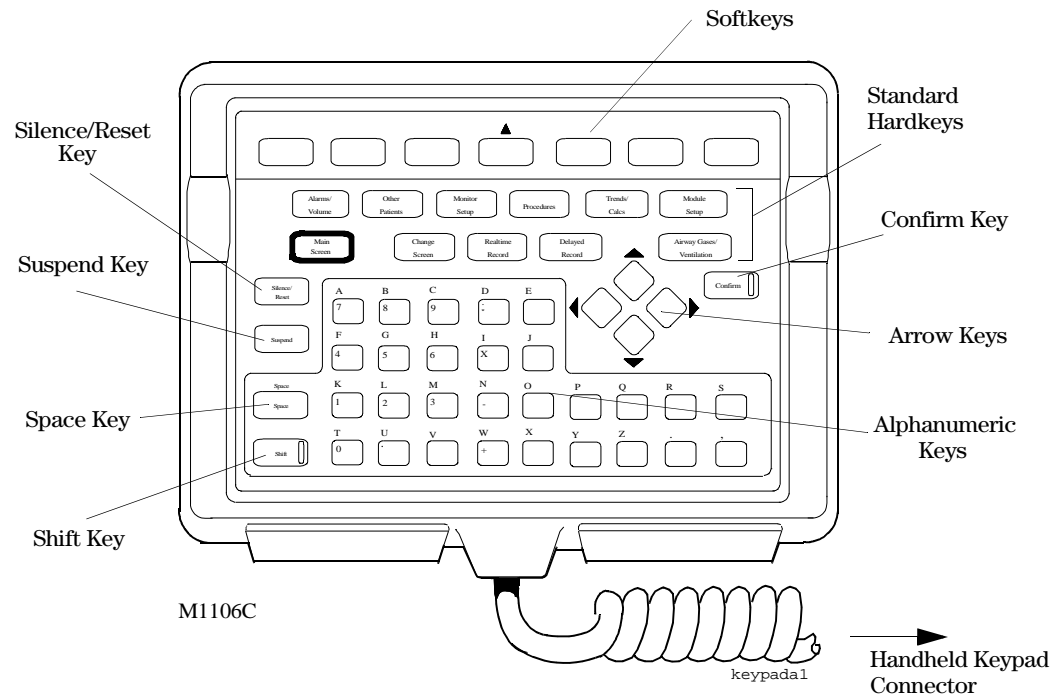


Figure 1-9 Handheld Keypad Controls and Connector

Table 1-9 Handheld Keypad Standard Control Panel

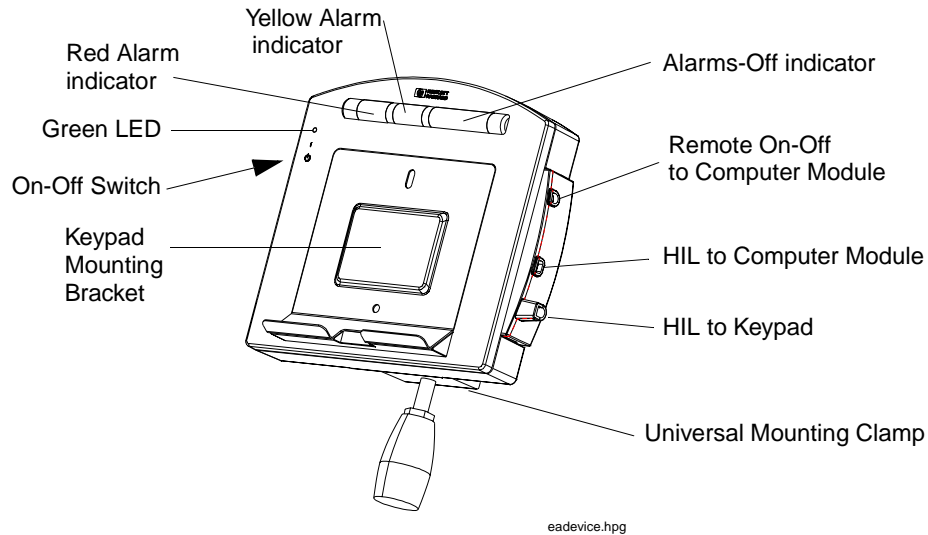
Standard Control Panel	Function
<b>Space</b>	Used to enter spaces between numbers or letters
<b>Shift</b>	Used to switch between alpha and numeric mode. The LED is lit when keypad is in alpha mode.
Alphabet Characters (A - Z)	These characters can be entered only in alpha mode (when the LED on the Shift key is lit).
Punctuation Marks ( , . )	The punctuation marks can be entered only in numeric mode (when LED on Shift key is not lit).
Numeric Characters (0 - 9)	These characters can be entered only in numeric mode (when LED on Shift key is not lit).
Arithmetic Operators ( + - * / )	These characters can be entered only in numeric mode (when LED on Shift key is not lit).
Decimal Point ( . )	The decimal point can be entered only in numeric mode (when LED on Shift key is not lit).
Handheld Keypad Connector (Philips-HIL)	This connector fits into the Philips-HIL connector on the lower right corner of the Display Module.

## Handheld Keypad

### Handheld Keypad Rear Cover

The rear cover of the Handheld Keypad contains a magnet to secure it to the keypad mounting bracket or to the External Alarm Device.

### External Alarm Device M1109A



The External Alarm Device, for use with off-the-shelf XGA displays, provides visual and audible alarm indicators. It has a bracket to hold the Handheld Keypad. It also provides an on/off switch to remotely control the M1046B CMS Computer Module.

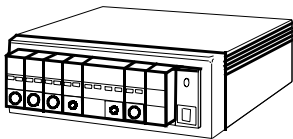
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#### CAUTION

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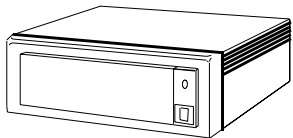
**Always locate this device in such a way that the speaker at the rear and the lights on the front are not blocked.**

# Computer Module



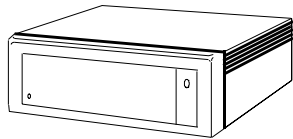
Computer Module (M1046A)  
with integral rack

The Computer Module of the CMS contains the hardware and software for the processing functions of the monitor. It can be thought of as the heart of the system. It distributes all the power, clocks and data for the whole system. There are several released configurations for the function cards of the Computer Module. Your configuration will depend on the version of software and hardware your monitor is running and the options it is supporting. All of the function cards connect to the Computer Module backplane, whether from the front or from the rear of the unit. Function cards that require external connections are located in the rear of the Computer Module.



Computer Module (M1046A)  
with integral blank rack

- Objective
- In order to meet this section’s goals, you should be able to:
- Identify the connectors of the Computer Module
  - Be familiar with the functions of the Computer Module.



Computer Module (M1046B)  
with integral power supply

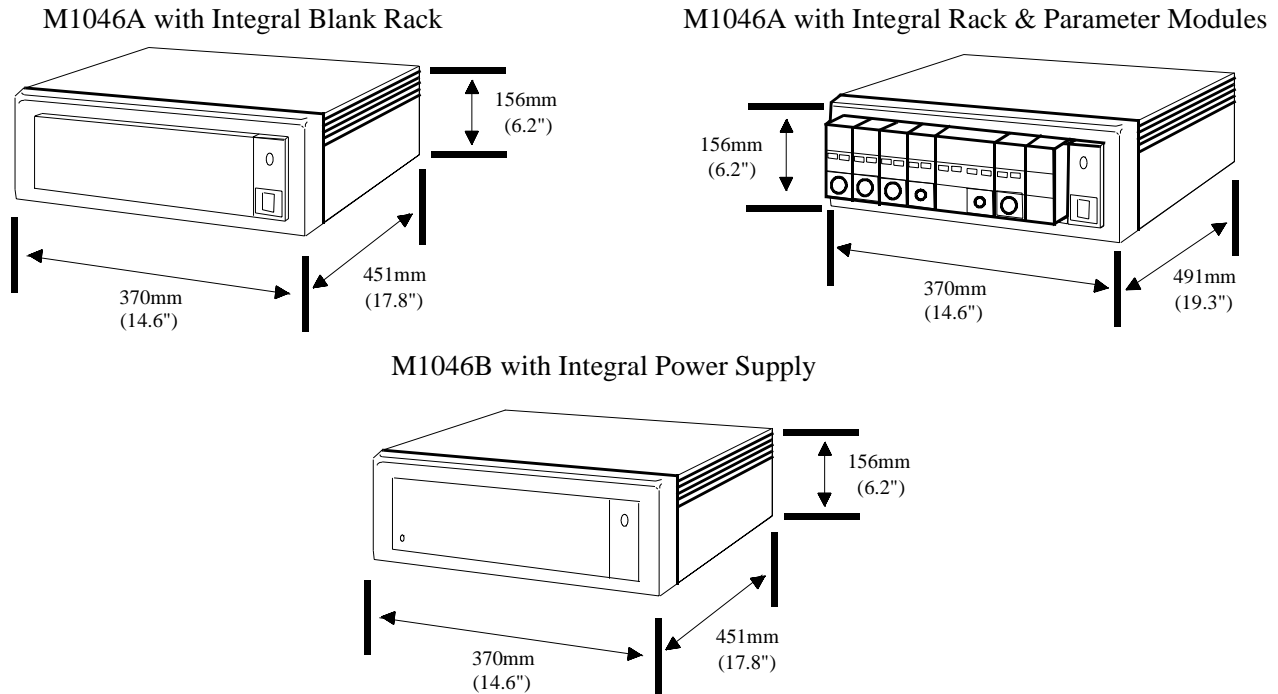
- Concepts
- The Computer Module of CMS is not fitted with any controls, just connectors. The front of the M1046A Computer Module can be mounted with an integral plug-in module rack or a blank rack. Each rack contains an internal rack connector used to output information from the rack to the Rack Interface function card placed in slot 18 of the computer module. All of the other connections for the Computer Module are in the rear and will depend on the options and revision of your monitor.

<b>Integral Plug-in Module Rack</b>	The integral plug-in module rack fits in the front of the Computer Module (M1046A) and holds plug-in modules. It contains a rear connector that is used to output information from the rack to the Computer Module.
<b>Blank Rack</b>	The blank rack is used to cover the front of the Computer Module (M1046A) when a satellite plug-in module rack is being used. It contains a rear connector that is used to output information from the rack to the Computer Module.
<b>Integral Power Supply</b>	The integral power supply is used to power the Computer Module (M1046B), a satellite plug-in module rack, and a flatscreen main display without the need for a Remote Power Supply. It connects to the REMOTE_SWITCH card in the Computer Module to allow the flatscreen display to control the Computer Module power.
<b>Backplane</b>	The backplane of the Computer Module contains the connections for the front and rear function cards.

## Computer Module

### CPC Flash Port

This port is located on the Configurable Processor Card (CPC) in slot 12 and is the connector for the CPC Programming Tool.



**Figure 1-10 Computer Module Dimensions**

## Brief Functional Overview

The Philips CMS Patient Monitoring System is a loosely coupled multi-processor system containing several CPU cards. They can communicate with each other but do not have access to each other's memory. They can only exchange information in the form of messages.

The backplane can be functionally sectioned into three logical parts or buses, the Message Passing Bus, the Local Bus and the Utility Bus.

### Message Passing Bus

This is the global communication bus for the system, and is used for communications between CPU cards as well as to intelligent interface cards (for example, RS232 Interface and the display controllers). This bus appears on all the connectors.

### Local Bus

This is the local communication system. It is a buffered processor bus that allows access to local memory cards, SRAM and EPROM that contain software for the exclusive use of the master processor.

The local bus appears on all the connectors on the backplane but is interrupted to connect groups of connectors into local clusters.

<b>Utility Bus</b>	This includes functions required by the whole system; for example, power and clock signal distribution. This bus appears on all the connectors.
<b>Local Clusters</b>	The local bus is connected to all the connectors in the backplane but it is interrupted to form clusters that share a connection to the same local bus. There are 10 local clusters in the backplane with varying numbers of connectors.

### Delivered Configurations

The versions and models described by this guide are listed as follows (models indicated by asterisk were discontinued. “(S)” indicates a non-US-model):

CMS: M1165A/66A/67A	Models 54(S)*, 56(S), 64(S), 66(S) and 68(S)
CMS: M1175A/76A/77A	Models 54*, 56, 66 and 68
ACMS: M1165A/66A/67A	Models 74(S)*, 76(S), 84(S), 86(S) and 88(S)
ACMS: M1175A/76A/77A	Models 74*, 76, 86 and 88
NCMS: M1165A/66A/67A	Models 34(S)*, 36(S)*, 44(S), 46(S)* and 48(S)
NCMS: M1175A/76A/77A	Models 34*, 36*, 46* and 48

The CMS products M1167A and M1177A use the Computer Module (M1046B).

There are three types of Application CPU Cards used in the Systems: M1054 (10 MHz) and M1051 (15 MHz) and M1053 (40 MHz CPC Card).

Function Card placement in the Backplane is dependent upon the variant of the System and the type of Application CPU Cards. Card placements for all variants of the CMS are illustrated in Table 1-10 Function Card Placement on page 1-23

### Function Cards of the Computer Module

The function cards are interconnected by the backplane within the Computer Module; refer to the *Concepts Guide* for a full functional description of the backplane and its theory of operation. The function cards are mounted on both sides of the backplane and may be located either in the front of the Computer Module (even-numbered connectors) or the rear (odd-numbered connectors). The local clusters of the backplane are color-coded on the Computer Module, so that they can be easily identified. On the rear of the backplane, to the left of connector 21, there is a triple-sized gap. This is the only place where the dc-dc converter can be located.

The newer Computer Module (M1046B) has an integral power supply. As a result these Computer Modules have additional function cards. These additional cards are described in Table 1-10 Function Card Placement on page 1-23.

## Function Card Placement

Function Card Placement in the backplane of the Philips monitor is dependent upon the following (“(S)” indicates the non-US-models):

1. The monitor model:

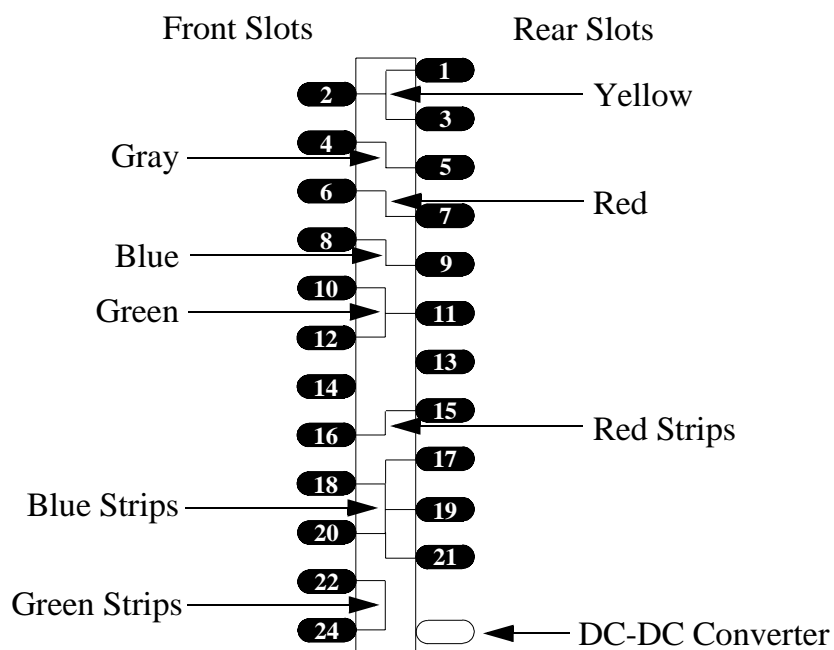
- **CMS:** Models 54 (S), 56 (S), 64 (S), 66 (S), 68 (S)
- **ACMS:** Models 74 (S), 76 (S), 84 (S), 86 (S), 88 (S)
- **NCMS:** Models 36 (S), 44 (S), 46 (S), 48 (S)

2. Type of processor cards used:

- 10 MHz CPU cards M1054-66501
- 15 MHz CPU cards M1051-66501
- 40 MHz CPC card M1053-66515

3. Type and combination of display controllers used:

- M1066-66501 DSPC (Monochrome)
- M1066-66531 DSPC (Monochrome)
- M1066-66543 DSPC (Monochrome with integrated DSPC-lang)
- M1072-66521 CDSPC-CTRL (Color) together with M1072-66501 CDSPC-VIDEO
- M1072-66531 CDSPC (Color)
- M1072-66543 (Color with integrated DSPC-lang)
- M1074-66501 DSPC-FLAT (Flatscreen color)
- M1074-66502 DSPC-FLAT (Flatscreen color)
- M1074-66503 DSPC-FLAT (Flatscreen Color with integrated DSPC-lang)
- M1075-66503 XGA DSPC (XGA with integrated DSPC-lang)



Use the following tables to determine the location of the function cards for your system.

**Table 1-10 Function Card Placement**

Software Release A	
Using 10MHz Application CPUs	Using 15MHz Application CPUs
<p><b>FRONT</b></p> <p>BLANK or CDSPC_CTRL 2</p> <p>EPROM MASTER 4</p> <p>CDSPC_CTRL #2 6</p> <p>APP_CPU 8</p> <p>SRAM 10</p> <p>EPROM SLAVE 12</p> <p>APP_CPU (Model 68 only) 14</p> <p>16</p> <p>RACK_IF 18</p> <p>20</p> <p>APP_CPU 22</p> <p>24</p>	<p><b>REAR</b></p> <p>DSPC or CDSPC_VIDEO 1</p> <p>3</p> <p>APP_CPU 5</p> <p>DSPC #2 or CDSPC_VID #2 7</p> <p>HDLC_IF (if present) 9</p> <p>APP_CPU 11</p> <p>RS232_IF (if present) 13</p> <p>15</p> <p>UTIL_CPU 17</p> <p>SDN_IF (if present) 19</p> <p>21</p> <p>DC/DC CONVERTER</p>

## Computer Module

Table 1-10 Function Card Placement

Software Release B	
Using 10MHz Application CPUs	Using 15MHz Application CPUs
<p><b>FRONT</b></p> <p>BLANK or CDSPC_CTRL 2</p> <p>EPROM MASTER 4</p> <p>CDSPC_CTRL #2 6</p> <p>APP_CPU 8</p> <p>SRAM 10</p> <p>EPROM SLAVE 12</p> <p>APP_CPU (Model 56 with #C10, 66 with #C10, or 68) 14</p> <p>RACK_IF 18</p> <p>APP_CPU 22</p> <p>24</p> <p><b>REAR</b></p> <p>1 DSPC or CDSPC_VIDEO</p> <p>3 DSPC_KANJI (if present)</p> <p>5 APP_CPU</p> <p>7 DSPC #2 or CDSPC_VID #2</p> <p>9 HDLC_IF (If present)</p> <p>11 APP_CPU</p> <p>13 RS232_IF (if present)</p> <p>15 ANALOG_IF (if present)</p> <p>17 UTIL_CPU</p> <p>19 SDN_IF (if present)</p> <p>21</p> <p>DC/DC CONVERTER</p>	<p><b>FRONT</b></p> <p>BLANK or CDSPC_CTRL 2</p> <p>EPROM MASTER 4</p> <p>CDSPC_CTRL #2 6</p> <p>APP_CPU (Model 68 only) 8</p> <p>SRAM 10</p> <p>EPROM SLAVE 12</p> <p>14</p> <p>RACK_IF 18</p> <p>APP_CPU 22</p> <p>24</p> <p><b>REAR</b></p> <p>1 DSPC or CDSPC_VIDEO</p> <p>3 DSPC_KANJI (if present)</p> <p>5 APP_CPU</p> <p>7 DSPC #2 or CDSPC_VID #2</p> <p>9 HDLC_IF (if present)</p> <p>11 APP_CPU</p> <p>13 RS232_IF (if present)</p> <p>15 ANALOG_IF (if present)</p> <p>17 UTIL_CPU</p> <p>19 SDN_IF (if present)</p> <p>21</p> <p>DC/DC CONVERTER</p> <p>Rel_b.mif</p>
Software Release C (15 MHz APP_CPUs)	
Models 54(S)/64(S) and Models 56(S)/66(S) without #C26	Models 56(S)/66(S) with #C26 and Model 68(S)
<p><b>FRONT</b></p> <p>BLANK or CDSPC_CTRL #1 2</p> <p>EPROM MASTER 4</p> <p>CDSPC_CTRL #2 6</p> <p>15 MHz APP_CPU 8</p> <p>SRAM 10</p> <p>EPROM SLAVE 12</p> <p>14</p> <p>16</p> <p>RACK_IF 18</p> <p>APP_CPU 22</p> <p>24</p> <p><b>REAR</b></p> <p>1 DSPC #1 or CDSPC_VID #1</p> <p>3 DSPC_LANG (KANJI, TAI or PRC)</p> <p>5 15 MHz APP_CPU</p> <p>7 DSPC #2 or CDSPC_VID #2</p> <p>9 HDLC_IF</p> <p>11 15 MHz APP_CPU</p> <p>13 RS232_IF</p> <p>15 ANALOG_IF</p> <p>17 UTIL_CPU</p> <p>19 SDN_IF</p> <p>21</p> <p>DC/DC CONVERTER</p>	<p><b>FRONT</b></p> <p>BLANK or CDSPC_CTRL #1 2</p> <p>EPROM MASTER 4</p> <p>CDSPC_CTRL #2 6</p> <p>15 MHz APP_CPU 8</p> <p>SRAM 10</p> <p>EPROM SLAVE 12</p> <p>14</p> <p>16</p> <p>RACK_IF 18</p> <p>15 MHz APP_CPU 22</p> <p>24</p> <p><b>REAR</b></p> <p>1 DSPC #1 or CDSPC_VID #1</p> <p>3 DSPC_LANG (KANJI, TAI or PRC)</p> <p>5 15 MHz APP_CPU</p> <p>7 DSPC #2 or CDSPC_VID #2</p> <p>9 RS232_IF #1</p> <p>11 15 MHz APP_CPU</p> <p>13 RS232_IF #2 or DSPC #3 (only 68(S))</p> <p>15 ANALOG_IF</p> <p>17 UTIL_CPU</p> <p>19 SDN_IF</p> <p>21 HDLC_IF</p> <p>DC/DC CONVERTER</p>



**Table 1-10 Function Card Placement**

Upgrade Backplane to Release C (without CPC)																																																	
<p>The table below shows the slot locations and quantity of 10 MHz (M1054-66501) and 15 MHz (M1051-66501) APP_CPUs for those Philips CMS Patient Monitoring System that have been upgraded from software release A or B with 10 MHz CPU's exclusively, to software release C <i>without</i> CPC.</p> <p><b>APP_CPU Slot Location and Quantity</b></p> <table><tr><td>A54S/A66S</td><td>5<sup>1</sup>, 8, 11, 14, 22</td></tr><tr><td>A56S./A66S</td><td>5<sup>1</sup>, 8, 11, 14, 22</td></tr><tr><td>A56(S)/A66(S) (#C10)</td><td>5<sup>1</sup>, 8, 11, 14, 16<sup>2</sup>, 22</td></tr><tr><td>A56(S)/A66(S) (#C26)</td><td>5<sup>1</sup>, 8, 11, 14, 16<sup>1</sup>, 22</td></tr></table> <p>1 This is a 15 MHz CPU.</p> <p>2 The systems that have been upgraded from software release B to software release C with existing C10 will contain a 10 MHz processor in slot 16. If C10 is added to a Software Release C monitor, there will not be a 10 MHz processor in slot 16.</p>		A54S/A66S	5 <sup>1</sup> , 8, 11, 14, 22	A56S./A66S	5 <sup>1</sup> , 8, 11, 14, 22	A56(S)/A66(S) (#C10)	5 <sup>1</sup> , 8, 11, 14, 16 <sup>2</sup> , 22	A56(S)/A66(S) (#C26)	5 <sup>1</sup> , 8, 11, 14, 16 <sup>1</sup> , 22	<p><b>Rel. C+ to Rel. G 15 MHz APP_CPU Requirements</b></p> <table><tr><th>Model</th><th>Slot 22</th><th>Slot 4</th></tr><tr><td colspan="3">Standard CMS</td></tr><tr><td>A68(S)</td><td>Required</td><td>Extra card</td></tr><tr><td>A56(S)/A66(S)</td><td>Required<sup>a</sup></td><td>Extra card</td></tr><tr><td>A54(S)/A64(S)</td><td>Extra card</td><td>Extra card</td></tr><tr><td colspan="3">Anesthesia CMS (from Rel. E<sub>g</sub>)</td></tr><tr><td>A88(S)</td><td>Required</td><td>Required</td></tr><tr><td>A76(S)/A86(S) (#C25)</td><td>Required</td><td>Required</td></tr><tr><td>A76(S)/A86(S) without (#C25)</td><td>Extra card</td><td>Extra card</td></tr><tr><td>A74(S)/A84(S) (#C24)</td><td>Required</td><td>Extra card</td></tr><tr><td>A74(S)/A84(S) w/o (#C24)</td><td>Extra card</td><td>Extra card</td></tr><tr><td colspan="3">Neonatal CMS (from Rel. F)</td></tr><tr><td>A36(S)/A46(S)/A48(S)</td><td>Required</td><td>Extra card</td></tr></table> <p>a. Not required in certain earlier releases.</p>	Model	Slot 22	Slot 4	Standard CMS			A68(S)	Required	Extra card	A56(S)/A66(S)	Required <sup>a</sup>	Extra card	A54(S)/A64(S)	Extra card	Extra card	Anesthesia CMS (from Rel. E <sub>g</sub> )			A88(S)	Required	Required	A76(S)/A86(S) (#C25)	Required	Required	A76(S)/A86(S) without (#C25)	Extra card	Extra card	A74(S)/A84(S) (#C24)	Required	Extra card	A74(S)/A84(S) w/o (#C24)	Extra card	Extra card	Neonatal CMS (from Rel. F)			A36(S)/A46(S)/A48(S)	Required	Extra card
A54S/A66S	5 <sup>1</sup> , 8, 11, 14, 22																																																
A56S./A66S	5 <sup>1</sup> , 8, 11, 14, 22																																																
A56(S)/A66(S) (#C10)	5 <sup>1</sup> , 8, 11, 14, 16 <sup>2</sup> , 22																																																
A56(S)/A66(S) (#C26)	5 <sup>1</sup> , 8, 11, 14, 16 <sup>1</sup> , 22																																																
Model	Slot 22	Slot 4																																															
Standard CMS																																																	
A68(S)	Required	Extra card																																															
A56(S)/A66(S)	Required <sup>a</sup>	Extra card																																															
A54(S)/A64(S)	Extra card	Extra card																																															
Anesthesia CMS (from Rel. E <sub>g</sub> )																																																	
A88(S)	Required	Required																																															
A76(S)/A86(S) (#C25)	Required	Required																																															
A76(S)/A86(S) without (#C25)	Extra card	Extra card																																															
A74(S)/A84(S) (#C24)	Required	Extra card																																															
A74(S)/A84(S) w/o (#C24)	Extra card	Extra card																																															
Neonatal CMS (from Rel. F)																																																	
A36(S)/A46(S)/A48(S)	Required	Extra card																																															
Software Release C+ or D (40 MHz CPC)																																																	
<p>Models 54(S)/64(S) and Models 56(S)/66(S)</p> <p>FRONT</p> <p>BLANK or CDSPC_CTRL #1</p> <p>15 MHz APP_CPU *</p> <p>CDSPC_CTRL #2</p> <p>40 MHz CPC</p> <p>RACK_IF</p> <p>15 MHz APP_CPU *</p> <p>REAR</p> <p>DSPC #1 or CDSPC_VID #1</p> <p>DSPC_LANG (KANJI, TAI or PRC)</p> <p>DSPC #2 or CDSPC_VID #2</p> <p>RS232_IF</p> <p>ANALOG_IF</p> <p>UTIL_CPU</p> <p>SDN_IF</p> <p>HDLC_IF</p> <p>DC/DC CONVERTER</p>	<p>Models 56(S)/66(S) with #C26 and Model 68(S)</p> <p>FRONT</p> <p>BLANK or CDSPC_CTRL #1</p> <p>15 MHz APP_CPU *</p> <p>CDSPC_CTRL #2</p> <p>40 MHz CPC</p> <p>RACK_IF</p> <p>15MHz APP_CPU</p> <p>REAR</p> <p>DSPC #1 or CDSPC_VID #1</p> <p>DSPC_LANG (KANJI, TAI or PRC)</p> <p>DSPC #2 or CDSPC_VID #2</p> <p>RS232_IF #1</p> <p>RS232_IF #2 or DSPC #3 (only 68(S))</p> <p>ANALOG_IF</p> <p>UTIL_CPU</p> <p>SDN_IF</p> <p>HDLC_IF</p> <p>DC/DC CONVERTER</p> <p>* An extra CPU may be left in for future use.</p>																																																

## Computer Module

Table 1-10 Function Card Placement

Software Release E or E <sub>g</sub>		Software Release F	
<u>FRONT</u>	<u>REAR</u>	<u>FRONT</u>	<u>REAR</u>
BLANK or CDSPC_CTRL #1	2	* BLANK	2
15 MHz APP_CPU	4	15 MHz APP_CPU	4
CDSPC_CTRL #2	6	CDSPC_CTRL #2	6
	8		8
40 MHz CPC	10	40 MHz CPC	10
	12		12
	14		14
	16		16
RACK_IF	18	RACK_IF	18
	20		20
15 MHz APP_CPU	22	15 MHz APP_CPU	22
	24		24
	1 DSPC #1 or CDSPC_VIDEO #1		1 DSPC #1 or CDSPC #1 or DSPC_FLAT #1
	3 DSPC_LANG #1 (KANJI, TAI or PRC)		3 DSPC_LANG #1 (KANJI, TAI or PRC)
	5		5
	7 DSPC #2 or CDSPC_VIDEO #2		7 DSPC #2 or CDSPC #2 or DSPC_FLAT #2
	9 RS232_IF #1		9 RS232_IF #1
	11		11
	13 ANALOG_IF or DSPC #3 (only model 88)		13 ANALOG_IF or DSPC #3 or DSPC_FLAT #3 or CDSPC #3 (only model 88)
	15 RS232 IF #2		15 RS232 IF #2
	17 UTIL_CPU		17 UTIL_CPU
	19 SDN_IF		19 SDN_IF
	21 HDLC_IF		21 HDLC_IF
	25 DC/DC CONVERTER		25 DC/DC CONVERTER

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\* If upgraded (to F) may still have CDSPC\_CTRL #1.

Software Release G			
M1046A Computer Module		M1046B Computer Module	
FRONT	REAR	FRONT	REAR
\* BLANK	2	BLANK	2
15 MHz APP\_CPU	4	15 MHz APP\_CPU	4
CDSPC\_CTRL #2	6	CDSPC\_CTRL #2	6
	8	REMOTE\_SWITCH	8
	10		10
40 MHz CPC	12	40 MHz CPC	12
	14		14
	16		16
RACK\_IF	18	RACK\_IF	18
	20		20
15 MHz APP\_CPU	22	15 MHz APP\_CPU	22
	24	AUX\_CONNECTOR	24
	1 DSPC #1 or CDSPC #1 or DSPC\_FLAT #1		1 DSPC\_FLAT\_NON\_ASIA #1 or DSPC\_FLAT\_ASIA #1
	3 DSPC\_LANG #1 (KANJI, TAI or PRC)		3
	5		5
	7 DSPC #2 or CDSPC #2 or DSPC\_FLAT #2		7 DSPC #2 or CDSPC #2 or DSPC\_FLAT #2
	9 RS232\_IF #1		9 RS232\_IF #1
	11		11
	13 ANALOG\_IF or DSPC #3 or DSPC\_FLAT #3 or CDSPC #3 (only model 88)		13 ANALOG\_IF or DSPC #3 or DSPC\_FLAT #3 or CDSPC #3 (only model 88)
	15 RS232 IF #2		15 RS232 IF #2
	17 UTIL\_CPU		17 UTIL\_CPU
	19 SDN\_IF		19 SDN\_IF
	21 HDLC\_IF		21 HDLC\_IF
	25 DC/DC CONVERTER		25 DC/DC CONVERTER

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\* If upgraded (to G) may still have CDSPC\_CTRL #1.

Table 1-10 Function Card Placement

Software Releases A.0 to C.0	
<p><b>M1046A Computer Module</b> Systems with M1066-66531 or M1066-66543** (DSPC) or M1072-66531 or M1072-66543** (CDSPC) or M1074-66501 (DSPC_FLAT) or M1074-66502 (DSPC_FLAT)**</p> <p><u>FRONT</u>                      <u>REAR</u></p> <p>*For future use – if upgraded      ** with these controllers no DSPC_LANG is required</p>	<p><b>M1046B Computer Module</b> Systems with M1074-66501(DSPC_FLAT) or M1074-66502 (DSPC_FLAT)</p> <p><u>FRONT</u>                      <u>REAR</u></p> <p>*For future use – if upgraded</p>
<p><b>M1046A Computer Module</b> Systems with M1066-66501 (DSPC) or M1072-66521 (CDSPC_CTRL) + M1072-66501 (CDSPC_VIDEO)</p> <p><u>FRONT</u>                      <u>REAR</u></p> <p>* For future use – if upgraded.</p>	<p><b>M1046B Computer Module</b> Systems with M1075-66503 (XGA_DSPC) or M1074-66503 (DSPC_FLAT)</p> <p><u>FRONT</u>                      <u>REAR</u></p> <p>* For future use – if upgraded.</p>

## Computer Module

## EEPROM Numbers

The part numbers listed in the table below are for cross-reference purposes only. Order a blank EEPROM (1818-4869) and reprogram it using the relevant upgrade programming tool.

**Table 1-11 CMS EEPROM/CPU Matrix (M1059-85xxx)  
Releases A to G**

CMS Model XX	10MHz Monitors			15 MHz Monitors			40 MHz CPC Monitors					
	Rel A	Rel B	Rel C	Rel A	Rel B	Rel C	Rel C	Rel D	Rel E	Rel E $\beta$	Rel F	Rel G
A54(S)/A64(S)	'231	'251	'301	'241	'261	'341	'441	'541	'641	'741	'841	'943
A54(S)/A64(S) (C02)	'234	'254	'301	'244	'264	'341	'441	'541	'641	'741	'841	'943
A54(S)/A64(S) (C03)	'237	'257	-	'247	'267	-	-	-	-	-	-	-
A54(S)/A64(S) (C05)	-	-	'303	-	-	'343	'443	'543	'643	'743	'843	'943
A54(S)/A64(S) (C10)	-	'271	'304	-	'281	'344	'444	'544	'644	'744	'844	'949
A54(S)/A64(S) (C02,C10)	-	'274	'304	-	'284	'344	'444	'544	'644	'744	'844	'949
A54(S)/A64(S) (C03,C10)	-	'277	-	-	'287	-	-	-	-	-	-	-
A54(S)/A64(S) (C05,C10)	-	-	'309	-	-	'349	'449	'549	'649	'749	'849	'949
A56(S)/A66(S)	'232	'255	'321	'242	'265	'361	'461	'561	'661	'761	'861	'963
A56(S)/A66(S) (C02)	'235	'255	'321	'245	'265	'361	'461	'561	'661	'761	'861	'963
A56(S)/A66(S) (C03)	'238	'258	'322	'248	'268	'362	'462	'562	'662	'762	'862	'966
A56(S)/A66(S) (C05)	-	-	'323	-	-	'363	'463	'563	'663	'763	'863	'963
A56(S)/A66(S) (C10)	-	'275	'324	-	'285	'364	'464	'564	'664	'764	'864	'969
A56(S)/A66(S) (C26)	-	-	'325	-	-	'365	'465	'565	-	-	-	-
A56(S)/A66(S) (C03,C05)	-	-	'326	-	-	'366	'466	'566	'666	'766	'866	'966
A56(S)/A66(S) (C03,C10)	-	'278	'327	-	'288	'367	'467	'567	'667	'767	'867	'971
A56(S)/A66(S) (C03,C26)	-	-	'328	-	-	'368	'468	'568	-	-	-	-
A56(S)/A66(S) (C05,C10)	-	-	'329	-	-	'369	'469	'569	'669	'769	'869	'969
A56(S)/A66(S) (C10,C26)	-	-	'330	-	-	'370	'470	'570	-	-	-	-
A56(S)/A66(S) (C03,C05,C10)	-	-	'331	-	-	'371	'471	'571	'671	'771	'871	'971
A56(S)/A66(S) (C03,C10,C26)	-	-	'332	-	-	'372	'472	'572	-	-	-	-
A68(S)	'233	'256	-	'243	'266	'381	'481	'581	'681	'781	'881	'981
A68(S) (C02)	'236	'256	-	'246	'266	'381	'481	'581	'681	'781	'881	'981
A68(S) (C03)	'239	'259	-	'249	'269	'382	'482	'582	'681	'781	'881	'981
A68(S) (C10)	-	'276	-	-	'286	'384	'484	'584	'681	'781	'881	'981
A68(S) (C03,C10)	-	'279	-	-	'289	'387	'487	'587	'681	'781	'881	'981

**Table 1-12 CMS EEPROM/CPU Matrix (M1059-xxxxx)  
Releases A.0 to C.0**

System Model	Options	Rel. A.0	Rel. B.0	Rel. C.0	Rel. C.1
64/64S	Standard	-80040	-80140	-80242	-80342
	C04	-80041	-80141	-80243	-80343
	C12	—	-80142	-80242	-80342
	C04, C12	—	-80143	-80243	-80343
	C80	-80042	-80140	-80242	-80342
	C04, C80	-80043	-80141	-80243	-80343
56/56S and 66/66S (Rel.B.0 and C.0)	Standard	-80060	-80160	-80262	-80362
	C04	-80061	-80161	-80263	-80363
	C12	—	-80162	-80262	-80362
	C04, C12	—	-80163	-80263	-80363
	C80	-80062	-80160	-80262	-80362
	C04, C80	-80063	-80161	-80263	-80363
	J26	-80070	-80170	-80272	-80372
	J26, C04	-80071	-80171	-80273	-80373
	J26, C32	—	—	-80274	-80374
	J26, C04, C32	—	—	-80275	-80375
	J26, C12	—	-80172	-80272	-80372
	J26, C04, C12	—	-80173	-80273	-80373
	J26, C80	-80072	-80170	-80272	-80372
	J26, C04, C80	-80073	-80171	-80273	-80373
68/68S	Standard	-80080	-80180	-80282	-80382
	C04	-80081	-80101	-80283	-80383
	C12	—	-80182	-80282	-80382
	C80	—	—	-80282	-80382
	C04, C80	-80083	-80101	-80283	-80383
	J28	-80090	-80190	-80292	-80392
	J28, C04	-80091	-80111	-80293	-80393
	J28, C32	—	—	-80294	-80394
	J28, C04, C32	—	—	-80295	-80395
	J28, C12	—	-80192	-80292	-80392
	J28, C80	-80092	-80190	-80292	-80392
	J28, C04, C80	-80093	-80111	-80293	-80393

**Table 1-13 ACMS EEPROM/CPU Matrix (M1059-87xxx)  
Rel. E to G**

ACMS Model XX	40 MHz CPC Monitors			
	Rel E	Rel E $\beta$	Rel F	Rel G
A74(S)/A84(S)	'641	'741	'841	'943
A74(S)/A84(S) (C05)	'643	'743	'843	'943
A74(S)/A84(S) (C24)	'644	'744	'844	'949
A74(S)/A84(S) (C05,C24)	'649	'749	'849	'949
A76(S)/A86(S)	'661	'761	'861	'963
A76(S)/A86(S) (C03)	'662	'762	'862	'966
A76(S)/A86(S) (C05)	'663	'763	'863	'963
A76(S)/A86(S) (C25)	'665	'765	'865	'971
A76(S)/A86(S) (C03,C05)	'666	'766	'866	'966
A76(S)/A86(S) (C03,C25)	'668	'768	'868	'972
A76(S)/A86(S) (C05,C25)	'671	'771	'871	'971
A76(S)/A86(S) (C03,C05,C25)	'672	'772	'872	'972
A88(S)	'681	'781	'881	'981
A88(S) (C11)		-	'880	'980

**Table 1-14 ACMS EEPROM/CPU Matrix (M1059-xxxxx)  
Rel. A.0 to C.0**

System Model	Options	Rel. A.0	Rel. B.0	Rel. C.0	Rel. C.1
84/84S (Rel. C.0)	Standard	—	—	-81242	-81342
	C79	—	—	-81243	-81343
76/76S and 86/86S (Rel.B.0 and C.0)	Standard	-81060	-81160	-81262	-81362
	C79	-81061	-81161	-81263	-81363
	C12	—	-81162	-81262	-81362
	C12, C79	—	-81163	-81263	-81363
	C80	-81062	-81160	-81262	-81362
	C80, C79	-81063	-81161	-81263	-81363
	J26	-81070	-81170	-81272	-81372
	J26, C79	-81071	-81171	-81273	-81373
	J26, C12	—	-81172	-81272	-81372
	J26, C12, C79	—	-81173	-81273	-81373
	J26, C80	-81072	-81170	-81272	-81372
	J26, C79, C80	-81073	-81171	-81270	-81370
	J26, C32	—	—	-81274	-81374
	J26, C79, C32	—	—	-81275	-81375
88/88S	Standard	-81080	-81180	-81282	-81382
	C79	-81081	-81181	-81283	-81383
	C12	—	-81182	-81282	-81382
	C12, C79	—	-81183	-81283	-81383
	C80	-81082	-81180	-81282	-81382
	C79, C80	-81083	-81181	-81283	-81383
	J28	-81090	-81190	-81292	-81392
	J28, C79	-81091	-81191	-81293	-81393
	J28, C32	—	—	-81294	-81394
	J28, C32, C79	—	—	-81295	-81395
	J28, C12	—	-81192	-81292	-81392
	J28, C12, C79	—	-81193	-81293	-81393
	J28, C80	-81092	-81190	-81292	-81392
	J28, C79, C80	-81093	-81191	-81293	-81393
	J28, C11	-81095	-81190	-81292	-81392
	J28, C11, C79	-81096	-81191	-81293	-81393
	J28, C11, C80	-81097	-81190	-81292	-81392
	J28, C11, C79, C80	-81098	-81191	-81293	-81393

**Table 1-15 NCMS EEPROM/CPU Matrix (M1059-85xxx)  
Releases F and G**

NCMS Model XX	40 MHz CPC Monitors	
	Rel F	Rel G
A36(S)/A46(S)	'860	'960
A36(S)/A46(S) (C10)	'870	'970
A48(S)	'880	'980

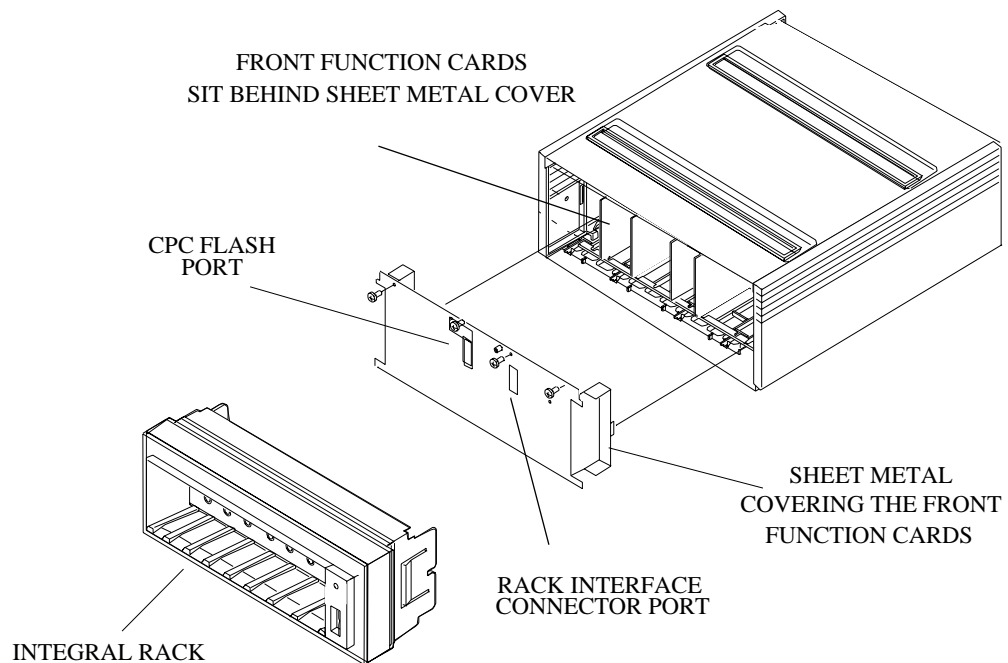
**Table 1-16 NCMS EEPROM/CPU Matrix (M1059-xxxxx)  
Releases A.0 to C.0**

System Model	Options	Rel. A.0	Rel. B.0	Rel. C.0	Rel. C.1
44/44S	Standard	—	—	-80220	-80320
	C04	—	—	-80221	-80321
48/48S	Standard	-80000	-80100	-80200	-80300
	C04	-80001	-80101	-80201	-80301
	C80	-80002	-80100	-80200	-80300
	C04, C80	-80003	-80103	-80201	-80301
	J28	-80010	-80110	-80210	-80310
	J28, C04	-80011	-80111	-80211	-80311
	J28, C80	-80012	-80110	-80210	-80310
	J28, C04, C80	-80013	-80111	-80211	-80311
	C32	—	—	-80214	-80314
	C04, C32	—	—	-80215	-80315



## Front Connectors

The front of the Computer Module contains two function cards with connectors, the Rack Interface card connector in slot 18 and the CPC card connector in slot 12 in later releases. The Rack Interface connector is used to collect output for the Computer Module from the plug-in module rack (integral or blank) and the CPC Flash port is used by the CPC Programming Tool for programming functions. Most models contain a Sheet Metal Cover over the front function cards. The cover has two ports for access to the front connectors.



