**Service Guide****IntelliVue Patient Monitor****MX800****Release N.0****Patient Monitoring****PHILIPS**



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# Introduction

This Service Guide contains technical details for the IntelliVue MX800 Patient Monitor, the measurement modules, the Multi-Measurement Modules (MMS/MMX/X2/X3), the 4-Slot and 8-Slot Module Racks (FMS), and the Measurement Extensions.

This guide provides a technical foundation to support effective troubleshooting and repair. It is not a comprehensive, in-depth explanation of the product architecture or technical implementation. It offers enough information on the functions and operations of the monitoring systems so engineers who repair them are better able to understand how they work.

It covers the physiological measurements that the products provide, the Multi-Measurement Module that acquires those measurements, and the monitoring system that displays them.

## Who Should Use This Guide

This guide is for biomedical engineers or technicians qualified and responsible for installing, troubleshooting, repairing, and maintaining Philips' patient monitoring systems and IntelliVue Cableless Measurements.

## How to Use This Guide

Navigate through the table of contents at the left of the screen to select the desired topic. Links to other relevant sections are also provided within the individual topics. You can also scroll through the topics using the page up and page down keys.

## Abbreviations

Abbreviations used throughout this guide are:

Abbreviation	Name
The Monitor	IntelliVue MX800 Patient Monitor
AGM	Anesthetic Gas Module
EMC	Electromagnetic Compatibility
FMS	Module Rack
MIB	Medical Information Bus
MMS	Multi-Measurement Module M3001A X1
MMX	Multi-Measurement Module 867036
MSL	Measurement Link
X2	Multi-Measurement Module M3002A
X2	Multi-Measurement Module 867030

## Responsibility of the Manufacturer

Philips only considers itself responsible for any effects on safety, EMC, reliability and performance of the equipment if:

- assembly operations, extensions, re-adjustments, modifications or repairs are carried out by persons authorized by Philips, and
- the electrical installation of the relevant room complies with national standards, and
- the instrument is used in accordance with the instructions for use.

To ensure safety and EMC, use only those Philips parts and accessories specified for use with the monitor. If non-Philips parts are used, Philips is not liable for any damage that these parts may cause to the equipment.

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## Passwords

To access different modes within the monitor, you must enter a password. The default passwords are listed on the sticker inside the Documentation DVD case. Philips recommends you change these passwords before putting the monitor into operation. Changing the passwords requires an **Admin** password. Use secure passwords and ensure that anyone requiring these passwords has access to them.

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### **CAUTION**

Your hospital is responsible for ensuring that these passwords are revealed **only** to authorized personnel.

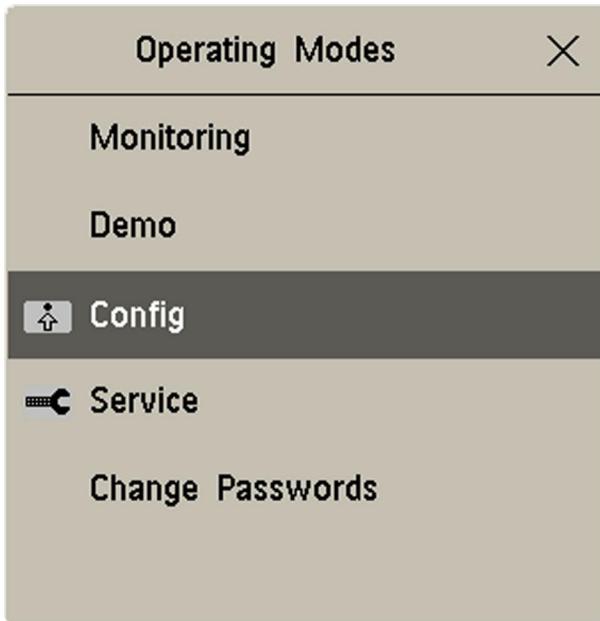
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Before you make any changes to the monitor configuration, consult the Configuration Guide.

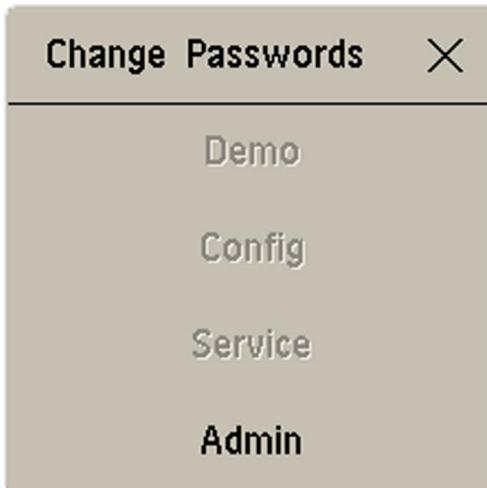
## Changing Passwords

You can change the passwords for the different operating modes in either service or config mode.

- 1 Select **Main Setup -> Operating Modes -> Change Passwords**

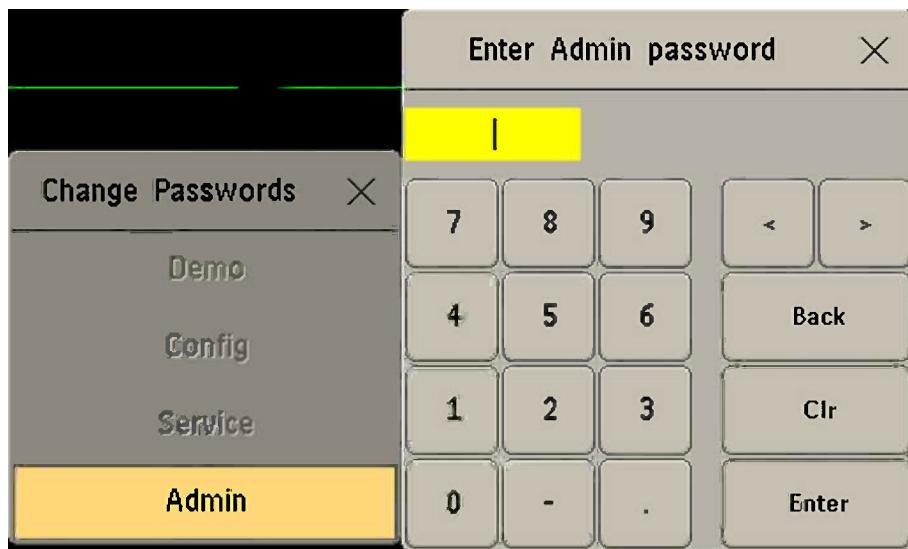


This will open the **Change Passwords** window.

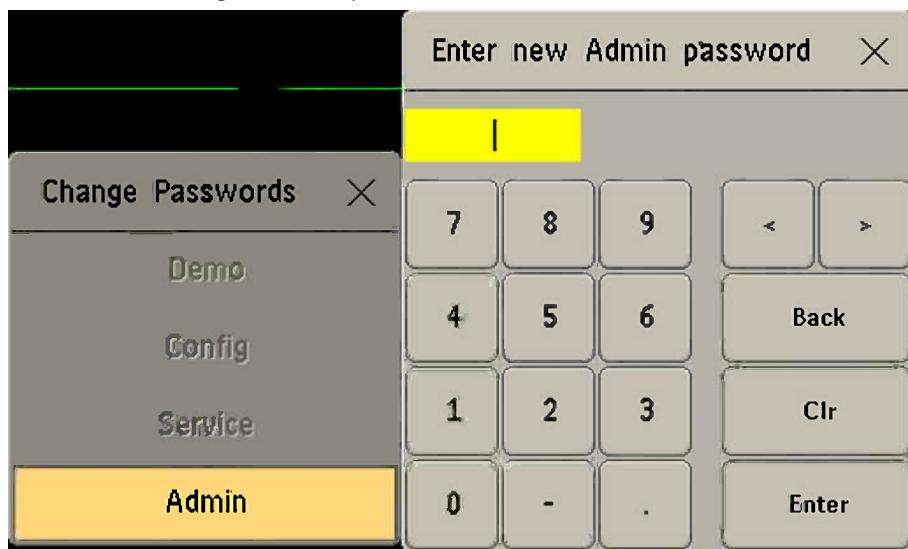


## 1 Introduction

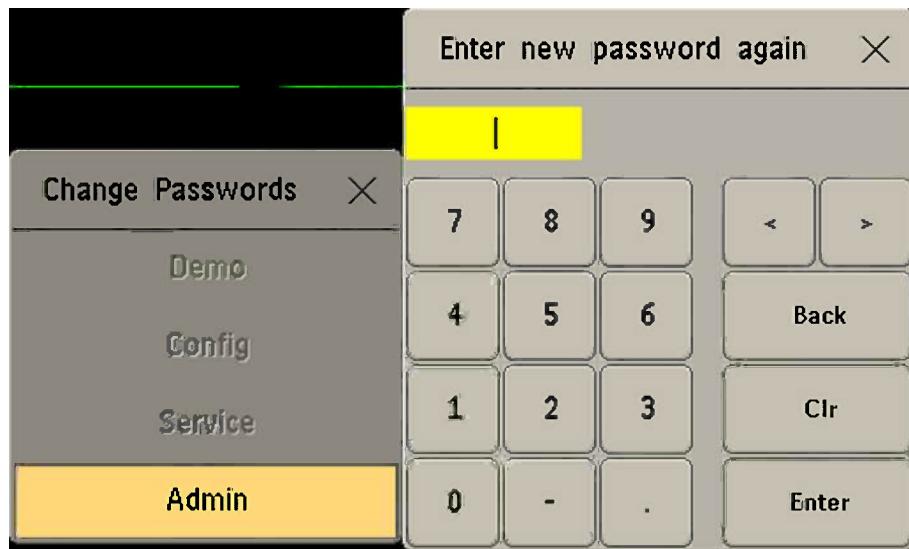
- 2 If you have already set your own Admin password, proceed to step 5. If you have not, all entries in the **Change Passwords** window except **Admin** will be greyed out. Select **Admin** and enter the default password (on the sticker inside the Documentation DVD case).



- 3 Enter a new Admin password of your choice.

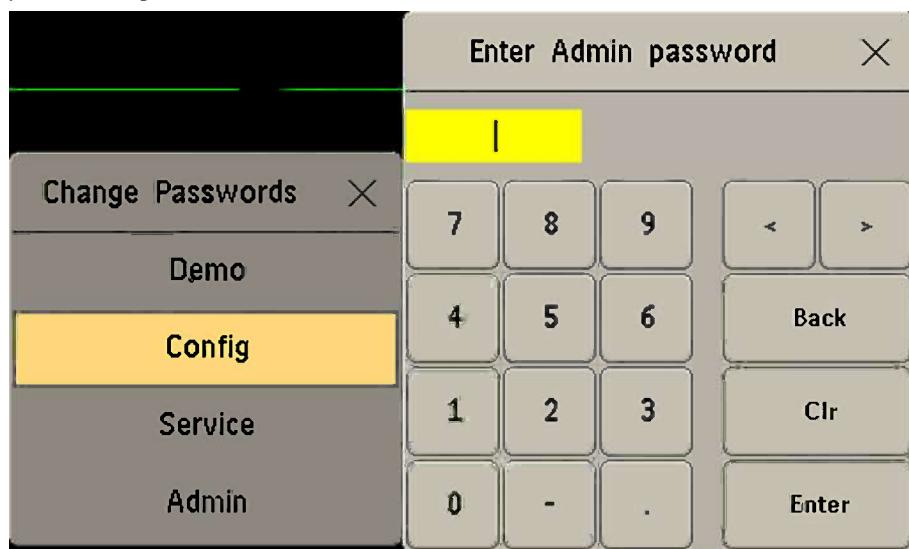


- 4 Confirm by re-entering the new password.



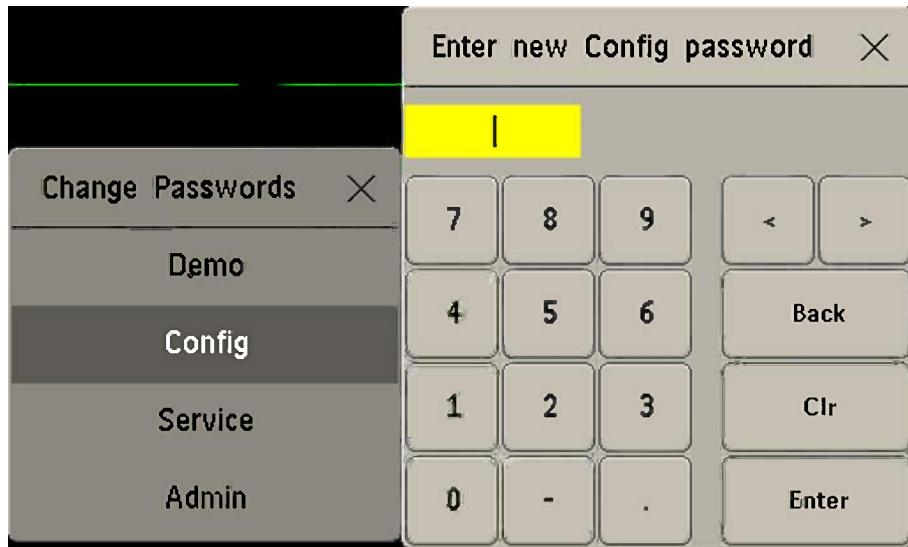
Once the Admin password has been set, you will be able to change the other passwords.

- 5 Select the mode for which you want to change the password (**Config** in the example below) and enter your Admin password.

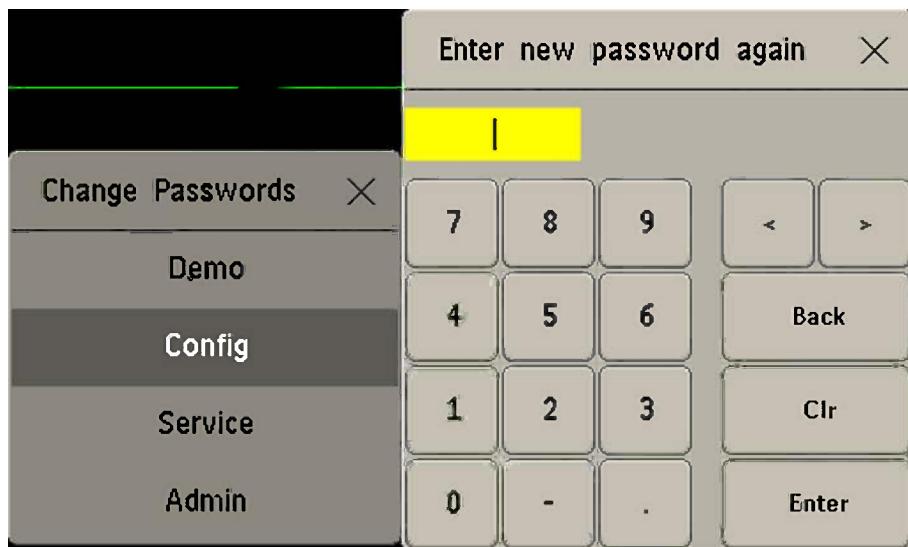


## 1 Introduction

- 6 Enter the new password for the operating mode.



- 7 Confirm the new password.



The password is now changed and the old password will no longer be accepted.

## One-Time Access

One-Time Access is an emergency mechanism which can be used if the password for the desired operating mode has been forgotten or lost. One-Time Access is enabled by default and can be disabled in configuration mode in the Global Settings window.

Global Settings	
ConfirmAlarmsOff	: No
Label Set	: Restricted
LAN Data Export	: All
Remote Display	
XDS DB Access	
One-Time Access	: Enabled

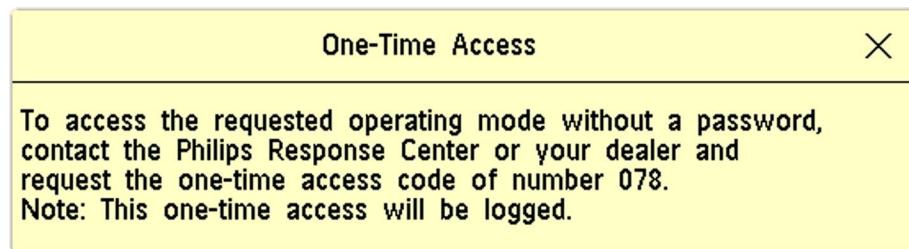
### NOTE

There is no one time access for the Admin password.

### Obtaining One-Time Access

- Instead of the password, enter --- (three minuses) and select **Enter**

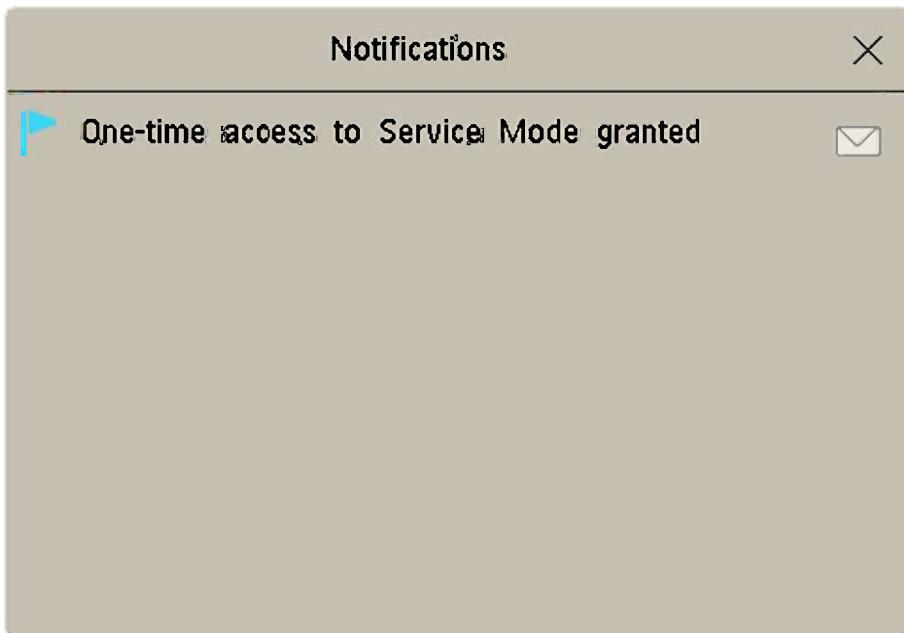
The following window will open and will provide a number with which you can contact your Philips representative to request your one-time access code (078 in the example below).



- Contact your Philips Service Representative with this number. Your Philips representative will then provide you with the password for your one time access.
- This password can only be used for a few minutes. If you enter the wrong password, you will have to start this procedure from the beginning.
- Once the one time access password has been entered, the following window will open. Enter your name and/or the reason for requesting One-Time Access.



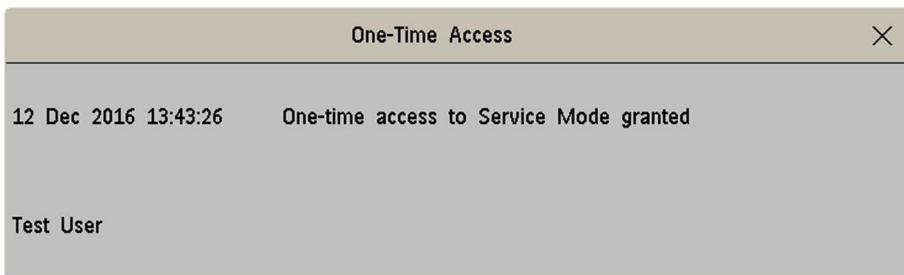
This will let you enter the requested operating mode. Once One-Time Access is granted, a notification is displayed persistently on the monitor.



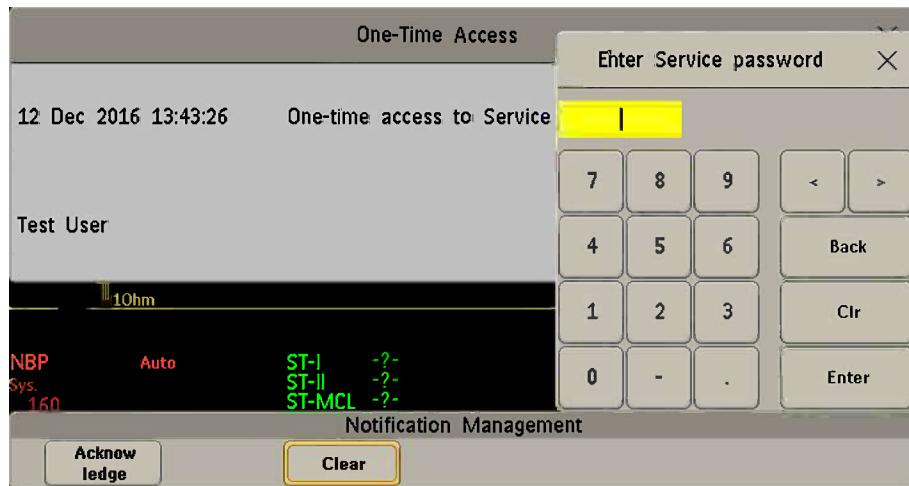
- Once you have acknowledged the notification, the notification is marked with a check mark.



- Click the notification for more details.



- Select **Clear** if you want to return to the Enter Password dialog and enter the correct password.



## Safety Information

### Warnings and Cautions

In this guide:

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

### Electrical Hazards and Interference

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#### **WARNING**

**Grounding:** To avoid the risk of electric shock, the monitor must be grounded during operation with mains power. If a three-wire receptacle is not available, consult the hospital electrician. Never use a three-wire to two-wire adapter.

**Electrical shock hazard:** Do not open the monitor or measurement device. Contact with exposed electrical components may cause electrical shock. Refer servicing to qualified service personnel.

**Leakage currents:** If multiple instruments are connected to a patient, the sum of the leakage currents may exceed the limits given in:

- IEC/EN 60601-1
- ANSI/AAMI ES60601-1
- CAN/CSA C22.2 No. 60601-1-14

Consult your service personnel.

**Radio frequency interference:** The monitor generates, uses and radiates radio-frequency energy, and if it is not installed and used in accordance with its accompanying documentation, may cause interference to radio communications.

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## Use Environment

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### WARNING

**Explosion Hazard:** Do not use in the presence of flammable anesthetics or gases, such as a flammable anesthetic mixture with air, oxygen or nitrous oxide or in the presence of other flammable substances in combination with air, oxygen-enriched environments, or nitrous oxide. Use of the devices in such environments may present an explosion hazard.

**Positioning Equipment:** The monitor should not be used next to or stacked with other equipment. If you must stack the monitor, check that normal operation is possible in the necessary configuration before you start monitoring patients.

**Environmental Specifications:** The performance specifications for the monitors, measurements and accessories apply only for use within the temperature, humidity and altitude ranges specified in the environmental specifications in the Instructions for Use.

**Liquid Ingress:** If you spill liquid on the equipment, battery, or accessories, or they are accidentally immersed in liquid, contact your service personnel or Philips service engineer. Do not operate the equipment before it has been tested and approved for further use.

**Prohibited Environments:** The monitors are not intended for use in an MRI environment or in an oxygen-enriched environment (for example, hyperbaric chambers).

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## Alarms

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### WARNING

- Do not rely exclusively on the audible alarm system for patient monitoring. Adjustment of alarm volume to a low level or off during patient monitoring may result in patient danger. Remember that the most reliable method of patient monitoring combines close personal surveillance with correct operation of monitoring equipment.
  - Be aware that the monitors in your care area may each have different alarm settings, to suit different patients. Always check that the alarm settings are appropriate for your patient before you start monitoring.
-

### Accessories

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#### **WARNING**

**Philips' approval:** Use only Philips-approved accessories. Using other accessories may compromise device functionality and system performance and cause a potential hazard.

**Reuse:** Never reuse disposable transducers, sensors, accessories and so forth that are intended for single use, or single patient use only. Reuse may compromise device functionality and system performance and cause a potential cross-infection hazard.