**Figure 1-11 M1046A Computer Module Front Connectors**

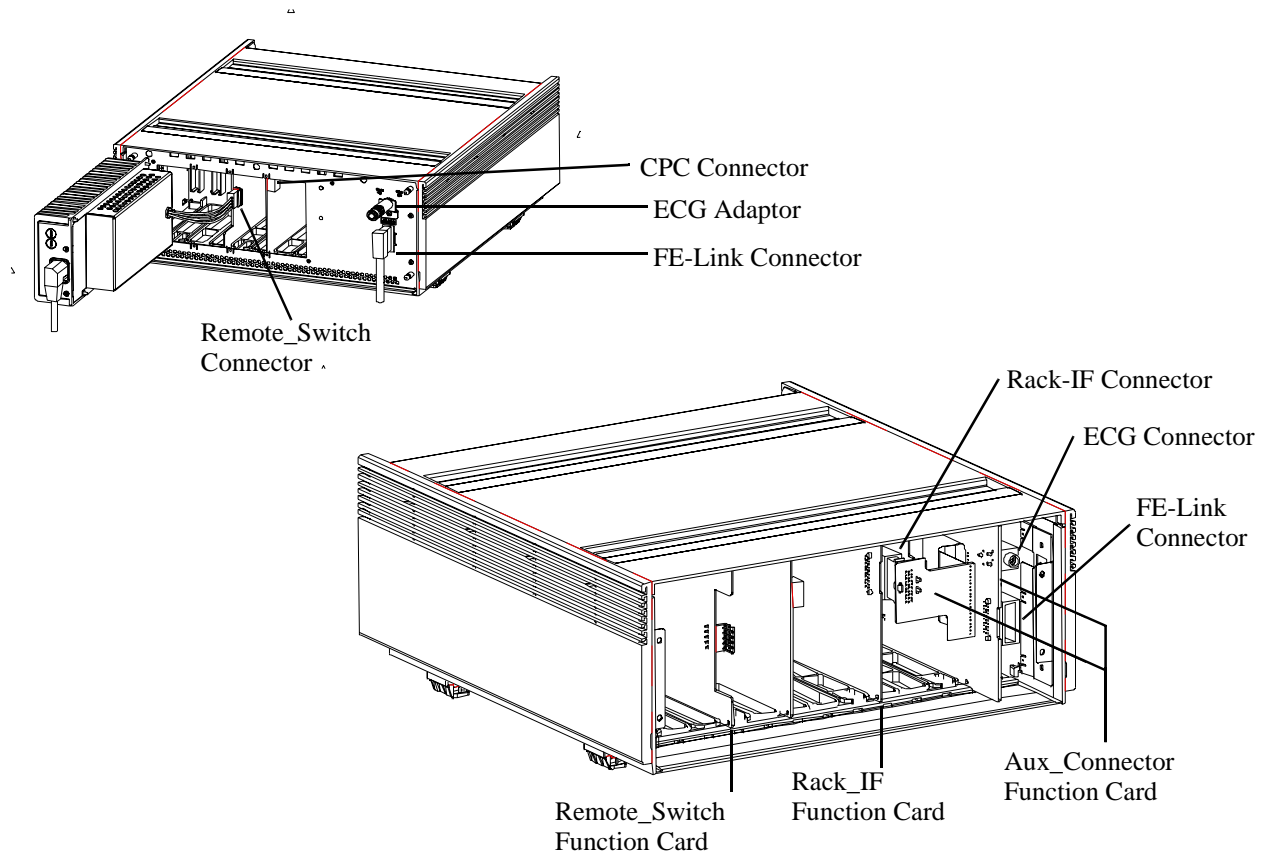
## Computer Module

### Front Connectors on Computer Module M1046B

There are extra connectors on the front of the M1046B Computer Module with an integral power supply.

**Remote Switch** This connects the integral power supply to the backplane of the computer module and allows the flatscreen display to control the power for the Computer Module.

**FE-Link & ECG sync** These connectors are found on the AUX\_CONNECTOR card in slot 24 to allow access to the RACK\_IF card in slot 18 behind the power supply. An ECG adapter allows you to connect to the ECG sync connector through a hole in the front plastic cover.



**Figure 1-12 M1046B Computer Module Front Connectors**

Rear Connectors

The rear panel of the Computer Module will have several connectors. The number and the type of connectors present is dependent upon which function cards are fitted in the Computer Module backplane. Any unused rear backplane function card slots are fitted with blank slot covers. A typical Computer Module rear panel is shown below.

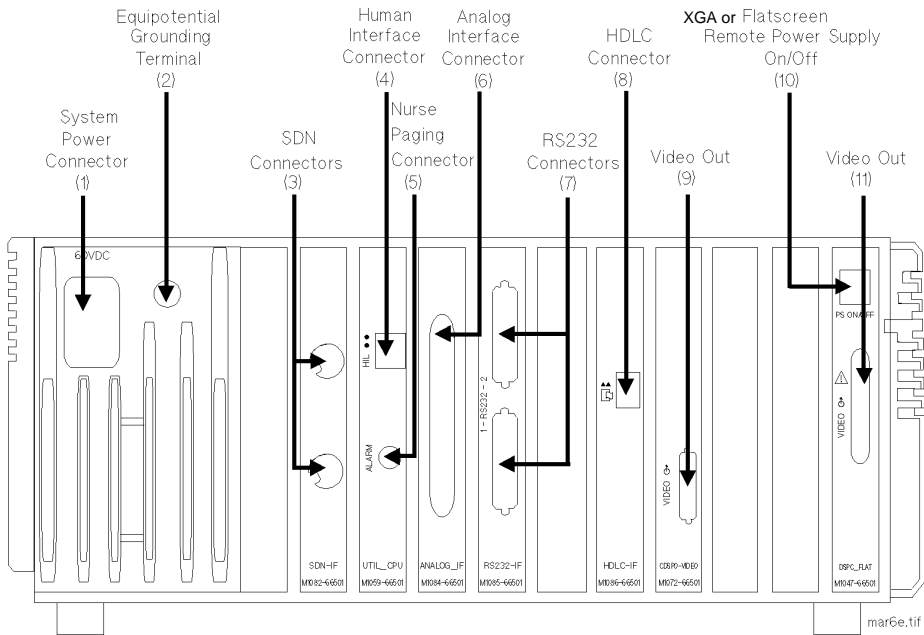


Table 1-17 Computer Module Rear Connectors

Connector	Function
1 System Power Connector (DC/DC Convertor)	15-pin "D"-type connector, used to input the 60V dc from either a Main CRT Display Module or the Remote Power Supply Module if a flatscreen is used as the main display. <b>For M1046B:</b> The 60V dc is supplied from an integral power supply and a shorting stub <b>MUST</b> be installed in this connector for the system to function correctly. <b>Note:</b> Daisychaining is not permitted with the M1046B.
2 Equipotential Grounding Terminal	Used to connect the Computer Module to the hospital's grounding system.
3 SDN Connectors (SDN Interface)	Philips connectors, used to input/output information to/from a SDN network.
4 Human Interface Connector (Utility CPU)	Human Interface Link (HIL) connector, used to input the information from the Control Panel in the Main Display Module and the Handheld Keypad.
5 Nurse Paging Relay output	Mini-phone jack, used to connect to the hospital's Nurse Paging System.
6 Analog Interface Connector	37-pin "D" type connector configured as shown in Figure 1-13, used to output information to analog devices.

## Computer Module

**Table 1-17 Computer Module Rear Connectors**

Connector	Function
7 RS232 Connectors (RS232 Interface)	Two 25-pin “D” type connectors configured as shown in Figure 1-14, used to output information to a printer or computer systems. Only the upper connector (port 2) can be used to output RS232 information to printers.
8 HDLC Connector	Used to connect to a STRIP recorder, M1117A.
9 Video Out Connector (CDSPC-Video or DSPC)	9-pin “D” type connector, used to output information to be displayed on the Display Module. See Table 1-19 on page 1-37 lists the connector pinouts.
10 PS ON/OFF connector (DSPC_Flat or CDSPC-XGA)	Used to control remotely the 60V DC output of the Remote Power Supply Module. <b>For M1046B</b> with an integral power supply, this connector is not used except for the XGA display configuration in which it is connected to the External Alarm Device
11 Video Out Connector (Flatscreen or XGA)	Used to output information to be displayed on the Flatscreen Display Module (25-pin) or XGA Display (15-pin), and also to output 60V DC to the Flatscreen Display Module. Table 1-19 Video / Power Connector on page 1-37 lists the connector pinouts.

### NOTE

No connection can be made to the following cards:

- APP\_CPU
- CDSPC\_CRTL
- EPROM (including character set EPROMs, for example, Kanji)
- SRAM

## Computer Module External Connector Pinouts

The following table lists the signals and appropriate notes for the pins on the Video Out Connector (CRT).

**Table 1-18 Video Out Connector**

Pin\No	Signal	Notes
1	Sync 1	(H sync - positive TTL level)
2	-	
3	Red signal	(1 V peak positive)
4	Green signal	(1 V peak positive)
5	Blue signal	(1 V peak positive)
6	Sync 2	(L sync - positive TTL level)
7	-	
8	-	
9	Ground	

The following table lists the signals for the pins on the Video Out connector (M1095A Flatscreen). For the Video/Power input a male 'SCST' connector with 25-pin pairs is used.

Note that an XGA display uses a standard 15-pin connector.

**Table 1-19 Video / Power Connector**

Pin Pair	Signal
1 / 26	Red 0
2 / 27	Red 1
3 / 28	Red 2
4 / 29	Red 3
5 / 30	Green 0
6 / 31	Green 1
7 / 32	Green 2
8 / 33	Green 3
9 / 34	Blue 0
10 / 35	Blue 1
11 / 36	Blue 2
12 / 37	Blue 3
13 / 38	HSYNC
14 / 39	VSNC
15 / 40	BLANK
16 / 41	Backlight ON/OFF
17 / 42	ID_0 / ID_1
18 / 43	ID_2 / ID_GND
19 / 44	Pixel Clock
20 / 45	GND
21 / 46	free
22 / 47	
23 / 48	FEPWR / FECOM (+60V)
24 / 49	FEPWR / FECOM (+60V)
25 / 50	Remote ON/OFF to Power Supply

Note: The shaded areas are differential signals.

Computer Module

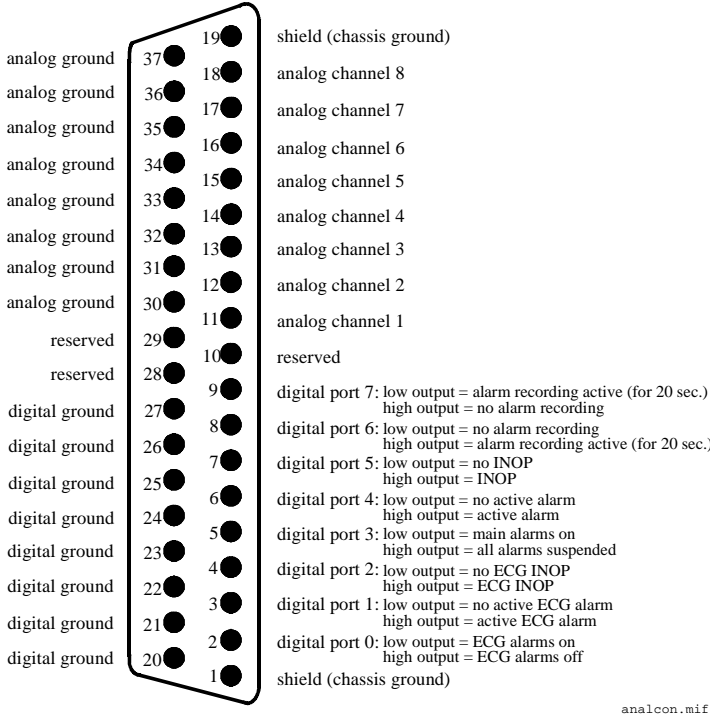


Figure 1-13 Analog Interface Connector

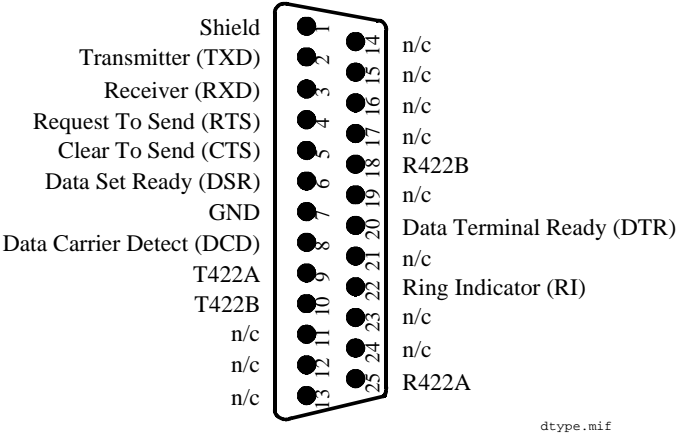


Figure 1-14 RS232 Connector

## Mounting the CMS

For the latest mounting options available for your system, please refer to the following website:

[http://www3.medical.philips.com/resources/hsg/docs/en-us/custom/pmd\\_ms\\_index\\_generic.asp](http://www3.medical.philips.com/resources/hsg/docs/en-us/custom/pmd_ms_index_generic.asp)

## Connecting the CMS Cables

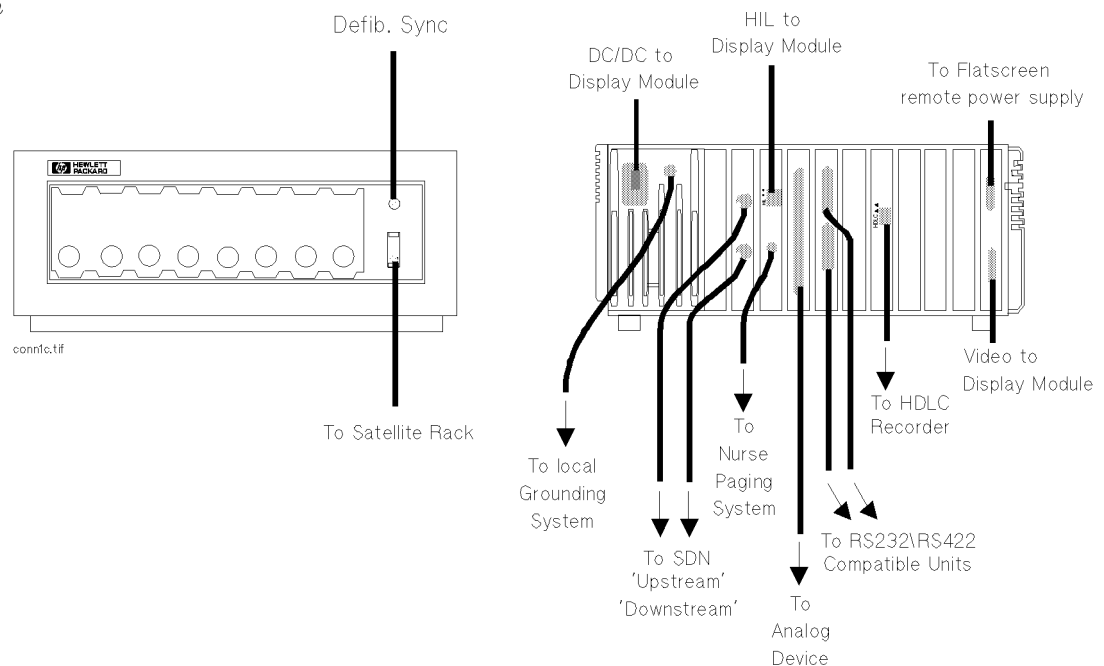
Once the CMS is mounted, the cables need to be connected. This section details the procedures for connecting the terminated cable-ends to the local equipment and faceplates as necessary.

The connections that can be made on the CMS are detailed for each component of the system in turn.

*The connections to the Computer Module and Plug-In Module Rack are made using fully terminated cables from either other equipment or from Faceboxes/Faceplates*

### To Connect the Computer Module and Plug-in Module Rack

The following figure shows all the possible connections to a Computer Module and the Plug-in Module Rack. The rack has an input on the left (female 20-way LNL) and an output on the right (male 20-way LNL).



**Figure 1-15 Computer Module and Rack Cable Connections**

## Connecting the CMS Cables

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### NOTES

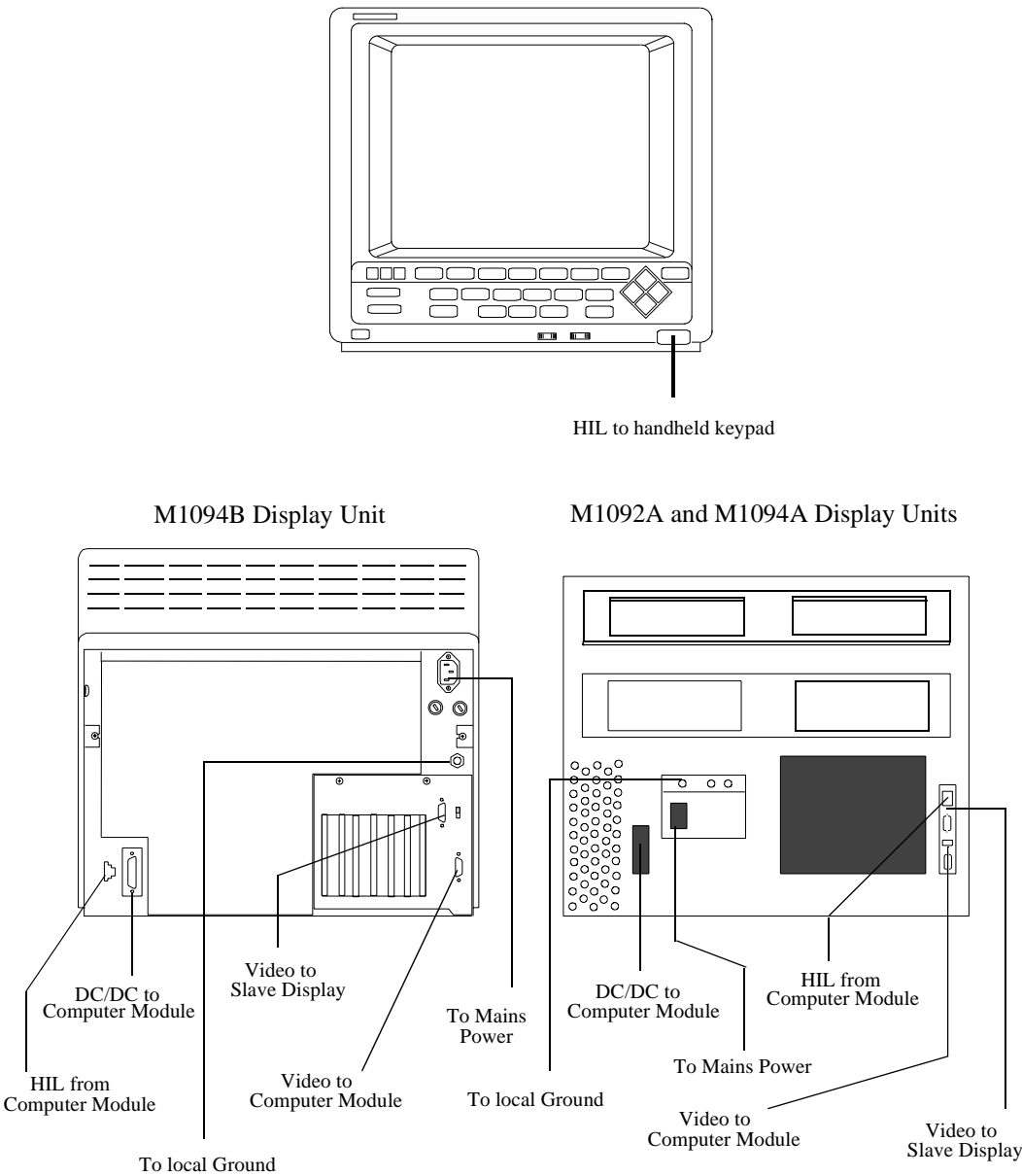
1. When the Computer Module and CRT Display Module are stacked together, only the ground cable from the Display Module needs to be connected to the local grounding system.
  2. The M1046B Computer Module allows access only to the Defib. Sync on the front cover. The Satellite Rack is connected to the connector on the metal cover and a mains power cable is connected to the integral power supply behind the plastic cover.
  3. The M1046B Computer Module has standoffs for the feet and locking cam to allow space to route the Satellite Rack and power cables under the Computer Module to the rear. See page 1-35.
-



*The connections to the Master Display Module are made using fully terminated cables from either other equipment or from Faceplates/Faceboxes.*

### To Connect the CRT Display to the Computer Module

The following figure shows all the possible connections to the M1092A, M1094A, and M1094B 14-inch Display Modules.

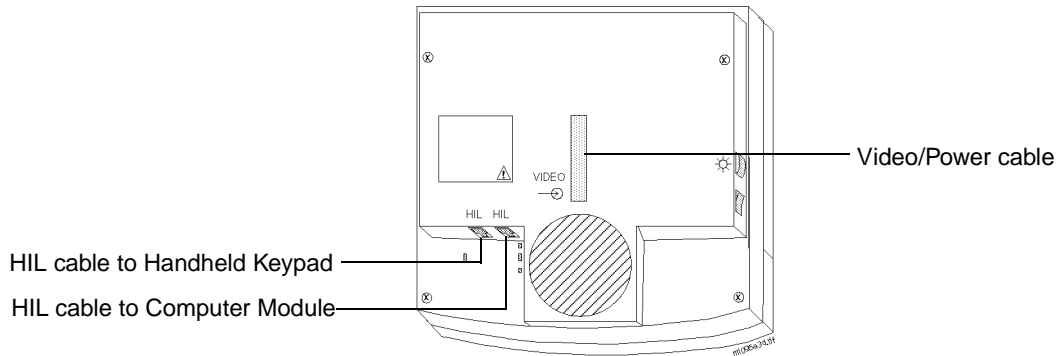


**Figure 1-16 Display Module Cable Connections**

**NOTE** When a 14" Display is used as a slave, the connections for DC/DC and Philips-HIL are NOT used.

## Connecting the CMS Cables

### To Connect the Flatscreen Display to the Computer Module



**Figure 1-17 Flatscreen Display Module Cable Connections**

The head of the 10m video cable is shrink-wrapped to facilitate passing through a narrow conduit. To connect the video cable, remove the shrink-wrap and assemble the two halves of the housing around the cable head, taking care to ensure that the cable hangs downwards.

### To Connect the XGA-Compatible Display to the Computer Module

Connect the video cable of the display to the Video Out Connector of the Computer Module.

### To Connect the Satellite Rack

Connect the male end of the cable to either the Computer Module or the Rack Output connector on another Satellite Rack and connect the female end of the cable to the Rack Input connector on this Satellite Rack.

### To Connect the Strip Recorder

The connection to the strip recorder is made using a fully terminated cable connected to either a faceplate or directly to the HDLC Interface card on the rear of the Computer Module.

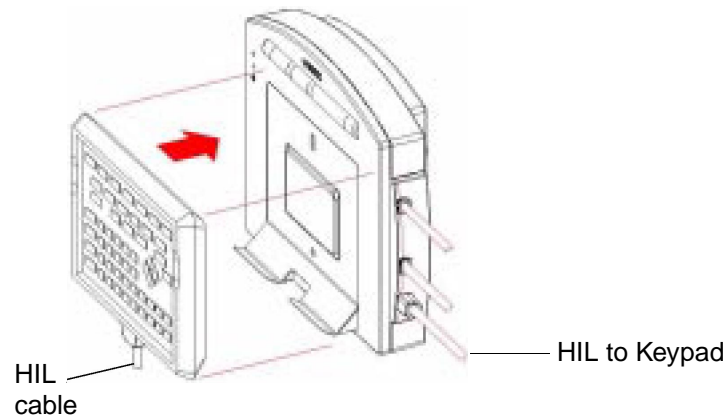
*The handheld keypad can only be used with a Master Display Module.*

### To Connect the Handheld Keypad to the CRT Display Module

Remove the small plastic insert on the Master Display Module (to the front right of the brightness and contrast controls). This exposes the Philips-HIL connector.

Insert the handheld keypad connector (with prongs down) into the Philips-HIL connector on the Master Display Module. This is located in the lower front right-hand corner. The connector clicks into place.

## To Connect the Handheld Keypad to the External Alarm Device



Connect the HIL connector of the Keypad to the corresponding connector of the External Alarm Device.

---

### NOTE

To connect any of the three cables to the External Alarm Device, you must first remove the connector cover. When the cables are plugged in, replace the cover.

---

## To Connect the External Alarm Device to the Computer Module

Connect the Alarm Device's Philips-HIL connector to the Philips-HIL connector of the Computer Module using the HIL cable provided. Connect the Alarm Device's On/Off Switch connector to the On/Off Switch connector of the Computer Module using the remote switch cable provided.

*Consult the central station service manual for a list of printers which can be used at the central station.*

## To Connect Printers and PCs

The CMS can print reports locally or at the central station. The printers must support Philips PCL Layer 3 Printer Commands. Local printers are connected to the RS-232 card in the rear of the Computer Module. Printers without serial port require a serial-to-parallel converter (Philips Part Number 5962-4340). This applies, for example, to the HP DeskJet 695C and the HP LaserJet 6P. Note that laser printers must contain at least 2 MB of RAM in order to be used with the CMS.

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### NOTE

Printers must only be connected to the Computer Module using the cable options (for example, a 1.5m cable option M1181A #A50): all M1181A #A5\*\* option numbers are for RS232/422 cables.

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For detailed information on how to configure local printers, please refer to "Local Jet Printer Configurations" on page 3-37.

## Connecting the CMS Cables

### Connecting External Computer Systems

An external personal computer can be connected to the CMS via the RS232 connector (port 1): this option (#J13) is the Medical Computer Interface capability. If a second RS232 card is supported in your monitor, the PC can then be connected through the RS232 connector (port 3). Refer to the RS232 Computer Interface Programming Guide for a comprehensive description of the option's capabilities.

With Option #J13, the following parameter module data can be accessed:

All wave, numeric and alarm data.

All external device data interfaced by the CMS through VueLink.

---

**NOTE**

Personal Computer Systems must only be connected to the RS232 connector on the Computer Module using the cable options (for example, a 1.5m cable option M1181A #A50).

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# Configuring and Adjusting Displays

## Introduction

When a new display is connected to the CMS, it needs to be adjusted so that all information is visible. If you are connecting a standard XGA display, please refer to the section entitled “XGA Display Adjustments” on page 1-46.

When a new touchscreen display is connected to the CMS, it needs to be configured and calibrated. After the display has been configured and calibrated, a functionality test must be performed. This procedure comprises of:

- RS-232 port configuration.
- Check and fine tuning of screen adjustment.
- Touch screen configuration and calibration.

If you are connecting a standard touchscreen display, please follow the instructions in

## Configuring the RS-232 Port

To configure an appropriate RS-232 port for the Touch Screen

**Step 1** Switch to Configuration Mode and press:

**Monitor Setup** → **RS232** → **Touch**

The following table shows the supported RS-232 configuration settings of one card:

Table 1-20 RS-232 Configuration Settings

Upper Port	Lower Port	Upper Port	Lower Port
Computer Off	Computer On	Touch	Computer On
	Touch		Computer Off
	Mouse		Mouse
	AGM		AGM
	VENT		VENT
AGM	Computer Off	VENT	Computer Off
	Touch		Touch
	Mouse		Mouse
	VENT		AGM

## Configuring and Adjusting Displays

**Step 2** Restart the CMS.

The RS-232 interface is now configured for *Touch* operation and the new **Touch Setup** softkey is available from the **Monitor Setup** window when in Configuration Mode.

---

**NOTE**


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Once Touch or Mouse configurations are made, the CMS Monitor must be restarted in order to activate the new configuration settings.

---

**NOTE**


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Multiple AGM, VENT, Touch or Mouse configurations are not supported.

### XGA Display Adjustments

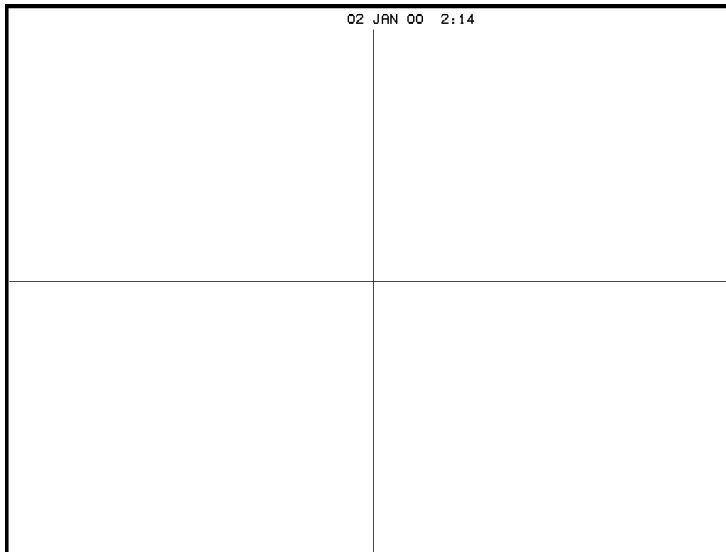
When setting up the M1097A XGA color flatscreen display, make sure that the whole image (all pixels) is visible on the display.

To test this and to make any adjustments:

**Step 1** Go to Service Mode by pressing **Monitor Setup** followed by **Operating Modes**.

**Step 2** Enter the password and select **Service**, then press **Confirm**.

**Step 3** When the main screen is displayed, press the fourth (middle) function key on the keypad.



You should see lines on the display, showing a cross right through the middle of the screen and a frame bordering the whole screen.

**Step 4** If you do not see the whole frame, adjust the display accordingly.

**NOTE**

If you are adjusting a touchscreen monitor, please do a new calibration to make sure that the screen responds in the expected way.

## Calibrating the Touch Screen

Once the RS-232 interface is configured for *Touch* operation, the CMS is able to communicate with the touch screen. If there is a communication problem between the CMS and the touch screen, the following message will be displayed:

**Touch Operation Not Available - Check Setup**

If communication is possible but the touch screen has not been calibrated, the following message will be displayed:

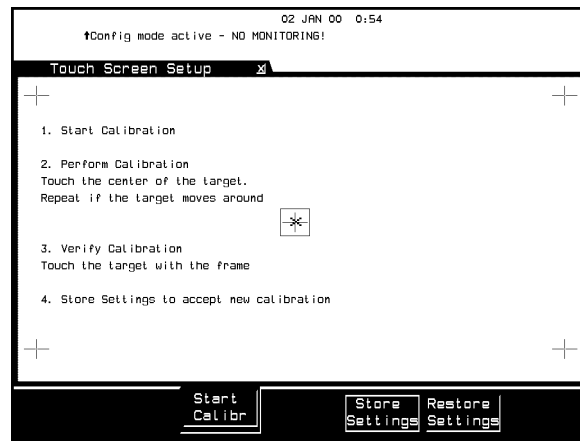
**Touch Operation Not Calibrated - Check Setup**

To calibrate the touch screen:

**Step 1** Switch to Configuration Mode and press:

**Monitor Setup** → **Touch Setup**

The **Touch Screen Setup** window is displayed with a list of the step to be followed.



**Step 2** Press the **Start Calibr** key on the touch screen to start calibration of the touch screen.

**Step 3** Tap the active (bright) cross sign target. Each target will in turn become active. Repeat the selection of each active target until all 5 targets have been selected. Calibration will now be carried out internally.

**Step 4** If calibration is successful, the following message is displayed:

## Configuring and Adjusting Displays

Calibration completed, press <store settings>

**Step 5** Press the **Store Settings** softkey.

### Performing the Functionality Test

After successfully calibrating the touch screen, complete the following test to check that the performance of the touch screen is correct:

- Step 1** Switch to Monitoring Mode. Icons for **Silence/Reset**, **Suspend** and **Control** should be seen on the screen.
- Step 2** Touch the **Suspend** button repeatedly. The alarms should switch between **Alarms Switched ON** and **Alarms Suspended**.
- Step 3** Touch the **Control Panel** button. The **Control Panel** task window should be displayed.
- Step 4** In the **Control Panel** task window, repeatedly touch the **Suspend Alarms** softkey. The alarms should switch between **Alarms Switched ON** and **Alarms Suspended**.
- Step 5** Touch outside the **Control Panel** task window should close the task window.
- Step 6** Touch any location on the screen.
- Step 7** Check to see that a sign (+ or x) is displayed at the location that was touched.
- Step 8** Repeat calibration if the confirmation sign is not acceptably close to the location that was touched and test again.



## Configuring the Mouse or Trackball

### Introduction

When a new mouse or trackball is connected to the CMS, the RS-232 port it is connected to, needs to be appropriately configured. After the RS-232 interface has been configured the mouse or trackball is operational. However, the response speed of the mouse or trackball can be adjusted.

### Configuring the RS-232 Port

To configure an appropriate RS-232 port for the mouse or trackball

**Step 1** Switch to Configuration Mode and press:

**Monitor Setup** → **RS232** → **Mouse**

Table 1-20 RS-232 Configuration Settings on page 1-45 shows the supported RS-232 configuration settings of one card:

**Step 2** Restart the CMS.

The RS-232 interface is now configured for *Mouse* operation and the new **Mouse Setup** softkey is available from the **Monitor Setup** window when in Configuration Mode. Once Touch or Mouse configurations are made, the CMS Monitor must be restarted in order to activate the new configuration settings.

**NOTE** Multiple AGM, VENT, Touch or Mouse configurations are not supported.

### Performing the Functionality Test

After connecting a mouse or trackball, complete the following test to check that the performance of the mouse or trackball is correct:

**Step 1** Switch to Monitoring Mode.

Icons for **Silence/Reset**, **Suspend** and **Control** should be seen on the screen.

A cursor sign (+ or x) is displayed and should move when the mouse/trackball is moved.

A black or white border should be visible on or around any accessible target.

## Configuring the Mouse or Trackball

- Step 2** Click the **Suspend** button repeatedly. The alarms should switch between **Alarms Switched ON** and **Alarms Suspended**. There should also be a “click” sound when clicking into this field.
- Step 3** Click the **Control Panel** button. The **Control Panel** task window should be displayed.
- Step 4** In the **Control Panel** task window, repeatedly click the **Suspend Alarms** softkey. The alarms should switch between **Alarms Switched ON** and **Alarms Suspended**.
- Step 5** Click outside the **Control Panel** task window should close the task window.
- Step 6** Move the cursor to any location on the screen. The cursor sign should change shape (+ or x) depending on whether or not it is placed over an active target.

### Adjusting the Pointer Speed of the Mouse or Trackball (Optional)

Once the RS-232 interface is configured for *Mouse* operation, the CMS is able to communicate with the mouse or trackball and normal operation is possible. The pointer speed of the mouse or trackball can however be adjusted if desired.

To adjust the response of the mouse or trackball:

- Step 1** Switch to Configuration Mode and press:

**Monitor Setup** → **Mouse Setup**

The **Mouse Setup** window is displayed with a list of the step to be followed.

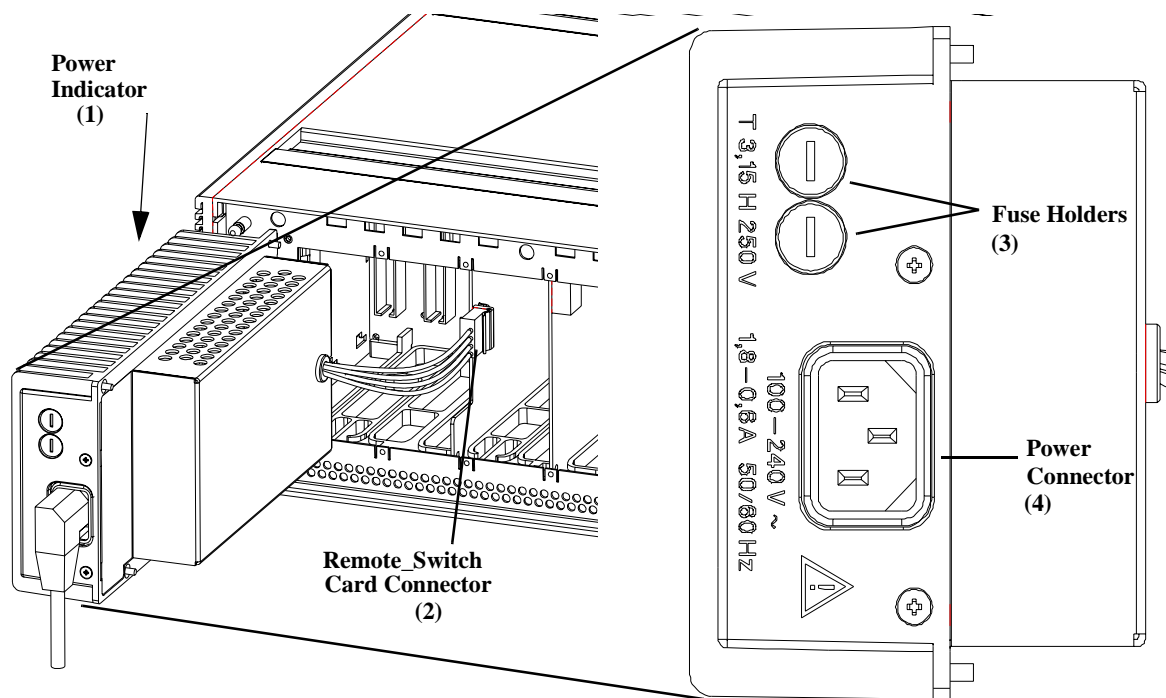
- Step 2** Adjust the speed of the mouse by use of the **Select Speed** up and down arrows.
- Step 3** Press the **Store Settings** softkey.

## Integral Power Supply - Computer Module (M1046B)

The M1046B Computer Modules use a flatscreen M1095A or XGA display as the main display. The power supply previously located in the Remote Power Supply is replaced by an Integral Power Supply located in this Computer Module (M1046B).

**Note:** Daisy-chaining is not permitted with the M1046B Computer Module.

### Integral Power Supply - Connectors and Controls



**Figure 1-18 Integral Power Supply Connectors and Controls**

**Table 1-21 Integral Power Supply Controls and Connectors**

Controls and Connectors	Function
1 LED mains power indicator	This indicates that the Integral Power Supply is connected to the local power.
2 REMOTE_SWITCH card connector	This is a cable-end connector, used to connect the Integral Power Supply to the REMOTE_SWITCH card in the Computer Module.
3 Fuse Holders	Two fuse holders for the line protection fuses. (2 x 3.15 A H)
4 Local Power Connector	This is a 3-pin connector, used to input the local line voltage.

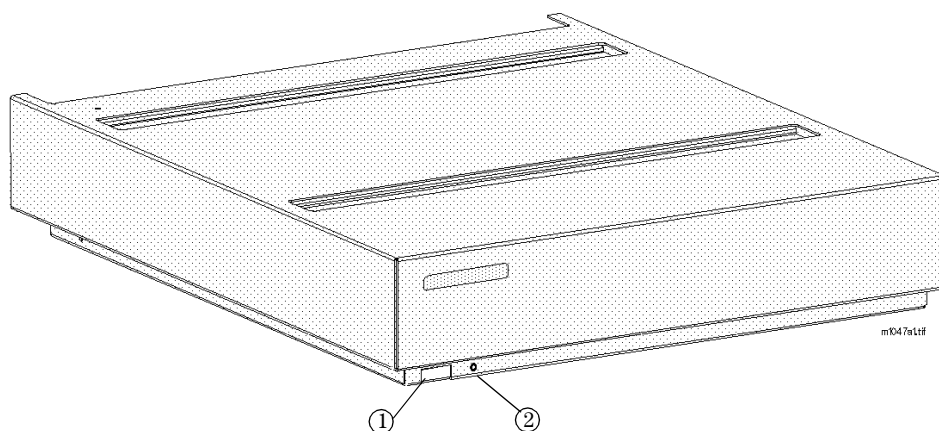
## Remote Power Supply

### Remote Power Supply

The CMS can use the flatscreen M1095A as the main display instead of a CRT display and the M1046A Computer Module. For older CMS models (prior to the introduction of the M1046B Module), the power supply located in the main CRT display is replaced by a Remote Power Supply.

#### Front Panel Controls - Remote Power Supply

The controls on the front panel of the Remote Power Supply are shown below:



**Figure 1-19 Remote Power Supply Front Panel**

**Table 1-22 Remote Power Supply Controls and Connectors**

	Controls	Function
1	ON/OFF Switch	Used to turn the Remote Power Supply ON/OFF.
2	Power ON indicator	Green LED which is lit when the power supply is switched ON.

Remote Power Supply - Rear Controls and Connectors

The controls on the rear panel of the Remote Power Supply are shown below:

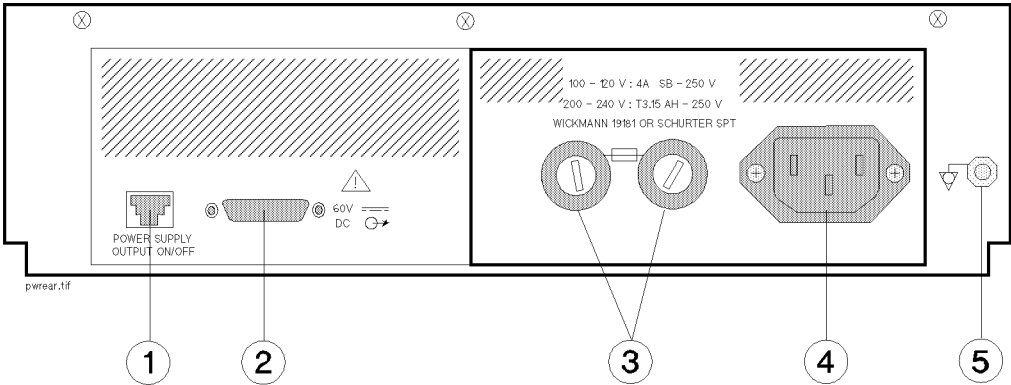


Figure 1-20 Remote Power Supply Rear Panel

Table 1-23 Remote Power Supply Rear Panel Controls and Connectors

Controls and Connectors	Function
1 Remote ON/OFF Input	This cable connects the Power Supply to the video interface board (located in the CMS Computer Module). It is a female “modular jack” connector with 6-pins, used to input the power supply output ON/OFF signal from the Flatscreen Display.
2 60 V DC (120W max) Output	This is a female 15-pin Sub-D-Type connector, used to output the 60 V dc line voltage to the Computer Module.
3 Fuse Holders	Two fuse holders for the line protection fuses.
4 Local Power Connector	This is a 3-pin connector, used to input the local line voltage.
5 Equipotential Grounding Terminal	This is a grounding stud connector, used to connect the system to an equipotential grounding system.