**Electromagnetic compatibility:** Using accessories other than those specified may result in increased electromagnetic emission or decreased electromagnetic immunity of the monitoring equipment.

**Damage:** Do not use a damaged sensor or one with exposed electrical contacts. Do not use damaged accessories. Do not use accessories where the packaging has been damaged or opened.

**Cables and tubing:** Always position cables and tubing carefully to avoid entanglement or potential strangulation.

**MR Imaging:** During MR imaging, remove all transducers, sensors and cables from the patient. Induced currents could cause burns.

**Use-by date:** Do not use accessories where the use-by date has been exceeded.

**Electrosurgery:** Do not use antistatic or conductive endotracheal tubes as they may cause burns in case of electrosurgery.

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## Maintenance, Repair and Care

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### **WARNING**

#### **Maintenance and Repair:**

- Do not maintain or repair the device in patient vicinity.
- Failure on the part of the responsible individual hospital or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.
- Performance verification: do not place the system into operation after repair or maintenance has been performed, until all performance tests and safety tests listed in Testing and Maintenance of this service manual have been performed. Failure to perform all tests could result in erroneous parameter readings, or patient/operator injury.

#### **Care and Disinfection:**

- To avoid contaminating or infecting personnel, the environment or other equipment, ensure you disinfect and decontaminate the monitor appropriately before disposing of it in accordance with your country's laws for equipment containing electrical and electronic parts.
  - For disposal of parts and accessories such as thermometers, where not otherwise specified, follow local regulations regarding disposal of hospital waste.
-

## 1 Introduction

# Theory of Operation

## Integrated Monitor Theory of Operation

The IntelliVue MX800 patient monitor is used for monitoring and recording multiple physiological parameters of adults, pediatrics, and neonates. The monitor also generates alarms for the measured parameters. The monitor is used by trained healthcare professionals in a hospital environment.

The monitor stores data in trend, event, and calculation databases. You can see tabular trends (vital signs) and document them on a printer. You can view measurement trend graphs, with up to three measurements combined in each graph, to help you identify changes in the patient's physiological condition. You can view fast-changing measurement trends with beat to beat resolution and see up to eight high resolution trend segments. Event surveillance enhances documentation and review of physiologically significant events by automatically detecting and storing up to 50 user-defined clinical events over a 24 hour period.

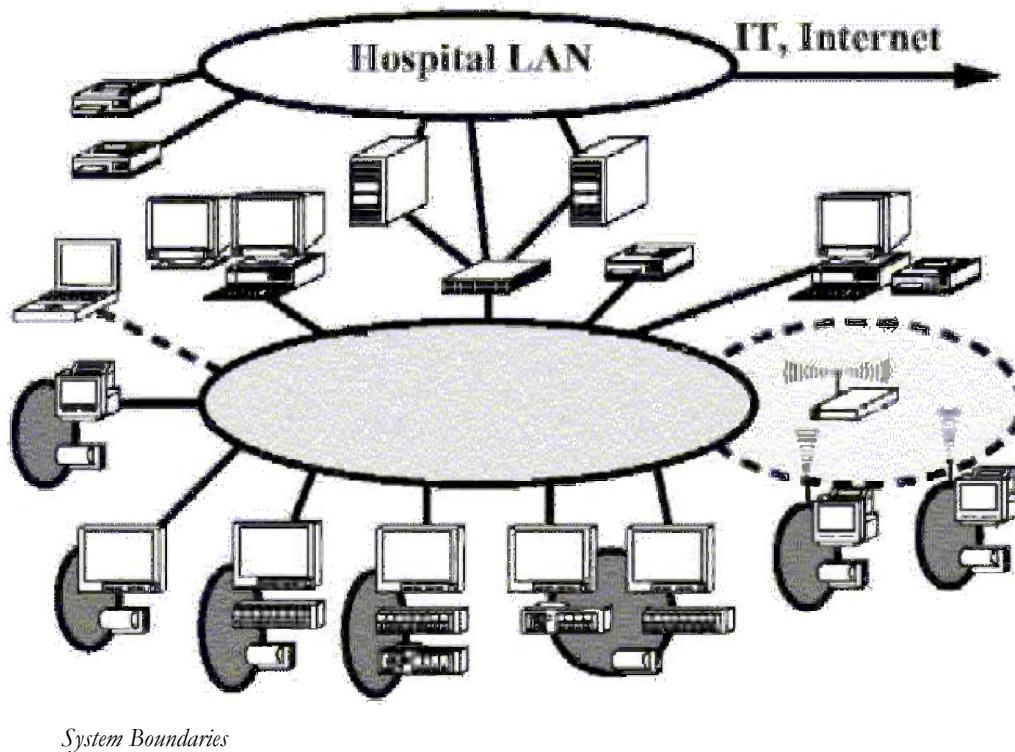
The IntelliVue MX800 Patient Monitor:

- displays real-time data
- controls the attached Multi-Measurement Modules
- alarms in the case of patient or equipment problems
- offers limited data storage and retrieval (trending)
- interfaces to the Philips Clinical Network and other equipment

A monitor with just a single integrated Multi-Measurement Module can be connected to additional building blocks to form a monitoring system with a large number of measurements, additional interface capabilities and multiple slave displays. These elements cooperate as one single integrated real-time measurement system.

### System Boundaries

The following diagram discusses specific boundaries within the overall system with respect to their openness and real-time requirements:



Shape	Meaning
●	Measurement connections Built-in measurement block
○	Philips Clinical Network (wired LAN) connects multiple patient monitors, information centers, application servers; closed system, only Philips qualified products (tested and with regulatory approval) are connected, Philips is responsible for guaranteed real-time functionality and performance
○	Philips Clinical Network (wireless) like Philips Clinical Network (wired) LAN, however due to current wireless technologies available it has reduced bandwidth, longer latencies, reduced functionality
○	Hospital LAN, Internet Standard Network, not under Philips control, no guaranteed service, no real-time requirements

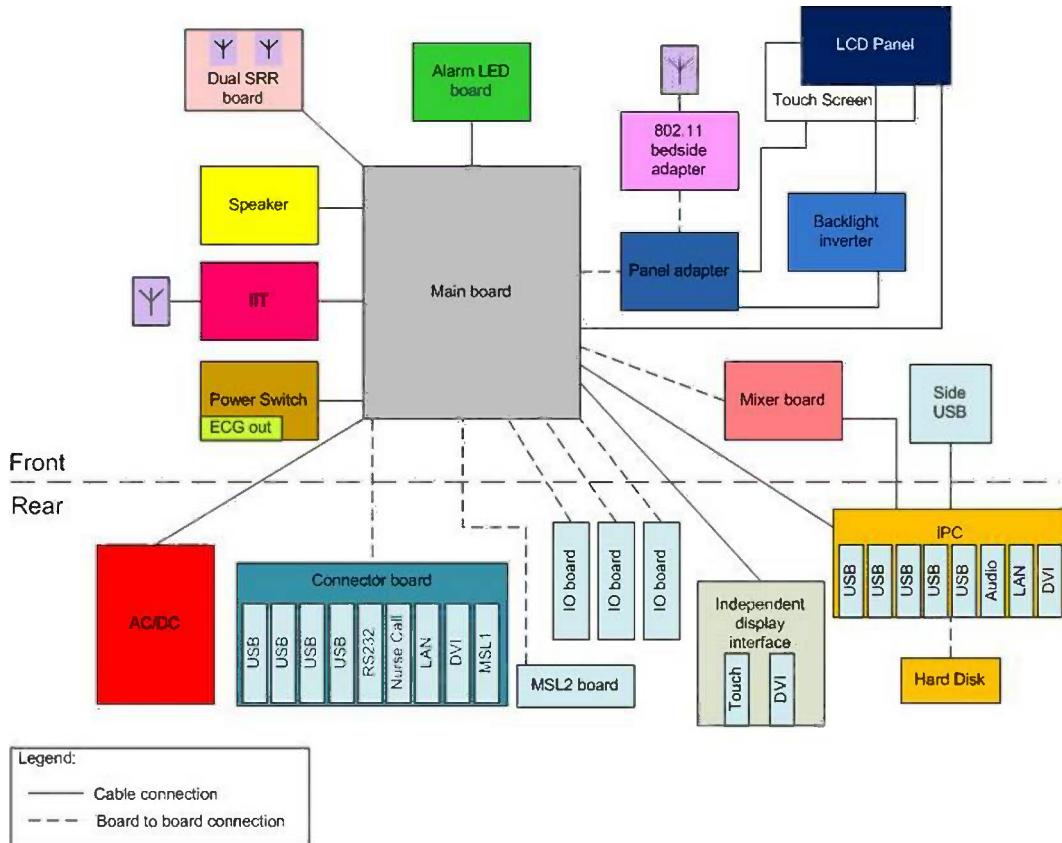
### Hardware Building Blocks

The following hardware building blocks make up the monitoring system:

## IntelliVue MX800

The IntelliVue MX800 Monitor:

- integrates the display and processing unit into a single package
- uses a 19" TFT WSXGA+ Color display
- Uses the touch screen as primary input device; a remote control and computer devices such as mice, trackball, and keyboard can be added optionally
- supports the Module Rack



### NOTE

- The Independent Display Interface and the iPC are mutually exclusive.
- The 802.11 Bedside Adapter (WLAN) and IIT are mutually exclusive.
- The iPC and the 802.11 Bedside Adapter (WLAN) are mutually exclusive.

## 2 Theory of Operation

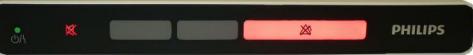
### Compatible Devices

Name	Image
M8048A 8-Slot Module Rack (FMS-8)	
865243 4-Slot Module Rack (FMS-4) (without and with Multi-Measurement Module Mount)	
867036 Multi-Measurement Module (MMX)	

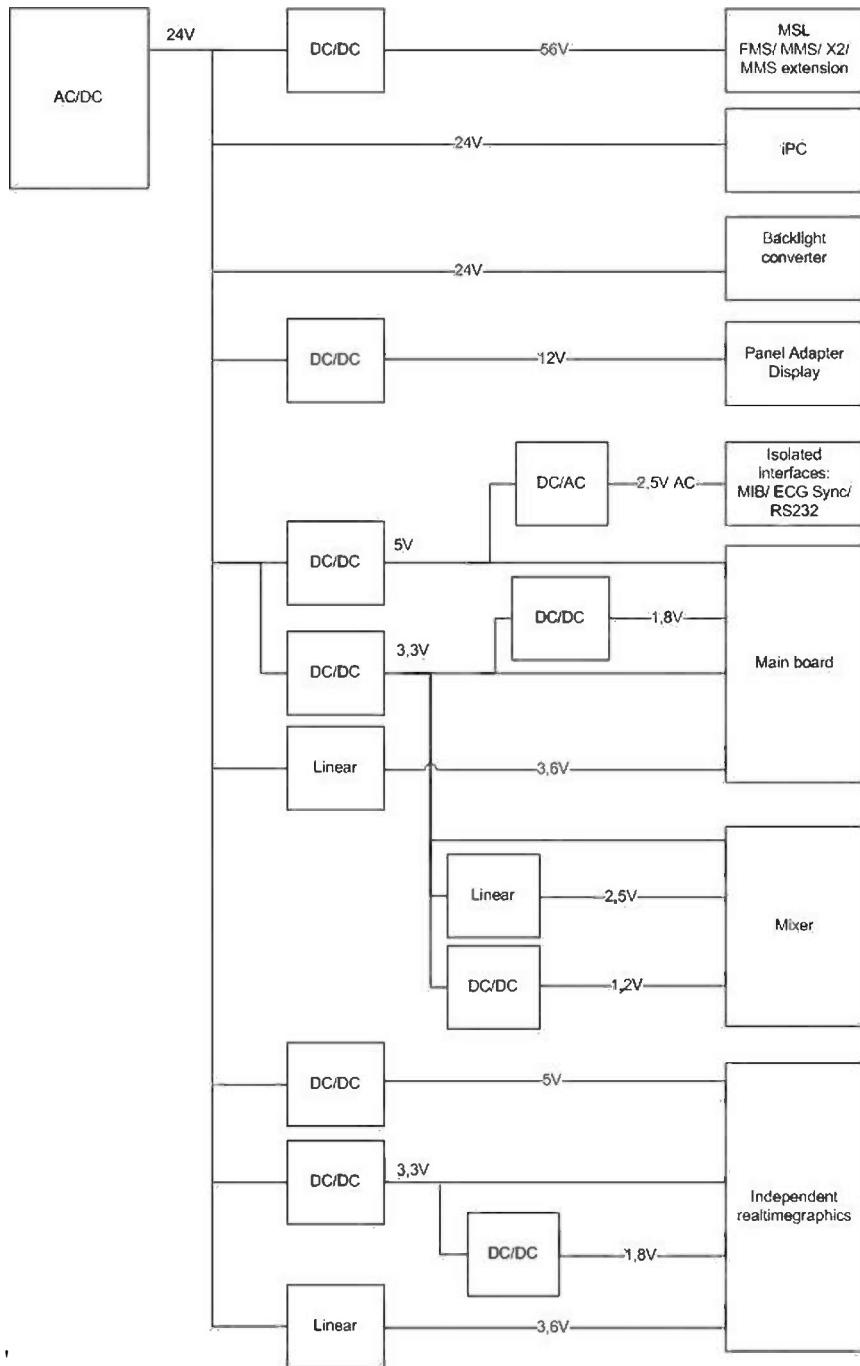
Name	Image
M3001A/AL Multi-Measurement Module (MMS)	
M3002A Multi-Measurement Module (X2)	
867030 Multi-Measurement Module (X3)	
<b>Current Generation Measurement Extensions</b>	
867039 IntelliVue Hemodynamic Extension	
867040 IntelliVue Capnography Extension  Note: PiCCO is not available for the 867040 Capnography extension in the USA and territories relying on FDA market clearance.	

## 2 Theory of Operation

Name	Image
867041 IntelliVue Microstream Extension  Note: PiCCO is not available for the 867041 Microstream CO2 extension in the USA and territories relying on FDA market clearance.	 A white rectangular medical device with a blue circular logo. It features several ports: a black D-sub port at the top left, a grey circular port labeled 'CO2' at the top center, a yellow circular port labeled 'PiCCO' below it, a grey circular port labeled 'Temp' at the bottom center, and a red circular port labeled 'Press' at the bottom right. There are also small indicator lights and a small screen or button area above the ports.
Previous Generation Measurement Extensions	
M3012A Hemodynamic Extension	 A silver rectangular medical device with a blue D-sub port at the top. It has four red circular ports labeled 'CO2', 'Temp', 'Press', and 'Temp' from left to right. Below each port is a small triangular warning symbol. The device is shown from a slightly elevated angle.
M3014A Capnography Extension	 A white rectangular medical device with a blue D-sub port at the top. It has four red circular ports labeled 'CO2CO', 'O2', 'Temp', and 'Press' from left to right. The 'CO2CO' port is specifically labeled 'PiCCO'. The device is shown from a slightly elevated angle.
M3015A Microstream Extension	 A beige rectangular medical device with a blue D-sub port at the top. It has three red circular ports labeled 'CO2', 'Microstream™', and 'Press' from left to right. The 'CO2' port is specifically labeled 'PiCCO'. The device is shown from a slightly elevated angle.

Name	Image
M3015B Microstream Extension	 A white medical device with a small screen and various ports and buttons. It is labeled "Microstream" and "CO2".
865244 Remote Control	 A black Philips remote control with a central trackball, yellow directional buttons, and a numeric keypad.
866406 Remote Alarm Device	 A small black rectangular device with a green power LED, a red alarm LED, and a red button labeled "PHILIPS".

### Power Supply



The AC/DC converter transforms the AC power coming from the plug into 24V/ 150W DC source and isolates the monitoring system from the AC power mains. The 24V is distributed via power bus either directly or over additional converters to all components of the system:

The 56V DC power needed for the MSL is created by an isolating DC/DC converter.

The iPC and the backlights converter are supplied with 24V. The power needed for the panel is converted to 12V by the panel adapter DC/DC converter.

The isolated interfaces are supplied with 2.5V AC. The main board is supplied with 5V, 3.3V and 1.8V.

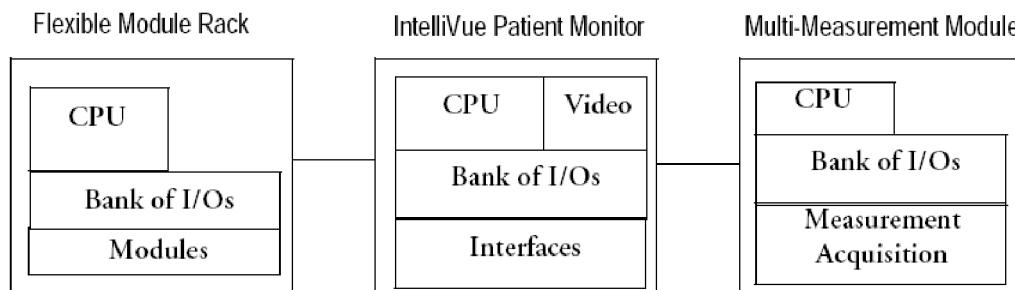
Additionally, for some infrastructural functions 3.6V is provided to the main board

The mixer board requires a power of 3.3V, 2.5V and 1.2V.

The independent real time graphics interface is supplied with 5V, 3.6V, 3.3V, and 1.8V.

## CPU Boards

The CPU boards have an MPC860 50 MHz or MPC86x 100 MHz processor that provides a number of on-chip, configurable interfaces. An array of 12 fast UARTS with configurable protocol options are implemented in an ASIC (along with other system functions such as independent watchdogs etc.), providing interfacing capabilities to measurement modules and I/O boards. The serial interfaces can easily be electrically isolated. The main board contains additional video hardware.



The CPUs provide two LAN interfaces to interconnect CPUs (via the MSL) and to connect to the Philips Clinical Network.

The CPU capabilities are identical. Different loading options are coded on serial EEPROMs to support the automatic configuration of the operating system at boot time.

## Independent Display Interface

The optional Independent Display Interface provides a Video and a Touch Connector for use with additional independent displays.

## iPC

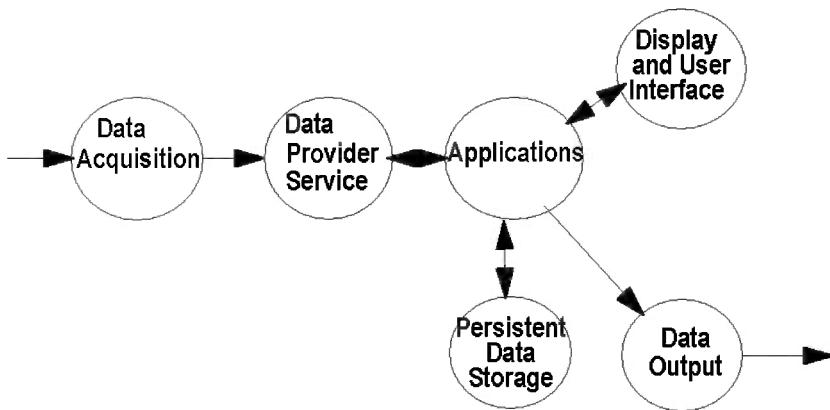
The iPC is a full standard PC that is built into the MX800 patient monitors as a hardware option

## I/O Boards

A single MIB/RS232 or Flexible Nurse Call Relay board can be added optionally.

### Data Flow

The following diagram shows how data is passed through the monitoring system. The individual stages of data flow are explained below.



*Data Flow*

### Data Acquisition

Monitoring data (for example patient measurement data in the form of waves, numerics and alerts) is acquired from a variety of sources:

- Multi-Measurement Modules

The Multi-Measurement Modules connected to the internal LAN convert patient signals to digital data and apply measurement algorithms to analyze the signals.

- External measurement devices

Data can be also acquired from devices connected to interface boards of the monitor. Software modules dedicated to such specific devices convert the data received from an external device to the format used internally. This applies to parameter modules and the Anesthetic Gas Module.

- Server systems on the Philips Clinical Network

To enable networked applications such as the other bed overview, data can be acquired from server systems attached to the Philips Clinical Network, for example a Philips Information Center

### Data Provider System Service

All data that is acquired from Multi-Measurement Modules or external measurement devices is temporarily stored by a dedicated data provider system service. All monitor applications use this central service to access the data in a consistent and synchronized way rather than talking to the interfaces directly.

This service makes the applications independent of the actual type of data acquisition device.

The amount of data stored in the data provider system service varies for the different data types. For example several seconds of wave forms and the full set of current numerical values are temporarily stored in RAM.

## Persistent Data Storage System Service

Some applications require storage of data over longer periods of time. They can use the persistent data storage system service. Dependent on the application requirements, this service can store data either in battery backed-up (buffered) memory or in flash memory. The buffered memory will lose its contents if the monitor is without power (not connected to mains) for an extended period of time. The flash memory does not lose its contents.

The trend application for example stores vital signs data in a combination of flash memory and buffered memory, while the system configuration information (profiles) is kept purely in flash memory.

## Display and User Interface Service

Applications can use high level commands to display monitoring data or status and command windows on the internal LCD panel. These commands are interpreted by the display manager application. This application controls the dedicated video hardware which includes video memory and a special ASIC.

User input is acquired from a variety of input devices, for example the SpeedPoint, the touchscreen or other standard input devices (keyboard, mouse). The system software makes sure that the user input is directed to the application which has the operating focus.

## Data Output

The monitoring system is very flexible and customizable regarding its data output devices. Built-in devices (for example LAN, video) provide the basic output capabilities.

These capabilities can be enhanced by adding additional I/O boards, as required in the specific end-user setup. The additional I/O boards typically provide data to externally attached devices, for example to RS232 based data collection devices.

The monitor can identify I/O boards by means of a serial EEPROM device that stores type and version information. The operating system detects the I/O boards and automatically connects them with the associated (interface driver) application. For some multi-purpose boards it is necessary to configure the board for a particular purpose first (for example the MIB/RS232 board can support external touch display , data import, data export).

## Monitor Applications

The monitor applications provide additional system functionality over the basic measurement and monitoring capabilities. This includes for example trending, report generating, event storage or derived measurements.

In general, the monitor applications use the data provider system service to access the measurement data. Application interfaces to the other system services allow the application to visualize data, to store data over extended periods of time or to output data to other devices.

## 2 Theory of Operation

### Internal LAN (Measurement Link)

All components of the monitoring system (including Multi-Measurement Modules and CPUs in the monitor) communicate using an IEEE802.3/ Ethernet LAN in the Measurement Link (MSL). This network is used to distribute data between the components, for example:

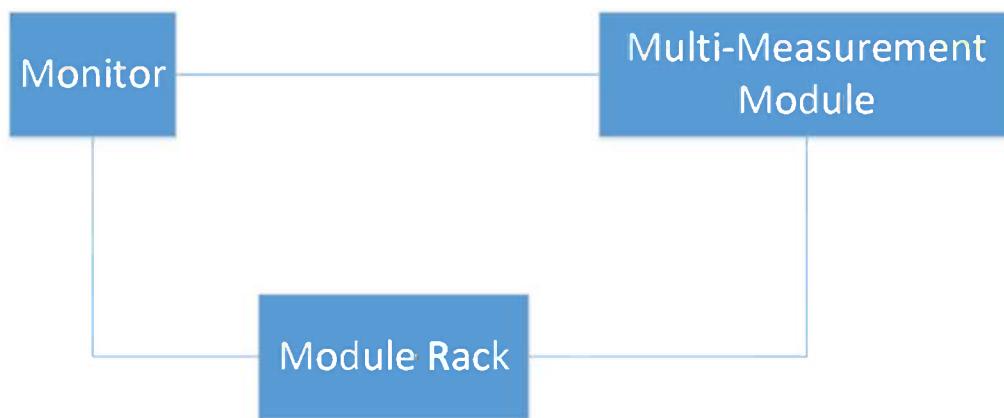
- Digitized patient signals including wave data, numerical data and status information (typically from the Multi-Measurement Module to a display unit)
- Control data representing user interactions (typically from the display unit to a Multi-Measurement Module)
- Shared data structures, for example representing patient demographical data and global configuration items

The internal LAN allows plug and play configuration of the monitoring system. The system automatically detects plugging or unplugging of Multi-Measurement Modules and configures the system accordingly.