## Fuse Values

## Fuse Values

All CRT Display Modules, main and slave, remote power supply and the integral power supply, contain system fuses. The fuse values for each are recorded on a label near the fuse holders. The following table gives the fuse values for the CRT Display Modules, the Remote Power Supply, and the integral power supply located in the M1046B Computer Module and refers you to the page number that contains an illustration showing the fuse positions.

**Table 1-24 CMS Fuses**

CRT Display Type / Power Supply Type	Line Voltage 100-120 V		Line Voltage 200-240 V			Page Location
	Fuse Rating	Part Number	Fuse Rating	Part Number		
				VDE	UL	
M1092A Mono CRT Display (Main / Slave)	2 x T4.0 A	2110-0365	2 x T2.0 A	24220862 5096FMI	24220860 1266FMI	1-12 / 1-15
M1094A Color CRT Display (Main / Slave)	2 x T4.0 A	2110-0365	2 x T2.5 A	24220861 0219FMI	24220861 0009FMI	1-12 / 1-15
M1094B Color CRT Display (Main / Slave)	2 x T4.0 A	2110-0365	2 x T3.15 A H	242208610239FMI		1-12 / 1-15
M1047A Remote Power Supply	2 x T4.0 A	2110-0365	2 x T3.15 A H	242208610239FMI		1-53
M1046B Integral Power Supply	2 x T3.15 A H	2110-1025	2 x T3.15 A H	242208610239FMI		1-51

## Plug-in Module Racks

The Plug-in Module Rack of the CMS is the interface between the Plug-in Modules and the Computer Module. The racks can be either *integral*, located in the M1046A Computer Module or *satellite*, located in the patient vicinity connected by a cable to the rack interface of the Computer Module (M1046A or M1046B). Satellite Racks can also be daisy-chained, depending on how many modules your system can support. Three plug-in module racks are currently supported by the monitor: 8-slot integral rack, M1043A, 8-slot Satellite Rack M1041A and 6-slot rack of the Philips Component Transport System, M1276A.

A blank rack is also available for the M1046A Computer Module. The blank rack is used if you do not require plug-in modules to be placed close to the Computer Module. The blank rack acts as the connection between the Satellite Rack and the Computer Module.

### Objective

In order to meet this section's goals, you should be able to:

- Identify the connectors of the plug-in module racks.
- Be familiar with the function of the plug-in module racks.

### Concepts

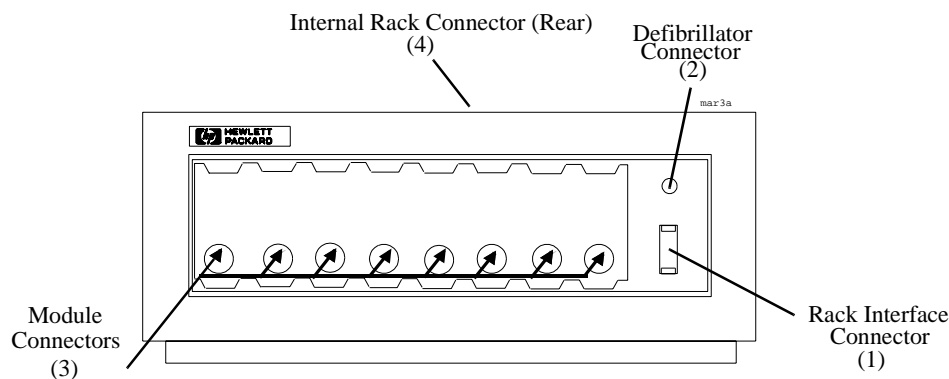
The plug-in module racks of CMS are not fitted with any controls, just connectors. The function of the rack is to connect the plug-in modules to the Computer Module. A standard CMS integral rack contains eight slots for plug-in modules. Modules can be single-width modules or double-width modules so the number per rack depends on which plug-in modules are being used. To accommodate more modules, you can daisy-chain Satellite Racks to the rack in the Computer Module. The number of monitoring slots supported depends on the model of your monitor.

<b>Integral Rack</b>	The integral rack is a plastic rack that sits in the front of the M1046A Computer Module and connects the plug-in modules to the system. It contains a rack interface connector, a defibrillator connector, module connectors and a rear internal rack connector.
<b>Satellite Rack</b>	The Satellite Rack is a plastic rack that is remote to the Computer Module and connects plug-in modules to the system. It connects by a cable to a rack interface connector to route the data between the plug-in modules and the Computer Module. It contains input and output rack interface connectors and module connectors, but it does not have a defibrillator connector.
<b>Blank Rack</b>	The blank rack is a plastic rack that sits in the front of the M1046A Computer Module and provides connections for a defibrillator and

## Plug-in Module Racks

Satellite Racks to the system. It is used if you do not require plug-in modules to be placed close to the M1046A Computer Module.

### Front and Rear Connectors

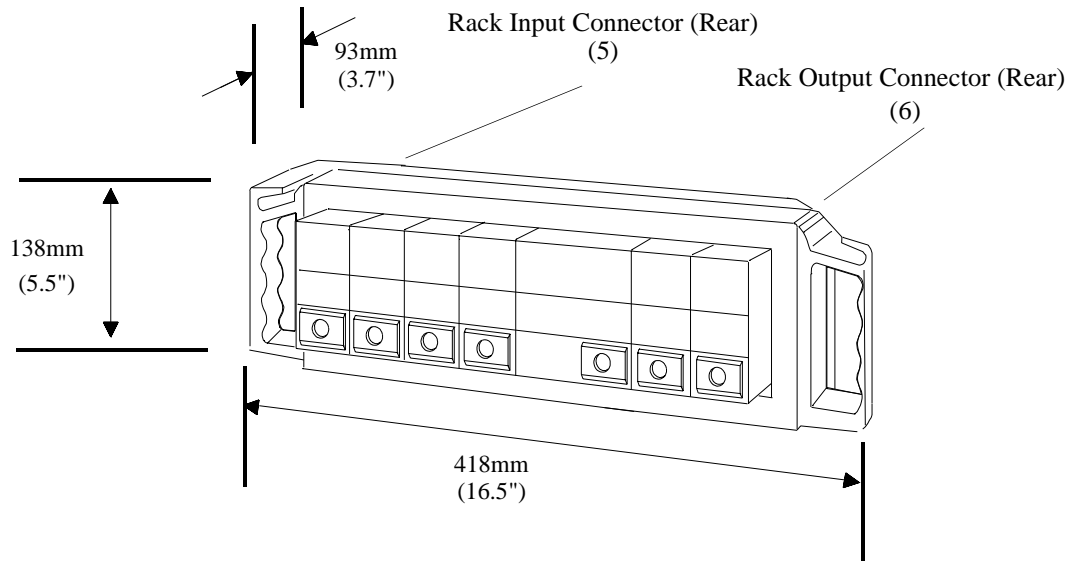


**Figure 1-21 Integral Plug-in Module Rack M1043A**

**Table 1-25 Plug-in Module Rack Connectors**

Connector	Function
1 Rack Interface Connector	Female interface connector, used to daisy-chain Satellite Racks.
2 Defibrillator Connector	0.25" phone socket, used to output an ECG wave to synchronize a defibrillator and provide an input for the defibrillator marker signal. It is also used as an output of ECG waveforms during the specification tests. See Parts List for ECG-Sync Cables.
3 Module Connectors	Female plug-in module connectors, used to input the information from the plug-in modules to the integral rack.
4 Internal Rack Connector	Rack Interface connector (located on rear of the integral rack or blank rack), used to output the information from the rack to the Rack Interface function card placed in slot 18 of the Computer Module.





**Figure 1-22 Satellite Plug-in Module Rack M1041A with Parameter Modules**

**Table 1-26 Plug-in Module Rack Connectors**

Connector		Function
5	Rack Input Connector	Male Rack Interface Connector, used to connect the Satellite Rack to the Computer Module or to the previous rack in the chain.
6	Rack Output Connector	Female Rack Interface Connector, used to connect the Satellite Rack to the next rack in the chain.

## Plug-in Modules

The plug-in parameter modules of the CMS can be thought of as the specialists of the monitor. Each module carries out a specific task and can be moved from one monitor to another, depending upon the functionality of the respective monitors. Plug-in modules are labeled with a symbol or the name of the measurement that they perform.

### Objective

In order to meet this section's goals, you should be able to:

- Identify the controls found on the front of plug-in modules.
- Be familiar with the function of the controls of the plug-in modules.
- Identify the connectors found on the front and rear of plug-in modules.

### Concepts

The plug-in modules of CMS have one or more hardkeys on the front panel. The hardkey labeled with the parameter name is the setup key, which lights up the setup indicator and gets you directly into the Task Window for that parameter.

The connector socket on the front of each module varies, but it is the same color as the corresponding connector plug on the transducer or patient cable for that module. The connector on the rear panel of each plug-in module is a male connector, used to supply power and allow communication from the module to the module rack.

Plug-in modules can be either single-width or double-width units. A single-width module will occupy one slot in a module rack while a double-width module will require two-slots. Therefore, you must consider the width of the plug-in modules and number of slots that you have available to determine how many modules you can use in a single monitor. See Appendix A Product Information for more module information.

<b>Parameter</b>	The parameter of the plug-in module is the specific clinical measurement performed by the module. Some modules, like the ECG/Resp module, are capable of monitoring more than one parameter.
<b>Single-width Module</b>	A module that occupies only one slot in the module rack.
<b>Double-width Module</b>	A module that occupies two slots in the module rack.

Plug-In Module Control Panel Keys and Indicators

The following drawings represent the types of controls, indicators and connectors found on the front panels of the plug-in modules. The controls, indicators and connections are described in the following table.

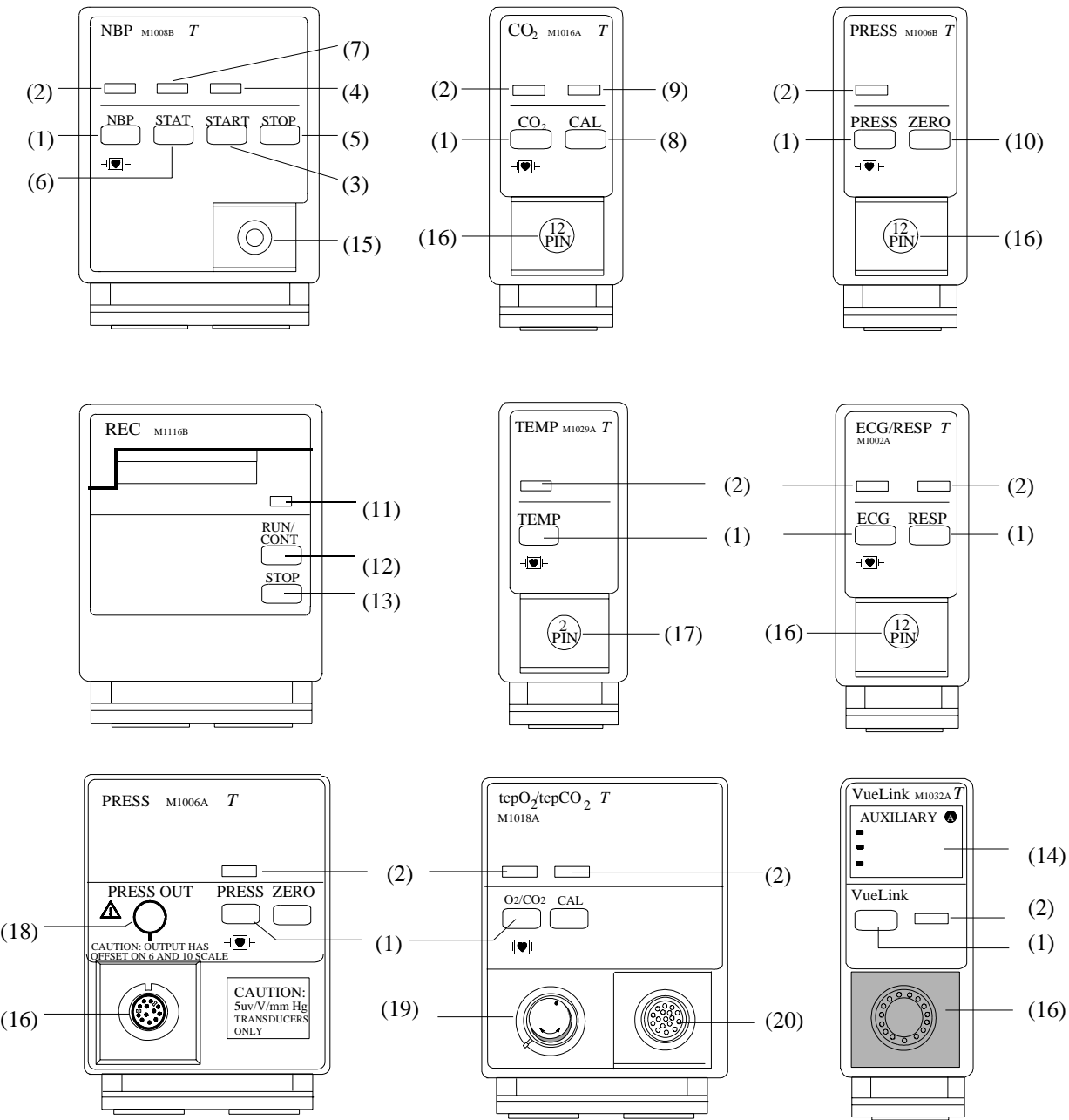


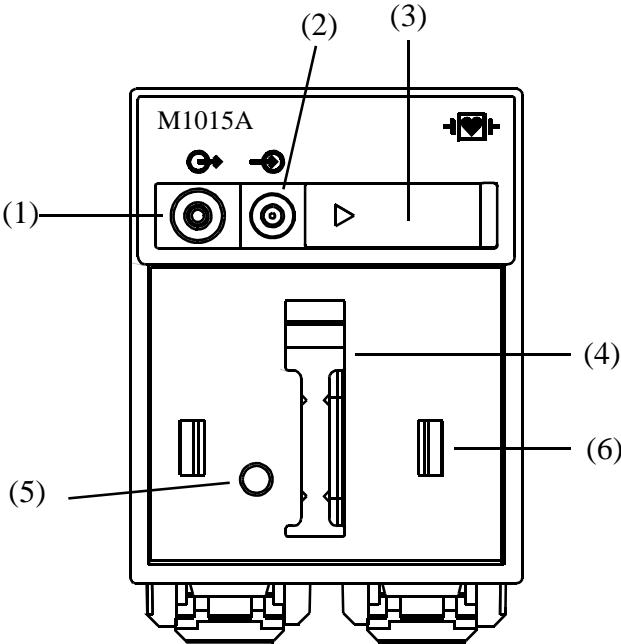
Figure 1-23 Examples of the Plug-in Module Front Panels

## Plug-in Modules

**Table 1-27 Plug-in Module Controls and Connectors**

	General Controls	Function
1	Setup Key	Used to enter the module setup screen or Task Window.
2	Setup Indicator	Green LED lit when in the module setup screen.
3	Start Key	Used to start a measurement cycle.
4	Start Indicator	Green LED which will be lit when the measurement cycle is entered.
5	Stop Key	Used to stop the measurement cycle.
6	Stat Key	Used to start a Static measurement cycle.
7	Stat Indicator	Green LED lit when the static measurement cycle is entered.
8	CAL Key	Used to enter the module's calibration screen and initiate module calibration procedures.
9	CAL Indicator	Green LED lit during a module calibration procedure.
10	Zero Key	Used to zero a transducer without using the main display controls.
11	Continue LED	Lights if the current recording is continuous. The LED also blinks twice when the module is first plugged in. This indicates that the recorder self-test has been completed successfully.
12	RUN/CONT Key	Used to start a Mode A continuous real-time recording, if the recorder is not running. If the recorder is running, it makes the current recording continuous (if possible).
13	STOP Key	Stops the current recording.
14	Labels	Labels giving names of the external devices to which the VueLink module can be connected and an LED beside each label, indicating the selected device.
15	NBP Connector	Standard NBP connector for connection to the cuff.
16	12-pin Connector	Standard 12-pin connector for use with Transducers. Refer to the tables on page 1-63.
17	2-pin Connector	Standard 2-pin connector for use with standard series temperature probes.
18	Analog Output Jack	Standard 1/4 inch phone jack used to provide analog signals to an intra-aortic balloon pump on the M1006A Option #C01. The M1006B Option #C01 has 3.5mm phone jack socket, supplied with adapter for those customers who have been using a 6.3mm (1/4 inch) phone jack.
19	Calibration Chamber	Calibration chamber, with gas inlet for tcpO <sub>2</sub> /tcpCO <sub>2</sub> module.
20	20-pin Connector	20-pin connector for use with a tcpO <sub>2</sub> /tcpCO <sub>2</sub> transducer.

The following is the front panel of the SideStream CO<sub>2</sub> module.



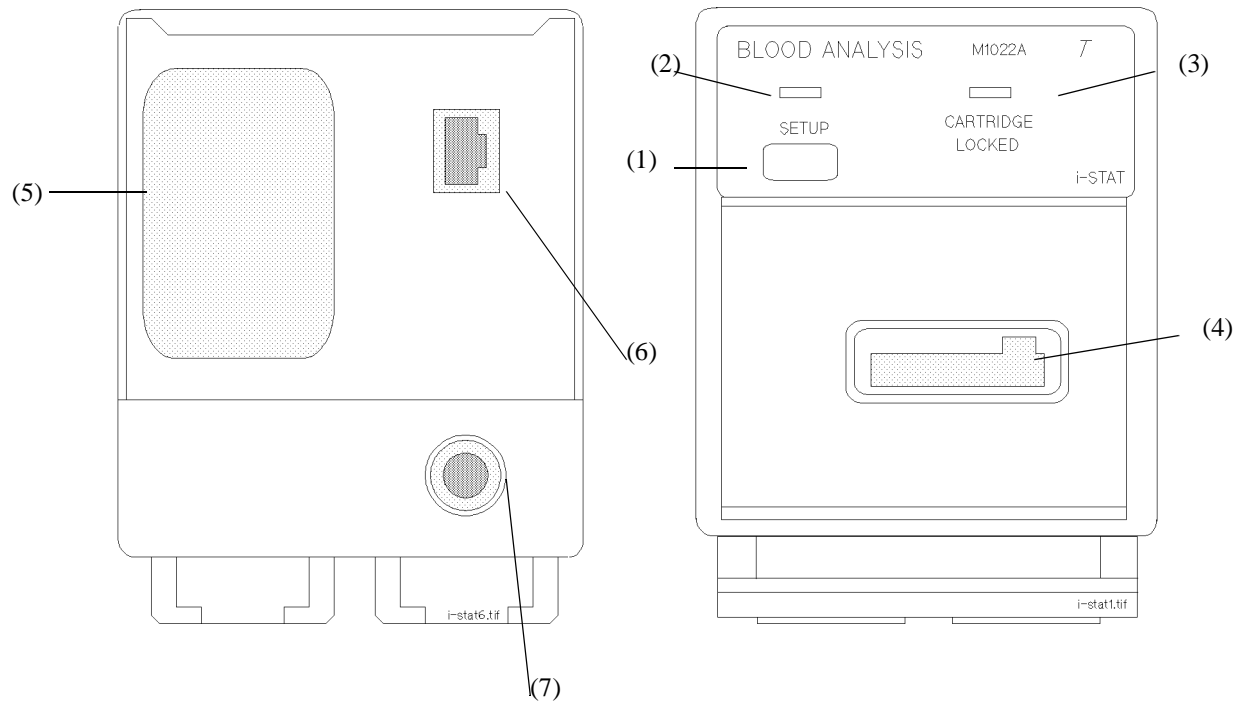
**Figure 1-24 Sidestream CO<sub>2</sub> Module Controls and Connectors**

**Table 1-28 Sidestream CO<sub>2</sub> Module**

	Connector	Function
1	Gas Outlet Connector	Lets out the gas after it has been sampled.
2	Gas Inlet Connector	Provides the connection for the sample tubing (and bacterial filter) which receives the patient's gas sample.
3	Slide Cover	Protects the gas inlet connector when the module is not in use.
4	Sample Cell	The CO <sub>2</sub> transducer is mounted on the sample cell of the sidestream module. The transducer plug is connected to the M1016A CO <sub>2</sub> Plug-in Module.
5	Switch	Activates the sidestream pump when the CO <sub>2</sub> transducer is mounted on the sample cell.
6	Mounting Clamp	Holds the CO <sub>2</sub> transducer in place.

## Plug-in Modules

The following are the front and rear panels of the Blood Analysis Module:



**Figure 1-25 Blood Analysis Module**

**Table 1-29 Blood Analysis Module Controls and Connectors**

	Control/Connector	Function
1	Setup Key	Used to enter the Blood Analysis Setup or Results screen.
2	Setup Indicator	Green LED lit when in Blood Analysis screens.
3	Cartridge Locked Indicator	Green LED blinks when a cartridge is being processed; the cartridge must be left in the slot until the blinking stops and the light is off.
4	Cartridge Insertion Slot	The cartridge is inserted here for processing.
5	Identification Label	Contains product serial number and identification details.
6	Software Update Link Connector	For connecting to the Central Data Station (or other PC) to perform software upgrades. During the upgrade process, the module is powered via this link.
7	Parameter Module Connector	Connects the module to the rack.

## Plug-in Module Pin-outs

There are several types of connectors found on the front of the plug-in modules. The following tables give the pin-out information for the plug-in modules that contain front panel connectors.

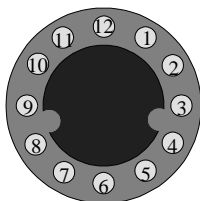
**Table 1-30 Parameter Module Connector Signals**

Pin #	Parameter Module							
	ECG M1001A/B	ECG/Resp M1002A/B	Pressure M1006A/B	C.O. M1012A	CO <sub>2</sub> M1016A	FIO <sub>2</sub> M1017A	SpO <sub>2</sub> /Pleth M1020A	EEG M1027A
1	right arm	right arm + resp	Shield (M1006B)	-	detector signal	-	signal (photocurrent)	EEG1-
2	right leg	right leg	-	GND	detector bias	-	GND + shield	REF
3	-	-	-	injectate temp	heater return	-	resistor code 1	-
4	-	-	-	GND	drive coil	-	LED com	-
5	chest	chest	jumper to 8	blood temp	sense coil	-	resistor code 2	EEG1+
6	left leg	left leg + resp	-	code resistor	GND	-	LED com	EEG2-
7	left arm	left arm	-	GND	IR-source	-	LED 12	EEG2+
8	-	-	jumper to 5	-	heater power	-	LED 34	-
A	-	-	- excitation	start key (to C)	GND	feedback resistor	GND	-
B	-	-	+ input	-	GND	input current	-	-
C	shield	shield	+ excitation	start key	temp. sense high	polarization voltage	-	shield
D	-	-	$\pm$ input	-	temp. sense low	-	-	shorted to C

## Plug-in Modules

**Table 1-31 More Parameter Module Connector Signals**

Pin Number	Parameter Module		
	tcpO <sub>2</sub> /CO <sub>2</sub> M1018A	VueLink M1032A	SvO <sub>2</sub> M1021A Connector signals to and from the Abbott Optical Module (50131-04)
1	GND	Analog 1	n.a.
2	Temp Sensor 1 (NTC1)	Analog 2	Analog RXD
3	Temp Sensor 1 (NTC2)	Analog 3-Ring Indicator	Analog GND
4	GND	Analog 4-Data carrier Detected	n.a.
5	+5V (transducer supply voltage)	Analog 5-Data Send Ready	n.a.
6	- 9V (transducer supply voltage)	Analog 6-Data Terminal Ready	+ 12V (heater regulator antinodal signal Amp. supply voltage)
7	Polarization voltage	Analog 7-Clear to Send	- 9V (Analog Signal Amp.supply voltage)
8	O <sub>2</sub> Input	Analog 8-Read to Send	n.a
9	GND	Digital ground	n.a.
10	Transducer Code (not used)	Transmit Data	+ 5V (Serial Comm. and EEPROM supply voltage)
11	Heater current return	Receive Data	- 12 V (heater supply voltage)
12	Heater current send	Analog ground	SER GND (Power supply ground for Serial Comm. and EEPROM)
13	CO <sub>2</sub> Input	n.a.	Chip-Select-Signal EEPROM
14	Temp 2 Input	n.a.	Clock Signal EEPROM
15	-	n.a.	Serial Data In/Out (bi-directional)
16	Transducer Code (O <sub>2</sub> )	n.a.	Current Diode A
17	GND	n.a.	Current Diode B
18	Transducer Code (CO <sub>2</sub> )	n.a.	Current Diode C
19	-	n.a.	LED GND (ground for LED current lines)
20	-	n.a.	-



Pin numbers (frontal) of the VueLink connector



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## Operating Modes

There are four operating modes for the CMS: Monitoring, Service, Demo, and Configuration Mode. The only mode that supports monitoring is the Monitoring Mode. All modes are entered through passwords to prevent unintentional mode changes. From Rel. C.0 returning to monitoring mode is allowed without entering a password.

### Objective

In order to meet this section's goals, you should be able to:

- Identify the monitoring modes of CMS.
- Be familiar with the function of the monitoring modes of CMS.

### Concepts

The operating modes of CMS are designed for specific tasks.

- Monitoring Mode is the standard operating mode that supports patient monitoring.
- Service Mode is used to perform service functions.
- Demo Mode is used to demonstrate the functions of the system.
- Configuration Mode is used to modify the behavior of the system.

Monitoring Mode is the only mode that should be used on a monitor that is attached to a patient. To ensure that the operating mode is not changed by unauthorized personnel, passwords are required to change operating modes.

When you change the operating mode of the monitor, you reset the patient database and all temporary changes that you have made to the system. This is why the system will always display a warning message "Patient data cleared - Settings reset" and ask you to confirm the action before it changes operating modes.

<b>Main Screen</b>	This screen shows the waveforms and numerical readouts of the parameters you have chosen to monitor: alarms, INOP messages, bed label, date and time, and arrhythmia messages (when assigned).
<b>Selection Window</b>	The Selection Window is the first operating level where you can choose a specific activity or function. It is entered through a hardkey on the Control Panel or the Handheld Keypad.
<b>Task Window</b>	The Task Window is the second operating level which allows you to make changes or adjustments to the parameters and screen displays, or to perform procedures. It is entered through a softkey in the Selection Window or directly through the Control Panel of the plug-in module.

## Operating Modes

**Status Message** The status message is a string of text displayed in the top center of the screen below the date and time. A message is displayed in status line to indicate the current operating mode if not Monitoring.

### Operating Rules to Remember

- Pressing the **Main Screen** or **Standard Display** hardkey always returns you to the main screen.
- To get into a Selection Window press a hardkey.
- Active softkeys are highlighted and/or look like “pushed-in” buttons (3-D effect).
- Softkeys only function in the Selection and Task Windows.
- The parameter module setup key gets you directly into a Task Window.
- The arrow keys and Confirm key are always illuminated when available for use.
- If after pressing a setup key the LED is not lit, the system is busy and the setup screen cannot be entered. The setup key must be pressed again. If you continue to have problems see the troubleshooting chapter.
- When an operating mode is entered or left, all monitoring settings are reset to the user defaults and the database is cleared.

### Identifying Monitoring Mode

Monitoring Mode is the standard mode and is used when the monitor is attached to a patient. No other mode should be used when a patient is connected to a monitor. In this mode you will have access to three types of screens: the Main Screen, the Selection Windows and Task Windows. Through these screens you can make temporary changes to customize the parameter settings and the monitor setup as well as perform all of the monitoring tasks of CMS.

When you are in monitoring mode, you will see active messages on the screen indicating the status of the patient and the monitor. INOP messages are displayed in the upper left-hand corner of the display and alarm message in the upper right. When the monitor is in any mode other than Monitoring Mode, you will find a text message in the status line that indicates the active mode.

*The Demo Mode does not support patient monitoring and should never be active while a patient is attached to the monitor.*

### Identifying Demo Mode

Demo Mode is the mode used to demonstrate the monitoring functions of the system. It provides the user with sample waves and screens but it does not support monitoring and should not be used when a patient is attached to the monitor. All three levels of monitoring screens are available in Demo Mode: Main Screen, Selection Window and Task Window. Demo Mode demonstrates the modules that are currently plugged into the monitor so don't expect to see waves for modules that are not in the rack.

To clearly identify the Demo mode, a text message is displayed in the status prompt. The message reads “DEMO Mode Active - NO MONITORING”. If your monitor is running Release E or later, the message “DEMO” is displayed in inverse low-intensity white characters in the first wave channel underneath the status prompt line. This message is alternatively displayed to two lines of normal characters in the same inverse block telling the user “to exit: press CONFIRM”. To leave Demo Mode in systems running Release D or earlier, you must use the standard procedure of using a password to change the operating mode. Either way, leaving Demo Mode or any other mode causes the patient data to be cleared and the settings to be reset.

## Identifying Configuration Mode

*The Config Mode does not support patient monitoring and should never be active while a patient is attached to the monitor.*

The Configuration Mode is the operating mode used to change the monitoring behavior and screen layout. This mode is used to customize the monitor to meet your hospital’s monitoring protocols. When you make changes in the Config Mode, you are creating permanent user settings to replace the standard factory settings that came with the monitor. A cold start or operating mode change will clear the patient data and reset any temporary changes you made in Monitoring Mode to the permanent user settings you made in Config Mode.

To clearly identify the Config Mode, a text message is displayed in the status prompt. The message reads “Config Mode Active - NO MONITORING”. No waveforms, INOPS or alarms are displayed in Config Mode. Like the other operating modes, you must input a password to enter and exit the Config Mode.

## Identifying Service Mode

*The Service Mode does not support patient monitoring and should never be active while a patient is attached to the monitor.*

The service mode is the operating mode used by service personnel to access complete error message listings and perform service related tasks, like specification tests. The Service Mode is also used to troubleshoot the monitor.

To clearly identify the Service Mode, a text message is displayed in the status prompt. The message reads “Service Mode Active - NO MONITORING”. No waveforms, INOPS or alarms are displayed in Service Mode. Like the other operating modes, you must input a password to enter and exit the Service Mode.

## Operating Modes

### Changing Operating Modes

Now that you know about the various operating modes of CMS, let's look at how to move between two operating modes. This requires operating mode-specific passwords. Mode-specific passwords guard against unauthorized changes to the monitor.

The operating modes of CMS can be changed using the following sequence of keys and passwords.

**Note:** From Rel. C.0, returning to monitoring mode is allowed without entering a password. Just press **Monitor Setup** followed by **Resume Monitor** .

**Table 1-32 Procedure to Change Operating Mode**

Step	Action	Comment
1	Press <b>Monitor Setup</b> (or <b>Instrument Config</b> )	The monitor setup or instrument configuration Selection Window is displayed.
2	Press <b>More Choices</b> if available	Shows additional choices for softkeys in this Selection Window.
3	Press <b>Operating Modes</b> softkey	The Operating Mode Task Window displays the current operating mode in words (for example, "Operating Mode - Monitoring") and prompts for the password.
4	Enter the password. Configuration Mode: 1245 Demo Mode: 14432 <sup>a</sup> Service Mode: 4311 Master Password: 14432 <sup>a</sup>	Use the keys labeled 1 to 5. If the password is correct, then the Change OpMode softkey is highlighted. If the password is incorrect, the system returns to the Standard Display.
5	Press <b>Change OpMode</b> softkey	The Operating Mode Task Window displays both Monitor and Config in reverse video, with the current operating mode highlighted.
6	Select the required Operating Mode.	Use the arrow keys or press the Change Opmode softkey.
7	Press <b>Confirm</b> .	The system performs a cold-start and switches operating modes.

a. Note: Use of this password allows access to all operating modes

# Chapter 2 Testing & Maintaining the CMS

The first section in this chapter describes the procedures required to ensure that the CMS is in safe working order. The following sections describe recommended procedures for maintaining the equipment. These procedures apply to all versions of the CMS. The procedures are grouped as follows:

## Mandatory Periodic Maintenance and Safety Checks

- Performance and Safety Test requirements
- Preventive Maintenance Procedure for the CMS Wall Mount Assembly

## Recommended Maintenance Procedures

- General Inspections of the System
- Cleaning and Disinfecting Procedures for the CMS

See “Procedure Overview” on page 2-2 for a more detailed overview.

---

## Objectives

In order to meet the chapter’s goals, you should be able to:

- Perform required safety checks and maintenance procedures.
- Perform a general inspection of the system.
- Clean the major units of the CMS.

---

## Concepts

The Philips CMS Patient Monitoring System has different levels of preventive maintenance and checks that should be performed on a periodic basis or as recommended.

If you wish to perform more detailed tests on the plug-in parameter modules, please see Chapter 4 “Troubleshooting the Plug-in Modules”.

The procedures described in this chapter should be performed at the specified time intervals to ensure effective preventive maintenance. The checklist may be photocopied, completed by the maintainer, and filed for reference.

## Procedure Overview

**Table 2-1 Mandatory Periodic Maintenance and Safety Checks**

Procedure	Steps	Page
“Test and Inspection Requirements”	When to Perform Test Blocks	2-3
	Tests and Inspection Requirements	2-5
	Safety Tests	2-11
	Safety Test Diagrams	2-12
“Preventive Maintenance Procedure for the Philips M1180A #A01 and #A02 Wall Mount Assembly”	Step 1: Inspect visible fasteners	2-15
	Step 2: Check maximum tilt range	2-17
	Step 3: Inspect mounting plate for movement	2-17

**Table 2-2 Recommended Maintenance Procedures**

Procedure	Steps	Page
“General Inspections of the System”	Inspect the System Hardware	2-19
	Inspect the Cables	2-20
	Inspect the Red Power Indicators (LEDs) of the System	2-20
	Inspect the Display CRT / LCD	2-21
	Inspect the Controls of the System	2-22
“Cleaning and Disinfecting Procedures”	General Cleaning of the System	2-24
	General Disinfecting of the System	2-25
	Cleaning the Recorder Module	2-26
	Cleaning the Blood Analysis Module	2-27

# Test and Inspection Requirements

**NOTE** The Test and Inspections Procedures described in this section are mandatory requirements.

This section is intended primarily for Philips customer engineers and lists the mandatory test requirements for CMS for servicing, installation and preventive maintenance. For some tests it is required that the Philips engineer documents the results in a service record.

Table 2-3 When to Perform Test Blocks explains when to perform the procedures. Table 2-4 Tests and Inspection Requirements explains the procedures to be performed. Table 2-5 CMS Test and Inspection Requirements – Safety and Table 2-6 Safety Test Diagrams give full details of the Safety Tests.

**NOTE** Note: Only Philips service engineers are required to report the results of the following safety and performance tests back to the factory. Of the performance tests, only those for NBP and Sidestream CO<sub>2</sub> need to be reported.

Table 2-3 When to Perform Test Blocks

Service Event – When performing	Test Block(s) Required Complete these tests
Installation of CMS with Medical equipment connections (for example, AGM or Vuelink) but with NO System (SDN)	Perform Visual and Power On test blocks (see page 2-5).
Installation of CMS that is connected to a System (SDN)	Perform Visual and Power On test blocks. If the 78581A safety test (see the 78581A service manual) has passed previously no further safety tests are required. If the 78581A safety test has not been performed, it must be completed.

**Table 2-3 When to Perform Test Blocks**

Service Event – When performing	Test Block(s) Required Complete these tests		
<p>Installation of CMS that has connections to non-medical devices (for example, XGA Display, Laser Printer or PC)</p> <p><b>Note:</b></p> <p>If a non-medical device requires the use of an isolation transformer in order to limit the enclosure leakage current to meet the requirements of IEC 601-1, the power cable connecting the non-medical device to the isolation transformer must be fixed. It must not be possible to remove the power cable without the use of appropriate tools.</p> <p><b>Note:</b></p> <p>If a non-medical device requires the use of additional protective earthing in order to limit the enclosure leakage current to meet the requirements of IEC 601-1, the earthing components must be securely fixed at both ends and must not be removable without the use of appropriate tools.</p> <p><b>Note:</b></p> <p>Interface cables over 3.0m are not to be used.</p>	Device type and test required	Test results (where appropriate)	Action required
	Device is <b>NOT</b> IEC 601-1, IEC 60950 or IEC 61010 compliant	Not applicable	Device <b>NOT</b> acceptable. <b>DO NOT USE</b>
	Device is IEC 601-1 compliant	No tests required	Device acceptable. No action required.
	Device is IEC 60950 or IEC 61010 compliant Class I Equipment (Protectively Earthed Equipment) Perform Visual and Power On test blocks (see page 5). Perform Safety (1) test block (see page 11).	Compliant with IEC 601-1 Enclosure Leakage Current limitations	Device acceptable. No action required.
		Normal condition is within the requirements of IEC 601-1	Additional Protective Earthing must be provided for non-medical device, and must not be removable without the use of appropriate tools or Non-medical device must be connected to the mains supply via an Isolation Transformer
		Single fault condition exceeds IEC 601-1 requirements	
		Normal condition exceeds IEC 601-1 requirements	Non-medical device must be connected to the mains supply via an Isolation Transformer
		Normal condition exceeds IEC 601-1 requirements	Non-medical device must be connected to the mains supply via an Isolation Transformer or Non-medical device must be isolated from the medical device by use of a separation device
Repairs where the power supply in the M1094A/M1094B/M1092A/M1046B assembly is replaced	Perform Power On and Safety (2) test blocks (see page 2-11).		
Repairs where the monitor has been dropped	Perform Power On and Safety (2) and (3) test blocks (see page 2-12).		
All other CMS repairs, Hardware or Software Upgrades	Perform Power On test block.		



**Table 2-3 When to Perform Test Blocks**

Service Event – When performing	Test Block(s) Required Complete these tests
Preventive Maintenance <sup>a</sup>	Perform the NBP and Sidestream CO <sub>2</sub> Module Performance test blocks <b>every year</b> (see page 2-6). Perform the Preventive Maintenance Procedure for the M1180A #A01/A02 Wall Mount Assembly <b>every year</b> (see page 2-15). If an AGM is present, refer to the AGM (M1026A) test matrix. For the BIS module no periodic preventive maintenance is required.
Performance Assurance and Safety Tests <sup>b</sup>	Perform all other Performance test blocks and all Safety test blocks (1), (2) and (3) once every two years.

- a. For **Germany only**: For modules that do not have the CE mark, contact the Customer Response Center in Ratingen for information.
- b. For the BIS module performance and safety testing is optional (Philips recommends yearly testing). However, safety testing (Safety test block (3)) is required if there is suspected liquid ingress or after every time the case of any of the BIS components has been opened.

**Table 2-4 Tests and Inspection Requirements**

Test Block Name	Test or “Inspection” to Perform	Expected Test Results	What to Record on Service Record								
<b>Visual Test</b>	Inspect the system for obvious signs of damage. Also check external leads and accessories.	The system does not have any obvious signs of damage = Pass.	<b>V:P or V:F</b> where P = Pass and F = Fail								
<b>Visual Test for M1180A #A01/A02</b>	Step 1: Inspect visible fasteners Step 2: Check maximum tilt range Step 3: Inspect mounting plate for movement	Mounting is within Specs as described on page 2-15 and following.	<b>VM:P or VM:F</b> where P = Pass and F = Fail								
<b>Power On Test</b>	<table><tr><th>Step</th><th>Step</th></tr><tr><td>1</td><td>Switch on the monitor.</td></tr><tr><td>2</td><td>Plug in an ECG Module.</td></tr><tr><td>3</td><td>Observe whether the monitor boots up successfully without displaying an error code and if an ECG wave appears on the display.</td></tr></table>	Step	Step	1	Switch on the monitor.	2	Plug in an ECG Module.	3	Observe whether the monitor boots up successfully without displaying an error code and if an ECG wave appears on the display.	Monitor boots up. All Alarm LEDs light up shortly. From release B.0, the loudspeaker gives a series of test sounds. No error codes are displayed. An ECG wave is displayed.	<b>PO:P or PO:F</b> where P = Pass and F = Fail
Step	Step										
1	Switch on the monitor.										
2	Plug in an ECG Module.										
3	Observe whether the monitor boots up successfully without displaying an error code and if an ECG wave appears on the display.										