The components on the internal LAN are time-synchronized to keep signal data consistent in the system. Dedicated hardware support for synchronization eliminates any latency of the network driver software.

The integrated LAN provides deterministic bandwidth allocation/reservation mechanisms so that the real-time characteristic of signal data and control data exchange is guaranteed. This applies to the data flow from the Multi-Measurement Module to the monitor (for example measurement signal data) and the data flow from the monitor to a Multi-Measurement Module (for example to feed data to a recorder module).

Integrated communication hubs in the monitor and the Module Rack allow flexible cabling options (star topology, daisy chaining of servers).



### Microstream CO<sub>2</sub>

CO<sub>2</sub> sample rate: 20 samples/second

#### Calculation of end tidal CO<sub>2</sub> (etCO<sub>2</sub>)

The M3015A/B Measurement Extension uses Microstream® non-dispersive infrared (NDIR) spectroscopy to continuously measure the amount of CO<sub>2</sub> during every breath, the amount of CO<sub>2</sub> present at the end of exhalation (etCO<sub>2</sub>), the amount of CO<sub>2</sub> present during inhalation (imCO<sub>2</sub>), and the respiratory rate. The displayed etCO<sub>2</sub> is the maximum etCO<sub>2</sub> over the previous peak-picking interval as defined by the Max Hold setting (configuration mode). It can be set to no peak picking (off), 10 seconds and 20 seconds.

#### Test method for respiration rate range

A breath simulator system combined with CO<sub>2</sub> and N<sub>2</sub> gases was used to simulate respiration rates covering the specified range. The resulting end tidal CO<sub>2</sub> values were compared to the expected value. Differences between actual and expected end tidal CO<sub>2</sub> values were within the limits of the specified accuracy for the respective respiration rate, i.e. there was no effect of the respiration rate on the end tidal CO<sub>2</sub> values beyond those limits.

## G7m Gas Analyzer Module

The G7m Gas Analyzer module provides a non-dispersive infrared measurement of respiratory and anesthetic gases and a paramagnetic measurement of oxygen. It also produces display waves for O<sub>2</sub>, CO<sub>2</sub>, N<sub>2</sub>O, and anesthetic agents, together with numerics for inspired and end-tidal values for O<sub>2</sub>, CO<sub>2</sub>, N<sub>2</sub>O, anesthetic agents, MAC values and airway respiration rate.

The measured values along with status information, alarm messages and INOPs are sent from the G7m to the IntelliVue Patient Monitor. The G7m can only be controlled and operated from a host monitor.

The G7m is compatible with the IntelliVue MP40/50/60/70/80/90 and MX500, MX550, MX600, MX700 and MX800 Patient Monitors with a Software Revision L.0. or higher.

### NOTE

The IntelliVue G7m is not compatible with MP60 and MP70 internal Module slots.

### General Measurement Principles

The IntelliVue G7m gas analyzer module uses a technique called Non-Dispersive Infrared Gas Concentration Measurement (NDIR) to measure the concentration of certain gases.

The gases which can be measured by the gas analyzer absorb infrared (IR) light. Each gas has its own absorption characteristic. The gas is transported into a sample cell, and an optical IR filter selects a specific band of IR light to pass through the gas. For multiple gas measurement, such as in the gas analyzer, there are multiple IR filters. The higher the concentration of gas in a given volume the more IR light is absorbed. This means that higher concentrations of IR absorbing gas cause a lower transmission of IR light. The amount of IR light transmitted after it has been passed through an IR absorbing gas is measured. From the amount of IR light measured, the concentration of gas present can be calculated. This calculation provides the gas measurement value. Oxygen is measured by an additional sensor in the gas analyzer using its paramagnetic properties. The gas is transported into a sample cell. The higher the oxygen concentration, the higher the measured effect. The oxygen concentration can be calculated from the amplitude of the effect.

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### WARNING

- The presence of organic cleaning solutions such as Ethanol, Isopropanol or Aceton or gases containing freon and inhaler propellants may affect the accuracy of the infrared gas measurement.
  - The presence in the gas path of gases, aerosols, etc. other than those specified for the gas analyzer may result in incorrect readings.
  - Gas measurement values might be inaccurate at high respiratory rates due to the technical limitations of the gas measurement system. See the measurement specifications.
- 

### Pump

The software-controlled pump generates the flow through the system and pulls the gas from the airway adapter through the measurement subsystems to the exhaust outlet. It also delivers the zero calibration gas to the sample cells of the measurement subsystems for the periodic zero procedures and it exhausts the patient's sample gas, the zero calibration and field calibration gases.

The flow-rate control logic drives the pump as hard as necessary to maintain the selected flow rate. A partial occlusion or an inefficient pump results in the pump being driven harder. A serious occlusion results in the pump being driven at or near its maximum load. If, as a result of this occlusion, the desired flow rate cannot be upheld, an occlusion INOP is triggered.

## 2 Theory of Operation

### Watertrap

The water trap prevents water and other fluids from passing into the gas analyzer and causing contamination and/or internal occlusions. It has a water reservoir in which fluids are collected, two water separation filters, and two shut-off fuses as a backup mechanism for the water separation filters.

The water trap is for multi-patient use. It must be replaced after a service life of four weeks at the latest, during this time it can be emptied and reused as often as required. Regularly check the level of fluid in the water trap and empty as required.

### Philips Clinical Network

The monitoring system may be connected to the Philips Clinical Network, for example to provide central monitoring capabilities or other network services. This connection may be through a normal wired connection or through a wireless connection.

The monitor supports the connection of an internal wireless adapter (#J35). Switching between wired and wireless networks is automatically triggered by the plugging or unplugging of the network cable.

The Philips Clinical Network protocols function very similarly to the protocols used on the internal LAN.

After configuration, the monitoring system sends the digitized patient signals including wave data, numerical data and status information onto the network. Control data representing user interactions can be exchanged between the monitoring system and a central station bi-directionally.

Additional protocols are supported for networked applications, for example for the other bed overview function, which allows viewing of monitoring data from other patients on the network.

For plug and play operation, the monitoring system uses the standard BootP protocol to automatically acquire a network address.

### How does the Support Tool Work with the Monitor

The support tool is a Windows application typically installed on the laptop of a customer engineer or a biomedical engineer working in the customer's own service department.

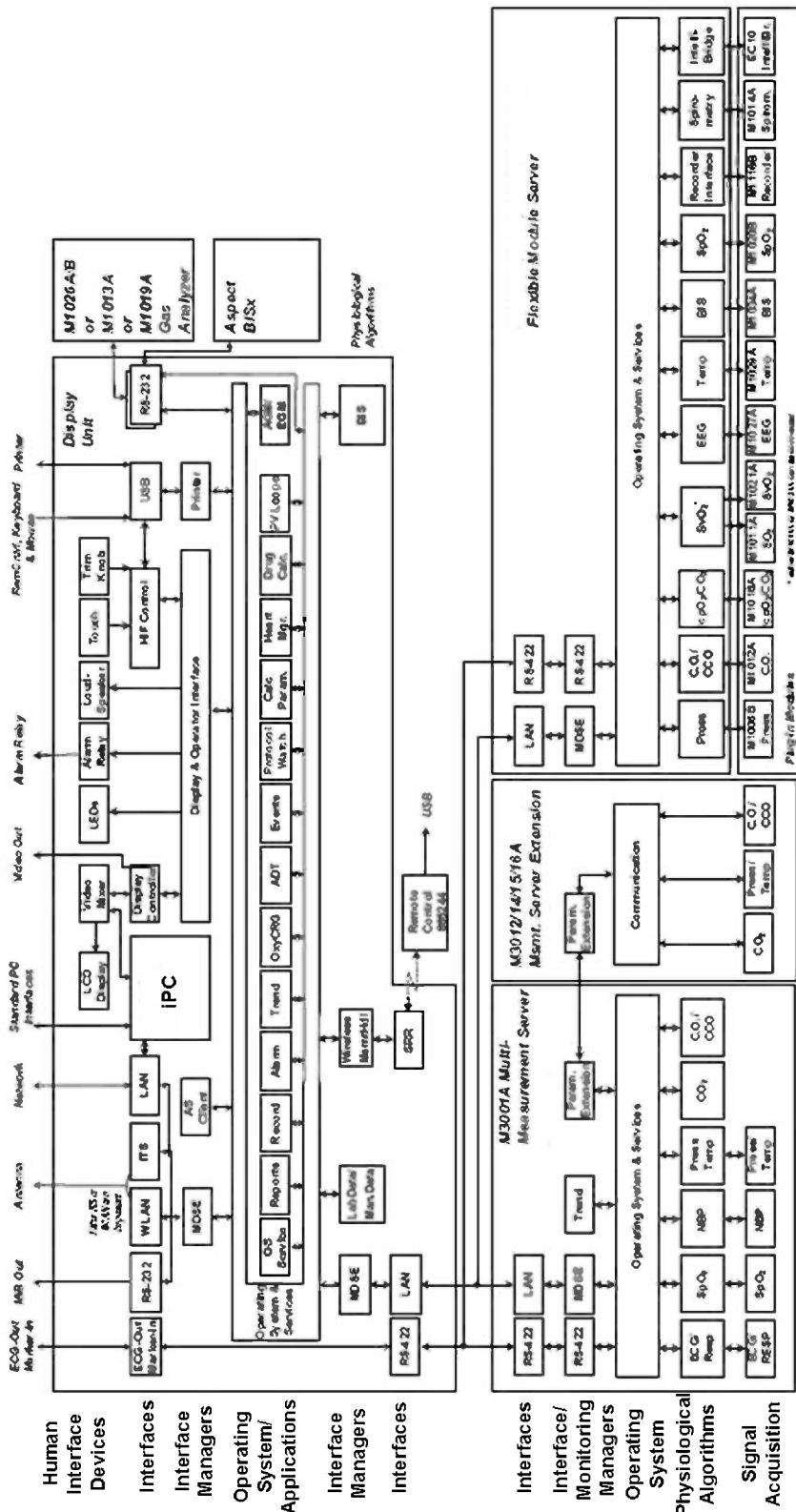
The purpose of the support tool is to upgrade, configure and diagnose all monitoring components (modules, Multi-Measurement Modules, and monitors) in the system over the network.

The service protocol developed for this purpose uses a raw access to the devices without the need for IP addresses etc. over a standard customer network installation, so that even defective devices can be upgraded as long as the few kBytes of initial boot code are working. The boot code itself can also be upgraded using the same protocol.

The tool allows access to internal service information and to serial numbers. It can be remote-controlled, for example via a dial-up connection from a response center, provided the proper infrastructure is in place.

For details see the *Instructions for Use* for the Support Tool.

## Monitor Software Block Diagram



## 2 Theory of Operation

### Block Diagram Legend

Functional Block	Description
<b>Services</b>	
Operating System	The Operating System (OS) provides a layer of isolation between the specific hardware implementation and the application software. The OS performs system checks and allocates resources to ensure safe operation when the system is first started. This includes internal self-tests on several hardware modules and configuration checks for validity of configuration with the operating software. During normal operation, the OS continues to run checks on system integrity. If error conditions are detected the OS will halt monitoring operations and inform the operator about the error condition.
System Services	The System Services provide generic common system services. In particular: They use a real-time clock component to track time. They synchronize to network time sources and verify the accuracy of the system time information. They are also responsible for managing persistent user configuration data for all Multi-Measurement Modules, Module Racks and IntelliVue Patient Monitoring System software modules. User configuration data is stored in a non-volatile read/write storage device
<b>Applications</b>	
Application Server Client	The Application Server Client provides the Citrix1 thin client functionality.
Reports	<p>The Reports Service retrieves current and stored physiological data and status data to format reports for printing paper documentation. The following reports are supported:</p> <ul style="list-style-type: none"> <li>• Vital Signs Report</li> <li>• Graphical Trend Report</li> <li>• Event Review Report</li> <li>• Event Episode Report</li> <li>• ECG Report (12 Lead/Multi-Lead)</li> <li>• Cardiac Output Report</li> <li>• Calculations Report (Hemodynamic/Oxygenation/Ventilation)</li> <li>• Calculations Review Report</li> <li>• Wedge Report</li> <li>• Test Report</li> <li>• Other reports (e.g. Loops, Review Applications, Drug report)</li> </ul> <p>The Reports service generates report data which can be printed on a local or a central printer.</p>

Functional Block	Description
Record	The Record Service retrieves current and stored physiological data and status data to format a continuous strip recording. A recording can be triggered manually by the operator or automatically by an alarm condition. The Record Service uses the services of the Recorder Interface to control an M1116B Recorder in the Module Rack. The Record Service can also send data to a central recorder.
Alarm	The Alarm Service contains logic that prioritizes alarm conditions that are generated either by the Multi-Measurement Modules, Module Rack, or by IntelliVue Patient Monitoring System software modules. Visual alarm signals (messages) are displayed at the top of the IntelliVue Patient Monitoring System display and alarm sounds are generated by a loudspeaker. Alarm conditions may be generated when a physiological parameter exceeds preselected alarm limits or when a physiological parameter or any other software module reports an inoperative status (technical alarm, for example, the ECG leads may have fallen off the patient). The Alarm service manages the alarm inactivation states, for example suspension of alarms, silencing of alarms, and alarm reminder. Alarm signals may also be configured as latching (alarm signals are issued until they are acknowledged by the operator, even when the alarm condition is no longer true). The Alarm service controls the visual alarm signals (alarm lamps).
Trend	The Trend service stores the sample values of physiological data and status data with a resolution of 12 seconds, 1 minute or 5 minutes for a period of up to 48 hours. The data is kept in battery buffered read/write storage and flash memory devices to be preserved across power failures. The stored data is protected via consistency checks and checksums. When a new patient is admitted, the trend database erases all data of the previous patient.
OxyCRG	The OxyCRG (Oxygen CardioRespiroGram) service derives a high-resolution trend graph from the Beat-to-Beat Heart Rate, SpO2 or tcpO2, and Respiration physiological data. The OxyCRG is specialized for neonatal applications, allowing the operator to identify sudden drops in Heart Rate (Bradycardia) and SpO2 or tcpO2 (Desaturations), and supporting the operator in visualizing Apnea situations.
ADT	The ADT (Admit/Discharge/Transmit) service maintains the patient demographics information. The operator may admit a new patient, discharge the old patient and enter or modify the patient demographics. The ADT service also supports the transport of a patient (trend database) with the M3001A/AL Multi-Measurement Module. The ADT service controls the deletion of old patient data, the upload of trend data from the M3001A/AL and the switching back of all settings to user defaults. It also synchronizes patient information with a central station on the network.
Events	The Events Application captures physiological data from episodes for later review and documentation purposes. Events can be triggered automatically by an alarm condition, by user-defined conditions or manually by the operator.

## 2 Theory of Operation

Functional Block	Description
Protocol Watch	ProtocolWatch allows the execution of pre-defined clinical protocols in the IntelliVue patient monitor by combining events such as automatically triggered events, time and manually triggered events with textbook knowledge thus aiding the operator to follow clinical guidelines. ProtocolWatch notifies the operator when certain combinations of clinical conditions occur and it documents the developments and clinician actions in a log which can be reviewed on the monitor and documented on a printer.
Calc Param	The Calc Param (Calculated Parameters) service accesses current, stored and manually entered physiological data as input to calculation formulas. With these formulas, derived hemodynamic, oxygenation and ventilation variables are computed. The calculation results, including the input parameters, are stored for later review using the Trend service.
Heart Mgr.	The Heart Manager Application allows the selection of the alarming source to be either heart rate (from ECG) or the system pulse rate. The system pulse rate can be chosen from any of the possible pulse rate sources (e.g., SpO <sub>2</sub> and invasive pressures). The module implements automatic fall-backs when selected signal sources are not available.
Drug Calc	The Drug Calc application aids in calculating drug dosages for patients.
AGM/EGM	AGM (Anesthesia Gas Module) and EGM (extensible Gas Module) interface anesthesia gas measurement devices. The AGM/EGM Module (Anesthesia Gas Module) interfaces the M1013A, M1019A or M1026A/B Gas Analyzer devices. The AGM Module retrieves the measurement data and controls the external device. It provides numerical data, wave form data and alarm data for the gas parameters measured by the attached analyzers.
PV Loops	The PV Loops application compares graphic representations of airway waves to help detect changes in the patient airway condition.
<b>Interface Managers</b>	
MDSE	The MDSE (Medical Data Service Element) Interface Manager is responsible for the exchange of real-time data between the IntelliVue Patient Monitoring System display unit and the Multi-Measurement Modules and Module Rack as well as between the IntelliVue Patient Monitoring System display unit and other devices attached to the network. MDSE establishes and maintains a data communication link between the devices. It provides configuration information about the remote device to applications in the local device and it allows the exchange of measurement data and status information between the devices.

Functional Block	Description
Printer	<p>The Printer Interface Manager provides a high level interface to a printer. It provides means to:</p> <ul style="list-style-type: none"> <li>• establish a connection to the printer</li> <li>• transfer data to the printer</li> <li>• get status of the printer</li> <li>• close connection to the printer</li> </ul> <p>The Printer Interface Manager also supervises the connection to the printer and whether the printer accepts data (for example paper out). The Printer Interface Manager notifies the operator in such cases.</p>
Display & Operator Interface	<p>The Display and Operator Interface Manager performs the following tasks:</p> <ul style="list-style-type: none"> <li>• Screen presentation of real-time and stored physiological measurement data, alarm condition data and status information received from the MDSE interface manager, the Alarm service or other IntelliVue Patient Monitoring System modules</li> <li>• Screen presentation of operating controls (control windows)</li> <li>• Processing of operating control commands received from HIF Control interface. The module verifies and interprets the received commands and forwards them to other software modules of the IntelliVue Patient Monitoring System display unit, Multi-Measurement Modules or Module Rack</li> <li>• Sound generation (issues audible alarm signals and generates audible information signals, for example QRS and SpO2 tones, operator audible feedback)</li> </ul>
LabData/Manual Data	<p>The Laboratory Data/ Manual Data Entry Interface Manager allows acquisition of laboratory data (e.g. acquired by the central station from a laboratory information system). It also allows to manually enter measurement data to make additional, manually acquired measurements available to internal applications and to the system.</p>
Wireless Measurement Manager (WMM)	<p>The WMM Interface Manager provides connectivity to the SRR interface. It establishes communication between SRR enabled devices and the ASW module that manages the data provided by the device</p>
Interfaces	
LAN	<p>The LAN interface implements the physical layer of IEEE 802.3. The LAN interface performs Manchester encoding/decoding, receive clock recovery, transmit pulse shaping, jabber, link integrity testing, reverse polarity detection/correction, electrical isolation, and ESD protection. Electronically separated interfaces are used for communication to the Multi-Measurement Modules or Module Rack and to the network.</p>
WLAN	<p>The WLAN Interface is a network interface that provides access to an IEEE 802.11 wireless Local Area Network. The configuration of this interface is done by an OS Service.</p>

## 2 Theory of Operation

Functional Block	Description
Display Controller	The Display Controller Interface consists of a video controller chip, video RAM and the controlling software. The Display Controller interface processes the high level display commands (character and graphic generation, wave drawing) and translates them into pixels, which are written into the video RAM where the video controller chip generates the video synchronization signals and the pixel stream for the Color LCD Display.
Independent Display Interface	The optional Independent Display Interface provides a Video and a Touch Connector for use with additional independent displays.
HIF Control	The HIF (Human Interface Control) interface scans the Human Interface devices for operator controls (Touch Screen, and USB devices), formats the collected data and sends it to the display and Operating Interface.
ECG-Out	The ECG Out interface receives the ECG waveform directly from the ECG/Resp Arrhythmia ST-Segment physiological algorithm via an RS-422 serial interface and converts the digital ECG signal to an analog ECG signal.
Sync Out (ECG)	A pulse signal is provided on the Sync Out connector to allow synchronization with other medical devices.
RS-232	The RS-232 component represents a generic serial communication interface to connect external devices as shown in the diagram, also providing power in some cases.
RS-422	The serial link RS-422 interface communicates the ECG signal to the ECG Output of the IntelliVue Patient Monitoring System display unit. The interface is a serial, differential, full-duplex link. The interface is ESD protected.
Nurse Call	The Nurse Call board has a modular jack 6P6C connector. The connector has an open and close contact on alarm.
MIB	The MIB interface allows full-duplex, short-haul asynchronous binary communication between the monitor and an arbitrary (medical/non-medical) device using an eight-pin RJ45 modular connector. Switching between MIB and RS232 protocol is possible.
IIT Interface	The IIT interface allows operation of the monitors with IntelliVue Instrument Telemetry.
SRR	The built-in SRR interface allows wireless communication of the monitor with an IntelliVue Instrument Telemetry Transceiver.
USB Interface	The USB interface allows connection of USB devices (Mouse, Keyboard, Barcode Scanner, Printer) to the monitor.
iPC	The iPC is a full standard PC that is built into the MX800 patient monitors as a hardware option.
Remote Control	The remote control allows remote operation of the monitor via a USB cable connection.
Remote Interface	The remote interface allows connection of the Remote Alarm device.

# Testing and Maintenance

## Introduction

This chapter provides a checklist of the testing and maintenance procedures to ensure the performance and safety of the monitor, the Multi-Measurement Modules, the Measurement Extensions and the Module Rack associated modules.

These tests must be performed only by qualified personnel certified by the responsible organization. Qualifications required are: training on the subject, knowledge, experience and acquaintance with the relevant technologies, standards and local regulations. The personnel assessing safety must be able to recognize possible consequences and risks arising from non-conforming equipment.

All recurring safety and performance assurance tests must be performed under equal environmental conditions to be comparable.

Preventive Maintenance refers specifically to the series of tests required to ensure the measurement results are accurate. The accuracy and performance procedures are designed to be completed as specified in the following sections or when readings are in question.

For detailed instructions on the maintenance and cleaning of the monitor and its accessories, see *Care and Cleaning, Using Batteries and Maintenance and Troubleshooting* in the monitor's *Instructions for Use*.

## Terminology and Definitions

The following terms and definitions are used throughout this chapter and taken from the international standards IEC 60601-1 and IEC 62353.

- **Medical System:** a medical electrical system is a combination of at least one medical electrical device and other electrical equipment, interconnected by functional connection or use of a multiple socket-outlet.
- **Patient Environment:** any area in which intentional or unintentional contact can occur between the patient and parts of the medical system or between the patient and other persons who have had contact with parts of the medical system. The patient environment is defined anywhere within 1.5m (5 feet) of the perimeter of the patient's bed and 2.5m (8.2 feet) from the floor.
- **Separation Device/Transformer:** a component or arrangement of components with input parts and output parts that, for safety reasons, prevent a transfer of unwanted voltage or current between parts of a medical system.
- **Multiple Socket-Outlet:** a combination of two or more socket-outlets intended to be connected to or integrated with flexible cables or cords, which can easily be moved from one place to another while connected to the power mains.
- **Functional Connection:** an electrical connection for transfer of signals and/or power.
- **Tests:** Safety or Performance Assurance test procedures which may consist of several steps.
- **Equipment Leakage Current:** total current flowing from mains parts to earth via:
  - a. the protective earth conductor and accessible conductive parts of the enclosure and applied parts (differential and alternative method), or
  - b. the accessible conductive parts of the enclosure and applied parts (direct method)
- **Patient Leakage Current:**
  - flowing from the patient connections via the patient to earth, or
  - originating from the unintended appearance of a voltage from an external source on the patient and flowing from the patient via the patient connections of an F-type applied part to earth
- **Protective Earth Resistance:**
  - resistance between any accessible conductive part which has to be connected for safety purposes to the protective earth terminal and the
    - protective connector of the mains plug, or
    - protective connector of the appliance inlet, or
    - protective conductor permanently connected to the supply mains;
  - resistance between protective connectors at each end of a detachable power supply cord
- **Touch Current:** leakage current flowing from the enclosure or from parts thereof, excluding patient connections, accessible to any operator or patient in normal use, through an external path other than the protective earth conductor, to earth or to another part of the enclosure

**NOTE**

The meaning of this term is the same as that of “Enclosure Leakage Current” in the first and second editions of IEC 60601-1. The term has been changed to align with IEC60950-1 [3]/IEC62368-1 and to reflect the fact that the measurement now applies also to parts that are normally protectively earthed.