**Table 2-4 Tests and Inspection Requirements(Continued)**

Test Block Name	Test or “Inspection” to Perform	Expected Test Results	What to Record on Service Record																		
Performance Test <b>NBP</b> Module	<b>Accuracy Test</b> <table><tr><th>Step</th><th>Action</th></tr><tr><td>1</td><td>Connect the manometer and the pump with tubing and expansion chamber to the NBP connector on the NBP Module.</td></tr><tr><td>2</td><td>Go to Service Mode.</td></tr><tr><td>3</td><td>Press the <b>NBP</b> button on the NBP Module.</td></tr><tr><td>4</td><td>Press <b>Start</b> button in the task window to close valves.</td></tr><tr><td>5</td><td>Raise the pressure to 280 mmHg with the manometer pump.</td></tr><tr><td>6</td><td>Wait 10 sec for the measurement to stabilize.</td></tr><tr><td>7</td><td>Compare the manometer values with the displayed values.</td></tr><tr><td>8</td><td>Document the value displayed by the Monitor. If the difference is greater than 3 mmHg, calibrate the module.</td></tr></table>	Step	Action	1	Connect the manometer and the pump with tubing and expansion chamber to the NBP connector on the NBP Module.	2	Go to Service Mode.	3	Press the <b>NBP</b> button on the NBP Module.	4	Press <b>Start</b> button in the task window to close valves.	5	Raise the pressure to 280 mmHg with the manometer pump.	6	Wait 10 sec for the measurement to stabilize.	7	Compare the manometer values with the displayed values.	8	Document the value displayed by the Monitor. If the difference is greater than 3 mmHg, calibrate the module.	Value displayed on Monitor = x1  If difference (<= 3mm)  Proceed to next test.	
		Step	Action																		
		1	Connect the manometer and the pump with tubing and expansion chamber to the NBP connector on the NBP Module.																		
		2	Go to Service Mode.																		
		3	Press the <b>NBP</b> button on the NBP Module.																		
		4	Press <b>Start</b> button in the task window to close valves.																		
		5	Raise the pressure to 280 mmHg with the manometer pump.																		
		6	Wait 10 sec for the measurement to stabilize.																		
		7	Compare the manometer values with the displayed values.																		
		8	Document the value displayed by the Monitor. If the difference is greater than 3 mmHg, calibrate the module.																		
Performance Test <b>NBP</b> Module (contd.)	<b>Leakage Test</b> <table><tr><th>Step</th><th>Action</th></tr><tr><td>1</td><td>Press the <b>NBP</b> button on the Module.</td></tr><tr><td>2</td><td>Press the <b>Start</b> softkey in the task window.</td></tr><tr><td>3</td><td>Pressurize the gauge to 280 mmHg.</td></tr><tr><td>4</td><td>Watch the pressure value for 60 seconds. After 60 seconds the value should have decreased by less than 6 mmHg.</td></tr><tr><td>5</td><td>Calculate and document: Leakage test = Accuracy – displayed value</td></tr></table>	Step	Action	1	Press the <b>NBP</b> button on the Module.	2	Press the <b>Start</b> softkey in the task window.	3	Pressurize the gauge to 280 mmHg.	4	Watch the pressure value for 60 seconds. After 60 seconds the value should have decreased by less than 6 mmHg.	5	Calculate and document: Leakage test = Accuracy – displayed value	Leakage test value = x2 (<= 6 mmHg)  Proceed to next test.							
		Step	Action																		
		1	Press the <b>NBP</b> button on the Module.																		
		2	Press the <b>Start</b> softkey in the task window.																		
		3	Pressurize the gauge to 280 mmHg.																		
		4	Watch the pressure value for 60 seconds. After 60 seconds the value should have decreased by less than 6 mmHg.																		
		5	Calculate and document: Leakage test = Accuracy – displayed value																		

**Table 2-4 Tests and Inspection Requirements(Continued)**

Test Block Name	Test or “Inspection” to Perform	Expected Test Results	What to Record on Service Record																
	<b>Linearity Test</b> <table><tr><th>Step</th><th>Action</th></tr><tr><td>1</td><td>Reduce the manometer pressure down to 150 mmHg.</td></tr><tr><td>2</td><td>Wait 10 sec for the measurement to stabilize.</td></tr><tr><td>3</td><td>Compare the manometer values with the displayed values.</td></tr><tr><td>4</td><td>Document the value displayed by the Monitor. If the difference is greater than 3 mmHg then calibrate the module.</td></tr></table>	Step	Action	1	Reduce the manometer pressure down to 150 mmHg.	2	Wait 10 sec for the measurement to stabilize.	3	Compare the manometer values with the displayed values.	4	Document the value displayed by the Monitor. If the difference is greater than 3 mmHg then calibrate the module.	Value displayed on Monitor = x3 If difference (<= 3 mmHg)  Proceed to next test	<b>PN:P/x1/x2/x3/x4 or PN:F/x1/x2/x3/x4</b> where P = Pass and F = Fail						
	Step	Action																	
1	Reduce the manometer pressure down to 150 mmHg.																		
2	Wait 10 sec for the measurement to stabilize.																		
3	Compare the manometer values with the displayed values.																		
4	Document the value displayed by the Monitor. If the difference is greater than 3 mmHg then calibrate the module.																		
	<b>Valve Test</b> <table><tr><th>Step</th><th>Action</th></tr><tr><td>1</td><td>Raise the pressure to 280 mmHg.</td></tr><tr><td>2</td><td>Press <b>Stop</b> on the module to open valves.</td></tr><tr><td>3</td><td>Wait 5 seconds then document the value.</td></tr></table>	Step	Action	1	Raise the pressure to 280 mmHg.	2	Press <b>Stop</b> on the module to open valves.	3	Wait 5 seconds then document the value.	Value displayed on Monitor = x4 (< 10 mmHg)									
Step	Action																		
1	Raise the pressure to 280 mmHg.																		
2	Press <b>Stop</b> on the module to open valves.																		
3	Wait 5 seconds then document the value.																		
<b>Performance Test</b> <b>Sidestream</b> <b>CO<sub>2</sub></b>	<b>Flow Adjustment Procedure</b> <table><tr><th>Step</th><th>Action</th></tr><tr><td>1</td><td>Enter the CO<sub>2</sub> Sidestream Task Window by pressing <b>Parameters</b> followed by <b>CO<sub>2</sub> Sidestream</b>.</td></tr><tr><td>2</td><td>Press <b>Start Pump</b>. The date and time of the last flow adjustment are displayed.</td></tr><tr><td>3</td><td>Start the Flow Adjustment procedure by connecting the flow meter and pressing <b>Start Pump</b>. After about 5 seconds, the flow in ml/min displays in the Task Window.</td></tr><tr><td>4</td><td>Use the <b>Adjust Flow</b> to adjust the value displayed in the Task Window to the value displayed by the external flow meter.</td></tr><tr><td>5</td><td>Write down the value displayed by the CMS (<b>x1</b>).</td></tr><tr><td>6</td><td>Press <b>Confirm</b> to store the readjusted flow rate value. After about 5 seconds, the message “Adjustment done” displays. The flow is automatically set to 100 ml/min.</td></tr><tr><td>7</td><td>If the displayed value is not 100 ml/min, repeat Steps 3 through 5.</td></tr></table>	Step	Action	1	Enter the CO <sub>2</sub> Sidestream Task Window by pressing <b>Parameters</b> followed by <b>CO<sub>2</sub> Sidestream</b> .	2	Press <b>Start Pump</b> . The date and time of the last flow adjustment are displayed.	3	Start the Flow Adjustment procedure by connecting the flow meter and pressing <b>Start Pump</b> . After about 5 seconds, the flow in ml/min displays in the Task Window.	4	Use the <b>Adjust Flow</b> to adjust the value displayed in the Task Window to the value displayed by the external flow meter.	5	Write down the value displayed by the CMS ( <b>x1</b> ).	6	Press <b>Confirm</b> to store the readjusted flow rate value. After about 5 seconds, the message “Adjustment done” displays. The flow is automatically set to 100 ml/min.	7	If the displayed value is not 100 ml/min, repeat Steps 3 through 5.	Value displayed on CMS = x1 (where x1 = 100 +/- 10 ml/min)  Proceed to next test	
Step	Action																		
1	Enter the CO <sub>2</sub> Sidestream Task Window by pressing <b>Parameters</b> followed by <b>CO<sub>2</sub> Sidestream</b> .																		
2	Press <b>Start Pump</b> . The date and time of the last flow adjustment are displayed.																		
3	Start the Flow Adjustment procedure by connecting the flow meter and pressing <b>Start Pump</b> . After about 5 seconds, the flow in ml/min displays in the Task Window.																		
4	Use the <b>Adjust Flow</b> to adjust the value displayed in the Task Window to the value displayed by the external flow meter.																		
5	Write down the value displayed by the CMS ( <b>x1</b> ).																		
6	Press <b>Confirm</b> to store the readjusted flow rate value. After about 5 seconds, the message “Adjustment done” displays. The flow is automatically set to 100 ml/min.																		
7	If the displayed value is not 100 ml/min, repeat Steps 3 through 5.																		

Table 2-4 Tests and Inspection Requirements(*Continued*)

Test Block Name	Test or “Inspection” to Perform	Expected Test Results	What to Record on Service Record												
Performance Test Sidestream CO <sub>2</sub> (contd.)	<b>Barometric Pressure Adjustment Procedure</b>		<b>PSC:P/x1/x2</b> <b>or</b> <b>PSC:F/x1/x2</b> where P = Pass and F = Fail												
	<table><tr><th>Step</th><th>Action</th></tr><tr><td>1</td><td>Press <b>Barometer Pressure</b> to adjust the Barometric Pressure value. The Task Window displays the stored barometric pressure in mmHg.</td></tr><tr><td>2</td><td>If the displayed value is incorrect, use the <b>Barometer Pressure</b> key to adjust the value to atmospheric pressure.</td></tr><tr><td>3</td><td>Document the Difference (x2) between the actual atmospheric pressure and the value displayed by the CMS.</td></tr><tr><td>4</td><td>Press <b>Confirm</b> to store the displayed or adjusted value. After about 5 seconds, the message “Adjustment done” displays. The barometric pressure is then set to the value you entered.</td></tr><tr><td>5</td><td>Press <b>Main Screen</b> (or <b>Standard Display</b>) to return to the standard display in Service mode</td></tr></table>	Step		Action	1	Press <b>Barometer Pressure</b> to adjust the Barometric Pressure value. The Task Window displays the stored barometric pressure in mmHg.	2	If the displayed value is incorrect, use the <b>Barometer Pressure</b> key to adjust the value to atmospheric pressure.	3	Document the Difference (x2) between the actual atmospheric pressure and the value displayed by the CMS.	4	Press <b>Confirm</b> to store the displayed or adjusted value. After about 5 seconds, the message “Adjustment done” displays. The barometric pressure is then set to the value you entered.	5	Press <b>Main Screen</b> (or <b>Standard Display</b> ) to return to the standard display in Service mode	Difference = x2 (<= 4 mmHg)
	Step	Action													
	1	Press <b>Barometer Pressure</b> to adjust the Barometric Pressure value. The Task Window displays the stored barometric pressure in mmHg.													
	2	If the displayed value is incorrect, use the <b>Barometer Pressure</b> key to adjust the value to atmospheric pressure.													
	3	Document the Difference (x2) between the actual atmospheric pressure and the value displayed by the CMS.													
	4	Press <b>Confirm</b> to store the displayed or adjusted value. After about 5 seconds, the message “Adjustment done” displays. The barometric pressure is then set to the value you entered.													
5	Press <b>Main Screen</b> (or <b>Standard Display</b> ) to return to the standard display in Service mode														
Performance Test ECG	<b>Step 1</b> Connect the patient simulator to the ECG Parameter Module using the Patient cable. <b>Step 2</b> Configure the Patient simulator as follows: ECG sinus rhythm HR = 120 BPM (Amplitude 1 mV) <b>Step 3</b> Check displayed ECG wave and HR value against the simulator configuration.	HR = 120 +/- 2 BPM	These results do not have to be reported.												
Performance Test Respiration	<b>Step 1</b> Connect the patient simulator to the ECG/Resp Module using the patient cable. <b>Step 2</b> Configure the patient simulator as follows: Base impedance line 1500 Ohm Delta impedance 0.5 Ohm Respiration Rate 40/min <b>Step 3</b> Check displayed respiration rate against the simulator configuration.	RPM = 40 +/- 2 /min	These results do not have to be reported.												
Performance Test Cardiac Output	<b>Step 1</b> Connect the patient simulator to the C.O. Module using the patient cable. <b>Step 2</b> Configure the Patient simulator as follows: Injection temperature: 2 °C Computation Const: 0.542 (Edward's Catheter) Flow 5 l/min <b>Step 3</b> Check displayed value against the simulator configuration.	C.O. = 5 +/- 1 l/min.	These results do not have to be reported.												

Table 2-4 Tests and Inspection Requirements(*Continued*)

Test Block Name	Test or “Inspection” to Perform	Expected Test Results	What to Record on Service Record
<b>Performance Test Cardiac Output (contd.)</b>  <b>Service Tool procedure, Version 1</b>	<p><i>Note: This procedure applies for Service Tool M1012-14232C and/or C.O. modules without option C10 and/or software revision B.0 and below.</i></p> <p><b>Step 1</b> Make sure to be in Monitoring Mode. Connect C.O. Interface Cable to module.</p> <p><b>Step 2</b> Connect one side of the Service Tool to Injectate receptacle of C.O. Interface Cable and the other side to Catheter Cable receptacle.</p> <p><b>Step 3</b> Enter Measure C.O. Task Window and check results.</p>	<p>Tblood = 37.0°C +/- 0.1°C Tinj = 0.0°C +/- 0.1°C</p>	<p>These results do not have to be reported.</p>
<b>Performance Test Cardiac Output (contd.)</b>  <b>Service Tool procedure, Version 2</b>	<p><i>Note: This procedure only applies for Service Tool M1012-61601 in combination with C.O. modules with option C10 and software revision C.0 and greater.</i></p> <p><b>Step 1</b> Make sure to be in Monitoring Mode. Connect C.O. Interface Cable to module.</p> <p><b>Step 2</b> Connect one side of the Service Tool to Injectate receptacle of C.O. Interface Cable and the other side to Catheter Cable receptacle.</p> <p><b>Step 3</b> Enter Setup C.O. Task Window and check results for: Method of Measurement Arterial Catheter Constant Enter Measure C.O. Task Window and check results.</p> <p><b>Step 4</b> Disconnect Catheter Cable receptacle from Service Tool.</p> <p><b>Step 5</b> Enter Module Setup Task Window. Press <b>Parameter On/Off</b>. Press <b>On/Off Setup</b> to switch Setup On</p> <p><b>Step 6</b> Enter Setup C.O Task Window and change method of measurement to “Right Heart”.</p> <p><b>Step 7</b> Enter Measure C.O. Task Window and check results.</p>	<p>Transpulmonary 341 Tblood = 37.0°C +/- 0.1°C       Tinj = 0.0°C +/- 0.1°C</p>	<p>These results do not have to be reported.</p>
<b>Performance Test Invasive Pressure</b>	<p><b>Step 1</b> Connect the patient simulator to the Pressure module.</p> <p><b>Step 2</b> Set patient simulator to 0 pressure.</p> <p><b>Step 3</b> Make a Zero Calibration with the module.</p> <p><b>Step 4</b> Configure the patient simulator for P(static) = 200 mmHg.</p> <p><b>Step 5</b> Wait for the display.</p> <p><b>Step 6</b> Check displayed value against the simulator configuration. If there is a difference, calibrate the module.</p> <p><i>Note: If the Module was calibrated with a dedicated reusable catheter, check the calibration together with this catheter.</i></p>	<p>P = 200 +/- 5 mmHg</p>	<p>These results do not have to be reported.</p>
<b>Performance Test Temperature</b>	<p><b>Step 1</b> Connect the patient simulator to the temperature input.</p> <p><b>Step 2</b> Configure the patient simulator to 40 °C or alternatively 100 °F.</p> <p><b>Step 3</b> Check displayed value against the simulator configuration.</p>	<p>+/- 0.2 °C or +/- 0.4 °F</p>	<p>These results do not have to be reported.</p>

Table 2-4 Tests and Inspection Requirements(*Continued*)

Test Block Name	Test or “Inspection” to Perform	Expected Test Results	What to Record on Service Record
<b>Performance Test SpO<sub>2</sub></b>	<b>Step 1</b> Connect the sensor to the SpO <sub>2</sub> module. <b>Step 2</b> Measure the SpO <sub>2</sub> value on your own finger (this assumes that you are healthy). <b>Step 3</b> Check displayed value against the simulator configuration.	Between 95 and 100%	These results do not have to be reported.
<b>Performance Test ECG-Sync</b>	This test is recommended for customer sites where ECG Sync is in use or is configured for potential use. <b>Step 1</b> Connect the patient simulator to the ECG input and the defibrillator to the CMS ECG-Sync output. <b>Step 2</b> Configure the patient simulator as follows: ECG sinus rhythm HR = 100 BPM (Amplitude 1 mV) <b>Step 3</b> Switch defibrillator to simulation mode. <b>Step 4</b> Check that the marker pulse is displayed before the T-Wave begins.	Marker pulse is displayed before T-Wave begins.	These results do not have to be reported.
<b>Performance Test Nurse Call Relay</b>	This test is recommended for customer sites where the nurse call is in use. The Nurse Call Relay performance test is performed at the phone jack type connector. This test checks the operation of the Nurse Call Relay. The functionality of the Nurse Call depends on the configuration of the relay (see the CMS Configuration Guide). <b>Tools required:</b> Ohmmeter <b>Step 1</b> Plug a phono connector into the Nurse Call Relay connector. <b>Step 2</b> Connect the Ohmmeter. <b>Step 3</b> Simulate an alarm-free and then an alarm condition.	While no alarm occurs, the relay contacts are open. When an alarm occurs, the relay contacts close	These results do not have to be reported.
<b>Performance Test BIS</b>  <b>PIC/DSC Test</b>	<b>Step 1</b> In Monitoring mode connect the <b>Sensor Simulator</b> (for maximum usage please refer to the documentation delivered with the Sensor Simulator) to the Patient Interface Cable <b>Step 2</b> Enter the BIS Task Window by pressing <b>Module Setup</b> , followed by <b>BIS</b> . <b>Step 3</b> Start Impedance Check by pressing <b>Start Check</b> . This brings up the BIS Cyclic Check Task Window. Check the displayed results.	Electrode 1: 4-6 kΩ Electrode 2: 8-12 kΩ Electrode 3: 1-3 kΩ	These results do not have to be reported.
<b>Performance Test BIS (continued)</b>  <b>DSC Test</b>	<b>Step 1</b> Enter Service Mode <b>Step 2</b> Enter the BIS Task Window by pressing <b>Module Setup</b> , followed by <b>BIS</b> . <b>Step 3</b> Start Test by pressing <b>Test DSC</b> . Check the displayed results.	Module: <b>Test passed</b> BIS engine: <b>Test passed</b> DSC: <b>Test passed</b>	These results do not have to be reported.

## Safety Tests

*For Europe and Asia-Pacific:*

M1165A, M1166A, M1167A

according to IEC 601-1:1988+A1+1991+A2:1995 = EN60601-1:1990+A1:1991+A2:1995

*For the US:*

M1175A, M1176A according to UL 544

M1177A according to UL 2601-1

The test procedures outlined in this section are to be used **only** for verifying safe installation or service of the product in question.

The set-ups used for these tests and the acceptable ranges of values are derived from local and international standards but may not be equivalent.

These tests are **not a substitute for local safety testing** where it is required for an installation or a service event.

If using the Metron Safety tester, use your local regulation to perform the test, *for example*, in Europe IEC601-1/IEC601-1-1, and in the U.S. UL2601-1. The Metron Report should print results with the names listed below, along with other data.

The Safety Tests required to ensure that the CMS is in safe working order are detailed in the following tables.

**Table 2-5 CMS Test and Inspection Requirements – Safety**

Test Block Name	Test or “Inspection” to Perform	Expected Test Results	What to Record on Service Record
<b>Safety (1):</b>	System Safety Test Enclosure Leakage Current / <b>Normal Condition:</b>  System Safety Test Enclosure Leakage Current / <b>Single Fault Condition</b>	<b>Normal Condition</b> maximum leakage current = <b>x1</b> . x1 <= 100 µA IEC601-1, UL2601-1 (UL544 test not required)  <b>Single Fault</b> maximum leakage current = <b>x2</b> . x2 is <= 500 µA (IEC601-1) or <= 300 µA (UL2601-1) or <= 100 µA (UL544)	<b>S1:P/x1/x2 or S1:F/x1/x2</b> where P = Pass and F = Fail
<b>Safety (2):</b>	Protective Earth	With mains cable: Maximum impedance = x <= 100 mOhms All authorities (IEC601-1, UL2601-1, UL544)	<b>S2:P/x or S2:F/x</b> where P = Pass and F = Fail

**Table 2-5 CMS Test and Inspection Requirements – Safety**

Test Block Name	Test or “Inspection” to Perform	Expected Test Results	What to Record on Service Record
<b>Safety (3):</b>	Patient Leakage Current AC	Maximum leakage current = x $\leq 50 \mu\text{A}$ @ 250V (IEC601-1 or UL2601-1) or $\leq 10 \mu\text{A}$ @ 120V without patient leads connected (UL544) or $\leq 20 \mu\text{A}$ @ 120V with patient leads connected (UL544)	<b>S3:P/x or S3:F/x</b>  where P = Pass and F = Fail

**Table 2-6 Safety Test Diagrams**

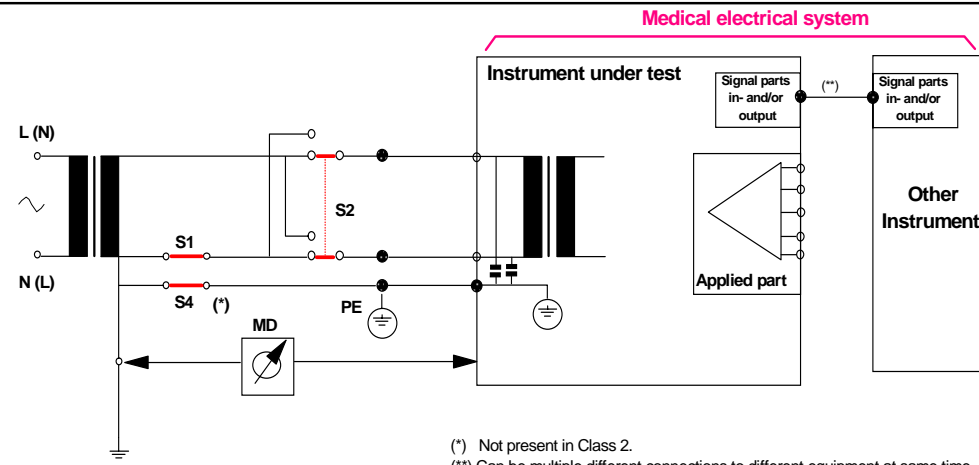
Test Block Name	Test or Inspection to Perform
Safety(1) System Enclosure Leakage Current – NC (normal condition)	 <p>(*) Not present in Class 2.  (**) Can be multiple different connections to different equipment at same time.</p> <p>Measures leakage current of exposed metal parts of Instrument under Test (IUT) and between parts of the system within the <b>patient environment</b>; normal and reversed polarity using S2.  <i>Safety test according to IEC 601-1-1 (Clause 19.201.1). Report largest value.</i></p>



Table 2-6 Safety Test Diagrams

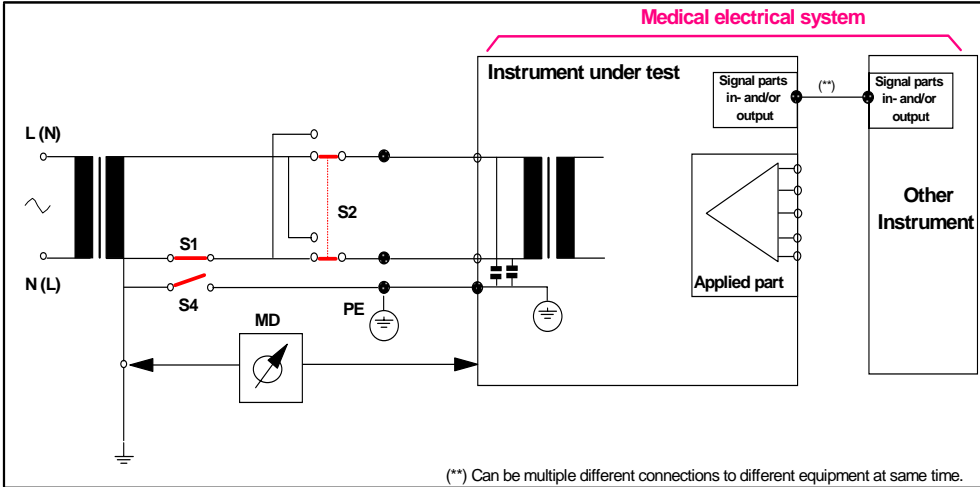
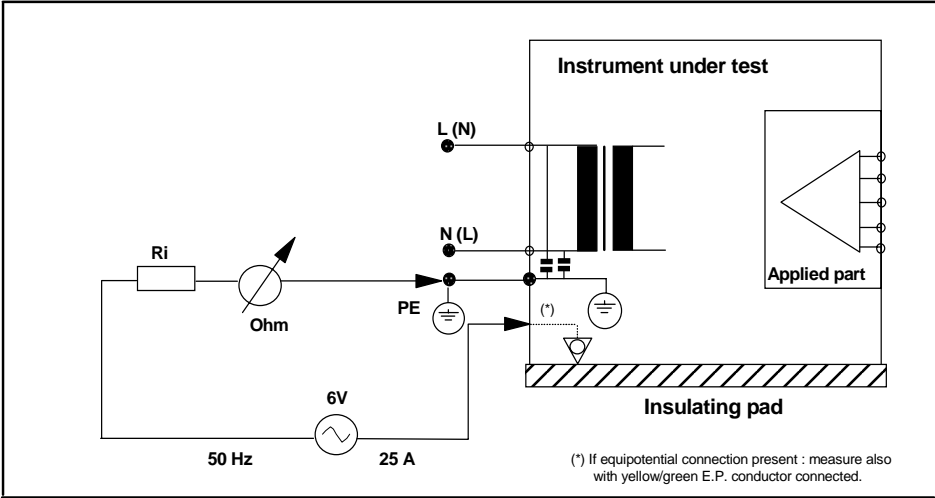
Test Block Name	Test or Inspection to Perform
Safety(1) System Enclosure Leakage Current – OE (open earth)	 <p>(**) Can be multiple different connections to different equipment at same time.</p> <p>Measures leakage current of exposed metal parts of IUT with Protective Earth (PE) open circuit (S4 = open) and between parts of the system within the <b>patient environment</b>; normal and reversed polarity using S2. <i>Safety test according to IEC 601-1-1 (clause based on 19.201.1).</i> Report largest value.</p>
Safety(2) Protective Earth	 <p>(*) If equipotential connection present : measure also with yellow/green E.P. conductor connected.</p> <p>Measures impedance of Protective Earth (PE) terminal to all exposed metal parts of IUT, which are for safety reasons connected to the Protective Earth (PE). Max. 100 mOhm. Test current 25 Amps applied for 5 to 10 seconds. The recommendation is to flex the main cable during the test in order to identify potential <b>bad</b> contact or damage of the earth wire. <i>Safety test according to IEC 601-1 (Clause 18).</i> Report largest value.</p>

Table 2-6 Safety Test Diagrams

Test Block Name	Test or Inspection to Perform
Safety(3) Patient Leakage Current – AC	<div><p>(*) Not present in Class 2</p><p>Measures patient leakage current from Applied Part to earth caused by external main voltage on Applied Part with switch S5 open and closed. Each polarity combination possible is tested using S2 and S6. This test is applicable for every listed module (ECG, ECG/Resp, Invasive Pressure, Cardiac Output, CO<sub>2</sub>, SpO<sub>2</sub>, SvO<sub>2</sub>, FiO<sub>2</sub>, EEG, Temperature). <i>Safety test according to IEC 601-1 (Clause 19.4.h). Report largest value.</i></p></div>

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## Preventive Maintenance Procedure for the Philips M1180A #A01 and #A02 Wall Mount Assembly

### Overview

The objective of this procedure is to inspect the mounting hardware for proper operation.

---

#### NOTE

**The Preventive Maintenance Procedure described in this section is a mandatory requirement, which has to be performed once a year. All fasteners should be checked and tightened or replaced as necessary.**

---

The procedure consists of the following steps:

**Step 1**    Inspect all visible mounting-related fasteners

**Step 2**    Check maximum tilt range

**Step 3**    Inspect mounting plate for movement

### Step 1: Inspect visible fasteners

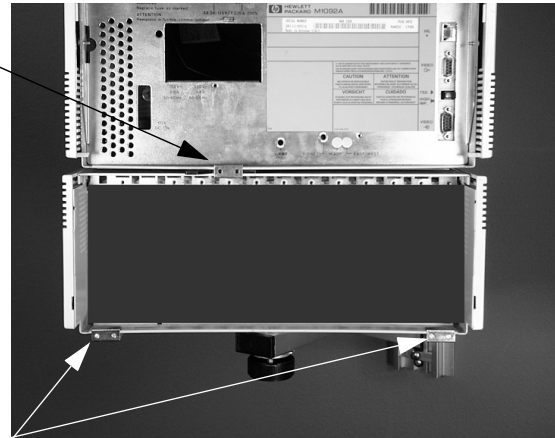
Please refer to the diagrams on page 2-16 and 2-17 for mounting component identification.

1. Inspect gold and silver stabilizing clips viewable from the rear of the monitor.  
If a clip is missing, install new clips to ensure safety of the mount (See picture below).  
The Kit M1180-60504 contains the three clips and the necessary screws.

## Preventive Maintenance Procedure for the Philips M1180A #A01 and #A02 Wall Mount Assembly

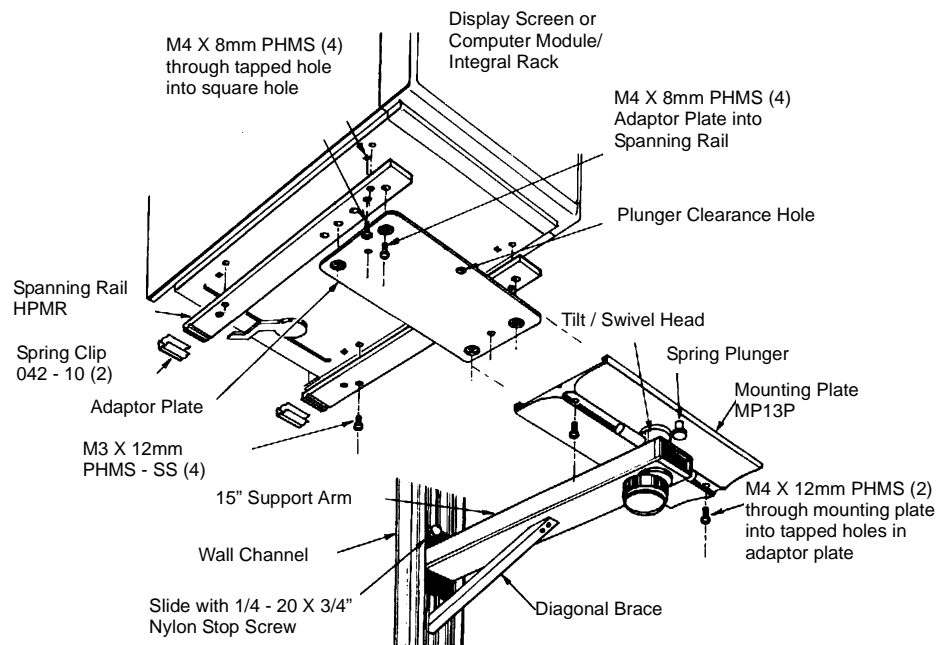
2. Refer to the diagram on page 2-16, inspect all visible fasteners and tighten as required. If a fastener is broken or missing, install new fasteners. The Kit M1180-60504 contains the three clips and the necessary screws.

Gold Spring clip to locate Cam  
Handle



Silver Spring clips to stabilize  
rails and housing

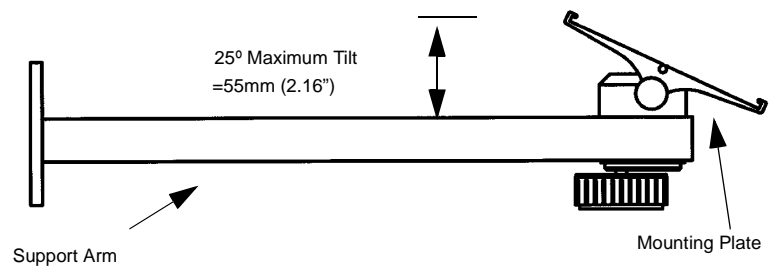
**Figure 2-7. Wall Mount Components Diagram**



## Step 2: Check maximum tilt range

Please refer to the diagrams above and on page 2-17 for mounting component identification.

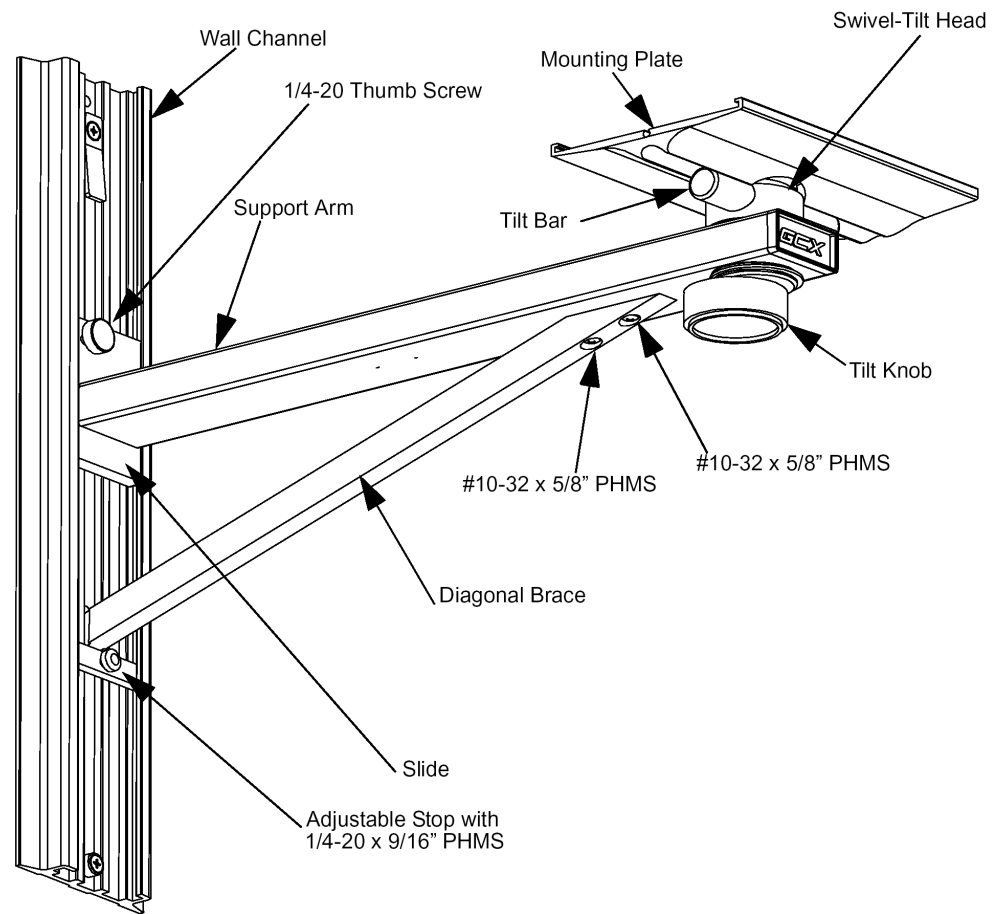
1. Rotate Tilt Knob counterclockwise until the knob stops. This is the maximum forward tilt angle. The maximum forward tilt range should not exceed 25° or 55mm (2.16"). (Refer to diagram below for reference angle). If the tilt range exceeds these specifications, the wall mount must be replaced.



## Step 3: Inspect mounting plate for movement

1. With monitor set at desired tilt angle, apply pressure to the front of the monitor in an attempt to move it in a "rocking" motion. If the Mounting Plate "rocks", or movement is observed between the mounting plate and tilt bar, the wall mount assembly **must** be replaced. **Note:** Minor "flexing" movement of the entire mounting assembly is normal.
2. If no "rocking" is detected, the mounting assembly is functioning properly, and the inspection procedure is complete.

Figure 2-8. Wall Mount Assembly Diagram



## General Inspections of the System

The CMS is designed to withstand the stresses of the Clinical Care environment. Each module of the system is encased in plastic and all of the cables and cords of the CMS are tested for patient safety. To keep your system in good physical condition, Philips recommends that you perform an annual inspection of the modules and cables of the CMS.

### Objective

In order to meet the chapter's goals, you should be able to perform a general inspection of the CMS.

### Concepts

The CMS is composed of various modules: the Display Module, the Computer Module, the plug-in modules, the plug-in module rack, the Handheld Keypad, and, in certain configurations, the remote power supply (for the flatscreen display module) or the External Alarm Device (used with an XGA-compatible display). Each module contains connectors, controls or cables that should be checked annually to ensure that they are in good condition and functioning normally.

Since the CMS is used in situations where the modules may come in contact with human fluids, you should follow all of the procedures of your department for dealing with contaminated equipment before proceeding with any maintenance procedures.

### Inspect the System Hardware

*Inspecting the system on an annual basis will help you keep track of your system and identify potential parts that need to be replaced.*

No tools are required to perform this inspection.

- Step 1** Examine the exterior of the unit for cleanliness and general physical condition. Check that the plastic housings are intact, that all hardware is present and tight, and that there are no signs of spilled liquids or other serious abuse.
- Step 2** Check fuse values and type against that marked on the chassis, and ensure that a spare is provided.
- Step 3** Inspect connectors of the module rack and ensure that the plug-in modules are locked into place and do not slide out without first releasing the locking plate on the bottom of the module.
- Step 4** Ensure all labeling is present and legible.
- Step 5** Inspect all accessories external to the system such as transducers, referring to the manufacturer's documentation.

*Cables and electrical cords could be potential hazards if they are not kept in good working condition.*

### Inspect the Cables

A screwdriver may be required to complete this inspection.

- Step 1** Examine the line/power plug for damage. Ensure that the prongs of the plug do not move in the casing. Shake the plug and listen for loose screws. If any damage is suspected, open the plug and inspect it.
- Step 2** Inspect the line/power cord for signs of damage. If damaged, replace the entire cord or, if the damage is near one end, cut out the defective portion. Ensure that any new line/power cord or plug is fitted with the same polarity as the old one.
- Step 3** Examine the strain reliefs at both ends of the line/power cord; be sure that they hold the cord securely.
- Step 4** Inspect the interconnecting cables between the Display Module and the Computer Module for general condition. Examine them carefully to detect breaks in the insulation. Ensure that the cable connectors are properly engaged and that any connector screws are fully tightened.
- Step 5** Inspect the patient cables and leads and their strain reliefs for general condition. Examine cables carefully to detect breaks in the insulation and to ensure that they are gripped securely in the connectors of each end to prevent rotation or other strain.
- Step 6** Flex the patient cable near each end to verify that there are no intermittent faults.

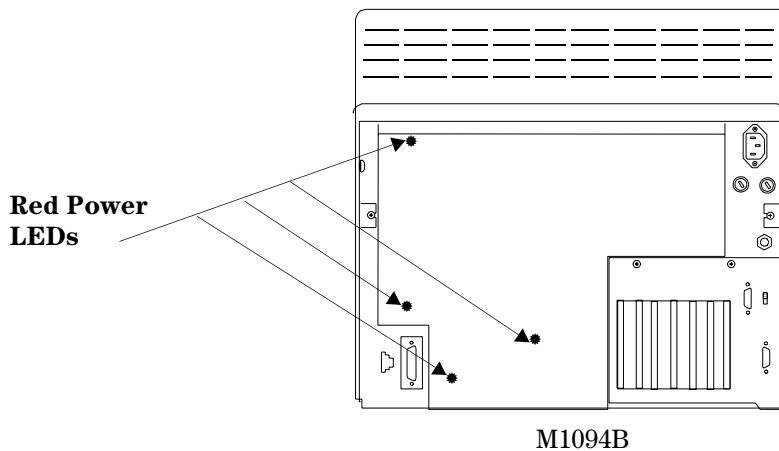
### Inspect the Red Power Indicators (LEDs) of the System

No tools are required to perform this inspection.

- Step 1** Turn the System On by pressing the power switch in the lower left-hand corner of the CRT display.
- Step 2** The system will click and light up the LEDs on the display. After several seconds, the LEDs will go off and the display will start showing waveforms and numerics if the monitor is in the monitoring or demo mode. If the system fails to boot, see the Troubleshooting chapter in this manual.
- Step 3** Check the rear of the display module and compare the red LEDs that are visible to those in Figure 2-9.

*The power indicators light up every time the system is switched ON. This procedure is not applicable for the flatscreen. (Red LEDs are located inside the separate power supply.)*





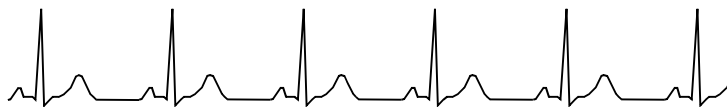
**Figure 2-9. Red LEDs on the Rear Panel of the M1094B Display Module**

### Inspect the Display CRT / LCD

*Inspecting the integrity of the display will help you verify that the display is working correctly.*

A fixed rate simulator is required to perform the inspection.

- Step 1** Note the positions of all of the shift, contrast and brightness controls (only brightness for the LCD display) so they are returned to their previous positions (assuming they are correct) at the end of the testing procedure.
- Step 2** Set up an ECG signal on the screen from a fixed rate simulator. Check the baseline. It should stay in focus across the CRT and it should be horizontal, not noticeably sloped or bowed.
- Step 3** Check the ECG complexes. They should be regularly spaced. Uneven spacing indicates a sweep non-linearity. All portions of a simulated ECG waveform should be clear and visible, including the P wave and QRS.



**Figure 2-10. A Standard ECG Wave**

- Step 4** Using the V SHIFT control on the bottom rear of the CRT Display, vary the vertical position of the baseline. It should be possible to move the baseline through all of the vertical height of the CRT. There should be no distortion on the baseline as it is moved up or down on the screen.
- Step 5** Adjust the contrast and brightness controls so that they are at the maximum settings and then adjust them so that they are at the minimum setting. (For the CRT, the phosphor may “burn”: check the condition of the phosphor on the CRT by noting if any “burn” spots [discoloration] are visible.)

## General Inspections of the System

- Step 6** With the ECG simulator attached, check to see if any noise (interference) is superimposed on the baseline. Baseline interference may be apparent as a thick baseline at high gain settings (using V AMP, H AMP and EAST WEST controls on bottom rear of Display), but should not be visible throughout the lower two-thirds of the gain control range.
- Step 7** Apply an external 1 mV pulse. The trace should exhibit a leading edge with minimal rounding and a spike (or overshoot) of less than 10%. After 1 second, the pulse should have decayed no more than half of its original amplitude.
- Step 8** Return the controls to their previous positions (assuming they are correct). Refer to the Troubleshooting section if any problems were identified.

---

### NOTE

The fluorescent tube (“backlight”) in the Flatscreen Display module will darken over time, resulting in a dimmer display. As a preventive maintenance procedure, it is recommended that the tube be replaced after a certain time of continuous use or if an unacceptable decrease in backlight intensity is noted. Please refer to “M1095A Backlight Removal and Replacement Procedures” in Chapter 5 “Repairing the CMS”

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## Inspect the Controls of the System

- Step 1** Examine all controls (hardkeys, softkeys, arrow keys, ON/OFF switch, contrast and brightness controls as shown in Chapter 1 “Introducing the CMS” (Figure 1-3) for physical condition. During the course of this examination, ensure that the controls perform their proper function as stated.
- Step 2** Check the module LEDs, see that they light up as expected. Pressing a module setup key should light up the setup indicator above the key.
- Step 3** Press the ECG key on the front of the ECG module in a system that is turned On. This brings up the ECG Task Window and verifies that the computer module and integral rack are communicating with the plug-in module. If the ECG module does not respond, perform the module self-test or check the troubleshooting chapter.
- Step 4** Confirm that the green LED of the Power indicator on the lower left-hand corner of the display is functioning.
- Step 5** Ensure correct operation (visually and audibly) of all Alarms using, if required, the User Guide and a Patient Simulator (Neurodyne Nevada Inc. Model 217A or medSim 300 or similar).
- Step 6** If possible connect the ECG parameter module of the unit to an ECG simulator and verify that an adequate trace is received at each patient lead selection.
- Step 7** If your system uses a handheld keypad, check the integrity of the adhesive on the mounting bracket. It is important to note that adhesives are more prone to failure in hostile (warm, humid) environments.

---

## Cleaning and Disinfecting Procedures

This section details the cleaning procedures for the System as a whole and for the Recorder and Blood Analysis Modules in particular.

### Objective

In order to meet the chapter's goals, you should be able to understand which cleaning and disinfecting agents you should use to safely clean a CMS.

### Concepts

The CMS is composed of various different modules: the Display, the Computer Module, the Plug-In Modules, the Module Rack, the Flatscreen Power Supply and the Handheld Keypad. Each module contains connectors, controls or cables that should be cleaned regularly to ensure that they are in good condition and functioning normally.

Since the CMS is used in situations where its modules may come in contact with human fluids, you should follow all of the procedures of your department for dealing with contaminated equipment.

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#### WARNING

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**Philips makes no claims regarding the efficacy of the listed chemicals or methods as a means for controlling infection. Consult your hospital's Infection Control Officer or Epidemiologist.**

For comprehensive details on cleaning agents and their efficacy, refer to "Guidelines for Prevention of Transmission of Human Immunodeficiency Virus and Hepatitis B Virus to Health Care and Public-Safety Workers." issued by the U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, Atlanta, Georgia, February 1989.

### General Cleaning of the System

- The CMS should be kept free of dust and dirt.
- Exterior cleaning of the case and screen is recommended. Clean it with a lint-free cloth, moistened with either warm water (40°C/104°F. max) and soap, a diluted non-caustic detergent or one of the approved cleaning agents listed below:

<b>Soaps</b>	mild soaps
<b>Tensides</b> (dishwasher detergents)	Edisonite Schnellreiniger <sup>®</sup> , Alconox <sup>®</sup>
<b>Ammonias</b>	Dilution of Ammonia <3%, Window cleaner
<b>Alcohol</b>	Ethanol 70%, Isopropanol 70%, Window cleaner

---

#### CAUTION

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To avoid damage to the product, observe the following general precautions for cleaning. You should only deviate when this is explicitly described in the cleaning instruction for the individual transducer or accessory.

- Do not use strong solvents such as acetone or trichloroethylene.
- Always dilute according to the manufacturers instructions, or use lowest possible concentration.
- Never use abrasive material (such as steel wool or silver polish).
- Do not allow liquid to enter into the product.
- Never submerge any part of the system.
- Do not pour liquid onto the system during cleaning.
- Do not allow cleaning agent to remain on any of the equipment surfaces - wipe it off immediately with a cloth dampened with water.

---

#### CAUTION

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If you want to clean a touch enabled display such as the M1097A #A02 Flatscreen Display, the touch operation has to be disabled during the cleaning procedure. If you use a mouse and want to clean it, mouse operation has to be disabled during the cleaning procedure. For more detailed information on how to perform these actions, please refer to the *User's Reference Manual*.

---

## General Disinfecting of the System

We recommend that you disinfect the product only when necessary as determined by your hospital's policy, to avoid long term damage to the product.

We also recommend that the products being disinfected be cleaned first, as described under "General Cleaning of the System" on page 2-24.