- **Single Fault Condition:** condition of medical electrical equipment in which a single means for reducing a risk is defective or a single abnormal condition is present
- **Type BF Applied Part:** F-type applied part complying with the specified requirements of IEC 60601-1 to provide a higher degree of protection against electric shock than that provided by type B applied parts
- **Type CF applied Part:** F-type applied part complying with the specified requirements of IEC 60601-1 to provide a higher degree of protection against electric shock than that provided by type BF applied parts

## Recommended Frequency

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

**Table 1 Suggested Testing Timetable**

Tests	Frequency
<b>Preventive Maintenance*</b>	NBP Performance Once every two years, or more often if specified by local laws.
	Microstream CO <sub>2</sub> Calibration <b>Once a year</b> or after <b>4000 hours</b> of continuous use and following any instrument repairs or the replacement of any instrument parts
	Tympanic Temperature Calibration Once a year. If the unit is dropped or damaged, check it and calibrate it before further use.
	G7m Fan Filter Check G7m Fan Filter Replacement G7m Gas Accuracy Check Once a year except Fan Filter Check every six months
<b>Other Regular Tests</b>	Visual Inspection Before each use.
	Power On Test
<b>Performance Assurance Tests</b>	ECG/Resp Performance ECG Out Performance SpO <sub>2</sub> Performance NBP Performance Invasive Pressure Performance Temperature Accuracy M3014A Capnography Extension Performance Tests Microstream CO <sub>2</sub> Performance Test Spirometry Accuracy Test C.O. Performance BIS Performance NMT Performance G7m Performance IntelliBridge Performance Test Nurse Call Relay Performance MSL Assurance Test Power Loss Alarm Buzzer Performance Test Recorder M1116C Performance Test Mounting Integrity Test Once every two years, or if you suspect the measurement is incorrect, except <b>Mainstream CO<sub>2</sub> Accuracy Check, Sidestream CO<sub>2</sub> Accuracy Check, Flow Check and G7m Performance</b> - required once a year. <b>Mounting Integrity Test:</b> Perform every two years, or: <ul style="list-style-type: none"><li>• whenever you have removed and reassembled a quick mount.</li><li>• if one or more of the quick mount screws are loose.</li><li>• If the monitor mounting is unstable.</li></ul>

Tests			Frequency
Safety Tests	Visual	Visual Inspection	After each service event
	Electrical	Protective Earth	Once every two years and after repairs where the power supply has been removed or replaced or the monitor has been damaged by impact.
		Equipment Leakage Current	
		Applied Part Leakage Current	
		System Test	Once every two years

**NOTE**

The EEG and SO<sub>2</sub> and parameters do not require performance testing. See “[EEG and SO<sub>2</sub> Performance Tests](#)” on page 122 for details.

## When to Perform Tests

The table below describes when to perform specific tests. The corresponding test procedures are described in the following sections. **All tests listed below must be performed on the monitor itself, any attached Multi-Measurement Module (MMS/MMX/X2/X3) and Module Racks (FMS) incl. parameter modules.**

Table 2 When to Perform Tests

Service Event (When performing...)	Tests Required ...Complete these tests)
<b>Installation</b>	
<b>Installation</b> of a monitor in combination with a medical or non-medical device connected to the same multiple socket outlet.	Perform Visual Inspection, Power On and System Tests
<b>Installation</b> of a monitor (with or without iPC or Independent Display Interface) with <b>no</b> display connected to the video output	Perform Visual Inspection and Power On Test
<b>Installation</b> of a monitor (with or without iPC or Independent Display Interface) with a medical display specified by Philips	Perform Visual Inspection and Power On Test
<b>Installation</b> of a monitor <b>without iPC or Independent Display interface</b> with an off-the-shelf display (non-compliant with IEC 60601-1)	Perform Visual Inspection, Power On and System Test (per each affected port)
<b>Installation</b> of a monitor <b>with iPC or Independent Display Interface</b> with off-the-shelf displays (non-compliant with IEC 60601-1) connected to both the monitor and the iPC	Perform Visual Inspection, Power On and System Test for both the monitor-display connection and the iPC-display connection
<b>Installation</b> of a monitor with AGM or IntelliVue G1/G5, connected to separate mains sockets.	Perform Visual Inspection and Power On Tests
<b>Installation</b> of a monitor with IntelliVue G7m	Perform Visual Inspection, Power On Test, Leak Check, Fan Check, zero Calibration Check, Gas Accuracy Test, Normal Operation Check
<b>Installation</b> of a monitor with an IntelliBridge connection to another medical device (compliant with IEC 60601-1), connected to separate mains sockets.	Perform Visual Inspection and Power On Tests
<b>Installation</b> of a monitor with recorder module M1116C	Perform Visual Inspection, Power On and Recorder Performance Test
<b>Installation</b> of a monitor (with or without iPC) with IT equipment e.g. printer, PC connected via a functional connection USB.	Perform Visual Inspection, Power On and System Tests
<b>Installation</b> of monitor with IntelliVue 802.11 Bedside Adapter	Perform Visual Inspection, Power On and IntelliVue 802.11 Bedside Adapter Communication Test
<b>Installation</b> of monitor with IntelliVue Instrument Telemetry	Perform Visual Inspection, Power On and IIT Communication Test

<b>Service Event (When performing...)</b>	<b>Tests Required ...Complete these tests)</b>
<b>Installation</b> of monitor with Short Range Radio (SRR)	Perform Visual Inspection, Power On and SRR Communication Test
<b>Installation</b> of networked monitor (LAN) without iPC	Perform Visual Inspection and Power On Test
<b>Installation</b> of networked monitor (LAN) with iPC (iPC LAN connected to non Philips network)	Perform Visual Inspection, Power On Test and System Tests for the iPC LAN connected to non Philips network
<b>Preventive Maintenance</b>	
Preventive Maintenance	Perform preventive maintenance tests and procedures: NBP Calibration Microstream CO <sub>2</sub> Calibration Tympanic Temperature Calibration G7m Fan Filter Replacement G7m Gas Accuracy Check
<b>Other Regular Tests and Tasks</b>	
Visual Inspection	Perform Visual Inspection
Power On Test	Perform Power On test
<b>Repairs</b>	
<b>Repairs</b> where the bottom housing has been removed.	Perform Visual inspection, Power On and Mounting Integrity Test
<b>Repairs</b> where the monitor, FMS, parameter modules, MMS/MMX or X2/X3, Independent Display Interface or iPC have been damaged by impact, liquid ingressation, fire, short circuit or electrical surge.	Perform Visual Inspection, Power On, all Safety Tests and Full Performance Assurance Tests
<b>Repairs</b> where the power supply, the mains socket or an interface board of the monitor or iPC is removed or replaced or the protective earth ground connection is disrupted.	Perform Visual Inspection, Power On, all Safety Tests and Basic Performance Assurance Test
<b>Repairs</b> of IntelliVue 802.11 Bedside Adapter	Perform Visual Inspection, Power On and IntelliVue 802.11 Bedside Adapter Communication Test
<b>Repairs</b> of IntelliVue Instrument Telemetry (IIT) Module	Perform Visual Inspection, Power On and IIT Communication Test
<b>Repairs</b> of Short Range Radio (SRR) Interface	Perform Visual Inspection, Power On and SRR Communication Test
<b>Repairs</b> of the parameter modules, FMS, MMS/MMX or X2/X3 (all service events where the parameter modules, FMS, MMS/MMX or X2/X3 have been opened)	Perform Visual Inspection, Power On, all Safety Tests (where applicable) and Basic Performance Assurance Test. If a certain parameter seems suspicious, perform Full Performance Assurance Test for this parameter.

### 3 Testing and Maintenance

Service Event (When performing...)	Tests Required ...Complete these tests)
<b>Repairs</b> where the NBP pump of the FMS or X2/X3 has been replaced	Perform Visual Inspection, Power On, all Safety Tests, Basic Performance Assurance Test and NBP Performance Test and Calibration
<b>Repairs</b> where the parameter module, MMS/MMX or X2/X3 has been replaced.	Perform Visual Inspection, Power On and Basic Performance Assurance
<b>Repairs</b> where the recorder module M1116C has been replaced or repaired.	Perform Visual Inspection, Power On and Recorder Performance Test
<b>Repairs</b> of the AGM or IntelliVue G1/G5	Perform Basic Performance Assurance Test. For further testing requirements, see the <i>AGM or IntelliVue G1/G5 Service Guides</i>
<b>Repairs</b> where the printer connected to the monitor or iPC via connector board has been replaced.	Perform Visual Inspection, Power On, System Test and Printer Test.
All other IntelliVue Monitoring System repairs (except when power supply is removed)	Perform Visual Inspection, Power On Test and Basic Performance Assurance Test
Performance Assurance	
Basic Performance Assurance	Perform basic performance assurance tests for the respective monitoring system component.
Full Performance Assurance	Perform all accuracy and performance test procedures listed in the following sections. If a particular measurement is in question, perform the measurement performance test only.
Upgrades	
<b>Software Upgrades</b>	Perform Visual Inspection, Power On Test and Basic Performance Assurance Test unless otherwise specified in the Upgrade Installation Notes shipped with the upgrade.
<b>Hardware Upgrades</b>	Perform Visual Inspection, Power On Test and Basic Performance Assurance Test unless otherwise specified in the Upgrade Installation Notes shipped with the upgrade.
Hardware <b>Upgrades</b> where the bottom housing has been removed.	Perform Visual inspection, Power On and Mounting Integrity Test
Hardware <b>Upgrades</b> where IntelliVue 802.11 Bedside Adapter is installed	Perform Visual Inspection, Power On Test, Basic Performance Assurance Test and IntelliVue 802.11 Bedside Adapter Communication Test
Hardware <b>Upgrades</b> where IntelliVue Instrument Telemetry (IIT) is installed	Perform Visual Inspection, Power On Test, Basic Performance Assurance Test and IIT Communication Test
Hardware <b>Upgrades</b> where Short Range Radio (SRR) is installed	Perform Visual Inspection, Power On Test, Basic Performance Assurance Test and SRR Communication Test

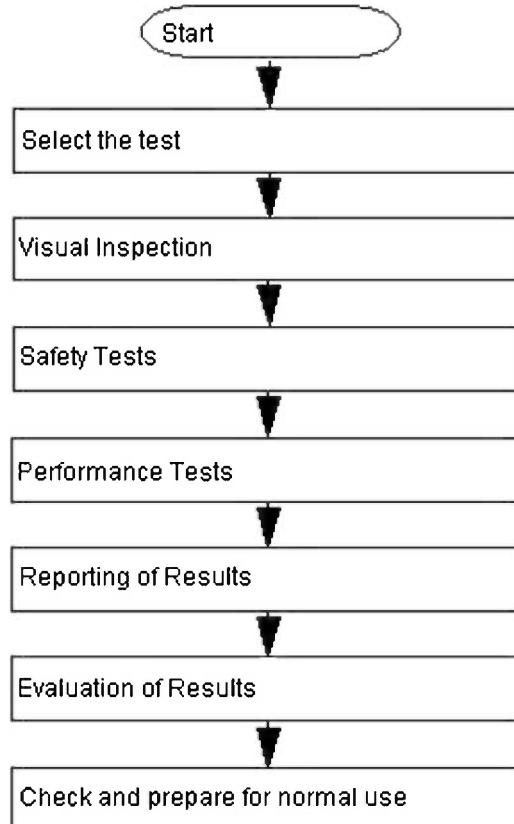
Service Event (When performing...)	Tests Required ...Complete these tests)
Installation of Interfaces or Hardware Upgrades where the power supply of the monitor or iPC or interface boards of the monitor need to be removed.	Perform Visual Inspection, Power On Test, Basic Performance Tests and all Safety Tests
<b>Combining or Exchanging System Components</b> (non-medical equipment connected to an IntelliVue monitor or medical system equipment operated on a multiple socket outlet)	Perform the System Test for the respective system components

**NOTE**

It is the responsibility of the facility operator or their designee to obtain reference values for recurring safety and system tests. These reference values are the results of the first test cycles after an installation. You may also purchase this service from Philips.