Use the recommended disinfecting substances listed below:

<b>Alcohol based</b>	Ethanol 70%, Isopropanol 70%, Cutasept <sup>®</sup> , Hospisept <sup>®</sup> , Kodan <sup>®</sup> Tinktur forte, Sagrosept <sup>®</sup> , Spitacid <sup>®</sup> , Sterilium fluid <sup>®</sup> . <sup>1</sup> only Ethanol 70% and Isopropanol 70% are tested and qualified
<b>Aldehyde based</b>	Dilution of formaldehyde (3-5%), Cidex <sup>®</sup> , Gigasept <sup>®</sup> . <sup>2</sup> only Cidex is tested and qualified
<b>Bleach</b>	Dilution of sodium hypochlorite (laundry bleach): concentration ranging from 500ppm (1:100 dilution of household bleach) to 5000ppm (1:10 dilution of household bleach), Hydrogen peroxide 3%, Chlorox <sup>®</sup> (1:10 dilution), Dakin's Solution.
<b>Phenol based</b>	Wofasept <sup>®</sup> , Sporidicin <sup>®</sup> .

### CAUTION

To avoid damage to the product, observe the following general precautions for disinfection. You should only deviate when this is explicitly stated in the disinfecting instruction of a specific product.

- Do NOT use Povodine<sup>®</sup>, Sagrotan<sup>®</sup>, Mucocit<sup>®</sup> disinfecting agents or strong solvents e.g. acetone.
- Always dilute according to the manufacturer's instructions or use lowest possible concentration.
- Do not allow any liquid to enter the case.
- Never submerge any part of the system.
- Do not pour liquid onto the system during cleaning.
- Never use abrasive material (such as steel wool or silver polish).
- Do not allow any disinfecting agent to remain on any of the equipment surfaces – wipe it off immediately with a cloth dampened with water.

### CAUTION

If you want to disinfect a touch enabled display such as the M1097A #A02 Flatscreen Display, the touch operation has to be disabled during the cleaning procedure.

If you use a mouse and want to disinfect it, mouse operation has to be disabled during the cleaning procedure.

## Cleaning and Disinfecting Procedures

### Cleaning the Recorder Module

The paper roller and paper out sensors should be cleaned periodically.

- Step 1** Open the recorder door and remove the roll of paper, if present.
- Step 2** Use a lint free cloth and Isopropyl Alcohol to wipe the roller. Be sure to clean all sides of the roller.

#### CAUTION

To avoid damage to the roller, do NOT use any of the following cleaning agents:

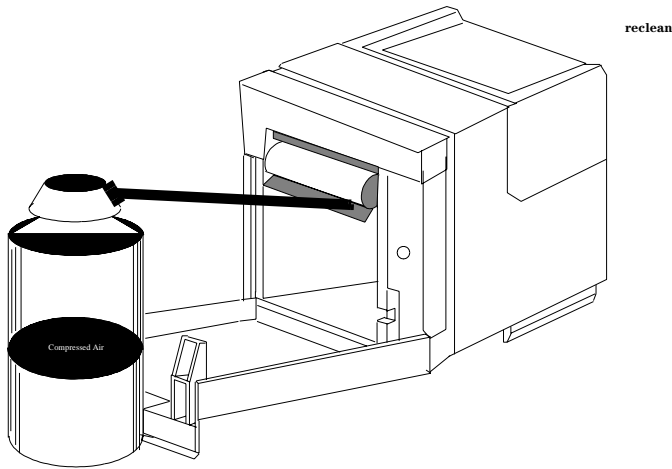
- ♦ Dilute sodium hypochloride (laundry bleach)
- ♦ Dilute formaldehyde
- ♦ Hydrogen peroxide

- Step 3** Use the same cloth to clean the inside casing of the Recorder Module.
- Step 4** Use a bottle of compressed air to clean the paper out sensor that is located just below the paper roller.

*The paper roller is cleaned to prevent paper slippage and to keep the recordings clean.*

*An optical sensor is used to detect when the recorder is out of paper. If an excessive amount of dust or dirt particles builds up around the sensor, the recorder will "think" it is out of paper even though this may not be the case.*

*If very slow speed (1 or 2 cm/min) recordings are run for extended periods of time, deposits of paper debris may collect on the printhead. Symptoms of this are recordings that are printed unevenly (have faint horizontal stripes).*

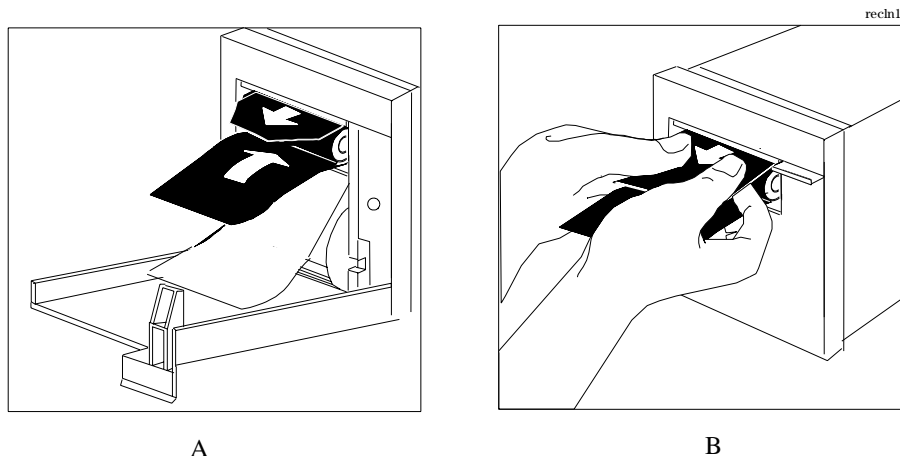


**Figure 2-11. Cleaning the paper out sensor**

The print head should also be cleaned periodically.

- Step 5** Thread a cleaning strip (included in the Recorder Module Cleaning Kit P/N M1116-60201) around the roller as in shown in diagram (A) below.
- Step 6** Close the recorder door, with both ends of the strip and the paper extending over the top of the door.
- Step 7** Grasp the top end of the strip as shown in diagram (B) below, and pull the strip out.

- Step 8** Open the door, re-thread the paper, and resume normal operation. (For best results use only Philips Recorder Paper - P/N 40477A/B.)

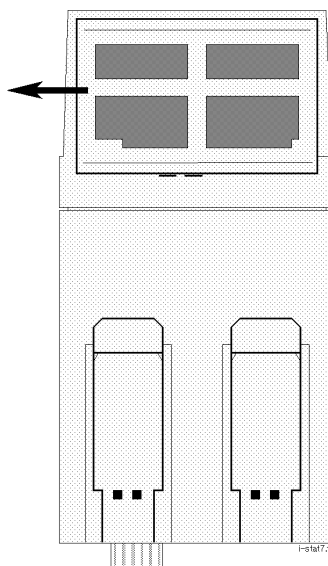


**Figure 2-12. Cleaning the Printhead of the Recorder Module**

## Cleaning the Blood Analysis Module

The filter for the ventilator fan should be cleaned periodically.

- Step 1** Slide the filter cover on the underside of the module to the left and remove.



- Step 2** Remove the filter from the cover.
- Step 3** Rinse the filter under running water to remove any dust or debris.
- Step 4** Shake the filter and leave to dry before replacing in the cover.

## **Cleaning and Disinfecting Procedures**



# Chapter 3 Troubleshooting the CMS

This chapter describes how to troubleshoot the CMS as a system. Once a fault has been isolated to either the display module or computer module, this chapter tells you how to further isolate faults to the field replaceable assemblies. All references to the CMS also refer to ACMS or NCMS unless specifically stated.

---

## Objectives

This chapter shows you how to:

- Recognize a properly operating CMS.
- Identify symptoms of improper operation for the CMS.
- Use any symptoms or indications to identify a fault as being in the display module, computer module, or the plug-in parameter modules.
- Further isolate faults down to field replaceable assemblies.

---

## Concepts

This chapter uses visual indications, error codes, and other operational symptoms to help you diagnose problems with the CMS. Symptoms have been grouped to form troubleshooting modules.

Each troubleshooting module contains procedures for isolating faults based on the symptoms, any supporting theory as to why you are being told to do a certain procedure, and any additional rationale that will help you to isolate faults. The following table lists the troubleshooting modules.

---

## Procedure Overview

**Table 3-1 Troubleshooting Procedure Overview**

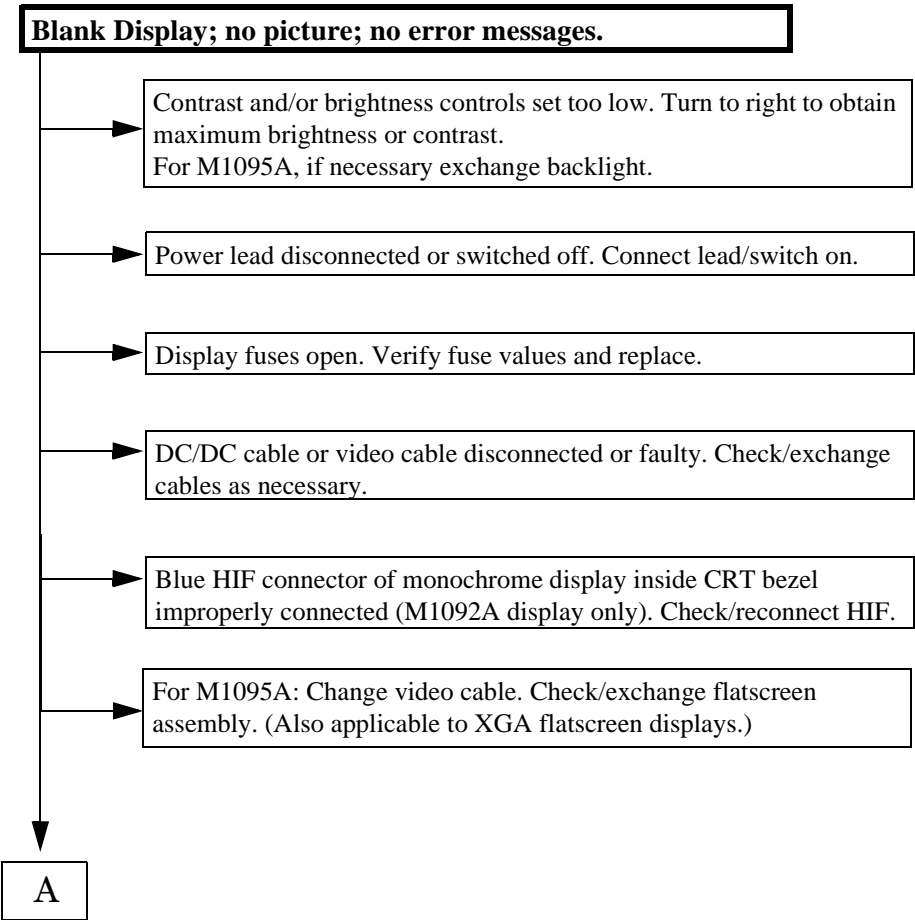
Topic	Page
General System Troubleshooting	3-3
Troubleshooting Module 1 - Fixing Display / Power Supply Problems	3-7
Troubleshooting Module 2 - Computer Module Faults	3-14
Troubleshooting Module 3 - Fixing Recorder Problems	3-35
Troubleshooting Module 4 - Fixing Handheld Keypad Problems	3-36
Troubleshooting Module 5 - Fixing Printing Problems	3-37
Troubleshooting Module 6 - Using the Service Mode	3-39

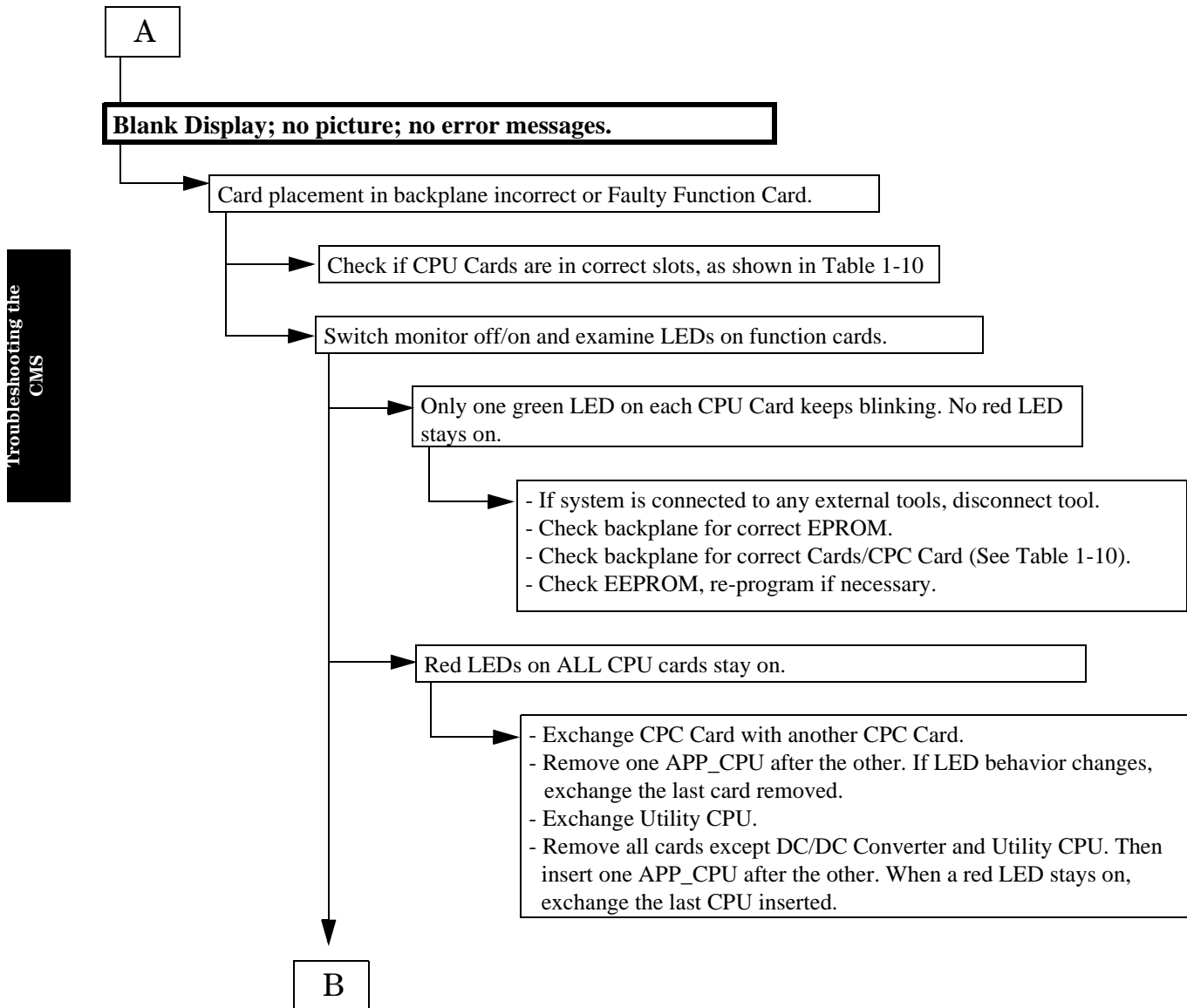
General System Troubleshooting

The following flowcharts are a good place to begin troubleshooting the CMS. Each bold box represents a general symptom of the monitor. After identifying the appropriate symptom, follow the arrow from the box to the possible corrective actions. If the first action listed does not resolve your problem, then proceed to the next box. If you need more help, proceed to the appropriate Troubleshooting Module.

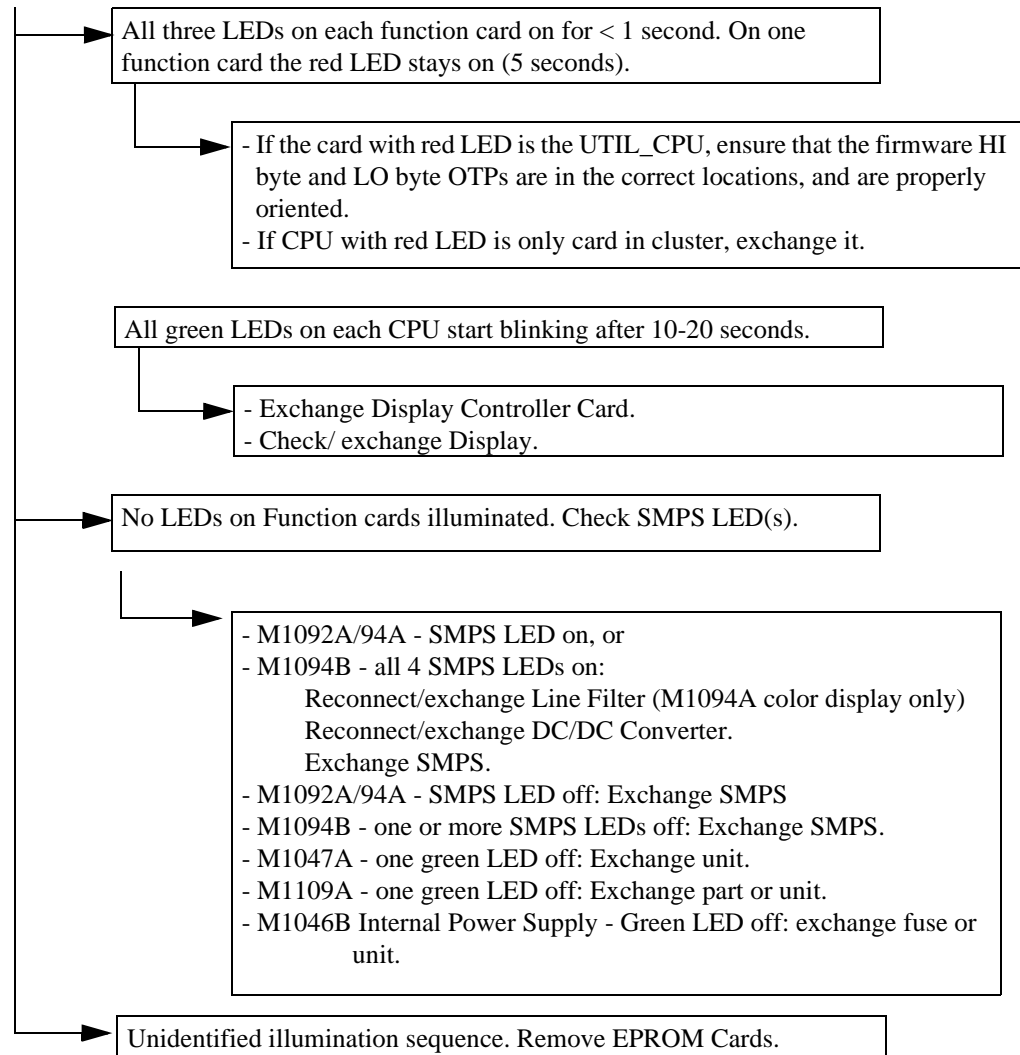
The letter with a box around it is a guide to help you through the flowchart. The corresponding letter on the following page marks your place in the chart.

Troubleshooting the  
CMS





B



### Keyboard and front panel switches not operating. Computer Module resets itself periodically.

HIL cable between Display or External Alarm Device and Computer Module is reversed. Reconnect cable, matching the dot indicators.

Faulty HIL cable. Exchange HIL cable.

Faulty HIF board or blue HIF connector in Display bezel. Exchange HIF board.

Faulty Utility CPU Card. Exchange Utility CPU.

### System resets and all Patient Data is lost.

SRAM checksum error on start-up. In Service Mode, perform the Extended Test. If the test indicates a faulty card, replace it.

### Some or all waves/numerics missing.

Plug-in Module(s) or Module Rack problem. See Chapter 4 "Troubleshooting the Plug-in Modules" for the module(s) in question.

### Overview (SDN) user default settings automatically reset to factory defaults.

For CMS Releases A - C: SDN connection has been interrupted (either through SCC power down, or SDN cable disconnection). In Configuration Mode, reconfigure the user defaults for all Overview.

# Troubleshooting Module 1 - Fixing Display / Power Supply Problems

This module shows you how to troubleshoot problems based on symptoms given by a faulty display. Use this module when your CMS display is blank, showing incorrect data, or if you are referred to this module from another procedure.

---

## Objectives

In order to meet this chapter's goal, you should be able to:

- Identify faulty conditions.
- Determine if your fault lies in the display or in the computer module.
- Know the likely causes of the fault and the likely remedy of the fault.

---

## Concepts

The display monitors (M1092A - monochrome, M1094A/94B - color, M1095A - color flatscreen, or XGA-compatible display) use basically the same signal path to display patient data on the screen. The big difference is in the type of display controller cards used. The M1092A uses a display controller card called the DSPC. Both the M1094A and M1094B use a color display controller card called the CDSPC. Older versions of the CDSPC did not have enough RAM and two CDSPC cards had to be used. However, the newer versions of the CDSPC contain the necessary RAM and only one is needed.

The Application CPU in the computer module produces the data to be displayed. The DSPC and CDSPC cards control the mechanism of displaying the information on the screen. All of the inputs to the CRT displays come through a 9-pin D-type video-in plug on the rear of the display.

The Flatscreen uses one display controller card called DSPC\_FLAT. All the inputs to the display come through a 25-pin twisted pair cable plugged in at the rear of the Flatscreen.

The XGA-compatible display uses one display controller card called CDSPC\_XGA. All the inputs to the display come through a standard 15-pin cable.

To troubleshoot a faulty display condition perform the following procedure.

## Procedures

### If the CRT display is blank...

*Check power LED.*

- ☐ If the display is blank, the first thing to check is the green LED near the power switch on the front of the display module. When the CMS is plugged into a correct power source and the power switch is pressed to ON, this LED should illuminate GREEN.

When you verify the two conditions are true (CMS plugged in and power switch ON) and the LED is not GREEN, check the fuse. If the fuse is blown, replace the fuse. If fuse continues to blow, there is a problem in the display, and the display should be replaced.

If the fuse is good and the LED is not GREEN, it is possible that the low-voltage output from the Switch Mode Power Supply is not present. Proceed to the next step. If the LED is GREEN, and the fuse is good, and the display is blank, proceed to the next step.

*Check contrast and brightness controls.*

- ☐ The contrast or brightness controls may have been turned down too low. Turn both controls fully to the right and see if this fixes your problem. If nothing at all happens to the screen when you turn the controls to the right, the high voltage output from the SMPS may not be present and the display might need to be replaced. Proceed to the next step.

If when you turn the controls to the right a raster appears, the fault could be in the DC-to-DC converter in the computer module. Look at the rear of the Computer Module and locate the Utility CPU board. The Utility CPU board should have three green LEDs illuminated. If it does not, replace the DC-to-DC converter. If the LEDs are illuminated green, refer to the section CMS System Hardware/Software Problems on page 3-27.

*Check video cable.*

- ☐ The video cable from the Computer Module to the Display is not connected correctly. Check the connection and reconnect if necessary. If the connection is correct, the cable may be faulty. Replace the cable and see if this corrects the problem.

*Check HIF connector.*

- ☐ The blue human interface connector of the monochrome display in the front assembly is improperly connected. Remove the front assembly and check the connector and reconnect if required.

*Check DSPC Card(s).*

- ☐ The wrong display controller (DSPC) card is in the Computer Module. If the wrong DSPC Card is in the backplane or the DSPC is missing from the backplane, the display may be blank. Check that the DSPC Card(s) is/are CMS display controller card(s) and that it is in the correct slot.

If the monitor is color, ensure that the DSPC\_Color Card (or both a CDSPC\_VIDEO and CDSPC\_CTRL Card) is plugged into the correct slot(s) in the backplane.

*Check Functional Cards.*

- ☐ The card placement in backplane is incorrect/faulty function card is present. If the corrective actions in General System Troubleshooting on page 3-3 did not resolve the symptom, refer to section Procedures on page 3-14.



**If there is poor display quality, inverse video, incorrect colors, faded image, ghosting, a scrambled picture, or missing information on the CRT display...**

*Check video termination.*

- ☐ The video termination switch on the rear of the display may be improperly set. If only a main display is being used, the main switch should be placed to **Switch ON (in)**. If a second (remote) display is connected to the main display, the switches should be set as follows:  
Main: **Switch OFF (out)**      Slave: **Switch ON (in)**

*Check video cable.*

- ☐ The video cable from the Computer Module to the Display is not connected correctly. Check the connection and reconnect if necessary. If the connection is correct, the cable may be faulty. Replace the cable and see if this corrects the problem.

*Check degaussing coils.*

- ☐ If you have a color display, there is a chance the de-gaussing coils of the CRT are faulty. These coils de-magnetize the CRT using two positive temperature coefficient thermistors. The current flow (maximum when cold, minimal when hot) changes as the thermistors heat up. Turn the unit off and wait 30 minutes for the thermistors to return to room temperature. Then turn the unit on. If the problem goes away and then returns after several minutes, suspect the de-gaussing circuit and replace the display.

*Check display controller.*

- ☐ The display controller in the computer module may be faulty. You can check this by re-booting the unit and checking the Status Log for any error codes concerning the display controller. If so, replace the display controller.

If you suspect the display controller is faulty, but there is no error code in the status log, refer to Procedures on page 3-14 to further isolate the problem.

Another condition can exist where you have a color monitor connected to a monochrome display controller or vice-versa. Check you have a match between your monitor and the display controller card. Refer to Procedures on page 3-14 to check the exact placement of your display controller.

*Check blue HIF connector.*

- ☐ The blue human interface connector in the front assembly is improperly connected. A way to check this is by turning the brightness and contrast controls to both the left and the right. If the screen remains unaffected, remove the front assembly and check the connector and reconnect if required. If the connector is intact, suspect the Human Interface board in the display bezel and replace it.

*Check plug-in modules.*

- ☐ If you have known waves or numerics missing from the screen but the screen is behaving normally, refer to Troubleshooting Module 3 - Plug-In Module Faults.

*Go to...*

If you have come this far and have not fixed your problem, go to Procedures on page 3-14. That module tells you how to check to see if the Computer Module Unit is working correctly. If the Computer Module Unit is working correctly, replace the display.

**If the (M1095A) Flatscreen Display is blank...**

- ❑ If the Flatscreen Display (M1095A) is blank, the first step is to check the green LEDs on the front of the display and on the power supply. The power supply is one of the following: M1047A Power Supply, a CRT Display (M1092A, M1094A or M1094B), or the M1046B Integral Power Supply. When the CMS is plugged into a correct power source and the power switches on the display and power supply are pressed to ON, both LEDs should illuminate GREEN.

When you verify that the two conditions are true and that the LEDs are not GREEN, check the fuses at the rear of the module that is supplying power, the Power Supply M1047A, CRT Display, or M1046B. Replace any blown fuses. If fuses continue to blow, there is a problem in the Display and/or the Computer Module.

- ❑ **Video/Power Cable**  
Check the video/power cable connection and reconnect if necessary. If the connection is correct, the cable may be faulty. Replace the cable to see if this corrects the problem. Check the video/power cable if: the LED on the M1047A Remote Power Supply is green, the LED on the Flatscreen is blank, and the red LEDs in the Computer Module are inactive.

- ❑ **M1047A Power Supply**  
If you suspect the M1047A Power Supply, test the Remote Control Board to determine whether this board or the Switch-Mode Power Supply itself is faulty. The Remote Control Board has a 12V(AC) input and outputs 12V(DC) to an optocoupler on the SMPS. Output from the SMPS is 60V(DC). Exchange part number for the Remote Control Board is 31192086411FMI. If the SMPS is faulty, replace the complete Power Supply.

If the LEDs are green and the fuses are good but the display is blank, proceed to the next step.

- ❑ **Computer Module**  
Check that the correct cards are located in the correct slots in the Computer Module. In particular check that the Flatscreen Display Controller Board is correctly located. Look at the rear of the Computer Module. The Utility CPU board should have three green LEDs illuminated plus one green blinking LED and the Flatscreen Display Controller Board should have one green blinking LED. Note that the Flatscreen Display Controller Board outputs 60V via the video/power cable to the Flatscreen Display. This board is protected with an SMT fuse.
- ❑ **Flatscreen Display**  
If you suspect the Flatscreen Display, check whether the backlight is defective. See Chapter 5 “Repairing the CMS” for this procedure. Alternatively, the LCD or the video board may be defective. If the LCD is defective, exchange the complete display.

**If there is poor display quality on a Flatscreen Display...**

- ☐ Check video cable  
Check the video cable connection and reconnect if necessary. If the connection is correct, the cable may be faulty. Replace the cable to see if this corrects the problem.
- ☐ Flatscreen Display Controller  
The Flatscreen Display Controller Board in the Computer Module may be faulty. You can check this by re-booting the unit and checking the Status Log for any error codes concerning the display controller.

If you suspect that the display controller is faulty but there is no error code in the status log, refer to Troubleshooting Module 2 - Computer Module Faults to further isolate the problem.

- ☐ Verify the integrity of the display  
Go to demo mode to verify the integrity of the display. The ECG complexes should be regularly spaced and all portions of the ECG waveform should be clear and visible. (A small number of missing pixels is normal with all LCD displays but, if the ECG waveform is not clear, this is an indication of an unacceptable number of pixel failures.)

It may be useful to use the white test picture in service mode.

If the display exhibits other quality problems such as misalignment or jitter, and you have checked the Video/Power cable and the Flatscreen Display Controller Card, this means that there is a problem in the Flatscreen Display itself and the display should be replaced. (For board-level troubleshooting, sound or control problems indicate that the HIF board is faulty; problems with the picture indicate that the video board is faulty.)

- ☐ Display Brightness  
The brightness control may be turned too low or the flatscreen display may not be angled for optimum viewing. If the display is still too dim with the brightness control at maximum, change the backlight. See Chapter 5 "Repairing the CMS" for this procedure.
- ☐ Check plug-in modules  
If you have known waves or numerics missing from the screen but the screen is behaving normally, refer to Troubleshooting Module 3 - Plug-In Module Faults.

**If an XGA Display is blank...**

- ☐ If the XGA Display is blank, the first step is to check the green LEDs on the front of the display and power supply. When the CMS is plugged into a correct power source and the power switches on the display and power supply are pressed to ON, both LEDs should illuminate GREEN.

When you verify that the two conditions are true and that the LEDs are not GREEN, check the fuses at the rear of the display, power supply and the computer module. Replace any blown fuses. If fuses continue to blow, there is a problem in the Display and/or the Computer Module.

- ☐ **Video/Power Cable**  
Check the video/power cable connection and reconnect if necessary. If the connection is correct, the cable may be faulty. Replace the cable to see if this corrects the problem.
- ☐ **Power Supply**  
If you suspect the Power Supply, test the Remote Control Board to determine whether this board or the Switch-Mode Power Supply itself is faulty. The Remote Control Board has a 12V(AC) input and outputs 12V(DC) to an optocoupler on the SMPS. Output from the SMPS is 60V(DC). Exchange part number for the Remote Control Board is 991920864111FMI. If the SMPS is faulty, replace the complete Power Supply.

If the LEDs are green and the fuses are good but the display is blank, proceed to the next step.

- ☐ **Computer Module**  
Check that the correct cards are located in the correct slots in the Computer Module. In particular check that the Flatscreen Display Controller Board is correctly located. Look at the rear of the Computer Module. The Utility CPU board should have three green LEDs illuminated plus one green blinking LED and the Flatscreen Display Controller Board should have one green blinking LED. Note that the Flatscreen Display Controller Board outputs 60V via the video/power cable to the Flatscreen Display. This board is protected with an SMT fuse.
- ☐ **Flatscreen Display**  
If you suspect the Flatscreen Display, check whether the backlight is defective. See Chapter 5 “Repairing the CMS” for this procedure. Alternatively, the LCD or the video board may be defective. If the LCD is defective, exchange the complete display.

**NOTE**

Note: For the XGA display, the switch on the External Alarm Device operates the computer module; the green LED on the Alarm Device shows whether it is on. If there are technical problems with the XGA display, consult the display device’s own service documentation.

**If the TouchScreen operation is malfunctioning...**

- ☐ Check cable connection between the RS232 connectors of the display and the function box. Reconnect, if necessary.
- ☐ Perform a visual inspection of the overlay. If the overlay is visibly damaged, it has to be replaced.
- ☐ Check the RS232 configuration:

**Step 1** Enter Config Mode and press **Monitor Setup** .

**Step 2** Press **RS 232** . This leads you to the RS232 setup window.

**Step 3** Make sure that the entries behind Port 1-4 show the correct devices. If not, select the correct devices for each port.

**Step 4** If you had to change the configuration, save it and switch power off and on.

**Step 5** If the problem still exists, proceed with the next step.

- ☐ Perform a Touch Screen calibration:

**Step 1** Enter Config Mode and press **Monitor Setup** .

**Step 2** Press **Touch Setup** . This leads you to the Touch Screen Setup window.

**Step 3** Perform the calibration procedure. Follow the steps as shown on the screen.

**If the font appears to be incorrect...**

After installing a display controller card, if the font appears to be incorrect, it may be because the Font ROM Switch setting for the language is incorrect. See “Configuring the Display Controller Card” in Chapter 5 “Repairing the CMS” for details.

## Troubleshooting Module 2 - Computer Module Faults

This module shows you how to troubleshoot problems based on symptoms given by a faulty Computer Module. Use this module when you suspect you have a problem in your Computer Module, or when you are referred to this module from another procedure.

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### Objectives

In order to meet this chapter's goal, you should be able to:

- Identify faulty conditions.
- Verify the correct function card locations in the Computer Module.
- Know what are the likely causes of the fault and what are the likely remedies.
- Use the Status Log to check for error codes, and other service information.
- Interpret error codes and how to use them to isolate faults.

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### Concepts

Each function card in the CMS comes with a red LED that illuminates to indicate a fault with the card. There are also green LEDs on each function card that show the normal operation of the system. Also associated with most fault conditions are **Error Codes** that can be viewed in the **Status Log** of the operating modes. This module uses each of these items to isolate faults and to determine the health of the Computer Module.

#### Error Codes

The first line of fault isolation is the **Error Codes**. Whenever one of the function cards is unable to perform an operation, an error code is generated. Error codes can be for fatal and non-fatal errors. **Fatal** errors are errors which cause the CMS to re-start. **Non-fatal** errors are general errors that are not significant enough to affect normal CMS operation.

Fatal error codes can be found in the **Status Log** while in any of the four operating modes. In the Service Mode, the Status Log also displays Non-fatal error messages. **If an error occurs when the CMS is starting up, a start-up error code is generated** and displayed at the top of the screen. Start-up error codes give similar information to that of the Status Log entries, except the codes are given in hexadecimal notation.

## What an Error Code Tells You

When you look at an error code in the Status Log, you can see the following information:

**Table 3-2 Error Code Description**

Field	Description
H, W, C or F	H, W, and C denote fatal errors which have caused a <b>H</b> ot, <b>W</b> arm, or <b>C</b> old start. F denotes a <b>F</b> atal error without deference to the type of restart caused.
Card Name	RACK_IF, for example
Part Number of function card	M1088-66501, for example
Device ID Code	The number referring to a hardware device or software module and used to indicate the location of a fault.
Slot number	Position of the faulty or <b>reporting</b> card in the computer module unit.
Error code	Number describing the type of fault identified. The error code tables in this module give more details.
Date\Time	Date and time the error occurred.

## Using Error Codes

This section includes procedures on how to access the Status Log in the various operating modes, and what actions to take when a fatal error is encountered. This module includes error code lists for the errors reported by the CMS, grouped by **Device ID**, and the recommended course of action for each fault.

Two possible conditions may occur in which the CMS generates error code information. These conditions are:

- A fault causing the system to restart occurs, but upon restarting the fault clears. If this happens, begin with the first step of this procedure.
- A fault causing the system to repeatedly restart occurs. If this occurs, go to the segment of this procedure that explains **Using Start-up Error Codes**.

### Using Status Log Error Codes

- ❑ Access the Status Log. You do this by:
  - Step 1** From any of the operating modes, press **Monitor Setup** (or **Instrument Config**) to bring up to the Selection Window.
  - Step 2** Use the ARROW keys to move the highlighting to the row of softkeys that include Status Log.
  - Step 3** Press the **Status Log** softkey. The screen displays the Status Log.
- ❑ Once in the Status Log, check it for entries that have an H, W, C, or F entered in their first field. This identifies fatal errors. We are only concerned with fatal errors because these are the errors which are significant enough to affect the CMS operation. Each fatal error shows you the following:
  - The Function card which has reported the fault,
  - The part number of the functions card,
  - The device ID code which indicates the hardware device or software piece which caused the fault,
  - Slot number of the function card reporting the fault,
  - The error code describing the fault identified,
  - The date and time the fault occurred. This is important because the status log contains the fourteen most recently occurring errors, with the most recent errors at the top.
- ❑ If you have more than one error message for a single incident, deal with the first occurring error message (error messages are listed chronologically by date and time) before dealing with the others pertaining to the incident.
- ❑ If you have fatal error codes in the Status Log, and you proceed with an EndCase (discharge from the monitor), the monitor will not enter Standby Mode. Instead, the monitor will go to Monitoring Mode. That is why it is a good practice to purge the Status Log after you have dealt with or recorded each error.

### Using Start-up Error Codes

- ❑ If your CMS is re-starting repeatedly, a start-up error code may appear at the top of the screen. The start-up error code gives information similar to that displayed in the status log, except the start-up error codes are listed in hexadecimal notation. These codes are identified by an “H” at the end of the code.
- ❑ Start-up Error Messages require the same corrective action as the error messages found in the status log. The Error Code Listings at the end of this module contain the hexadecimal equivalent for each error code and device ID.



## How Device ID Codes and Error Codes Relate to Each Other

For troubleshooting the CMS, the device ID code and the error code portions of the error message have an important relationship. Each device ID has a block of error codes assigned to it. A separate Error Code Listing has been setup for CMS's operating system, device ID code 16400, since most fatal errors occur in this area.

Refer to the Error Code Listing in this module for the device ID indicated by the error code. There are two tables in this module. The first is for device ID code 16400 (4010H). The second is for all other device IDs. The corrective actions listed in these tables are listed in one of the follow ways:

- For some device ID 16400 (4010H) corrective actions:
  - See “CMS System Hardware Configuration Problems” on page 3-23.
  - See “CMS System Hardware/Software Problems” on page 3-27.
  - See “CMS System RAM Problems” on page 3-27.
- For all other device IDs, specific corrective action depends on the type of error encountered. The error code listing gives you detailed instructions for each situation.

## Identifying the Slot Number Using the Error Code Chart

For error codes in the range 1000 to 1999 (03E8<sub>H</sub> to 07CF<sub>H</sub>) with Device ID 16400 (4010<sub>H</sub>), you can directly identify the slot number of the faulty board, using the hexadecimal error code and the following chart.

Use the error code chart as follows:

- Step 1** Locate the first three digits of the hex error code in the columns across the top of the chart.
- Step 2** Locate the last digit of the hex error code down the left-hand row of the chart.
- Step 3** Read the number at the point in the chart where the row and column intersect. This represents the slot number of the faulty board in the Computer Module. These error codes will normally be provided in hexadecimal at system start-up as part of a start-up error message. For most start-up errors, replace the card in the slot identified by this chart.

**Table 3-3 Error Code Chart for Slot Location (Device ID 16400 or 4010H)**

		Device ID 16400 (4010H) Only																	
		First Three Digits (Hex Error Code)																	
		03E	03F	040	041	042	043	044	045	046	047	048	049	04A	04B	04C	04D	04E	04F
				050	051	052	053	054	055	056	057	058	059	05A	05B	05C	05D	05E	05F
				060	061	062	063	064	065	066	067	068	069	06A	06B	06C	06D	06E	06F
Last Digit of Hex Error Code			070	071	072	073	074	075	076	077	078	079	07A	07B	07C				
	0		8	24	8	24	8	24	8	24	8	24	8	24	8	24	8	24	8
	1		9	25	9	25	9	25	9	25	9	25	9	25	9	25	9	25	9
	2		10		10		10		10		10		10		10		10		10
	3		11		11		11		11		11		11		11		11		11
	4		12		12		12		12		12		12		12		12		12
	5		13		13		13		13		13		13		13		13		13
	6		14		14		14		14		14		14		14		14		14
	7		15		15		15		15		15		15		15		15		15
	8		16		16		16		16		16		16		16		16		16
	9	1	17	1	17	1	17	1	17	1	17	1	17	1	17	1	17	1	17
	A	2	18	2	18	2	18	2	18	2	18	2	18	2	18	2	18	2	18
	B	3	19	3	19	3	19	3	19	3	19	3	19	3	19	3	19	3	19
	C	4	20	4	20	4	20	4	20	4	20	4	20	4	20	4	20	4	20
	D	5	21	5	21	5	21	5	21	5	21	5	21	5	21	5	21	5	21
	E	6	22	6	22	6	22	6	22	6	22	6	22	6	22	6	22	6	22
F	7	23	7	23	7	23	7	23	7	23	7	23	7	23	7	23	7	23	

**Device ID 16400 (or 4010<sub>H</sub>) Error Code Lists**

The first table gives the error code listing for device ID 16400 (4010H). Each error code entry provides the following information:

**Status Log Errors** - the decimal number range the error code gives in its status log entry.

**Start-up Error** - the hexadecimal number range of the start up error code.

**Possible Cause** - the possible cause for the error code report.

**Corrective Action** - actions which are designed to isolate the fault to a replaceable assembly.

Table 3-4 Error Code Listing for Device ID 16400 (or 4010H)

Status Log Errors	Start-up Errors	Possible Cause	Corrective Action
1 - 99	0001 <sub>H</sub> - 0063 <sub>H</sub>	Hardware test failure in the first boot stage.	RAM problem- refer to the corrective action on page 3-27.
100 - 199	0064 <sub>H</sub> - 00C7 <sub>H</sub>	Microprocessor interrupts due to a Hardware or Software problem in given slot or cluster.	Hardware/Software problem- refer to the corrective action on page 3-27.
200	00C8 <sub>H</sub>	MPB chip errors: Can be caused by hardware defects on the indicated CPU as well as hardware defects on any other MPB participant (Master Cards: for example Util CPU, APP_CPU, DSPC Ctrl, and others) in the system.	Hardware/Software problem- refer to the corrective action on page 3-27.
201 - 202	00C9 <sub>H</sub> - 00CA <sub>H</sub>	System configuration problem or invalid contents of the Util_CPU EEPROM.	System Configuration problem - refer to the corrective action on page 3-23.
203 - 239	00CB <sub>H</sub> - 00EF <sub>H</sub>	Same as error 200	Hardware/Software problem- refer to the corrective action on page 3-27.
240	00F0 <sub>H</sub>	Message transmission problem.	System Configuration problem - refer to the corrective action on page 3-23.
241	00F1 <sub>H</sub>	Same as errors 203 - 239.	Hardware/Software problem- refer to the corrective action on page 3-27.
242	00F2 <sub>H</sub>	Message transmission problem.	System Configuration problem - refer to the corrective action on page 3-23.
243 - 299	00F3 <sub>H</sub> - 012B <sub>H</sub>	Same as errors 203 - 239.	Hardware/Software problem- refer to the corrective action on page 3-27
300 - 301	012C <sub>H</sub> - 012D <sub>H</sub>	EPROM checksum incorrect.	With 10 and/or 15 MHz APP_CPU's in backplane, replace the EPROM in the cluster of the given slot.
			With 40 MHz CPC with Daughter Card in backplane, replace the Daughter Card.
			With 40 MHz CPC with Flash EPROM in backplane, reprogram Flash EPROM. If you still have a problem, replace CPC Card.
305 - 307	0131 <sub>H</sub> - 0133 <sub>H</sub>	Boot errors on CPC Card - software upgrade problem (for example: Flash Card corrupt). Will only occur when CPC Programming Tool is connected.	Switch the System off, re-insert the Upgrade Tool and switch the System on again. Replace the Flash Card. Replace the CPC Card in slot 12.
310 - 315	0136 <sub>H</sub> - 013B <sub>H</sub>	EPROM version and EEPROM version not compatible.	System Configuration problem - refer to the corrective action on page 3-23.

## Using Error Codes

**Table 3-4 Error Code Listing for Device ID 16400 (or 4010H)**

Status Log Errors	Start-up Errors	Possible Cause	Corrective Action
330, 335	014A <sub>H</sub> , 014F <sub>H</sub>	Only detected by the APP_CPU in slot 5 - indicates that another MPB participant (Master Card) does not boot up as required. There is no error in the indicated slot.	Hardware/Software problem- refer to the corrective action on page 3-27.
340, 356, 370	0154 <sub>H</sub> , 0164 <sub>H</sub> , 0172 <sub>H</sub>	Indication of communication problems between the APP_CPU in slot 5 and another MPB participant. The slot code may be incorrect.	Hardware/Software problem- refer to the corrective action on page 3-27.
380	017C <sub>H</sub>	Firmware revision is incompatible with current Software revision.	System Configuration problem - refer to the corrective action on page 3-23.
390	0186 <sub>H</sub>	Indication of a communication problem between the CPC in slot 12 and another MPB participant. The slot code may be incorrect.	Hardware/Software problem- refer to the corrective action on page 3-27. Exchange the Utility CPU Card.
391, 392	0187 <sub>H</sub> , 0188 <sub>H</sub>	Out of memory on the CPC Card.	Replace CPC Card.
393	0189 <sub>H</sub>	Plugged CPC isn't compatible with the Philips CMS Patient Monitoring System.	Ensure that the correct Software is loaded on the CPC Card (check SW Part Number).
400 - 409	0190 <sub>H</sub> - 0199 <sub>H</sub>	Out of memory.	With 10MHz and/or 15MHz APP_CPU's in backplane: Check Data Management Option and SRAM board compatibility. (See Parts Lists).  Replace RAM Card, if present in same cluster.  Replace CPU Card in indicated slot.
			With a 40MHz CPC in backplane, replace the CPU Card in indicated slot.
410 - 419	019A <sub>H</sub> - 01A3 <sub>H</sub>	Missing file errors.	System Configuration problem - refer to the corrective action on page 3-23.
420 - 449	01A4 <sub>H</sub> - 01C1 <sub>H</sub>	Utility CPU / EEPROM error.	System Configuration problem - refer to the corrective action on page 3-23.
500 - 699	01F4 <sub>H</sub> - 02BB <sub>H</sub>	Indicates a Software problem that cannot be solved by hardware exchange.	Check that the installed software is a released version. Contact your local Response Center. Install released software.
700 - 799	02BC <sub>H</sub> - 031F <sub>H</sub>	Communication problem between two CPUs.	System Configuration problem - refer to the corrective action on page 3-23.  Hardware/Software problem- refer to the corrective action on page 3-27.
800 - 899	0320 <sub>H</sub> - 0383 <sub>H</sub>	Configuration problem.	System Configuration problem - refer to the corrective action on page 3-23.

Table 3-4 Error Code Listing for Device ID 16400 (or 4010H)

Status Log Errors	Start-up Errors	Possible Cause	Corrective Action
900 - 914	0384 <sub>H</sub> - 0392 <sub>H</sub>	Something within the System memory has changed unexpectedly. This is usually caused by a RAM problem.  One or more pins on a Function Card may be bent.	RAM problem- - refer to the corrective action on page 3-27.  Remove and replace the affected Function Card.
915	0393 <sub>H</sub>	One of the CPUs has failed to send a test message to the next CPU. The reported slot code will not identify the defective CPU Card.	Swap/replace APP_CPU's one by one until the faulty card is found. Replace faulty card.
916 - 919	0394 <sub>H</sub> - 0397 <sub>H</sub>	Something within memory has changed unexpectedly (see error range 900-914).	RAM problem- - refer to the corrective action on page 3-27.
920	0398 <sub>H</sub>	Indicates a missing 32 ms interrupt on the CPU in the reported slot. This could be caused by a poor connection (CPU, backplane, etc.) or a failure on the Util CPU.	Inspect backplane connectors.  Swap/replace APP_CPU Card in given slot.  Swap/Replace UTIL_CPU Card.
921 - 999	0399 <sub>H</sub> - 03E7 <sub>H</sub>	Something within memory has changed unexpectedly (see error range 900-914).	RAM problem- - refer to the corrective action on page 3-27.
1000 - 1031	03E8 <sub>H</sub> - 0407 <sub>H</sub>	Missing mandatory card in slot indicated.	Consult the Error Code Chart in Table 3-3 on page 3-18 to determine the slot of the misplaced CPU Card - place the CPU Card in the correct slot.  Check backplane in Table 1-10 Function Card Placement on page 1-23 for correct Function Card placement.  System Configuration problem - refer to the corrective action on page 3-23.
1032 - 1063	0407 <sub>H</sub> - 0427 <sub>H</sub>	Wrong boot firmware revision on APP_CPU in slot indicated.	
1064 - 1095	0428 <sub>H</sub> - 0447 <sub>H</sub>	Insufficient MPB RAM on CPU in slot indicated.	
1096 - 1127	0448 <sub>H</sub> - 0467 <sub>H</sub>	No Extended Test result due to Hardware problem.	Consult the Error Code Chart in Table 3-3 on page 3-18 to determine the slot of the defective CPU Card. Exchange the defective card.
1128 - 1159	0468 <sub>H</sub> - 0487 <sub>H</sub>	Extended Test failed.	Consult the Error Code Chart in Table 3-3 on page 3-18 to determine the slot of the defective CPU Card. Exchange the defective card.

Table 3-4 Error Code Listing for Device ID 16400 (or 4010H)

Status Log Errors	Start-up Errors	Possible Cause	Corrective Action
1160 - 1191	0488 <sub>H</sub> - 04A7 <sub>H</sub>	RAM Card size not compatible with backplane configuration.	Ensure the correct RAM Card is installed in the backplane, and check backplane on Table 1-10 Function Card Placement on page 1-23 for correct Function Card placement.  Consult the Error Code Chart on page 3-18 to determine the slot of the defective CPU Card. Exchange the cards in cluster one by one.
1192 - 1223	04A8 <sub>H</sub> - 04C7 <sub>H</sub>	EEPROM configuration of the card in the slot indicated is not compatible to the Hardware configuration.	
1224 - 1255	04C8 <sub>H</sub> - 04E7 <sub>H</sub>	Wrong CPU type in slot indicated.	Check backplane on Table 1-10 Function Card Placement on page 1-23 for correct Function Card placement.  Consult the Error Code Chart on page 3-18 to determine the slot of the defective CPU Card. Exchange the defective card.
1256 - 1287	04E8 <sub>H</sub> - 0507 <sub>H</sub>	CPU is too slow in slot indicated.	
2100	0834 <sub>H</sub>	Unused card in the System (non-fatal error).	Check backplane on Table 1-10 Function Card Placement on page 1-23 for correct Function Card placement, remove unused card.
2110 - 2152	083E <sub>H</sub> - 0866 <sub>H</sub>	Unreleased Software installed (non-fatal error).	Contact your local response center - install released Software.
2160	0870 <sub>H</sub>	An extra CPU is present in indicated slot (non-fatal error).	Remove unused CPU Card in indicated slot.
2170 - 3300	087A <sub>H</sub> - 0C54 <sub>H</sub>	Hardware problem.	With 10 and/or 15MHz APP_CPU's in backplane, replace the EPROM boards.  With 40MHz CPC in backplane: 1. Replace the CPC Card. 2. Exchange the card in the indicated slot. 3. Exchange all other APP_CPUs one by one.

## CMS System Hardware Configuration Problems

This section tells you how to deal with hardware configuration problems. These problems generally occur when a **function card** is placed in the wrong slot or if a function card is incompatible with the CMS configuration.

### Concepts

#### Types of Function Cards

There are two basic types of function card: Master Cards and Local Cards.

*The RS232\_IF may be installed in any slot of the Computer Module as it has no connection to the Local Bus. The DC/DC Converter also has no connection to the Local Bus but must be inserted to the left of slot 21 of the Computer Module, because it may damage the system if placed in another slot.*

- **Master Cards** - The master cards are those cards that have both a Central Processing Unit (CPU) and a Message Passing Bus interface (MPB\_IF). These cards may also communicate with local cards (for example SRAM, EPROM and CDSPC\_VIDEO) over the Local Bus. Only one of each master card type may be used in the same Computer Module, with the exception of the Application CPU and the display controllers.
- **Local Cards** - The Local Cards have no MPB\_IF and can only communicate with the master card via the Local Bus within a cluster of connectors. These cards may be used on every cluster containing a master board within the Computer Module. All the Local Cards may be used more than once in the Computer Module, with the exception of the SDN\_IF and the Rack\_IF S-Ram, and more than one Local Card may be used by a master card. Therefore, an identifier is used so the master card can tell the Local Card type and position in the cluster. This may also be used to test the board for compatibility with the master card.

#### Interconnections

Three types of card in the backplane interconnect. The types are as follows:

*In addition, system interfaces and local cards may be interfaces to systems outside the CMS.*

- **Master Cards**. These cards are connected to both the MPB and the local bus.
- **System Interfaces**. These are master cards that are connected to the MPB but have no connection to the local bus.
- **Local Cards**. As the name suggests, these cards are only connected to the local bus and have no MPB connection.

### Rules for Card Placement

The rules governing where particular function cards may be positioned in the backplane are as follows:

- The DC/DC converter must be placed in the unnumbered slot (cluster 1).
- The Rack Interface card must be placed in slot 18.
- If required, the DSPC\_Lang card must be placed in slot 3.
- If present, a 40MHz CPC card must be inserted in slot 12.
- Master Cards can only be used once within any local cluster.
- Local Cards must be located in the same cluster as their associated master card. Therefore, the following cards must be clustered as indicated:
  - SDN Interface and Rack Interface with Util\_CPU
  - CDSPC\_Video with CDSPC\_Control
  - EPROM with an APP\_CPU
  - SRAM with an APP\_CPU
- The following cards, which have external connections, must be inserted in the rear of the backplane:
  - UTIL\_CPU
  - RS-232 Interface
  - SDN Interface
  - HDLC Interface
  - Analog Interface
  - Display Controller

The end of this section gives the delivered configurations for the different releases of the CMS.



## Procedures

The procedures for fixing CMS configuration problems vary depending upon your configuration and the type of APP\_CPU or CPC you have. In general, the procedure for your configuration requires you to perform some visual checks, verify you are operating with the proper software revision for your CMS, and then perform fault isolation procedures based on the hardware configuration.

*The LED behavior on the 40 MHz CPC Card is the same as the behavior on the 10 and 15 MHz Master CPU Cards.*

*For Monitors with 10 MHz and 15 MHz APP\_CPU Cards, the APP\_CPU in slot 5 of the System's backplane is the Master CPU.*

*For Monitors with the CPC Card (40 MHz), the card in slot 12 of the System's backplane configuration is the Master CPU.*

*The Master CPU reports errors in the System to the Status Log.*

*The reported CPU is not necessarily the defective CPU or Function Card.*

- ❑ If the Monitor reboots continuously, examine the LEDs of the Function Cards:

- Step 1** If the red LED of the Master CPU Card stays on, check if another CPU Card is plugged in the same cluster - there should be only one CPU per cluster. Otherwise exchange the CPU Card in the reported slot.
- Step 2** If the red LED on the Master CPU does not stay on, refer to Table 3-5 General Error Code Listing for Other Device IDs on page 3-28 to identify the faulty card.

- ❑ For monitors with 10MHz or 15MHz APP\_CPUs:

- Step 1** Verify that the Master and Slave EPROM Cards are plugged in the correct slots, and make sure they belong to the same software release.
- Step 2** Verify the correct EEPROM part number by:
  - checking the number displayed in the "Monitor Revision" screen or
  - using the appropriate cloning tool if the monitor is rebooting continuously or the display is blank.
- Step 3** If the part number is correct, reprogram the EEPROM to the factory defaults using the appropriate cloning tool.

- ❑ If the preceding actions do not correct the configuration problem, try the following:

- Step 1** Replace the EEPROM.
- Step 2** Replace the Utility CPU.
- Step 3** Replace EPROM Cards.

- ❑ For monitors with a 40MHz CPC (Flash EPROM):

- Step 1** Verify the correct EEPROM part number by:
  - checking the number displayed in the "Monitor Revision" screen or,
  - using the CPC cloning tool if the monitor is rebooting continuously or the display is blank. If the part number is correct, reprogram the EEPROM to the factory defaults using the CPC programming tool.

**Step 2** Reprogram the Software on the CPC Card using the CPC Programming Tool.

**Step 3** If the preceding actions do not correct the problem:

- Replace the EEPROM.
- Replace the Utility CPU.
- Replace CPC Card in slot 12.

❑ For monitors with a 40MHz CPC and Daughter Card (UV-EPR0M):

**Step 1** Verify the correct EEPROM part number by:

- checking the number displayed in the “Monitor Revision” screen or,
- using the CPC programming tool if the monitor is rebooting continuously or the display is blank.

**Step 2** If the part number is correct, reprogram the EEPROM to the factory defaults using the CPC programming tool.

**Step 3** If the preceding actions do not correct the problem:

- Replace the EEPROM.
- Replace the Utility CPU.
- Replace CPC Card in slot 12 with a CPC Flash Card.

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## CMS System Hardware/Software Problems

This section shows you how to fix problems that are of a hardware/software nature. The procedure for fixing these types of problem depends on the type of error code received.

### Procedures

- ☐ If you get an error code in the Status Log, go to the Service Mode and execute the extended test (see “Power On Modes” on page 3-44). If the test identifies a faulty card, replace it.
- ☐ If the CMS reboots continuously, replace the card in the slot identified by the start-up error message.
- ☐ Replace/swap the APP\_CPU Cards (or CPC Cards if present), one by one.

### Loudspeaker Test at Power On

From Release B.0, at every CMS cold or warm start the loudspeaker gives a series of test sounds in Monitoring and Demo mode. These sounds reassure you that the loudspeaker is functioning correctly. The sounds are in the following sequence:

- Yellow Alarm Sound
- Red Alarm Sound
- Yellow Alarm Sound

Each sound lasts about three seconds. During this short space of time the alarm manager functionality in terms of processing parameter alerts is disabled.

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## CMS System RAM Problems

This section shows you how to fix problems that occur in the CMS RAM. The procedure for fixing these types of problem depends on the type of error code received.

- ☐ If you get an error code in the Status Log, go to the Service Mode and execute the extended test. If the test identifies a faulty card, replace it.
- ☐ If the CMS reboots continuously:
  - Step 1** Exchange the APP\_CPU Card in the slot indicated by the start-up error message.
  - Step 2** Exchange other cards in the same cluster one by one.

## Error Code Lists for Other Device IDs

This table lists the general error codes for other devices. If the Device ID is not listed, then the source of the problem is not dependent on the Device ID.

**Table 3-5 General Error Code Listing for Other Device IDs**

Device ID	Error Codes	Possible Cause	Corrective Action
	10000 to 10999 2710 <sub>H</sub> - 2AF7 <sub>H</sub>	Software internal warning.	This is a non-fatal error and can be ignored.
	11000 to 11999 2AF8 <sub>H</sub> - 2EDF <sub>H</sub>	Buffered data either lost or corrupted by the APP_CPU Card. The reporting APP_CPU Card may be defective.	Continuous Rebooting: Allow the system to reboot as many times as the number of APP_CPU Cards fitted. (For a system with 5 APP_CUP cards, reboot 5 times.) If the error code recurs, replace the reporting APP_CPU. Replace the RAM Card if it is in the cluster of the reporting CPU Card. During Run-time: If occurrence is transient, ignore. If error code recurs often, perform the extended test in Service Mode. If the test identifies a faulty APP_CPU or RAM Card, replace it.
	12000 to 12999 2EE0 <sub>H</sub> - 32C7 <sub>H</sub>	EEPROM access failure.	Try to reprogram the EEPROM using the cloning tool. Replace the EEPROM on the UTIL_CPU Card. Replace probable defective UTIL_CPU Card. Find the slot code, and replace that card.
	13000 - 13999 32C8 <sub>H</sub> - 36AF <sub>H</sub>	System internal configuration related errors. This refers to the structure of the various software modules.	The structure of the various software modules cannot be changed in the field. These error codes do not relate to the <i>system field configuration</i> .
32709 or 7FC5 <sub>H</sub>	20120 - 20128 4E98 <sub>H</sub> - 4EAD <sub>H</sub>	Data Transfer Module failed.	Troubleshoot Data Transfer Module.
32744 or 7FE8 <sub>H</sub>	21035 or 522B <sub>H</sub> 21107 or 5273 <sub>H</sub> 24138 or 5E4A <sub>H</sub> 24088 or 5E18 <sub>H</sub> 24155 or 5E5B <sub>H</sub>	Internal time-handling problem. This error does not imply defective behavior.	Ignore.
32747 or 7FEB <sub>H</sub>	11200 or 2BC0 <sub>H</sub>	Battery on the S-RAM board (M1055-66501 or M1056-66501) is low or defective. OR CPC board in slot 12 is defective (Release C and later.)	Exchange the S-RAM board or replace the battery on the S-RAM board (1420-0375). OR Exchange the CPC board in slot 12 (Release C and later.)
32747 or 7FEB <sub>H</sub>	3733 or 0E95 <sub>H</sub> 20004 or 4E24 <sub>H</sub> 20133 or 4EA5 <sub>H</sub> 24088 or 5E18 <sub>H</sub> 24155 or 5E5B <sub>H</sub>	Internal time handling problem. This error does not imply defective behavior.	Ignore.

**Table 3-5 General Error Code Listing for Other Device IDs (Continued)**

Device ID	Error Codes	Possible Cause	Corrective Action
32747 or 7FEB <sub>H</sub>	64026 or FA1A <sub>H</sub>	Monitor reboots intermittently. Possible problem with SRAM Card.	In Service Mode, execute the extended test. If the test identifies a faulty card, replace it.
32752 or 7FF0 <sub>H</sub>	22300 or 571C <sub>H</sub>	Monitor reboots intermittently. Philips-HIL connection problem.	Check connection of Philips-HIL cable and replace if necessary. Check connection of black wire between bezel and display. Replace if faulty. Check HIF board in display and replace if faulty. Check UTIL_CPU and replace if faulty.
	22400 or 5780 <sub>H</sub>	No response from display controller card (DSPC or CDSPC_CTRL).	Replace DSPC or CDSPC card.
	22401 or 5781 <sub>H</sub>	Missing or defective DSPC_Lang Card.	Insert a DSPC_Lang Card if missing from the backplane. Replace the defective DSPC_Lang Card.
32753 or 7FF1 <sub>H</sub>	20300 or 4F4C <sub>H</sub>	Rack_IF communication problem.	Check Rack_IF connection. Replace Rack_IF Card. Check pins on backplane - replace the backplane if necessary.
	50497 or C541 <sub>H</sub>	SDN communication problem or temporary SCC power failure.	Check SDN connection - restart the monitor after reconnecting. Check/exchange SDN cable. Check/exchange SDN_IF Card. Check pins on backplane - replace the backplane if necessary.
32766 or 7FFE <sub>H</sub>	3212 or 0C8C <sub>H</sub>	Out of memory.	Check Data Management Option and SRAM board compatibility. Replace RAM Card, if present in same cluster. Replace CPU Card in indicated slot.
32767 or 7FFF <sub>H</sub>	90 or 005A <sub>H</sub>	Internal Software problem.	Ignore.

### Error Code List for Specific Device IDs other than 16400 (4010H)

The following table lists error codes with specific Device IDs other than 16400 (4010H). The source of the fault, and meaning of the error codes listed can only be determined by the identification of the error code's specific Device ID.

If the system reboots every 4 minutes, check the HIL cable connection before troubleshooting the System.

**Table 3-6 Error Code List for Specific Device IDs other than 16400 (4010H)**

Device ID	Error Code	Possible cause - Fault	Corrective Action
1897 (2005 <sub>H</sub> )	18995 (4A33 <sub>H</sub> )	SDN communication problem. (Could be caused by temporary SCC power Failure).	<ol style="list-style-type: none"> <li>1. Check SDN connection - Restart the monitor after reconnecting.</li> <li>2. Check/exchange SDN_IF cable.</li> <li>3. Check/exchange SDN_IF card.</li> <li>4. Check pins on backplane - replace the backplane if necessary.</li> </ol>
8199 (2007 <sub>H</sub> ) 8200 (2008 <sub>H</sub> )	2049 (0801 <sub>H</sub> )	DSPC Video Card missing.	<ol style="list-style-type: none"> <li>1. Check Function card placement in backplane.</li> <li>2. Insert a DSPC card if missing.</li> </ol>
		Old Display Controller Cards used with release B.0 Software	<ol style="list-style-type: none"> <li>1. Check if the Software version used is B.0.</li> <li>2. Check if the Display Controller Card has one of the following part numbers: M1066-66501 or M1072-66521. If so, proceed with the following steps:</li> <li>3. For a Monochrome Display, replace the old Display Controller Card M1066-66501 with the new version M1066-66531.</li> <li>4. For a Color Display, replace the old Display Controller Card M1072-66521 together with the Video Board M1072-66501 with the new version M1072-66531.</li> </ol>
8203 (200B <sub>H</sub> )	1, 20 (0001 <sub>H</sub> , 0014 <sub>H</sub> )	Overload on the RS-232 board due to accessing/sending too much data using the protocol with a remote computer.	Verify the external program against interface/RS-232 bandwidth limitations. Refer to RS-232 Computer Interface Programming Guide.
8203 (200B <sub>H</sub> )	6 (0006 <sub>H</sub> )	RS-232 F/W problem (large OTP).	Replace the large F/W OTP on the RS-232 card.
8203 (200B <sub>H</sub> )	7 (0007 <sub>H</sub> )	RS-232 F/W problem (small OTP).	Replace the small F/W OTP on the RS-232 card.
17000 (4268 <sub>H</sub> )	46146 (B442 <sub>H</sub> )	Non-fatal error reported by the recorder module.	<ol style="list-style-type: none"> <li>1. Ensure that there is paper in the module.</li> <li>2. Ensure that the recorder module door is firmly shut.</li> </ol>

**Table 3-6 Error Code List for Specific Device IDs other than 16400 (4010H)**

<b>Device ID</b>	<b>Error Code</b>	<b>Possible cause - Fault</b>	<b>Corrective Action</b>
17099 (42CB <sub>H</sub> )	29113 (71B9 <sub>H</sub> )	Overload of the RS-232 board due to accessing/sending too much data using the protocol with a remote computer.	Verify the external program against interface RS-232 bandwidth limitations. Refer to the RS-232 Computer Interface Programming Guide.
32744 (7FE8 <sub>H</sub> )	21035 (522B <sub>H</sub> ) 21107 (5273 <sub>H</sub> ) 24138 (5E4A <sub>H</sub> ) 24088 (5E18 <sub>H</sub> ) 24155 (5E5B <sub>H</sub> )	Internal time handling problem. This error does not imply defective behavior.	Ignore.
32747 (7FEB <sub>H</sub> )	11200 (2BC0 <sub>H</sub> ) 13561 (34F9 <sub>H</sub> )	Battery on S-RAM board (M1055-66501 or M1056-66501) is low or defective. OR CPC board in slot 12 may be defective (Release C or later).	Exchange the S-RAM board or replace the battery on the S-RAM board (1420-0375). OR Exchange CPC board in slot 12 (Release C or later).
32747 (7FEB <sub>H</sub> )	3733 (0E95 <sub>H</sub> ) 20004 (4E24 <sub>H</sub> ) 20133 (4EA5 <sub>H</sub> ) 24088 (5E18 <sub>H</sub> ) 24155 (5E5B <sub>H</sub> )	Internal time handling problem. This error does not imply defective behavior.	Ignore.
32747 (7FEB <sub>H</sub> )	64026 (FA1A <sub>H</sub> )	Monitor reboots intermittently. Possible problem with SRAM	In Service Mode, execute the extended test. If the test identifies faulty card, replace it.
32752 (7FF0 <sub>H</sub> )	22300 (571C <sub>H</sub> )	Monitor reboots intermittently. Philips_HIL connection problem.	1. Check connection of Philips_HIL cable and replace if necessary. 2. Check ground connection between bezel and display. Replace if necessary. 3. Check HIF board in display and replace if necessary. 4. Check UTIL_CPU and replace if necessary.
32752 (7FF0 <sub>HV</sub> )	22400 (5780 <sub>H</sub> )	No response from display controller card (DSPC or CDSPC_CTRL).	Replace DSPC or CDSPC card.

**Table 3-6 Error Code List for Specific Device IDs other than 16400 (4010H)**

<b>Device ID</b>	<b>Error Code</b>	<b>Possible cause - Fault</b>	<b>Corrective Action</b>
32752 (7FF0 <sub>H</sub> )	22401 (5781 <sub>H</sub> )	Missing or defective DSPC_Lang function card.	1. Insert a DSPC_Lang card if missing from the backplane. 2. Replace the defective DSPC_Lang card.
32753 (7FF1 <sub>H</sub> )	20300 (4F4C <sub>H</sub> )	Rack_IF communication problem.	1. Check Rack_IF connection. 2. Replace Rack_IF card. 3. Check pins on backplane - replace the backplane if necessary.
32753 (7FF1 <sub>H</sub> )	50497 (C541 <sub>H</sub> )	SDN communication problem (could be caused by temporary SCC power failure).	1. Check SDN connection - Restart the monitor after reconnecting. 2. Check/exchange SDN cable. 3. Check/exchange SDN_IF card. 4. Check pins on backplane - replace the backplane if necessary.
32766 (7FFE <sub>H</sub> )	3212 (0C8C <sub>H</sub> )	Out of memory.	1. Check Data Management Option and SRAM board compatibility. (see Parts List) 2. Replace RAM card if present in same cluster. 3. Replace CPU card in indicated slot.
32767 (7FFF <sub>H</sub> )	90 (005A <sub>H</sub> )	Internal Software problem.	Ignore.



## Device ID Codes for Software

The following tables lists all the available Device ID Codes, with the corresponding device. The first table is for software devices and the second table is for Computer Module or Processor ID Codes.

**Table 3-7 Software Device ID Codes**

Device ID Code		Software Device
Decimal	Hexadecimal	
16400	4010 <sub>H</sub>	CMS's Operating System
16500	4074 <sub>H</sub>	Global Information Handler
16501	4075 <sub>H</sub>	Operating Mode Handler
17000	4268 <sub>H</sub>	Strip Recorder Software
17001	4269 <sub>H</sub>	FE-Link Recorder Software
17002 - 17004	426A <sub>H</sub> - 426C <sub>H</sub>	Recorder Management Software
17020	427C <sub>H</sub>	Analog Output
17021 - 17023	427D <sub>H</sub> - 427F <sub>H</sub>	VueLink
17024	4280 <sub>H</sub>	Ohmeda 7800/7810 Ventilator interface
17025	4281 <sub>H</sub>	Anesthetic Gas Module
17027	4283 <sub>H</sub>	Ohmeda 7900/Aestiva3000 Ventilator interface
17028	4284 <sub>H</sub>	Loops Application
17029	4285 <sub>H</sub>	Loops Application
17099 - 17102	42CB <sub>H</sub> - 42CE <sub>H</sub>	RS232 Interface Related Software
17105	42D1	Touch Calibration
18002	4652 <sub>H</sub>	CRG Software
18003	4653 <sub>H</sub>	Blood Analysis Module Software
18004	4654 <sub>H</sub>	EEG Module Software
18005	4655 <sub>H</sub>	Neonatal Event Review Application
18006	4656 <sub>H</sub>	Blood Review Application
18007	4657	BIS Module Software
32700 - 32708	7FBC <sub>H</sub>	Patient Data Management
32709	7FC5 <sub>H</sub>	Data Transfer Module Software
32710 - 32711	7FC6 <sub>H</sub> - 7FC7 <sub>H</sub>	Patient Data Management
32712	7FC8 <sub>H</sub>	Tabular Trends on Recorder
32713	7FC9 <sub>H</sub>	Printing Applications
32714	7FCA	Configuration Screen Printout
32744 - 32748	7FE8 <sub>H</sub> - 7FEC <sub>H</sub>	Patient Data Management
32733	7FDD <sub>H</sub>	SvO <sub>2</sub> Module Software
32734	7FDE <sub>H</sub>	ST Segment Software
32735	7FDF <sub>H</sub>	SpO <sub>2</sub> Module Software
32736	7FE0 <sub>H</sub>	Delta Temperature Software
32737	7FE1 <sub>H</sub>	Prompt/Message Management Software

Table 3-7 Software Device ID Codes

Device ID Code		Software Device
Decimal	Hexadecimal	
32738	7FE2 <sub>H</sub>	Error Management Software
32739 - 32740	7FE3 <sub>H</sub> - 7FE4 <sub>H</sub>	Display Management Software
32741	7FE5 <sub>H</sub>	Date & Time Management Software
32742	7FE6 <sub>H</sub>	Cardiac Output Module Software
32744 - 32748	7FE8 <sub>H</sub> - 7FEC <sub>H</sub>	Patient Data Management
32750	7FEE <sub>H</sub>	Alarm Management Software
32751	7FEF <sub>H</sub>	Heart Rate Management Software
32752	7FF0 <sub>H</sub>	Display Management Software
32753	7FF1 <sub>H</sub>	Front-end Management Software
32754	7FF2 <sub>H</sub>	Invasive Pressure Module Software
32755	7FF3 <sub>H</sub>	Wedge/CPD Software
32756	7FF4 <sub>H</sub>	NBP Module Software
32757	7FF5 <sub>H</sub>	Temperature Module Software
32759	7FF7 <sub>H</sub>	tcpO <sub>2</sub> /tcpCO <sub>2</sub> Module Software
32762	7FFA <sub>H</sub>	CO <sub>2</sub> Module Software
32763	7FFB <sub>H</sub>	O <sub>2</sub> Module Software
32765	7FFD <sub>H</sub>	ECG/RESP Module Software
32766	7FFE <sub>H</sub>	SDN Management Software

Table 3-8 Processor Device ID Codes - Computer Module ID Codes

Device ID Code		Processor Device
Decimal	Hexadecimal	
8193	2001 <sub>H</sub>	Real-time Clock (on Util_CPU Card)
8194	2002 <sub>H</sub>	EEPROM (on Util_CPU Card)
8195	2003 <sub>H</sub>	Alarm Relay (on Util_CPU Card)
8196	2004 <sub>H</sub>	Philips HIL Controller (on Util_CPU Card)
8197	2005 <sub>H</sub>	SDN Interface (on Util_CPU Card)
8198	2006 <sub>H</sub>	FE-Link (on Util_CPU Card)
8199	2007 <sub>H</sub>	DSPC Card
8200	2008 <sub>H</sub>	Color DSPC Card
8202	200A <sub>H</sub>	Application CPU Card
8203	200B <sub>H</sub>	RS-232 Interface Card
8204	200C <sub>H</sub>	HDLIC Interface Card
8205	200D <sub>H</sub>	Analog Interface Card

## Troubleshooting Module 3 - Fixing Recorder Problems

The CMS uses the M1116A and M1116B Recorder Modules to make hard-copy recordings of the patient data which is displayed on the screen. The method for troubleshooting is the same for either recorder: identify the physical or functional problem, then find it in the accompanying table and follow the corrective action that is recommended.

Symptom	Possible Cause	Corrective Action
System thinks that door is open when it is not.	Module out of paper.	Insert new paper roll.
	Defective door switch.	Replace door switch. Exchange module.
System thinks that the recorder is out of paper when it is not.	Paper-out sensor dirty.	Clean paper-out sensor.
Recorder not communicating with System.	Poor connection to the front-end rack.	Unplug the module. Plug it back in and try it again in a few seconds. (Watch for the LED to flash.)
	Only one recorder module may be used with each monitor.	Remove one of the recorder modules.
	System not configured properly.	Check the configuration of the connected monitor.
	Too many modules connected.	Check and remove the extra modules.
Recorder won't run.	Recorder interface not working correctly.	Unplug the module. Plug it back in and try it again in a few seconds. (Watch for the LED to flash.)
Poor print quality.	Printhead dirty.	Clean the Printhead as described in "Cleaning the Recorder Module" on page 2-26 of this manual.
	Printhead failure.	Exchange the module.
Paper not feeding properly.	Paper roll off center.	Center paper roll on roller guides.
	Dirty roller.	Clean roller.
Module does not lock into rack.	Locking plates defective.	Remove and exchange the locking plates.

## Troubleshooting Module 4 - Fixing Handheld Keypad Problems

This module shows you how to troubleshoot problems based on symptoms given by a faulty Handheld Keypad. Use this module when your CMS Handheld Keypad is not functioning correctly or if you are referred to this module from another procedure.

All CMS 2000 models come with a Handheld Keypad. The Handheld Keypad is used to interact with the drug calculator and patient data management. Except for the option of an XGA-compatible main display, it is connected to the Main Display through the human interface connector. With the XGA-compatible display option, the Handheld Keypad is connected to the External Alarm Device which is connected to the Computer Module (HIL connector).

Symptom	Possible Cause	Corrective Action
Keypad not communicating with system.	HIL cable reversed.	Reconnect the HIL cable, making sure that the dot indicators match.
	Keypad cable loose or defective.	Check keypad cable. Exchange keypad if necessary.
Keypad generates system reset and erroneous error code in the system log.	Loose connection between logic board and switch board.	Check connection.
	Keypad defective.	Replace Keypad.
Some keys or LEDs not functioning.	Keys or LEDs not active in current screen.	Use keypad specification test to test the keys in the proper screen.
	Loose connection between the logic board and switch board.	Check connection.
	Keypad defective.	Replace Keypad.
	Overlay not correctly aligned.	Upgrade to a new interface.

## Troubleshooting Module 5 - Fixing Printing Problems

External printers can be connected to the CMS through the RS-232 Connector. This module shows you how to troubleshoot problems based on symptoms given by a printer. Use this module if your printer is causing a malfunction of the CMS or if you are referred to this module from another procedure.

**Table 3-9 Troubleshooting the External Printer**

Symptom	Possible Cause	Corrective Action
"No Printer Available" or "Printer Malfunction" status message.	Printer not connected to monitor or central station.	Check printer interface cable.
	Printer out of paper.	Check paper.
	Printer off.	Check printer power cord and switch.
	Printer configured incorrectly.	Check printer settings.
	Wrong printer set-up in Configuration Mode.	Check printer configuration settings in Configuration Mode (under Trends/Calc or Patient Data).
	Printer malfunction.	Consult service manual supplied with printer.
	RS-232 Interface Card defective.	Exchange RS-232 Interface Card.

### Local Jet Printer Configurations

While color HP DeskJet printers are compatible with the CMS, color printouts are not supported. Some printers require the following switch settings in order to be used with the CMS.

**Table 3-10 Printer Switch Settings**

HP QuietJet Printer	<p>The switches used to set the configuration are arranged in two banks of eight. Switch positions required to print locally are:</p> <table><tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr><tr><td>A</td><td>DN</td><td>Up</td><td>DN</td><td>DN</td><td>DN</td><td>DN</td><td>DN</td><td>DN</td></tr><tr><td>B</td><td>DN</td><td>Up</td><td>DN</td><td>DN</td><td>DN</td><td>Up</td><td>DN</td><td>DN</td></tr></table>		1	2	3	4	5	6	7	8	A	DN	Up	DN	DN	DN	DN	DN	DN	B	DN	Up	DN	DN	DN	Up	DN	DN
	1	2	3	4	5	6	7	8																				
A	DN	Up	DN	DN	DN	DN	DN	DN																				
B	DN	Up	DN	DN	DN	Up	DN	DN																				
HP DeskJet Printers  HP Desk Jet 500	<p>The switches used to set the configuration are arranged in two banks of eight. Switch positions required to print locally are:</p> <table><tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr><tr><td>A</td><td>DN</td><td>DN</td><td>DN</td><td>Up</td><td>DN</td><td>DN</td><td>DN</td><td>DN</td></tr><tr><td>B</td><td>DN</td><td>Up</td><td>DN</td><td>DN</td><td>Up</td><td>DN</td><td>DN</td><td>Up</td></tr></table>		1	2	3	4	5	6	7	8	A	DN	DN	DN	Up	DN	DN	DN	DN	B	DN	Up	DN	DN	Up	DN	DN	Up
	1	2	3	4	5	6	7	8																				
A	DN	DN	DN	Up	DN	DN	DN	DN																				
B	DN	Up	DN	DN	Up	DN	DN	Up																				

Table 3-10 Printer Switch Settings

HP DeskJet 550C	<p>The switches used to set the configuration are arranged in two banks of eight. Switch positions required to print locally are:</p> <pre>       1  2  3  4  5  6  7  8 A   DN DN DN Up DN DN DN DN B   DN Up DN DN DN Up DN DN </pre> <p>For Bank A, switch 6 varies depending upon the paper size:  Up: A4 (metric)    DN: Letter size (US Format)  Note that HP DeskJet 400 and 600 configure internally.</p>
HP ThinkJet Printer	<p>The switches used to set the configuration are on the rear. Switch positions required to print locally are:</p> <pre>       1  2  3  4  5  6  7  8 A   DN DN DN DN DN DN DN DN B   Up DN DN DN Up -- -- -- </pre>
HP LaserJet Printers	<p>Switch positions required to print locally are:</p> <pre>       1  2  3  4  5  6  7  8 S1 Off On  On  Off Off Off On On S2 all off S3 all off S4 all off </pre>
HP LaserJet II/III/IV/V/VI Printers	<p>Set the printer off line and enter the configuration menu by pressing the MENU key and holding it down until SYM SET =ROMAN-8* is displayed. Step through the menu items by pressing the MENU key. The items are set as follows:  SYM SET=ROMAN-8  AUTO CONT=OFF  I/O=SERIAL  BAUD RATE=19200  ROBUST XON=ON  DTR POLARITY=HI  Press + or - to alter the item settings. Press ENTER RESET MENU to store the new setting. (The "*" indicates that the setting is saved.) Set the printer on line when configuration is completed.</p>
HP 2673A Printer	<p>The configuration for printing locally to a Philips 2673A Printer is as follows:  BAUD RATE: 19200  PARITY: NONE  HANDSHAKES: XON/XOFF HARDWARE  DATA BITS: 8  STOP BITS: 1  STRIP NULL/DEL: OFF</p>

# Troubleshooting Module 6 - Using the Service Mode

This section gives you details on how to use the functions of the service mode to check the operation of the CMS and to test specific functions. This section includes a description of the power on modes.

## Accessing & Leaving Service Mode

The Service Mode of the CMS is entered and exited using the following instructions.

**Note:** From Rel. C.0, returning to monitoring mode is allowed without entering a password. Just press **Monitor Setup** followed by **Resume Monitor**.

**Table 3-11 Changing Operating Modes**

Step	Action	Comment
1	Press <b>Monitor Setup</b> (or <b>Instrument Config</b> ).	The monitor setup or instrument configuration selection window is displayed.
2	Press <b>More Choices</b> if available.	Shows additional choices for softkeys in this selection window.
3	Press <b>Operating Modes</b> softkey.	The Operating Mode task window displays the current operating mode in words (for example, "Operating Mode - Monitoring") and prompts for the password.
4	Enter the password. Service Mode: 4311	Use the keys labeled 1 to 5. If the password is correct, then the Change OpMode softkey is highlighted. If the password is incorrect, the system returns to the Standard Display.
5	Press <b>Change OpMode</b> softkey.	The Operating Mode task window displays both Monitor and Config in reverse video, with the current operating mode highlighted.
6	Select the required Service Mode.	Use the arrow keys or press the Change Opmode softkey.
7	Press <b>Confirm</b> .	The system performs a cold-start and switches operating modes.
8	Press <b>Monitor Setup</b> or <b>Instrument Config</b> .	Displays the Service Mode task window.

### NOTE

When Service Mode is entered or left, all monitor settings are reset to the user defaults and the database is cleared.  
In the Service Mode, the display becomes blank and the message "Service Mode active - NO MONITORING!" appears at the top of the screen.

---

## Facilities Available in the Service Mode

The following facilities are available in Service Mode and are described in the following paragraphs:

- Global Switches including Line Frequency, Settings Transfer and Altitude (applicable to software Release C and later releases) and French Homologation (applicable to software Releases A and B only)
- Date & Time
- Status Log
- Monitor Revision
- Power On Modes
- Display alignment patterns
- Network Test

### Changing the Global Switches

The Global Switches facility can be used to change the global configuration of the system. The global configuration is the same for all configuration sets.

To enter the Global Switches task window:

**Step 1** Press the **Monitor Setup** (or **Instrument Config**) hardkey.

**Step 2** Press the **Global Switches** softkey.

**Step 3** Change the global configuration of the system as required.

### Line Frequency

The line frequency is used to switch between 50 Hz and 60 Hz for the ECG filtering frequency.

---

#### CAUTION

**Ensure that the Line Frequency is set correctly for the country option ordered. The factory default is 60 Hz for all units.**

---



## Control Panel Software

A global switch is used to load software that is compatible with the Control Panel (Standard or Classic).

**Step 1** Press the Monitor Setup (or Instrument Config) hard key.

**Step 2** Press the Global Switches softkey.

**Step 3** For the Standard keypad *without* Help key, the text should read: <Help>key: No.  
For the Classic keypad *with* Help key, the text should read: <Help>key: Yes.  
(Note: The Classic keypad is not available with Release B.0 or later.)

## Settings Transfer

The patient-related settings of each parameter module can be stored in the EEPROM of the modules. During monitoring, changes in the active settings are recognized and saved. This allows the module to retain all settings, even if transported from one system to another. The Settings Transfer feature can be configured to “Yes” or “No”.

The parameter module stores its settings in the EEPROM until they are changed, either by modifying them in the parameter task window, or by resetting all parameter settings to user-configured default values while in Monitoring Mode. All parameter settings are reset to the user defaults when doing one of the following:

- Changing Operating Mode by pressing **Monitor Setup** (or **Instrument Config**), then **Global Switches**, More Choices, and then the **Operating Modes** softkey.
- Changing the Configuration Set by pressing **Monitor Setup** (or **Instrument Config**), and then the **Config Sets** or **Adult/Pedi/Neo** softkey.

### NOTE

Both actions result in a “Restart”, in which the instrument is rebooted and the user default settings of the parameter module are stored in the EEPROM of the module.

The following types of modules support Settings Transfer:

- All modules with **T** marked on the front panel
- The Pressure, CO, CO<sub>2</sub> and Temperature Modules (also without the **T** mark)

The Heart and ST applications have settings stored in the ECG and ECG/RESP modules respectively.

The Philips Monitor retains the labels of the multiple parameters, such as Temperature or Pressure. The identity labels such as ABP, PAP, Temp 1, and Temp 2, are transferred when the module is positioned in any slot on the same or other system. This Label Tracking feature is only active if Settings Transfer is set to Yes.

The parameter application software stores a label identifier. This allows the system to match the stored label with the parameters' set default label.

### Setting the Altitude

An adjustment for altitude must be entered before using the CO<sub>2</sub>, AGM, and tcpO<sub>2</sub>/CO<sub>2</sub> Modules. This is because the algorithm adjusts the measurement according to altitude. The altitude setting is made in the Global Switches task window.

### Setting the Date and Time

This facility allows you to set the system date and time. If the equipment is connected to the SDN Network, the date and time are set automatically by the Network.

Set the date and time as follows:

**Step 1** Press **Monitor Setup** (or **Instrument Config** ).

**Step 2** Press **Date & Time** .

**Step 3** Enter the new date and time.

### French Homologation (French language CMS only)

An option to configure the system to meet French Homologation requirements is available for software Release A, B, F and later releases. The French Homologation setting (ON or OFF) is the same for all configuration sets. The default setting is: “Fr. Hom. Behavior: NO”

### Displaying the Status Log

The Status Log contains error messages reported by the monitor either during the boot process or during operation. This information can be accessed in either Monitoring Mode or Service Mode. The Service Mode Status Log displays both fatal and non-fatal error codes. The Monitoring Mode Status Log displays fatal error codes only.

### RS-232 Interface

An external personal computer can be connected to the CMS via the RS-232 connector. Refer to the *RS-232 Computer Interface Programming Guide* for a comprehensive description of the capabilities of the interface.

The RS-232 Task Window is available to allow you to perform the RS-232 Loopback test. Refer to Maintaining the CMS, Specification Tests, in this manual for a full description of this test.

*There is no option to configure the system to meet French Homologation requirements for software Release C, D or E. French Homologation is achieved in these releases by using specific French Homologation software.*

*Any RS232 configuration alterations made in Service Mode will affect the configuration settings made in Configuration Mode.*

## Checking the Hardware and Software Revisions

The System has a revision log facility which provides information on the revision status of the hardware and software. These revision screens can be accessed in all operating modes.

The following information is contained in the header of the Monitor Revision Task Window:

- EEPROM Number: (for example: M1059-85781)
- Serial Number: (for example: 2916A02425)

### Displaying the Software or Hardware Revision

**Step 1** Press **Monitor Setup** (or **Instrument Config** ).

**Step 2** Press **Monitor Revision** .

**Step 3** Press the key corresponding to the required revision screen. ( **Show SW Rev** or **Show HW Rev** ).

### Hardware Revision

- Subsystem (for example, System)
- Part Number (hardware – for example, M1085-66501)
- Firmware Revision (for example, 6)

### Software Revision

The software revision screen lists the contents of the EPROM Cards as follows:

For each EPROM Card

- Slot Number
- EPROM Package
- Part Number (software)

## Facilities Available in the Service Mode

### Power On Modes

*The power on modes are provided for service purposes only. They do not influence the monitoring power on behavior, which is not configurable.*

This facility enables the service engineer to perform a power on reset of the system. Use the Power On facility as follows:

- Step 1** Press **Monitor Setup** (or **Instrument Config** ).
- Step 2** Press **Power On Modes** .
- Step 3** Type in the service password. The **Change Op Mode** key is highlighted if the password is entered correctly.
- Step 4** Press **Change Op Mode** .
- Step 5** Select Cold, Warm, Hot or Ext Test and press **Confirm** .

#### Overview of the Power On Modes

The type of Power On Mode executed depends on the system down-time or the detection of a fatal error by the operating system:

System Down Time	Power On Mode
< 1 minute	Hot Start - patient data and <i>active</i> user settings are recovered on restart.
≤ 3 hours	Warm Start - patient data is recovered. Default configurations are restored.
> 3 hours	Cold Start - patient data is lost. Default configurations are restored. System performs extended test.

### Display Alignment Patterns

This facility enables the service engineer to check whether the display patterns are in any way distorted. Use the Display Alignment Patterns facility as follows:

- Step 1** Press **Monitor Setup** (or **Instrument Config** ).
- Step 2** Press any of the softkeys to display varying patterns on the screen.

## Network Test

The test provides information about every SDN Device which is connected to the network. To start the Network Test, press the **Other Patient** (or **Overview**) hardkey, then press the softkey marked **Network Test**.

The Network Test information is presented on the screen in tabular format. The devices on each connected branch of the network are detailed in the table rows. Up to 15 rows of information are displayed at one time.

Use the **Scroll Page** and **Next Page** softkeys to scroll through the table, highlighting the items in the table. An example of the information displayed for one branch of the Network is provided below.

**Table 3-12 Example of the Network Information**

LBN	UNIT		REL	ERR	STATUS
03	CMS/24	0	X2	00	SDN, ON, NET, ST
	PIC6M	6 R	X2	00	SDN, ON, NET
	PIC6M	6 C	X2	00	SDN, ON, NET

### Column: LBN

Lists the Branch Numbers to which each of the devices are connected. Central stations are always shown at Branch 0, even if they are connected to, for example, Branch 31.

### Column: UNIT

Lists codes for the names of each device on each branch of the network. The codes, and the devices to which they refer, are as follows:

<b>CARPO</b>	78580A
<b>CLOVER</b>	78534 Patient Monitor
<b>CMS/24</b>	CMS Patient Monitoring System
<b>COMP1</b>	Computer
<b>COMP2</b>	Computer
<b>COMP3</b>	Computer
<b>COMP4</b>	Computer
<b>DIAG</b>	Diagnostic computer
<b>MINI</b>	783XX Series Patient Monitors

## Facilities Available in the Service Mode

<b>PIC4C</b>	Patient Information Center (4-Bed Computer)
<b>PIC4M</b>	78504 Patient Information Center (4-Bed Monitoring) M2350/60 Philips Component Central Monitor
<b>PIC6M</b>	78560 Patient Information Center (6-Bed Monitoring) M2350/60 Philips Component Central Monitor
<b>PIC8C</b>	Patient Information Center (8-Bed Computer)
<b>PIC8M</b>	78508 Patient Information Center (8-Bed Monitoring) M2350/60 Philips Component Central Monitor
<b>POGO</b>	78532 Patient Monitor
<b>REC_D</b>	Dedicated Recorder
<b>REC_S</b>	Shared Recorder (at Central Station)
<b>TELEM</b>	Telemetry
<b>PIC, AIC or VIC</b>	Philips Information Center
<b>?????</b>	Unknown (new) device

---

### NOTE

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Each UNIT code is followed by a number. This number is a private subcode, used for internal purposes on the central station (Patient Information Center). It is not significant for service purposes.

Additional lines are displayed below the device line when a device is assigned to a central station (as in the previous example). This does not signify that the central station is physically connected to the same branch as the device.

When a device is assigned to a central station, the letter “C” or “R” is displayed between the UNIT and REL columns for the central station.

- A C indicates that the device is also assigned to an arrhythmia system.
- An R indicates that recordings can be made at the central station.

### Column: REL

Displays the protocol release of each device on each branch.

**Column: ERR**

Lists hexadecimal error codes for each device on the network. If the code is “00”, no errors are present. Otherwise, interpret the error codes as follows:

**Step 1** Convert the two-digit hexadecimal error code to an eight-digit binary code.

**Step 2** Compare the resulting binary code with the error code chart below. Note the extreme left digit of the binary code is digit number “7”, the second from the left is number “6”, and so on. Each “1” in the binary code corresponds to an error.

**Table 3-13 Error Code Chart**

Digits								Error Indicated
7	6	5	4	3	2	1	0	
1	.	.	.	.	.	.	.	False SPS Event Flag
	1	.	.	.	.	.	.	Fatal Control Error Flag
		1	.	.	.	.	.	Recoverable Control Flag Error
			1	.	.	.	.	Physical Data Error Flag
				1	.	.	.	Logical Data Error Flag
					1	.	.	Poll Cycle Overflow Flag
						1	.	Command Response Fail Flag
							1	System Cycle Failure Flag

**Column: STATUS**

This column provides information about the SDN state of each device. An example status line would be:

*SDN, ON, NET, T*

Which can be interpreted as follows:

**SDN** Device is connected to the SDN Network.

**NET** Network is active.

**ON** Device is on-line.

**T** Test Mode is active.

If the device has only just been connected to the network, or has only just been powered-up, the letters “ST” (for “START”) are also displayed.

---

## Description of the Boot Process

### Overview

The boot process takes place in the following four stages:

1. Hardware self test.
2. File transfer.
3. Software initialization - phase 1.
4. Software initialization - phase 2.

When all tests are successful and no hardware failures are detected, the boot process lasts between 12 and 15 seconds before ECG monitoring can begin. These tests are described in detail in the following subsections.

All start modes of the system (hot, warm, and cold starts) follow these four stages. Only the status of the system at the last power down, and the time elapsed before the system is powered on again, determine the start mode. In all start modes the ECG parameter screen is displayed 12–15 seconds after the start-up is requested.

The actions performed in each start mode also differ in the extent to which the system components are tested. For example, a cold start runs more extensive memory tests than warm or hot starts.

An extended test can be activated in the Service Mode to run an extensive test of the Monitor. When selected, the extended test takes over the system after the hardware configuration has been determined in Stage 2 of the boot process.

### Stage 1: Hardware Self-Tests

During the first stage of the boot process all boards in the computer module run their self-tests. The success of the tests is indicated by the red LEDs on the System Boards.

At the start of the self test, the red LEDs are lit for 1 second, and then the SDN LED is turned off and the other two LEDs blink during normal operation.

Immediately following this stage, the system checks whether an external tool is connected, for example, a cloning tool. If an external tool is detected, then it is given full control of the self-tested system hardware; none of the system software is activated.



**Stage 2: File Transfer and System Configuration**

Four to six seconds after the boot request, information about the system board configuration is read from the central EEPROM. This information indicates what software must be present, and identifies which boards are mandatory and which are optional.

**Stage 3: Software Initialization -- Phase 1**

In the first software initialization phase, each software module initializes its buffers. A check of the local buffer data is also made. If a hot start is made, the data should be correct in the local buffer on the CPU.

Any problems are reported to the Status Log. If software on one Application CPU reports a problem, the operating system will try to clear this buffered data by rebooting. This will usually solve all problems.

**Stage 4: Software Initialization -- Phase 2**

At this stage the different parts of the software check whether other optional hardware or software is available in that particular system.

After the second software initialization phase, the Monitoring Mode is activated.

**Summary of the Power On Modes**

The type of Power On selected by the CMS depends on the down-time of the unit as follows:

System Down Time	Start Mode
< 1 minute	Hot Start.
< 3 hours	Warm Start.
> 3 hours	Cold Start.
NA	Extended Start can only be selected in the Service Mode.
NA	X-Start (occurs when changing operating Modes and configuration sets).

**Hot Start**

The Monitor makes a hot start when it has been powered down for a period less than one minute. The active user default values, including parameter module settings are recovered and retained on restart.

**Warm Start**

During a warm start the System behaves as during a cold start, but an abbreviated version of the self-test is carried out. The system database for patient data management is checked and recovered. All active settings are lost.

### Cold Start

---

**CAUTION**

---

**During a cold start the CPU Cards run a detailed test of memory which erases the system database for patient data management. All active settings and patient data are lost.**

---

All user default values for configurable items including parameter module settings are restored and an extensive self-test is carried out.

When Settings Transfer is configured to ON, patient-related settings are recovered from the module front-end's non-volatile memory. The system database for patient data management is cleared. Leaving the Demo Mode causes a cold start.

A cold start usually requires between 12 and 15 seconds before the Monitoring Mode is activated.

### Extended Test

---

**CAUTION**

---

**During the extended self-test the CPU Cards run a detailed memory test that erases the system database for patient data management. All patient data is lost as the memory test is equivalent to a cold start.**

---

This test is not performed during the standard boot process but is a software switch that can be selected in the Service Mode.

When all components are tested successfully, the extended test takes between 2 and 2.5 minutes to complete, and the upper limit is 255 seconds. An error message is directly displayed at the top of the screen when problems occur during the Extended test. After the test, inspect the Status Log for any device IDs and error codes generated.

### X-Start

During an X-start, the system reacts as after a cold start, the only difference being that the user default settings of the Monitor are downloaded to the EEPROM of the modules. An X-start occurs after changing operating mode or configuration set.

---

**NOTE**

---

Modules that are plugged in the System within 30 seconds after an "X- Start" is initiated, will receive the user default settings of the Philips Monitor.  
Modules that are plugged in 30 Seconds after an X-Start is initiated will transfer the stored patient settings to the Philips CMS Patient Monitoring System.

---

# Chapter 4 Troubleshooting the Plug-in Modules

This chapter tells you how to troubleshoot problems that come from faults within the plug-in modules or the associated circuitry within the rest of the CMS. The modules use visual indications, error messages, and INOP messages to indicate a fault. All references to the CMS also refer to the ACMS unless specifically stated.

See “Procedure Overview” on page 4-2 for a more detailed overview.

---

## Objectives

This chapter shows you how to:

- Recognize a properly operating Plug-in Module.
- Identify symptoms of improper operation of the Plug-in Modules.
- Use any symptoms or indications to identify a fault as being in the Plug-in Modules.
- Further isolate faults down to field-replaceable assemblies.

---

## Concepts

This chapter uses visual indications, Inops, error messages and other operational symptoms to help you diagnose problems with the Philips Plug-in Modules. Symptoms have been grouped based on the measurement performed by the Plug-in Module. Each troubleshooting section contains procedures for isolating faults based on the symptoms, any supporting theory as to why you are being told to do a certain procedure, and any additional rationale that will help you to isolate faults.

- **Inops** – Inops are messages displayed on the screen when the CMS cannot measure or process signals properly. This could be due to patient-related or equipment-related problems. This section deals only with those Inops which are equipment related.
- **Task Window** – The task window is an operating level of the CMS which allows you to make changes or adjustments to the parameters or screen displays, or to perform procedures. Each parameter has a series of task windows which can be accessed by pressing the setup key on the parameter module. This section uses the task windows for each parameter to check for error messages.

## Procedure Overview

**Table 4-1 Troubleshooting and Self-Test Procedures**

Topic	Page
Troubleshooting tcpO <sub>2</sub> /tcpCO <sub>2</sub> Problems	4-3
Troubleshooting ECG and ECG/RESP Problems	4-9
Troubleshooting Pressure Problems	4-11
Troubleshooting NBP Problems	4-13
Troubleshooting Cardiac Output Problems	4-17
Troubleshooting SpO <sub>2</sub> /Pleth Problems	4-22
Troubleshooting SvO <sub>2</sub> Problems	4-24
Troubleshooting FIO <sub>2</sub> Module Problems	4-28
Troubleshooting Temperature Module Problems	4-30
Troubleshooting CO <sub>2</sub> Module Problems	4-32
Troubleshooting Blood Analysis Module Problems	4-35
Troubleshooting EEG Module Problems	4-40
Troubleshooting BIS Module Problems	4-43
Troubleshooting VueLink Module Problems	4-52
“Self-Test Procedure Overview”	4-55
“Performing the ECG or ECG/RESP Module Self-Test”	4-57
“Performing the M1006A/B Pressure Module Self-Test”	4-57
“Performing the NBP Module Self-Test”	4-58
“Performing the SpO <sub>2</sub> /Pleth Module Self-Test”	4-58
“Performing the Cardiac Output Module Self-Test”	4-59
“Performing the tcpO <sub>2</sub> /tcpCO <sub>2</sub> Module Self-Test”	4-59
“Performing the SvO <sub>2</sub> Module Self-Test”	4-60
“Performing the SvO <sub>2</sub> Optical Stability Check”	4-60
“Performing the CO <sub>2</sub> Module Self-Test”	4-61
“Performing the Temperature Module Self-Test”	4-62
“Performing the Blood Analysis Module Self-Test”	4-62
“Performing the Recorder Module Self-Test”	4-63
“Performing the VueLink Module Self-Test”	4-63
“Performing the Data Management Database Self-Test”	4-63
“Performing the RS-232 Card Loopback Test”	4-64

## Troubleshooting tcpO<sub>2</sub>/tcpCO<sub>2</sub> Problems

This section describes how to troubleshoot and correct faults associated with the tcpO<sub>2</sub>/tcpCO<sub>2</sub> module. The procedures for recognizing, isolating, and correcting faults using this module are as follows:

- Identifying a problem based on visual indications or repeated INOPS.
- Checking the tcpO<sub>2</sub>/tcpCO<sub>2</sub> task window for specific error messages and performing the corrective actions suggested in the table given with this module.
- Calibrating the module as required.

### To Troubleshoot the Module

- ❑ If **neither numerics nor a -?-** are displayed for the tcpO<sub>2</sub>/tcpCO<sub>2</sub> module, perform the following actions:

- Step 1** Make sure there is a transducer connected to the module. If no transducer is connected, connect one.
- Step 2** Make sure the tcpO<sub>2</sub>/tcpCO<sub>2</sub> parameter is turned on. Turn it on, if it is not.
- Step 3** Make sure the tcpO<sub>2</sub>/tcpCO<sub>2</sub> numeric is turned on. Turn it on, if it is not.
- Step 4** Make sure you don't have more than one tcpO<sub>2</sub>/tcpCO<sub>2</sub> module plugged into the module racks you are using. If more than one tcpO<sub>2</sub>/tcpCO<sub>2</sub> module is plugged in, the supernumerary modules are ignored and should be removed.
- Step 5** Check the connection on the module and the rack interface.
  - 1. Unplug and re-plug the tcpO<sub>2</sub>/tcpCO<sub>2</sub> module and check if the green LED on the tcpO<sub>2</sub>/tcpCO<sub>2</sub> module lights up after re-plugging. If it does not, proceed with the following:
  - 2. Put the tcpO<sub>2</sub>/tcpCO<sub>2</sub> module into another slot and check the LED once again. If it lights up now, the connector for the previous slot is faulty and the rack needs to be replaced. If it does not, proceed with the following:

3. *Note: this procedure applies only for setups, in which the tcpO<sub>2</sub>/tcpCO<sub>2</sub> module is located in a Satellite Rack. If this does not apply for your situation, proceed with 4.*

Replace the cable from the Satellite Rack to the function box. Again unplug and re-plug the tcpO<sub>2</sub>/tcpCO<sub>2</sub> module and check if the LED lights up. If it does not, proceed with the following:

4. Plug any other (not faulty) module into the same slot and check if the LED lights up. If the LED of the alternative module lights up, the tcpO<sub>2</sub>/tcpCO<sub>2</sub> module is defect and has to be replaced. If it does not, either the rack or the rack interface card is defect. Proceed with the following:
5. Replace the rack and plug in the tcpO<sub>2</sub>/tcpCO<sub>2</sub> module into the new rack. If the LED on the module does not light up, replace the rack interface card in the function box.

- ❑ If a **-?- instead of a numeric** and one or more INOP messages are displayed for the tcpO<sub>2</sub>/tcpCO<sub>2</sub> module, perform the following actions:

*Please note that for proceeding to the next steps a transducer must be connected to the module.*

**Step 1** Perform a module self-test (See “Performing the tcpO<sub>2</sub>/tcpCO<sub>2</sub> Module Self-Test” on page 4-59). If the tcpO<sub>2</sub> test numeric reads exactly 60 mmHg (8.0 kPa) and the tcpCO<sub>2</sub> test numeric reads exactly 40 mmHg (5.3 kPa), proceed to the next step, if not, replace the module.

**Step 2** Enter the tcpO<sub>2</sub>/tcpCO<sub>2</sub> Task Window by pressing the setup key on the tcpO<sub>2</sub>/tcpCO<sub>2</sub> module. The Task Window displays messages dealing with the tcpO<sub>2</sub>/tcpCO<sub>2</sub> module failures. The following table describes the messages and corrective actions to take.

**Table 4-2 Task Window messages for the tcpO<sub>2</sub>/tcpCO<sub>2</sub> Module**

Message	Possible Cause	Corrective Action
TC Equip Malf, with prompt: module malfunction.	Module is faulty.  Transducer has been inserted and removed into/from calibration chamber too frequently.  Microswitch in Calibration chamber is intermittent.	Unplug then re-plug the Module. if the error prompt reappears within 10 seconds, exchange the Module.  Unplug, then re-plug the module.  Unplug and re-plug the module. If the error prompt reappears any time after 10 seconds, replace the Calibration chamber.
TC Equip Malf, with prompt: equipment malfunction. The transducer is plugged in.	Polarization voltage or transducer supply voltage is out of range.  Heating malfunction in the transducer.  Heating control in module is defective.	Disconnect the transducer. If the prompt changes to module malfunction, exchange the module. Otherwise replace the transducer.  Swap transducers to verify prompt message. If necessary, replace transducer.  Swap transducers to verify prompt message. If necessary, exchange module.
No numeric values, and no -?- in standard display when transducer is plugged in, but not inserted in the Calibration chamber.	Microswitch in Calibration chamber is faulty.	Replace the Calibration chamber.
Prompt: insert transducer in chamber appears when the transducer is in the chamber and the calibration is started.	Microswitch in Calibration chamber is faulty.	Replace the Calibration chamber.
Calibration has passed, but readings fluctuate more than 2.0 mmHg (0.3kPa)/30 seconds.	Membrane/electrolyte worn out.	Re-membrane the transducer and restart the calibration. If the values still fluctuate more than 2.0 mmHg (0.3kPa)/30 seconds, replace the transducer.

**Step 3** Refer to the following table. Correct the possible cause identified by the INOP message and verify that the INOP disappears.

**Table 4-3 INOP Messages for the tcpO<sub>2</sub>/tcpCO<sub>2</sub> Module**

INOP Message	Possible Cause	Corrective Action
tc UN-PLUGGED	Parameter is ON and unplugged from rack.	Perform Step 5 on page 4-3.
tc EQUIP MALF	Malfunction in the transducer or the module.	Refer to the related Task Window messages in Table 4-2 on page 4-5.
tc NO TRANSDUC	No transducer is connected to the module.	Connect transducer to module.
tc CHANGE SITE	The site timer in the module has expired.	Change application site and restart timer.
tc CAL FAILED	Calibration failed due to out of range or unstable signal during calibration.	For more information on the calibration of the module, refer to tcpO <sub>2</sub> /tcpCO <sub>2</sub> Module section of the <i>User's Reference Manual</i>
tc CAL REQUIRD	Calibration is required before applying the transducer to the patient.	Run a Calibration as described in tcpO <sub>2</sub> /tcpCO <sub>2</sub> Module section of the <i>User's Reference Manual</i> . Note: if the message is still displayed after calibration, run the calibration again. If you get the same message again, replace the module.
tc CAL RUNNING	A calibration is running.	Wait until calibration is finished.
tc STABILIZING	The transducer has not yet reached the selected temperature and/or the skin is not ready to be measured.	Wait until measurement site has warmed up and values become stable.
tc CHECK TIME	Site timer due to expire in 15 minutes or less.	Change application site and restart timer.



- If tcpO<sub>2</sub>/tcpCO<sub>2</sub> **readings are questionable**, perform the following actions:

Perform a tcpO<sub>2</sub> zero check and tcpCO<sub>2</sub> gain check for the transducer. These checks tell you whether the tcpO<sub>2</sub>/tcpCO<sub>2</sub> transducer is working correctly.

## Test Equipment

The following list gives you the test equipment recommended to perform the specification test on the tcpO<sub>2</sub>/tcpCO<sub>2</sub> plug-in:

- 1 Calibration Unit (Philips 15210B or Radiometer TCC3)
- 1 Calibration gas bottle of Cal 1 gas (20.9% O<sub>2</sub>, 5% CO<sub>2</sub>) (see Chapter 6 “Parts List for CMS”)
- 1 Calibration gas bottle of Cal 2 gas (0% O<sub>2</sub>, 10% CO<sub>2</sub>) (see Chapter 6 “Parts List for CMS”)
- 1 Accessory Kit (15209-60010)
- 1 tcpO<sub>2</sub>/CO<sub>2</sub> transducer (Philips M1918A or Radiometer transducer)
- 1 Calibration Tubing (M2205A)

## Procedure

- Step 1** Ensure correct function of the Calibration Unit (See “Gas Flow Performance Check” on page C-6 for Philips 15210B and Radiometer Service Documentation for Radiometer calibration unit TCC3).
- Step 2** Make sure that you are not in Service mode.
- Step 3** Set the transducer temperature to 43.0° C.
- Step 4** Using a calibration unit (Philips M1918A or Radiometer calibration unit TCC3) and Cal 1 gas, calibrate the module as described in the tcpO<sub>2</sub>/tcpCO<sub>2</sub> Module section of the *User's Reference Manual*.
- Step 5** Check and note down the displayed values for tcpO<sub>2</sub> and tcpCO<sub>2</sub>. The values should not fluctuate more than 2 mmHg (0.3kPa) in 30 seconds.
- Step 6** If the readings fluctuate more than 2 mmHg (0.3kPa), re-membrane the transducer ensuring that the old electrolyte is thoroughly removed and check whether you need to activate the transducer. The tcpO<sub>2</sub>/tcpCO<sub>2</sub> Module section of the *User's Reference Manual* tells you how to do this.
- Step 7** Repeat steps 4 and 5. If the test fails again, the transducer has unacceptable drift and has to be replaced. Repeat steps 4 and 5 with new transducer.

## Troubleshooting tcpO<sub>2</sub>/tcpCO<sub>2</sub> Problems

- Step 8** Replace the Cal 1 gas cylinder on the calibration unit with the Cal 2 gas cylinder. Turn on the gas supply of your calibration unit.
- Step 9** Check the values displayed on the screen. The displayed tcpO<sub>2</sub> must be < 6 mmHg (0.8kPa) within 10 minutes. The displayed tcpCO<sub>2</sub> value must be within the range listed in the table within 10 minutes. If the tcpO<sub>2</sub> is not < 6 mmHg (0.8kPa), and/or tcpCO<sub>2</sub> values are not within the acceptance range listed in the tables given, the transducer does not measure correctly and needs to be replaced.

**Table 4-4 Calibration Values**

tcpCO <sub>2</sub> at CAL1 gas		Min. tcpCO <sub>2</sub> at CAL2 gas		Max. tcpCO <sub>2</sub> at CAL2 gas	
39 mmHg	5.2 kPa	74 mmHg	9.9 kPa	88 mmHg	11.7 kPa
38 mmHg	5.1 kPa	72 mmHg	9.7 kPa	86 mmHg	11.5 kPa
37 mmHg	5.0 kPa	70 mmHg	9.5 kPa	84 mmHg	11.3 kPa
36 mmHg	4.9 kPa	68 mmHg	9.3 kPa	81 mmHg	11.1 kPa
35 mmHg	4.8 kPa	66 mmHg	9.1 kPa	79 mmHg	10.8 kPa
34 mmHg	4.7 kPa	64 mmHg	8.9 kPa	77 mmHg	10.6 kPa
33 mmHg	4.6 kPa	62 mmHg	8.7 kPa	75 mmHg	10.4 kPa
32 mmHg	4.5 kPa	60 mmHg	8.5 kPa	72 mmHg	10.2 kPa
31 mmHg	4.4 kPa	59 mmHg	8.3 kPa	70 mmHg	9.9 kPa
30 mmHg	4.3 kPa	57 mmHg	8.1 kPa	68 mmHg	9.7 kPa
29 mmHg	4.2 kPa	55 mmHg	7.9 kPa	66 mmHg	9.5 kPa
28 mmHg	4.1 kPa	53 mmHg	7.7 kPa	63 mmHg	9.3 kPa
27 mmHg	4.0 kPa	51 mmHg	7.5 kPa	61 mmHg	9.1 kPa
26 mmHg	3.9 kPa	49 mmHg	7.4 kPa	59 mmHg	8.8 kPa
25 mmHg	3.8 kPa	47 mmHg	7.2 kPa	57 mmHg	8.6 kPa
24 mmHg	3.7 kPa	45 mmHg	7.0 kPa	55 mmHg	8.4 kPa
23 mmHg	3.6 kPa	43 mmHg	6.8 kPa	52 mmHg	8.2 kPa
22 mmHg	3.5 kPa	41 mmHg	6.6 kPa	50 mmHg	7.9 kPa
21 mmHg	3.4 kPa	39 mmHg	6.4 kPa	48 mmHg	7.7 kPa
20 mmHg	3.3 kPa	37 mmHg	6.2 kPa	46 mmHg	7.5 kPa
19 mmHg	3.2 kPa	35 mmHg	6.0 kPa	43 mmHg	7.3 kPa

## Troubleshooting ECG and ECG/RESP Problems

This section describes how to troubleshoot and correct faults associated with the ECG/RESP module. The procedures for recognizing, isolating, and correcting faults using this module are as follows:

- Identifying a problem based on visual indications or repeated INOPS.

### To Troubleshoot the Module

- If **neither numerics nor a -?-** are displayed for the ECG/RESP module, perform the following actions:

- Step 1** Make sure there is a trunk cable with lead set connected to the module. If not, connect one.
- Step 2** Make sure the ECG and RESP parameters are turned on. If they are not, turn them on.
- Step 3** Make sure the ECG (HR) and RESP numerics are turned on. If they are not, turn them on.
- Step 4** Make sure you don't have more than one ECG/RESP module plugged into the module racks you are using. If more than one ECG/RESP module is plugged in, the supernumerary modules are ignored and should be removed.
- Step 5** Check the connection on the module and the rack interface.
  - 1. Unplug and re-plug the ECG/RESP module and check if the green LED on the ECG/RESP module lights up after re-plugging. If it does not, proceed with the following:
  - 2. Put the ECG/RESP module into another slot and check the LED once again. If it lights up now, the connector for the previous slot is faulty and the rack needs to be replaced. If it does not, proceed with the following:
  - 3. *Note: this procedure applies only for setups, in which the ECG/RESP module is located in a Satellite Rack. If this does not apply for your situation, proceed with 4.*  
Replace the cable from the Satellite Rack to the function box. Again unplug and re-plug the ECG/RESP module and check if the LED lights up. If it does not, proceed with the following:
  - 4. Plug any other (not faulty) module into the same slot and check if the LED lights up. If the LED of the alternative module lights up, the ECG/RESP module is defect and has to be replaced. If it does not, either the rack or the rack interface card is defect. Proceed with the following:
  - 5. Replace the rack and plug in the ECG/RESP module into the new rack. If the LED on the module does not light up, replace the rack interface card in the function box.

- ❑ If a **-?- instead of a numeric** and one or more INOP messages are displayed for the ECG/RESP module, perform the following actions:

*Please note that for proceeding to the next steps a trunk cable with lead set must be connected to the module.*

**Step 1** Perform a module self-test (See “Performing the ECG or ECG/RESP Module Self-Test” on page 4-57). If the ECG/RESP test numerics read exactly the listed values, proceed to the next step, if not, replace the module.

**Step 2** Refer to the following table. Correct the possible cause identified by the INOP message and verify that the INOP disappears. If the problem still exists, replace the module.

**Table 4-5 INOP Messages for ECG and ECG/Resp**

INOP Message	Possible Cause	Corrective Action
LEADS OFF	Not all required leads are attached or electrodes have been displaced. With activated EASI™ option the wrong lead set is used. Lead set or ECG Module may be defective.	Make sure all electrodes are correctly attached. With activated EASI™ option make sure you are using the correct (5 electrode) lead set. If INOP still is displayed, change lead set. If INOP persists, replace module.
LEADS OFF XX	Single electrode from lead xx detached.	Attach the missing electrode. If INOP still is displayed, see Corrective Action for “LEADS OFF”
LEADS OFF (EL.X)	Single electrode from lead E,S or I is detached (EASI™ lead set).	Attach the missing electrode. If INOP still is displayed, see Corrective Action for “LEADS OFF”
ECG/RESP UNPLUGGED	ECG/RESP module is unplugged from the rack.	Perform Step 5 on page 4-9.
ECG EQUIP MALF	Malfunction in ECG hardware.	Replace module.
ECG/RESP UNPLUGGED	ECG/RESP module is unplugged from the rack.	Perform Step 5 on page 4-9.
RESP LEAD OFF	RESP lead is off, electrode detached, or patient cable unplugged.	Make sure all electrodes are correctly attached. If INOP still is displayed, change lead set. If INOP persists, replace module.
RESP EQUIP MALF	Malfunction in RESP hardware.	Replace module.

## Troubleshooting Pressure Problems

This section describes how to troubleshoot and correct faults associated with the M1006A and M1006B Pressure plug-in modules. The procedures for recognizing, isolating, and correcting faults with this module are as follows:

- Identifying a problem based on visual indications or repeated INOPS.

### To Troubleshoot the Module

- If **neither numerics nor a -?-** are displayed for the PRESSURE module, perform the following actions:

- Step 1** Make sure there is a transducer connected to the module. If no transducer is connected, connect one.
- Step 2** Make sure the PRESSURE parameter is turned on. Turn it on, if it is not.
- Step 3** Make sure the PRESSURE numeric is turned on. Turn it on, if it is not.
- Step 4** If you want to measure CPP, make sure that one PRESSURE parameter is labeled ICP and both pressures display valid numerics.
- Step 5** Make sure you don't have too many PRESSURE module plugged into the module racks you are using. If too many PRESSURE modules are plugged in, you get two status messages: "Too many modules of the same type connected" and "Currently ignored module in rack position x.x". The last message enables you to identify the supernumerary module. These modules are ignored and should be removed. See Appendix A "Product Information" for specific information concerning your model of the CMS.
- Step 6** Check the connection on the module and the rack interface.
  1. Unplug and re-plug the PRESSURE module and check if the green LED on the PRESSURE module lights up after re-plugging. If it does not, proceed with the following:
  2. Put the PRESSURE module into another slot and check the LED once again. If it lights up now, the connector for the previous slot is faulty and the rack needs to be replaced. If it does not, proceed with the following:
  3. *Note: this procedure applies only for setups, in which the PRESSURE module is located in a Satellite Rack. If this does not apply for your situation, proceed with 4.*  
Replace the cable from the Satellite Rack to the function box. Again unplug and re-plug the PRESSURE module and check if the LED lights up. If it does not, proceed with the following:
  4. Plug any other (not faulty) module into the same slot and check if the LED lights up. If the LED of the alternative module lights up, the

PRESSURE module is defect and has to be replaced. If it does not, either the rack or the rack interface card is defect. Proceed with the following:

5. Replace the rack and plug in the PRESSURE module into the new rack. If the LED on the module does not light up, replace the rack interface card in the function box.

- ❑ If a **-?- instead of a numeric** and one or more INOP messages are displayed for the PRESSURE module, perform the following actions:

*Please note that for proceeding to the next steps a transducer must be connected to the module.*

**Step 1** Perform a module self-test (See “Performing the M1006A/B Pressure Module Self-Test” on page 4-57). If the PRESSURE test numerics read exactly the listed values, proceed to the next step, if not, replace the module.

**Step 2** Refer to the following table. Correct the possible cause identified by the INOP message and verify that the INOP disappears. If the problem still exists, replace the module.

**Table 4-6 INOP Messages for Pressure**

INOP Message	Possible Cause	Corrective Action
<Px> UNPLUGGED	Pressure module is unplugged from the rack.	Perform Step 6 on page 4-11.
<Px> NO TRANSDUCER	No transducer connected to the module.	Connect transducer to module.
<Px> EQUIP MALF	Malfunction in the pressure hardware.	Replace module.
<Px> ZERO + CHECK CAL	Occurs when new transducer attached to module, or when the power is off for longer than one minute and settings transfer is off.	Zero the PRESSURE module.
<Px> OVERRANGE	Measured pressure >361 mmHg, <-41 mmHg.	Replace transducer. If the INOP persists, replace module.
CPP CHECK SOURCES	Occurs for one minute if either the arterial or the intracranial pressure sources are switched off, or the front end modules are removed.	Connect module properly to rack and make sure that the PRESSURE parameter is turned on. Make sure you get valid numerics for ICP and the other pressure. Make sure that the preselected pressure label in the CPP source window is the same as for the second pressure.
CPP CHECK UNITS	Occurs if two pressure sources have different units.	Use the same unit for all PRESSURE modules.

## Troubleshooting NBP Problems

*Philips uses invasive pressure as reference for NBP. Diastolic measurements can be up to 8 mmHg lower than pressure measured by auscultatory (Korotkoff) method.*

To ensure accurate NIBP measurements, the NBP plug-in module can be calibrated. Philips recommends that the module is calibrated once every 12 months.

This section describes how to troubleshoot and correct faults associated with the NBP module. The procedures for recognizing, isolating, and correcting faults with this module are as follows:

- Identifying a problem based on visual indications or repeated INOPS.
- Checking the NBP task window for specific error messages and performing the corrective actions suggested in the table given with this module.
- Calibrating the module as required.

### To Troubleshoot the Module

- ❑ If **neither numerics nor a -?-** are displayed for the NBP module, perform the following actions:

**Step 1** Make sure the NBP parameter is turned on. Turn it on, if it is not.

**Step 2** Make sure the NBP numeric is turned on. Turn it on, if it is not.

**Step 3** Make sure you don't have more than one NBP module plugged into the module racks you are using. If more than one NBP module is plugged in, the supernumerary modules are ignored and should be removed.

**Step 4** Check the connection on the module and the rack interface.

1. Unplug and re-plug the NBP module and check if the green LED on the NBP module lights up after re-plugging. If it does not, proceed with the following:
2. Put the NBP module into another slot and check the LED once again. If it lights up now, the connector for the previous slot is faulty and the rack needs to be replaced. If it does not, proceed with the following:
3. *Note: this procedure applies only for setups, in which the NBP module is located in a Satellite Rack. If this does not apply for your situation, proceed with 4.*  
Replace the cable from the Satellite Rack to the function box. Again unplug and re-plug the NBP module and check if the LED lights up. If it does not, proceed with the following:

4. Plug any other (not faulty) module into the same slot and check if the LED lights up. If the LED of the alternative module lights up, the NBP module is defect and has to be replaced. If it does not, either the rack or the rack interface card is defect. Proceed with the following:
5. Replace the rack and plug in the NBP module into the new rack. If the LED on the module does not light up, replace the rack interface card in the function box.

- ❑ If a **-?- instead of a numeric** and one or more INOP messages are displayed for the NBP module, perform the following actions:

**Step 1** Refer to the following table. Correct the possible cause identified by the INOP message and verify that the INOP disappears. If the problem still exists, replace the module.

**Table 4-7 INOP Messages for the NBP Module**

INOP Message	Possible Cause	Corrective Action
NBP UNPLUGGED	NBP is unplugged from rack.	Perform Step 4 on page 4-13.
NBP EQUIP MALF	Hardware problem in module or tubing.	Exchange the tubing and restart measurement. If the INOP reoccurs and the message in the NBP task window reads "Pressure values of transducers different", attempt a calibration (See "Performance Test NBP Module" on page 2-6). If this fails, replace the module.
NBP INTERRUPTED	Strong patient movement or Inflation/deflation time-out – pump problem.	Make sure the patient does not move strongly and restart measurement. Check whether cuff is connected. Check tubing and cuff for leakages and restart measurement.
NBP CUFF OVER-PRESS	Strong patient movement or defect in pneumatic control.	Restart measurement making sure that patient does not move strongly. If INOP reoccurs, replace module.
NBP INCORRECT CUFF	Neonatal cuff used for adult patient size setting.	Make sure the patient size configuration is set to PEDI/NEO and restart measurement.
CUF NOT DEFLATED	Hardware problem in module or tubing.	Exchange the tubing and restart measurement. If the INOP reoccurs, replace module.



Using the Calibration Mode

This task window is displayed after pressing the **Cal Frontend** softkey in the NBP manometer task window.

The keys **Start** , **Stop** , and **Save Values** are displayed at the bottom of the Calibration Mode Task Window. The **Start** key is used to close the valves, the **Stop** key opens the valves and the **Save Values** key is used to store the calibration factor.

- Step 1** Press **Start** .
- Step 2** Pressurize the gauge as precisely as possible to 220 or 280 mmHg. One of these values (depending on the module) is shown in the NBP manometer task window.
- Step 3** Now press one of the following keys:
- Save Values** : to store the calibration factor.
  - or **Stop** : to abandon the calibration procedure.

Selecting NBP Measurement Characteristic

<b>WARNING</b>	<b>Consult technical support before changing the NBP measurement characteristic in adult or pediatric mode. Changing the NBP measurement characteristic will significantly change the NBP readings, especially in the elevated pressure range.</b>
<b>WARNING</b>	<b>The NBP measurement characteristic has to be set and stored individually for each configuration set. The same setting must be selected for all configuration sets.</b>
<b>NOTE</b>	This setting changes the NBP measurement characteristic in adult and pediatric mode. It has no influence on the NBP measurement characteristic in neonatal mode. In neonatal mode the intra-arterial method is always used as a reference standard to validate overall accuracy.

- 1.Go into service mode
2. Enter the NBP Task Window and press the ‘Change Refernce” key
3. Select desired NBP measurement characteristic (1, 2, or 3) according to the table below
4. Press “Confirm” to store new setting
- 5.Go into Config mode and select next Config Set
- 6.Repeat Steps 1 to 5 for all Config Sets

Selection	Description	Reference Standard for Validation
1	NBP measurement characteristic of CMS/V24/V26 Rel. B.0 and earlier. Recommended only in mixed installations with Rel. B.0 or earlier.	Intra-arterial according to ANSI/AAMI SP10-1987. The blood pressure measurements determined with this device and measurement characteristic set to “1” comply with the American National Standard for Electronic or Automated Sphygmomanometers (ANSI/AAMI SP-10-1987) in relation to mean error and standard deviation, when compared to intra-arterial measurements in a representative patient population.
2	NBP measurement characteristic of M3/M4 Rel. B and earlier (higher diastolic values than 1). Recommended if customer prefers calibration against manual auscultatory reference method.	<b>Auscultatory</b> according to ANSI/AAMI SP10-1992. The blood pressure measurements determined with this device and measurement characteristic set to “2” comply with the American National Standard for Electronic or Automated Sphygmomanometers (ANSI/AAMI SP-10-1992) in relation to mean error and standard deviation, when compared to auscultatory measurements in a representative patient population. For the auscultatory reference the 5th Korotkoff sound was used to determine the diastolic pressure.
3 (Factory Default)	NBP measurement characteristic of CMS/V24/V26 Rel. C.0 and later. Recommended in all other cases than described above.	<b>Intra-arterial</b> according to ANSI/AAMI-SP10-1992. The blood pressure measurements determined with this device and measurement characteristic set to “3” comply with the American National Standard for Electronic or Automated Sphygmomanometers (ANSI/AAMI SP10-1992) in relation to mean error and standard deviation, when compared to intra-arterial measurements in a representative patient population.

The setting of NBP measurement characteristic is stored in the monitor and can be cloned with the cloning tool.

## Troubleshooting Cardiac Output Problems

This section describes how to troubleshoot and correct faults associated with the Cardiac Output plug-in module. The procedures for recognizing, isolating, and correcting faults with this module are as follows:

- Identifying a problem based on visual indications or repeated INOPS.

### To Troubleshoot the Module

- If **neither numerics nor a -?-** are displayed for the C.O. module, perform the following actions:

- Step 1** Make sure there is a C.O. Interface Cable and a catheter connected to the module. If not, connect them.
- Step 2** Make sure the C.O. parameter is turned on. Turn it on, if it is not.
- Step 3** Make sure the C.O. numeric is turned on. Turn it on, if it is not.
- Step 4** Make sure you don't have more than one C.O. module plugged into the module racks you are using. If more than one C.O. module is plugged in, the supernumerary modules are ignored and should be removed.
- Step 5** Check the connection on the module and the rack interface.
  1. Unplug and re-plug the C.O. module and check if the green LED on the C.O. module lights up after re-plugging. If it does not, proceed with the following:
  2. Put the C.O. module into another slot and check the LED once again. If it lights up now, the connector for the previous slot is faulty and the rack needs to be replaced. If it does not, proceed with the following:
  3. *Note: this procedure applies only for setups, in which the CO module is located in a Satellite Rack. If this does not apply for your situation, proceed with 4.*  
Replace the cable from the Satellite Rack to the function box. Again unplug and re-plug the CO module and check if the LED lights up. If it does not, proceed with the following:
  4. Plug any other (not faulty) module into the same slot and check if the LED lights up. If the LED of the alternative module lights up, the C.O. module is defect and has to be replaced. If it does not, either the rack or the rack interface card is defect. Proceed with the following:
  5. Replace the rack and plug in the C.O. module into the new rack. If the LED on the module does not light up, replace the rack interface card in the function box.

- ❑ If a **-?- instead of a numeric** and one or more INOP messages are displayed for the C.O. module, perform the following actions:

*Please note that for proceeding to the next steps a C.O. Interface Cable plus catheter and Injectate Temperature Probe or the Service Tool (M1012-61601) must be connected to the module.*

**Step 1** Refer to the following table. Correct the possible cause identified by the INOP message and verify that the INOP disappears. If the problem still exists, proceed to the next step.

**Table 4-8 INOP Messages for the C.O. Module**

INOP Message	Possible Cause	Corrective Action
C.O. UNPLUGGED	C.O. module is unplugged from the rack.	Perform Step 5 on page 4-17.
Tblood NO TRANSDUC or CCO/Tbl NO TRANSD	No C.O. Interface Cable attached to the module. Catheter not connected to C.O. Interface Cable or cable broken.	Make sure that all cables are properly connected and the connectors are free from dirt. Connect Service Tool M1012-61601 to C.O. Interface Cable <sup>1</sup> . The Tblood numeric must read exactly 37.0 +/- 0.1°C, otherwise the module or C.O. Interface Cable is defect and has to be replaced. If you get the correct reading from the Service Tool and the INOP still appears, replace the catheter. If the INOP still appears, replace the C.O. Interface Cable. If the INOP still appears, replace the module.
C.O. EQUIP MALF	Malfunction in the C.O. hardware.	Perform Step 5 on page 4-17. If INOP is still displayed, replace module.
CCO NOT SUPPORTED	User has changed the Transpulmonary Catheter to a Right Heart Catheter. Defective catheter or cable broken.	Make sure that you use a CO module with option C10 and a Transpulmonary Catheter. If INOP remains, connect Service Tool <sup>1</sup> (M1012-61601) and enter the Setup C.O. Task Window by pressing the SETUP key on the module. Check if the entry behind “Method of Measurement” reads “Transpulmonary” and the entry behind “Arterial Catheter Constant” reads “341”. If INOP remains with connected Service Tool, perform corrective actions listed for CCO/Tbl NO TRANSD.
CCO NO ABP <sup>2</sup>	The pressure source which is selected for CCO Pulse Contour Calculation is not available.	Make sure that the pressure, which is used for the CCO Pulse Contour Calculation is labeled as selected in the CCO Setup Task Window.

**Table 4-8 INOP Messages for the C.O. Module**

INOP Message	Possible Cause	Corrective Action
CCO ABP <sup>a</sup> INVALID	The pressure for CCO Pulse Contour Calculation is not valid.	Make sure you get valid numerics for ABP <sup>a</sup> . For more information refer to the Pressure Module section in the <i>User's Reference Manual</i> .
CCO NO CAL.	No valid calibration for CCO.	Perform C.O. measurement and CCO calibration.
CCO BAD PRESS SIGN	The pressure wave for CCO Pulse Contour calculation cannot be analyzed.	Make sure to get a proper, undamped pressure wave. For more information refer to the C.O. Module section in the <i>User's Reference Manual</i> .

1. For correct use of the Service Tool, see "Performance Test Cardiac Output" on page 2-8
2. ABP is only a placeholder. Always the selected pressure label is shown in the string.

**Step 2** Enter the Measure C.O. Task Window by pressing the START key on the C.O. module. The Measure C.O. Task Window displays messages dealing with C.O. module failures. The following table describes the messages and corrective actions to take.

**Table 4-9 Task Window messages for the C.O. Module**

Task Window Message	Possible Cause	Corrective Action
no Tinj transducer connected	Cable of Injectate Temperature Probe is not connected or broken. Faulty module.	<p>Make sure that cable of the Injectate Temperature Probe is properly connected to the C.O. Interface Cable and the connector is free from dirt.</p> <p>Connect Service Tool M1012-61601 to C.O. Interface Cable<sup>1</sup>.</p> <p>If you use the <i>C.O. module without option C10</i> you must get the following results, otherwise the module or C.O. Interface Cable are defect and have to be replaced:</p> <ul style="list-style-type: none"> <li>• Tinj numeric reads exactly 0.0°C</li> <li>• No prompt message "Tinj transducer connected" appears in the Measure C.O. Task Window.</li> </ul> <p>If you use the <i>C.O. module with option C10</i> you must get the following results, otherwise the module or C.O. Interface Cable are defect and have to be replaced:</p> <ul style="list-style-type: none"> <li>• No prompt message "Tinj transducer connected" appears in the Measure C.O. Task Window.</li> </ul> <p>If you get the correct results from the Service Tool and the Task Window message still appears, replace the Injectate Temperature Probe.</p>

**Table 4-9 Task Window messages for the C.O. Module**

Task Window Message	Possible Cause	Corrective Action
Unexpected catheter, check catheter constant <sup>2</sup>	The C.O. module is not able to identify the Transpulmonary Catheter type. Faulty C.O. Interface Cable, module or catheter.	<i>Note: the following procedure applies only for C.O. modules with option C10:</i>  Make sure that catheter and C.O. Interface Cable are properly connected and the connector is free from dirt. Connect Service Tool M1012-61601 to C.O. module <sup>1</sup> and enter the Setup C.O. Task Window by pressing the SETUP key on the module. The entry behind “Method of Measurement” must read “Transpulmonary”. The entry behind “Arterial Catheter Constant” must read “341”. If you don’t get these results, replace the C.O. Interface Cable and check the readings again. If they are still wrong, the module is defect and has to be replaced.  If you get the correct results from the Service Tool and the Task Window message still appears, replace the catheter.
Unknown catheter	Faulty C.O. Interface Cable, module or catheter.	Make sure that catheter and C.O. Interface Cable are properly connected and the connector is free from dirt. Connect Service Tool M1012-61601 to C.O. module <sup>1</sup> . If Task Window message now has disappeared, replace catheter. If Task Window message still appears, replace C.O. Interface Cable. If Task Window message still appears, replace module.

1. For correct use of the Service Tool, see “Performance Test Cardiac Output” on page 2-8
2. #C10 modules only

- ❑ If a small **-?-** in addition to a numeric and one or more INOP messages are displayed for the C.O. module, the values are questionable. Correct the possible cause identified by the INOP message and verify that the INOP disappears.

**Table 4-10 INOP Messages with questionable values for the C.O. Module**

INOP Message	Possible Cause	Corrective Action
CCO CHECK CAL	CCO calibration is older than 8 hours.	Perform C.O. measurement and CCO calibration.
SVR MISSING CVP	No valid CVP available at the moment. CVP is automatically set to 0 mmHg for the continuous SVR calculation	If you need an accurate continuous SVR measurement, perform a CVP measurement and make sure that the pressure which is used for the CVP measurement is labeled "CVP". Make sure you get valid numerics for CVP. For more information refer to the Pressure Module section in the <i>User's Reference Manual</i> .

## Troubleshooting SpO<sub>2</sub>/Pleth Problems

This section describes how to troubleshoot and correct faults associated with the SpO<sub>2</sub>/Pleth plug-in module. The procedures for recognizing, isolating, and correcting faults with this module are as follows:

- Identifying a problem based on visual indications or repeated INOPS.

### To Troubleshoot the Module

- ❑ If **neither numerics nor a -?-** are displayed for the SpO<sub>2</sub>/Pleth module, perform the following actions:

- Step 1** Make sure there is a transducer connected to the module. If no transducer is connected, connect one.
- Step 2** Make sure the SpO<sub>2</sub>/Pleth parameter is turned on. Turn it on, if it is not.
- Step 3** Make sure the SpO<sub>2</sub>/Pleth numeric is turned on. Turn it on, if it is not.
- Step 4** Make sure you don't have too many SpO<sub>2</sub>/Pleth module plugged into the module racks you are using. If too many SpO<sub>2</sub>/Pleth modules are plugged in, you get two status messages: "Too many modules of the same type connected" and "Currently ignored module in rack position x.x". The last message enables you to identify the supernumerary module. These modules are ignored and should be removed. See Appendix A "Product Information" for specific information concerning your model of the CMS.
- Step 5** Check the connection on the module and the rack interface.
1. Unplug and re-plug the SpO<sub>2</sub>/Pleth module and check if the green LED on the SpO<sub>2</sub>/Pleth module lights up after re-plugging. If it does not, proceed with the following:
  2. Put the SpO<sub>2</sub>/Pleth module into another slot and check the LED once again. If it lights up now, the connector for the previous slot is faulty and the rack needs to be replaced. If it does not, proceed with the following:
  3. *Note: this procedure applies only for setups, in which the SpO<sub>2</sub>/PlethSpO<sub>2</sub>/Pleth module is located in a Satellite Rack. If this does not apply for your situation, proceed with 4.*  
Replace the cable from the Satellite Rack to the function box. Again unplug and re-plug the SpO<sub>2</sub>/Pleth module and check if the LED lights up. If it does not, proceed with the following:
  4. Plug any other (not faulty) module into the same slot and check if the LED lights up. If the LED of the alternative module lights up, the SpO<sub>2</sub>/Pleth module is defect and has to be replaced. If it does not, either the rack or the rack interface card is defect. Proceed with the following:



5. Replace the rack and plug in the SpO<sub>2</sub>/Pleth module into the new rack. If the LED on the module does not light up, replace the rack interface card in the function box.

- ❑ If a **-?- instead of a numeric** and one or more INOP messages are displayed for the SpO<sub>2</sub>/Pleth module, perform the following actions:

*Please note that for proceeding to the next steps a transducer must be connected to the module.*

**Step 1** Perform a Self-Test (See “Performing the SpO<sub>2</sub>/Pleth Module Self-Test” on page 4-58). If the SpO<sub>2</sub>/Pleth test numerics read exactly the listed values, proceed to the next step, if not, replace the module.

**Step 2** Refer to the following table. Correct the possible cause identified by the INOP message and verify that the INOP disappears. If the problem still exists, replace the module.

**Table 4-11 INOP Messages for the SpO<sub>2</sub>/Pleth Module**

INOP Message	Possible Cause	Corrective Action
SpO <sub>2</sub> /PLETH NO TRANSDUCER	No transducer is connected to the module	Connect transducer to module.
SpO <sub>2</sub> /PLETH EQUIP MALF	Malfunction in the transducer or module.	Replace transducer. If INOP persists, replace module
SpO <sub>2</sub> /PLETH UNPLUGGED	SpO <sub>2</sub> /PLETH module is unplugged from the rack.	Perform Step 5 on page 4-22
SpO <sub>2</sub> ERRATIC	Erratic SpO <sub>2</sub> measurements, often due to a faulty transducer, or invalid SpO <sub>2</sub> measurements; often due to the transducer being incorrectly positioned.	Reposition transducer. If the INOP persists, replace transducer.
SpO <sub>2</sub> /PLETH NOISY SIGNAL	Patient movement or electrical interference are causing irregular pulse patterns.	Make sure that patient does not move strongly. If INOP persists, move cable away from power cords.
SpO <sub>2</sub> /PLETH INTERF	Level of ambient light and/or cable induced electrical interference is so high, that the SpO <sub>2</sub> transducer cannot measure pulse rate.	Cover transducer against ambient light and move cable away from power cords.
SpO <sub>2</sub> /PLETH NON-PULSATILE	Pulse is too weak or not detectable.	Move transducer to another application site.
PLETH REDUCE SIZE	Transducer displaced or strong vasodilation after automatic wave fixing.	Press Optimize Size softkey in PLETH Task Window to restore the PLETH wave.
SpO <sub>2</sub> TRANSD MALF or PLETH TRANSD MALF	SpO <sub>2</sub> transducer is defective due to inadequate diode output.	Replace the transducer.

## Troubleshooting SvO<sub>2</sub> Problems

This section describes how to troubleshoot and correct faults associated with the SvO<sub>2</sub> plug-in module. The procedures for recognizing, isolating, and correcting faults with this module are as follows:

- Identifying a problem based on visual indications or repeated INOPS.

### To Troubleshoot the Module

- ❑ If **neither numerics nor a -?-** are displayed for the SvO<sub>2</sub> module, perform the following actions:

- Step 1** Make sure there is a Abbott optical module and catheter connected to the module. If not, connect one.
- Step 2** Make sure the SvO<sub>2</sub> parameter is turned on. Turn it on, if it is not.
- Step 3** Make sure the SvO<sub>2</sub> numeric is turned on. Turn it on, if it is not.
- Step 4** Make sure you don't have more than one SvO<sub>2</sub> module plugged into the module racks you are using. If more than one SvO<sub>2</sub> module is plugged in, the supernumerary modules are ignored and should be removed.
- Step 5** Check the connection on the module and the rack interface.
  1. Unplug and re-plug the SvO<sub>2</sub> module and check if the green LED on the SvO<sub>2</sub> module lights up after re-plugging. If it does not, proceed with the following:
  2. Put the SvO<sub>2</sub> module into another slot and check the LED once again. If it lights up now, the connector for the previous slot is faulty and the rack needs to be replaced. If it does not, proceed with the following:
  3. *Note: this procedure applies only for setups, in which the SvO<sub>2</sub> module is located in a Satellite Rack. If this does not apply for your situation, proceed with 4.*  
Replace the cable from the Satellite Rack to the function box. Again unplug and re-plug the SvO<sub>2</sub> module and check if the LED lights up. If it does not, proceed with the following:
  4. Plug any other (not faulty) module into the same slot and check if the LED lights up. If the LED of the alternative module lights up, the SvO<sub>2</sub> module is defect and has to be replaced. If it does not, either the rack or the rack interface card is defect. Proceed with the following:
  5. Replace the rack and plug in the SvO<sub>2</sub> module into the new rack. If the LED on the module does not light up, replace the rack interface card in the function box.

- ❑ If a **-?- instead of a numeric** and one or more INOP messages are displayed for the SvO<sub>2</sub> module, perform the following actions:

*Please note that for proceeding to the next steps a Abbott optical module and transducer must be connected to the module.*

**Step 1** Perform a Self-Test (See “Performing the SvO<sub>2</sub> Module Self-Test” on page 4-60). If the SvO<sub>2</sub> test numeric reads exactly the listed value, proceed to the next step, if not, replace the module.

**Step 2** Refer to the following table. Correct the possible cause identified by the INOP message and verify that the INOP disappears. If the problem still exists, replace the module.

**Table 4-12 INOP Messages for SvO<sub>2</sub> Module**

Symptom	Possible Cause	Corrective Action
SvO <sub>2</sub> UNPLUGGED	SvO <sub>2</sub> module is unplugged from the rack	Plug SvO <sub>2</sub> module into rack.
SvO <sub>2</sub> NO OPT-MOD	Abbott Optical Module not connected. Loose or broken connection between Abbott Optical Module and M1021A	Check set-up (described in Reference Manual). Replace Abbott Optical Module.
SvO <sub>2</sub> CONFIGURATION	Abbott Optical Module has been used with Abbott monitor (Oximetrix 3) and configured to SaO <sub>2</sub> Computation Mode.	Reconfigure the Abbott Optical Module to SvO <sub>2</sub> Computation Module using the Abbott Oximetrix <sup>®</sup> 3 monitor.
SvO <sub>2</sub> CAL REQUIRED	No valid calibration data in the Abbott Optical Module.	Perform Pre-insertion Calibration if the catheter is still in the Optical Reference or In-Vivo Calibration if the catheter has been inserted into the patient.
SvO <sub>2</sub> CONNCT OPTMOD	Abbott Optical Module became disconnected during storage of data.	Reconnect the Optical Module for at least 20 seconds.
SvO <sub>2</sub> OPT-MOD DEFECT	Abbott Optical Module or M1021A memory defect - calibration and patient data cannot be stored for transport.	Try different Abbott Optical Module. If problem persists try different M1021A.
SvO <sub>2</sub> EQUIP MALF	M1021A or Abbott Optical Module is defective.	Unplug Abbott Optical Module from M1021A and perform a self-test under the Monitor Setup Key. If INOP remains, replace the SvO <sub>2</sub> module. If INOP disappears, replace Abbott Optical Module then consult local Abbott representative for information relating to the Abbott Optical Module.

**Table 4-12 INOP Messages for SvO<sub>2</sub> Module**

Symptom	Possible Cause	Corrective Action
SvO <sub>2</sub> WARM UP	Initial one minute Abbott Optical Module warm-up/connection period.	Inop is displayed for minimum time required. However, prior to performing Pre-Insertion or In-Vivo Calibration, Abbott recommends a full 15 minute warm-up period.
SvO <sub>2</sub> LOW LIGHT	<p>Unusually low level of light is being received by the system from the catheter due to:</p> <p>Catheter tip or Abbott Optical Module exposed to room light.</p> <p>Damaged catheter fiberoptics.</p> <p>Poor catheter connection to Abbott Optical Module.</p> <p>Poor connection between Abbott Optical Module and M1021A.</p> <p>Defective Abbott Optical Module.</p> <p>Defective M1021A.</p>	<p>Check setup and connections. Ensure that fiber-optic interfaces of Abbott Optical Module and catheter are clean.</p> <p>If no catheter is connected to Abbott Optical Module, close Optical Module door and shield from room light. If message persists, try, in turn, different Optical Modules and M1021A to isolate the source.</p> <p>If catheter is connected to Abbott Optical Module and catheter tip has been removed from the Optical Reference but has not yet been inserted into the patient, the SvO<sub>2</sub> LOW LIGHT INOP is displayed until the catheter is inserted into the patient.</p> <p>If catheter is still in tray, ensure that the catheter tip is correctly positioned in the Optical Reference. If INOP persists, disconnect catheter, close Abbott Optical Module door and shield from room light. If INOP disappears, try a different catheter. If INOP remains, either the optical Module or M1021A is at fault. Isolate accordingly as above.</p> <p>If catheter is inserted into patient, review light intensity signals. Check catheter positioning, patency and catheter clamping to ensure optimal signal. If INOP persists, replace Abbott Optical Module (perform In-Vivo calibration if INOP disappears). If INOP still persists, replace catheter and recommence measurement procedure.</p>

**Table 4-12 INOP Messages for SvO<sub>2</sub> Module**

Symptom	Possible Cause	Corrective Action
SvO <sub>2</sub> LIGHT INTENS	<p>Intensity changed considerably since last Light Intensity Calibration.</p> <p><i>High Intensities:</i> Catheter tip against vessel wall</p> <p><i>Low Intensities:</i> Damaged catheter</p> <p>Inadequate blood flow past catheter tip. Poor optical interface between the catheter and Abbott Optical Module</p> <p><i>Damped or Erratic Intensities:</i> Catheter tip clotting</p> <p>Spontaneous catheter wedging.</p>	<p>Check Light Intensity trend using most detailed time frame.</p> <p>Confirm proper catheter position by examination of pressure waveforms.</p> <p>Check for kinks in the catheter or excessive catheter clamping. Check for distal lumen patency.</p> <p>Check for clean and secure connection.</p> <p>Check pressure waveform for damping and ensure distal lumen patency. Check pressure waveform and ensure catheter is correctly positioned.</p> <p>After making all efforts to obtain a normal Light Intensity, perform a Light Intensity Calibration. (An In-Vivo Calibration may also be required.) Run a Calibration as described in SvO<sub>2</sub> Module section of the <i>User's Reference Manual</i>.</p>
SvO <sub>2</sub> CAL FAILED	<p>Light Intensity signal drift has occurred after completion of Pre-insertion Calibration and before insertion of catheter into patient.</p>	<p>Allow optimum warm-up time before any calibration procedure (minimum 15 minutes). If INOP appears prior to removing catheter tip from Optical Reference, repeat Pre-insertion Calibration. If INOP is noted after the catheter tip is removed from the Optical Reference, insert the catheter into patient, ensure optimal light intensity signal, then perform In-Vivo Calibration.</p>
SvO <sub>2</sub> UNABLE TO MEASURE	<p>Signal received is outside normal range such that SvO<sub>2</sub> values cannot be derived.</p>	<p>Check for problems associated with LOW LIGHT or LIGHT INTENS INOPs. Check catheter position, patency and clamping, ensure optimal Light Intensity signal and perform Light Intensity and In-Vivo Calibrations.</p>

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### Troubleshooting FIO<sub>2</sub> Module Problems

This section describes how to troubleshoot and correct faults associated with the FIO<sub>2</sub> module. The procedures for recognizing, isolating, and correcting faults using this module are as follows:

- Identifying a problem based on visual indications or repeated INOPS.

#### To Troubleshoot the Module

- ❑ If **neither numerics nor a -?-** are displayed for the FIO<sub>2</sub> module, perform the following actions:

- Step 1** Make sure there is a transducer connected to the module. If no transducer is connected, connect one.
- Step 2** Make sure the FIO<sub>2</sub> parameter is turned on. Turn it on, if it is not.
- Step 3** Make sure the FIO<sub>2</sub> numeric is turned on. Turn it on, if it is not.
- Step 4** Make sure you don't have more than one FIO<sub>2</sub> module plugged into the module racks you are using. If more than one FIO<sub>2</sub> module is plugged in, the supernumerary modules are ignored and should be removed.
- Step 5** Check the connection on the module and the rack interface.
  1. Unplug and re-plug the FIO<sub>2</sub> module and check if the green LED on the FIO<sub>2</sub> module lights up after re-plugging. If it does not, proceed with the following:
  2. Put the FIO<sub>2</sub> module into another slot and check the LED once again. If it lights up now, the connector for the previous slot is faulty and the rack needs to be replaced. If it does not, proceed with the following:
  3. *Note: this procedure applies only for setups, in which the FIO<sub>2</sub> module is located in a Satellite Rack. If this does not apply for your situation, proceed with 4.*  
Replace the cable from the Satellite Rack to the function box. Again unplug and re-plug the FIO<sub>2</sub> module and check if the LED lights up. If it does not, proceed with the following:
  4. Plug any other (not faulty) module into the same slot and check if the LED lights up. If the LED of the alternative module lights up, the FIO<sub>2</sub> module is defect and has to be replaced. If it does not, either the rack or the rack interface card is defect. Proceed with the following:
  5. Replace the rack and plug in the FIO<sub>2</sub> module into the new rack. If the LED on the module does not light up, replace the rack interface card in the function box.

- ❑ If a **-?- instead of a numeric** and you find INOP messages displayed for the FIO<sub>2</sub> module, perform the following actions:

Please note that for proceeding to the next steps a transducer must be connected to the module.

**Step 1** Perform a Self-Test (See “Performing the FIO<sub>2</sub> Module Self-Test” on page 4-61). If the FIO<sub>2</sub> test numerics read exactly the listed values, proceed to the next step, if not, replace the module.

**Step 2** Refer to the following table. Correct the possible cause identified by the INOP message and verify that the INOP disappears. If the problem still exists, replace the module.

**Table 4-13 INOP Messages for the FIO<sub>2</sub> Module**

INOP Message	Possible Cause	Corrective Action
FIO <sub>2</sub> UNPLUGGED	FIO <sub>2</sub> module is unplugged from the rack.	Perform Step 5 on page 4-28
FIO <sub>2</sub> EQUIPM MALF	Internal test or offset values out of range or transducer lead C cable break.	Change electrolyte and membrane If INOP persists, replace transducer. If INOP persists, replace module.
FIO <sub>2</sub> NO TRANS-DUCER	Transducer not connected or transducer lead cable A or B cable break.	Make sure that transducer is connected properly. If INOP persists, replace transducer lead cables.
FIO <sub>2</sub> FAILED CAL	Signal out of range or it drifts during calibration.	If electrolyte and membrane have been changed before, wait at least 4 hours, before restarting calibration. For detailed information on how to perform a calibration please refer to the <i>User's reference Manual</i> . If 100% calibration failed, check gas supply. If INOP persists, change electrolyte and membrane, wait 4 hours and restart calibration.
FIO <sub>2</sub> CAL RUNNING	The 21% or 100% calibration is running.	Wait until calibration has finished.
FIO <sub>2</sub> OUT OF RANGE	FIO <sub>2</sub> <0.10, >1.10 due to incorrect calibration.	Re-calibrate transducer. For detailed information on how to perform a calibration please refer to the <i>User's reference Manual</i> .
FIO <sub>2</sub> CHECK CAL	Transducer not calibrated since last start.	Perform calibration. For detailed information on how to perform a calibration please refer to the <i>User's reference Manual</i> .
FIO <sub>2</sub> BATTERY	Module battery is not charged or is defective.	Wait 2 hours until battery has been recharged. If INOP still is displayed, replace module.

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### Troubleshooting Temperature Module Problems

This section describes how to troubleshoot and correct faults associated with the Temperature plug-in module. The procedures for recognizing, isolating, and correcting faults using this module are as follows:

- Identifying a problem based on visual indications or repeated INOPS.

#### To Troubleshoot the Module

- ❑ If **neither numerics nor a -?-** are displayed for the TEMP module, perform the following actions:

**Step 1** Make sure there is a TEMP probe connected to the module. If not, connect one.

**Step 2** Make sure the TEMP parameter is turned on. Turn it on, if it is not.

**Step 3** Make sure the TEMP numeric is turned on. Turn it on, if it is not.

**Step 4** Make sure you don't have too many TEMP module plugged into the module racks you are using. If too many TEMP modules are plugged in, you get two status messages: "Too many modules of the same type connected" and "Currently ignored module in rack position x.x". The last message enables you to identify the supernumerary module.

These modules are ignored and should be removed. See Appendix A "Product Information" for specific information concerning your model of the CMS.

**Step 5** Check the connection on the module and the rack interface.

1. Unplug and re-plug the TEMP module and check if the green LED on the TEMP module lights up after re-plugging. If it does not, proceed with the following:
2. Put the TEMP module into another slot and check the LED once again. If it lights up now, the connector for the previous slot is faulty and the rack needs to be replaced. If it does not, proceed with the following:
3. *Note: this procedure applies only for setups, in which the TEMP module is located in a Satellite Rack. If this does not apply for your situation, proceed with 4.*  
Replace the cable from the Satellite Rack to the function box. Again unplug and re-plug the TEMP module and check if the LED lights up. If it does not, proceed with the following:
4. Plug any other (not faulty) module into the same slot and check if the LED lights up. If the LED of the alternative module lights up, the TEMP module is defect and has to be replaced. If it does not, either the rack or the rack interface card is defect. Proceed with the following:



5. Replace the rack and plug in the TEMP module into the new rack. If the LED on the module does not light up, replace the rack interface card in the function box.

- If a **-?- instead of a numeric** and a INOP message is displayed for the TEMP module, perform the following actions:

*Please note that for proceeding to the next steps a transducer must be connected to the module.*

**Step 1** Perform a Self-Test (See “Performing the Temperature Module Self-Test” on page 4-62). If the TEMP test numeric reads exactly the listed value, proceed to the next step, if not, replace the module.

**Step 2** Refer to the following table. Correct the possible cause identified by the INOP message and verify that the INOP disappears. If the problem still exists, replace the module.

**Table 4-14 INOP Messages for the Temp Module**

INOP Message	Possible Cause	Corrective Action
<Tx> UNPLUGGED	TEMP module is unplugged from the rack.	Perform Step 5 on page 4-30.
<Tx> NO TRANSDUC	Temperature probe disconnected from the module.	Connect Temperature probe to module.
<Tx> OVERRANGE	Temperature out of range <-1°C or >45°C.	Replace Temperature probe. If problem still persists, replace module.
<Tx> EQUIP MALF	Malfunction in the TEMP module hardware	Replace module.

### Troubleshooting CO<sub>2</sub> Module Problems

This section describes how to troubleshoot and correct faults associated with the CO<sub>2</sub> plug-in module. The procedures for recognizing, isolating, and correcting faults with this module are as follows:

- Identifying a problem based on visual indications or repeated INOPS.

#### To Troubleshoot the Module

- ❑ If **neither numerics nor a -?-** are displayed for the CO<sub>2</sub> module, perform the following actions:

- Step 1** Make sure there is a transducer connected to the module. If no transducer is connected, connect one.
- Step 2** Make sure the CO<sub>2</sub> parameter is turned on. Turn it on, if it is not.
- Step 3** Make sure the CO<sub>2</sub> numeric is turned on. Turn it on, if it is not.
- Step 4** Make sure you don't have more than one CO<sub>2</sub> module plugged into the module racks you are using. If more than one CO<sub>2</sub> module is plugged in, the supernumerary modules are ignored and should be removed.
- Step 5** Check the connection on the module and the rack interface.
  1. Unplug and re-plug the CO<sub>2</sub> module and check if the green LED on the CO<sub>2</sub> module lights up after re-plugging. If it does not, proceed with the following:
  2. Put the CO<sub>2</sub> module into another slot and check the LED once again. If it lights up now, the connector for the previous slot is faulty and the rack needs to be replaced. If it does not, proceed with the following:
  3. *Note: this procedure applies only for setups, in which the CO<sub>2</sub> module is located in a Satellite Rack. If this does not apply for your situation, proceed with 4.*  
Replace the cable from the Satellite Rack to the function box. Again unplug and re-plug the CO<sub>2</sub> module and check if the LED lights up. If it does not, proceed with the following:
  4. Plug any other (not faulty) module into the same slot and check if the LED lights up. If the LED of the alternative module lights up, the CO<sub>2</sub> module is defect and has to be replaced. If it does not, either the rack or the rack interface card is defect. Proceed with the following:
  5. Replace the rack and plug in the CO<sub>2</sub> module into the new rack. If the LED on the module does not light up, replace the rack interface card in the function box.

- ❑ If a **-?- instead of a numeric** and one or more INOP messages are displayed for the CO<sub>2</sub> module, perform the following actions:

Please note that for proceeding to the next steps a transducer must be connected to the module.

**Step 1** Perform a Self-Test (See “Performing the CO<sub>2</sub> Module Self-Test” on page 4-61). If the CO<sub>2</sub> test numerics read exactly the listed values, proceed to the next step, if not, replace the module.

**Step 2** Refer to the following table. Correct the possible cause identified by the INOP message and verify that the INOP disappears. If the problem still exists, replace the module.

**Table 4-15 INOP Message for CO<sub>2</sub> Module**

INOP Message	Possible Cause	Corrective Action
CO <sub>2</sub> UNPLUGGED	CO <sub>2</sub> module is unplugged from the rack.	Perform Step 5 on page 4-32.
CO <sub>2</sub> EQUIPM MALF	Malfunction in the transducer or module.	Replace transducer. If INOP persists replace module.
CO <sub>2</sub> NO TRANS-DUCER	No Transducer is connected to the module.	Connect transducer to module. Run a calibration as described in CO <sub>2</sub> Module section of the <i>User's Reference Manual</i> . (If the transducer is replaced, the new transducer must be re-calibrated.)
CO <sub>2</sub> FAILED CAL	Calibration aborted due to power failure, unstable signal during calibration, or transducer being placed on the wrong cal cell.	Run a calibration as described in CO <sub>2</sub> Module section of the <i>User's Reference Manual</i> . Make sure that calibration cell is changed when prompted. If INOP persists replace module.
CO <sub>2</sub> SENSOR WARM UP	The transducer has not reached operating temperature.	Wait until transducer has warmed up.
CO <sub>2</sub> CAL RUNNING	The CO <sub>2</sub> calibration is running.	Wait until calibration is finished.
CO <sub>2</sub> CAL MODE	Cal mode is set but the calibration has not been initiated.	Perform accuracy check or start a calibration as described in CO <sub>2</sub> Module section of the <i>User's Reference Manual</i> .
CO <sub>2</sub> CHECK CAL	CO <sub>2</sub> value <-2mmHg, >150mmHg.	Perform accuracy check for low and high calstick cell as described in CO <sub>2</sub> Module section of the <i>User's Reference Manual</i> .
CO <sub>2</sub> REDUCE SIZE	ETCO <sub>2</sub> >60mmHg in 40mmHg wave scale.	Select the 60 mmHg scale. This enables the full wave to be displayed.

**Table 4-15 INOP Message for CO<sub>2</sub> Module**

INOP Message	Possible Cause	Corrective Action
CO <sub>2</sub> LOW FLOW	Sidestream flow between 50-80 ml for up to 10 minutes. CO <sub>2</sub> values may not be accurate.	Replace tubing.
CO <sub>2</sub> OCCLUSION	Sidestream flow between 50-80 ml for more than 10 minutes or Tubing locked in pump system, tubing or filter to patient.	Replace tubing.
CO <sub>2</sub> SIDESTRM MALF	Sidestream malfunction in the transducer or module.	Replace module.
CO <sub>2</sub> SIDESTRM OFF	Pump automatically has turned off after 60 min of CO <sub>2</sub> < 3 mmHg or apnea.	Restart Sidestream in CO <sub>2</sub> setup.

## Troubleshooting Blood Analysis Module Problems

This section describes how to troubleshoot and correct faults associated with the Blood Analysis plug-in module. The procedures for recognizing, isolating, and correcting faults with this module are as follows:

- Identifying a problem based on repeated INOPS.
- Checking the Blood Analysis task window for specific error messages and performing the corrective actions suggested in the table given with this module.

### To Troubleshoot the Module

- ❑ If you are **unable to access the Blood Analysis module Task Window**, perform the following actions:

**Step 1** Make sure the Blood Analysis parameter is turned on. Turn it on, if it is not.

**Step 2** Make sure you don't have more than one Blood Analysis module plugged into the module racks you are using. If more than one Blood Analysis module is plugged in, the supernumerary modules are ignored and should be removed.

**Step 3** Check the connection on the module and the rack interface.

1. Unplug and re-plug the Blood Analysis module and check if the 2 green LEDs on the Blood Analysis module light up after re-plugging. If they do not, proceed with the following:
2. Put the Blood Analysis module into another slot and check the LEDs once again. If they light up now, the connector for the previous slot is faulty and the rack needs to be replaced. If they do not, proceed with the following:
3. *Note: this procedure applies only for setups, in which the Blood Analysis module is located in a Satellite Rack. If this does not apply for your situation, proceed with 4.*  
Replace the cable from the Satellite Rack to the function box. Again unplug and re-plug the Blood Analysis module and check if the LEDs light up. If they do not, proceed with the following:
4. Plug any other (not faulty) module into the same slot and check if the LEDs light up. If the LEDs of the alternative module light up, the Blood Analysis module is defect and has to be replaced. If it does not, either the rack or the rack interface card is defect. Proceed with the following:
5. Replace the rack and plug in the Blood Analysis module into the new rack. If the LEDs on the module do not light up, replace the rack interface card in the function box.

- ❑ If **INOP messages** are displayed for the Blood Analysis module, perform the following actions. More detailed information relating to the cause of some of the INOPs can be found in the Blood Analysis Task Window (see Table 4-17 on page 4-37). Correct the possible cause identified by the INOP message and verify that the INOP disappears.

**Table 4-16 INOP Messages for Blood Analysis Module**

INOP Message	Possible Cause	Corrective Action
BLOODANL UNPLUGGED	Blood Analysis module has been unplugged from the rack.	Perform Step 3 on page 4-35.
BLOODANL EQU. MALF	Permanent malfunction in the module.	Refer to the related Task Window messages in Table 4-17 on page 4-37.
BLOODANL CONFIG	A configuration problem has been detected.	Refer to the related Task Window messages in Table 4-17 on page 4-37.
BLOODANL ROOM TEMP?	Module environment is too warm or too cold - operating range 16 to 30°C (64 to 86°F).	Refer to the related Task Window messages in Table 4-17 on page 4-37.

- ❑ If a **measurement is unsuccessful** or parameters are missing, perform the following actions:

- Step 1** *Note: This step only applies for customers, who preselected the <Result Selection> ON in Configuration Mode.*  
 Make sure that all parameter results you intended to display are switched on in the Results Selection Task Window.  
 If you have already confirmed the measurement, perform a new measurement to check, if the error still exists. If you haven't confirmed the measurement yet, the change will be visible immediately.
- Step 2** The Task Window displays messages dealing with Blood Analysis module failures. The following table describes the messages and corrective actions to take.  
 If errors occur repeatedly, make a note of the error codes as these can be used for diagnostic purposes at the factory and must be documented when a module is exchanged.

Table 4-17 Task Window messages for the Blood Analysis Module

Message in Task Window	INOP or prompt message	Error Code	Possible Cause	Corrective Action
Temperature out of range	BLOODANL ROOM TEMP	2	The room temperature is too cold or warm - operating range is 16 to 30°C (64 to 86°F).  The filter is blocked or the ventilator fan in the module malfunctions.	Ensure that ambient temperature is within the operating limits and leave time for the module to acclimatize after transport or storage.  Inspect the filter and clean it if necessary. If the message still appears, call your service representative.
New Software Installed, Use Simulator		3	The software or CLEW was recently updated.	Run the electronic simulator.
Analysis Interrupted, Use Other Cartridge		4, 8	Module has been pulled out of the rack during a measurement and then replaced.	Wait for the locked LED to go off then remove the cartridge and start the measurement again with a new cartridge.
Invalid Date, Check clock	BLOODANL CONFIG	11	Implausible date in CMS.	Check date settings in the CMS and make sure they are correct.
Invalid or Expired CLEW, See Manual	BLOODANL CONFIG	12, 13	Invalid date code in CMS.  CLEW version maybe expired.  CLEW update has not been successfully finished.	Check date settings in the CMS and make sure your date settings are correct.  Refer to the application note of the current CLEW version.  Reinstall the current CLEW version.
Invalid Customization Data	BLOODANL CONFIG	14	Customization update unsuccessful	Reinstall the current Customization version.
Invalid Software Detected	BLOODANL CONFIG	53	Wrong software type installed.	Update System with correct type of software.
Incompatible Language	BLOODANL CONFIG	297	CMS language and module language are not compatible.	Call your service representative.

**Table 4-17 Task Window messages for the Blood Analysis Module**

Message in Task Window	INOP or prompt message	Error Code	Possible Cause	Corrective Action
Module Error, Use Electronic Simulator	Blood Analysis failed	48, 50-52, 58-62, 70	A cartridge or electronic simulator was inserted at an angle or the simulator is malfunctioning.	If the error occurs when using a cartridge, run the electronic simulator. If the error occurs when running the simulator, use another simulator. If the error recurs, the module or simulator may need repair - call your service representative.
Module Error, See Manual	BLOODANL EQU. MALF	1, 23, 63, 65-68, 72-74, 76-78, 82, 85, 86, 89, 90, 91-94, 256-296, 298-299	May have various malfunction causes located in the module.	Use an electronic simulator twice then use a cartridge with sample or control solution. If an error condition occurs, call your service representative.
Cartridge Not Inserted Properly	Blood Analysis failed	47	Cartridge or simulator is probably not pushed in completely.  Cartridge was removed after starting a measurement.	Reinsert the cartridge or electronic simulator.  Start measurement with a new cartridge.  If error recurs, call your service representative.
Cartridge Preburst, Use Other Cartridge	Blood Analysis failed	21	The module detected fluid on the Sensors before it should have.	Cartridge was probably either pressed in the centre bursting the calibration pack or was stored in conditions too warm or too cold. Try another cartridge.
Unable to Position Sample	Blood Analysis failed	31, 34	No movement of sample detected, possibly due to a clot in sample, not closing the sample well cover or an aberrant cartridge.	Perform a new measurement making sure that you fill the cartridge properly.



**Table 4-17 Task Window messages for the Blood Analysis Module**

Message in Task Window	INOP or prompt message	Error Code	Possible Cause	Corrective Action
Sample Positioned Short of Fill Mark	Blood Analysis failed	35, 36	The cartridge was underfilled, the sample must reach the fill mark.	Perform a new measurement making sure that you fill the cartridge properly.
Sample Positioned Beyond Fill Mark	Blood Analysis failed	30, 37	Cartridge was overfilled. The sample was past the fill mark.	Perform a new measurement making sure that you fill the cartridge properly.
Insufficient sample	Blood Analysis failed	38, 39	Either not enough sample in the sample well or there are bubbles in the sample.	Perform a new measurement making sure that you fill the cartridge properly and without bubbles.
Cartridge Error, Use Other Cartridge	Blood Analysis failed	20, 22, 24-29, 32, 33, 40-43, 45, 46, 79, 80, 81, 87	Can be caused by sample related problems, cartridge or module. Single or sporadic errors are most likely a sample-related problem (an interference), an aberrant cartridge or a user-induced situation such as touching contacts or pressing on center of cartridge.	Try another cartridge. If error recurs repeatedly, call your service representative.
Cartridge Type Not Recognized	Blood Analysis failed	69	Either the cartridge type is not compatible with the software revision, or the module is at fault.	If this is a new type of cartridge being used, arrange a software upgrade. If not, call your service representative.

### Troubleshooting EEG Module Problems

This section describes how to troubleshoot and correct faults associated with the EEG plug-in module. The procedures for recognizing, isolating, and correcting faults using this module are as follows:

- Identifying a problem based on visual indications or repeated INOPS.
- Using an EEG Module accessory, the EEG Test Device (see Chapter 6 “Parts List for CMS”).

#### To Troubleshoot the Module

- ❑ If **neither numerics nor a -?-** are displayed for the EEG module, perform the following actions:

- Step 1** Make sure there is a EEG transducer connected to the module. If not, connect one.
- Step 2** Make sure the EEG parameter is turned on. Turn it on, if it is not.
- Step 3** Make sure the EEG numeric is turned on. Turn it on, if it is not.
- Step 4** Make sure you don't have more than one EEG module plugged into the module racks you are using. If more than one EEG module is plugged in, the supernumerary modules are ignored and should be removed.
- Step 5** Check the connection on the module and the rack interface.
  1. Unplug and re-plug the EEG module and check if the green LED on the EEG module lights up after re-plugging. If it does not, proceed with the following:
  2. Put the EEG module into another slot and check the LED once again. If it lights up now, the connector for the previous slot is faulty and the rack needs to be replaced. If it does not, proceed with the following:
  3. *Note: this procedure applies only for setups, in which the EEG module is located in a Satellite Rack. If this does not apply for your situation, proceed with 4.*  
Replace the cable from the Satellite Rack to the function box. Again unplug and re-plug the EEG module and check if the LED lights up. If it does not, proceed with the following:
  4. Plug any other (not faulty) module into the same slot and check if the LED lights up. If the LED of the alternative module lights up, the EEG module is defect and has to be replaced. If it does not, either the rack or the rack interface card is defect. Proceed with the following:
  5. Replace the rack and plug in the EEG module into the new rack. If the LED on the module does not light up, replace the rack interface card in the function box.

- ❑ If a **-?- instead of a numeric** and one or more INOP messages are displayed for the EEG module, perform the following actions:

**Step 1** Check the performance of the module with the EEG test device (if available). The test device enables you to compare the module electrode impedance values with the expected values. This information enables you to isolate a problem either to the module or to the cable.

The EEG Test Device looks like a connector cable. One end plugs into the 12-pin connector at the front of the EEG Module. The other end of the Test Device cable is a BNC connector.

The BNC connector of the EEG Test Device can be plugged into a function generator (for example, the Philips 33120A) to generate a simulated EEG signal on the CMS monitor.

Perform the following actions:

1. Select monitoring mode on the CMS.
2. Plug the Test Device into the EEG Module, leaving the BNC connector end unconnected.
3. Press the EEG hardkey on the module.
4. Press the “Electrode Impedance” softkey on the CMS.
5. Check that the observed values in the task window match the following values within  $\pm 2 \text{ k}\Omega$

**Table 4-18 Expected Impedance Values for EEG Electrodes**

Electrode	Expected Value
EEG1+	5 k $\Omega$
EEG1–	10 k $\Omega$
EEG2+	12 k $\Omega$
EEG2–	15 k $\Omega$

6. If any value is outside the expected value range ( $\pm 2 \text{ k}\Omega$ ), please replace your EEG Module.

**NOTE**

The Attenuation Factor of the Test Device is 10,000. In testing with a function generator, you must divide the generator amplitude reading by 10,000 or 5,000, depending on the generator used, to match the value on the CMS monitor.

7. If the problem persists, perform step 2 below.

**Step 2** Refer to the following table. Correct the possible cause identified by the INOP message and verify that the INOP disappears. If the problem still exists, replace the module.

**Table 4-19 INOP Messages for the EEG Module**

INOP Message	Possible Cause	Corrective Action
EEG UNPLUGGED	EEG module is unplugged from the rack.	Perform Step 5 on page 4-40.
EEG EQUIP MALF	Malfunction in the EEG module hardware	Replace module.
EEG NO TRANSDUCER	EEG trunk cable disconnected from the module.	Connect EEG trunk cable to module. If INOP persists, replace EEG trunk cable. If INOP still persists, replace module.
EEG1 LEADS OFF  EEG1 LEAD OFF XXX	Lead electrodes of channel EEG1 are not connected to or have fallen off the patient's head. If a single lead electrode is disconnected, the INOP is shown with the electrode location label (e.g. F3).	Connect channel 1 electrodes.  Connect specified electrode (e.g. F3).
EEG2 LEADS OFF  EEG2 LEAD OFF XXX	Lead electrodes of channel EEG2 are not connected to or have fallen off the patient's head. If a single lead electrode is disconnected, the INOP is shown with the electrode location label (e.g. F3)	Connect channel 2 electrodes.  Connect specified electrode (e.g. F3).
EEG LEADS OFF	If multiple lead electrodes are not connected, this INOP is issued.	Connect electrodes properly (start with reference electrodes). If INOP is still displayed, replace leads. If INOP is still displayed, replace module.
EEG1 LINE NOISE EEG2 LINE NOISE	Excessive Line noise in channel EEG1 or EEG2	Keep all EEG cables together and away from metallic bodies, other cables and radiated fields.
EEG LINE NOISE	Excessive Line Noise in both channels at the same time.	Keep all EEG cables together and away from metallic bodies, other cables and radiated fields.
EEG1 OVERRANGE EEG2 OVERRANGE	Input signal is too high. This is usually caused by interfering signals such as line noise or electrosurgery.	Perform corrective action for INOP "EEG LINE NOISE". If INOP is still displayed, make sure that all electrodes are correctly attached.