## Testing Sequence

Summary of the Philips recommended sequence of testing:

**NOTE**

If any single test fails, testing must be discontinued immediately and the device under test repaired or labeled as defective.

## Visual Inspection

### Before Each Use

Check all exterior housings for cracks and damage. Check the condition of all external cables, especially for splits or cracks and signs of twisting. If serious damage is evident, the cable should be replaced immediately. Check that all mountings are correctly installed and secure. See the instructions that accompany the relevant mounting solution.

### After Each Service, Maintenance or Repair Event

Ensure all fuses accessible from the outside comply with the manufacturer's specification.

Check:

- the integrity of mechanical parts, internally and externally.
- any damage or contamination, internally and externally
- that no loose parts or foreign bodies remain in the device after servicing or repair.
- the integrity of all relevant accessories.

### Power On Test

- 1 Connect the monitoring system to mains and switch it on. This includes connected displays, Multi-Measurement Module, Measurement Extensions, X2/X3, Module Rack and Module Rack associated modules, gas analyzers and IntelliBridge devices.
- 2 Ensure all steps listed in the table *Initial Instrument Boot Phase* in the Troubleshooting section are completed successfully and that an ECG wave appears on the screen.

The expected test result is pass: the monitor boots up and displays an ECG wave. The wave might be a flat line if no simulator is attached.

## Safety Tests

Safety tests are comprised of the following tests performed on the monitoring system:

- Protective earth resistance
- Equipment leakage current
- Applied part leakage current
- System test (if applicable)

Safety test requirements are set according to international standards, their national deviations and specific local requirements. The safety tests detailed in this Service Guide are derived from international standards but may not be sufficient to meet local requirements. Philips recommends you file the results of safety tests. This may help to identify a problem early particularly if the test results deteriorate over a period of time.

Each individual piece of equipment which has its own connection to mains or which can be connected or disconnected from mains without the use of a tool must be tested individually. The monitoring system as a whole must be tested according to the procedure described in "["System Test" on page 72](#)".

Accessories which can affect the safety of the equipment under test or the results of the safety test must be included in the tests and documented.

## Warnings, Cautions, and Safety Precautions

- These tests are well established procedures of detecting abnormalities that, if undetected, could result in danger to either the patient or the operator.
- Disconnect the device under test from the patient before performing safety tests.
- Disconnect the device under test from mains before performing safety tests. If this is not possible, ensure the performance of these tests does not result in danger to the safety analyzer operator, patients or other individuals.
- Test equipment (for example, a *Safety Analyzer*) is required to perform the safety tests. See Annex C of IEC/EN 62353 for exact requirements for the measurement equipment and for measurement circuits for protective earth resistance and leakage currents. See the documentation that accompanies the test equipment. Only certified technicians should perform safety testing.
- The consistent use of a *Safety Analyzer* as a routine step in closing a repair or upgrade is emphasized as a mandatory step to maintain user and patient safety. You can also use the *Safety Analyzer* as a troubleshooting tool to detect abnormalities of line voltage and grounding plus total current loads.
- During safety testing, mains voltage and electrical currents are applied to the device under test. Ensure there are no open electrical conductive parts during the performance of these tests. Ensure no users, patients or other individuals come into contact with touch voltage.
- For information on standards compliance, see the Instructions for Use.
- Local regulations supersede the testing requirements listed in this chapter.
- If a non-medical electrical device is connected to a medical electrical device, see “System Test” on [page 72](#) for compliance and testing requirements.
- Perform safety tests as described on the following pages.

## Safety Test Procedures

Use the test procedures outlined here **only** for verifying and recording the initial values prior to or at installation, safe installation or service of the product, and for periodic recurrent testing. The setups used for these tests and the acceptable ranges of values are derived from local and international standards but may not be equivalent. These tests are not a substitute for local safety testing where it is required for an installation or a service event. If using an approved safety tester, perform the tests in accordance with the information provided by the manufacturer of the tester and in accordance with your local regulations, for example IEC/EN 60601-1, ANSI/AAMI ES60601-1, and IEC/EN 62353. The safety tester should print results as detailed in this chapter, together with other data.

See Annex C of IEC/EN 62353 for requirements for the measurement equipment and for measurement circuits for protective earth resistance and leakage currents.

The following symbols are used in the diagrams illustrating the safety tests:

	Supply mains		Protective earth
L, N	Supply mains terminals	PE	Protective earth terminal
	Mains part		Applied part
			Measuring device
	Resistance measuring device		Connection to accessible conductive parts
.....	Optional connection	N.C.	Normal Condition
S.F.C.	Single Fault Condition	AP1,AP2	Applied parts with different functions

---

### CAUTION

#### After each service, maintenance or repair event:

Ensure all fuses accessible from the outside comply with the manufacturer's specification.

Check:

- the integrity of mechanical parts, internally and externally.
  - any damage or contamination, internally and externally.
  - that no loose parts or foreign bodies remain in the device after servicing or repair.
  - the integrity of all relevant accessories.
-

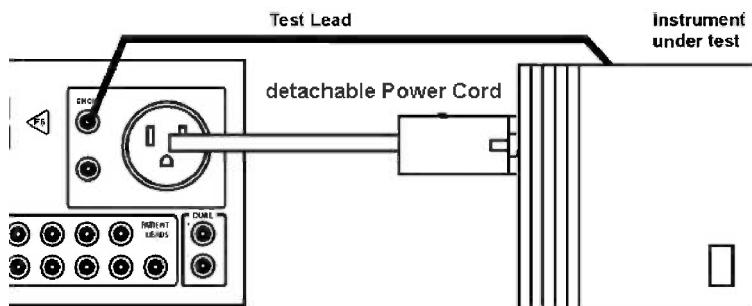
### Hints for Correct Performance of Safety Tests

- Perform a visual inspection on all detachable power cords used with the monitoring system and include these in all safety test procedures.
- Connection lines, such as data lines or functional earth conductors, may appear to behave like protective earth connections. These may lead to incorrect measurements and must be considered during testing. If necessary, unplug these connections.
- During measurements, the device under test shall be isolated from earth (for example, test on an insulated work bench), except the protective earth conductor in the power supply cord.
- Position all cables and cords such that they do not influence the safety tests.
- Measurement of insulation resistance is not required.
- Measure equipment in the operating conditions (for example, switch positions) that influence the leakage current. Document the highest value and the related condition, if relevant. Functions that initiate an intended physiological effect shall not be activated.
- When testing a medical electrical system, where possible, test it such that potential ground voltage variations are present as they may be during actual use.

#### Guideline for Performance of Safety Tests

This section introduces the general principle of performing recurrent safety tests. Product specific test descriptions are described in the following sections.

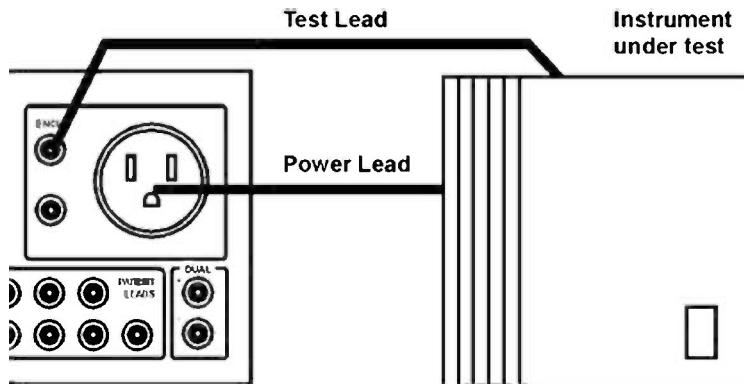
Connect the detachable power cord of the device under test to the safety analyzer's test mains port. Connect the enclosure test lead of the safety analyzer to the enclosure of the device under test, e.g. to the equipotential connector or unearthing conductive accessible parts where applicable during Equipment Leakage Current Tests and Applied Part Leakage Current Tests. For testing the applied part leakage current, connect all applied parts to the safety analyzer using the appropriate patient lead or adapter cable. For the ECG parameter, all ten ECG-leads must be connected to the safety analyzer. If necessary, use an adapter cable to connect all ten ECG-leads. If necessary, repeat the safety test procedure until all available applied parts have been tested. See the documentation that accompanies the safety analyzer for further details on how to set up and perform the test.



Protective Earth Resistance Test - Setup Example

#### NOTE

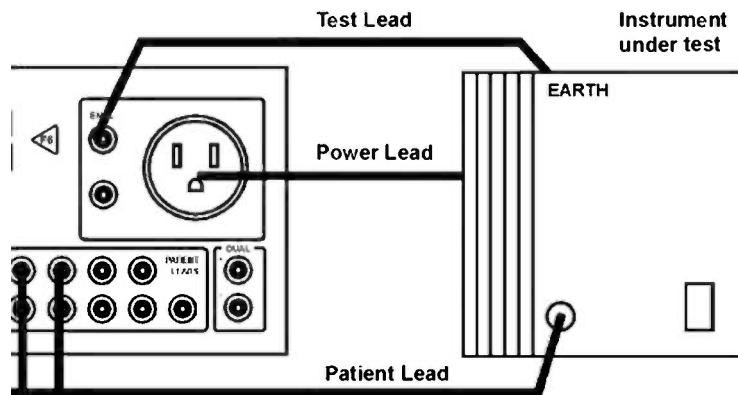
The test lead must go to parts that require protective earthing. This may be a single connection or several tested after each other



Equipment Leakage Current Test - Setup Example

**NOTE**

The test lead must go to the grounded enclosure parts, the ungrounded enclosure parts and all of the applied parts connected together.



Applied Part Current Test - Setup Example

**NOTE**

The above graphics resemble the Metron QA-90 setup and are protected by copyright. Copyright owned by Fluke (Metron).

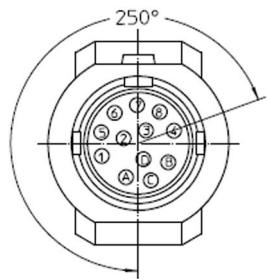
**Safety Test Adapter Cable - Schematics**

The following graphics provide schematics of safety test (patient lead) adapter cables which can be used for electrical safety testing. These schematics can also be used as a guideline for making your own safety test adapter cables. Alternatively, other methods to make safety test adapter cables can be used, e.g. using a modified accessory cable.

**NOTE**

You may not need all of the cables displayed below for electrical safety testing of your respective monitor.

## ECG



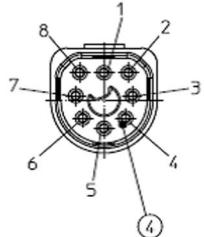
PLUG 12-PIN  
MALE

### Wiring Schematic

#### Conductor Coloring



**SpO<sub>2</sub> (MX100/X3/MMX #SP1 & #SP6, MP2/X2/M3001A/M3001AL/M1020B #A01 - #A04, MP5 #SP1 - #SP4, 867192 #SP3)**

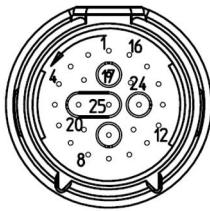
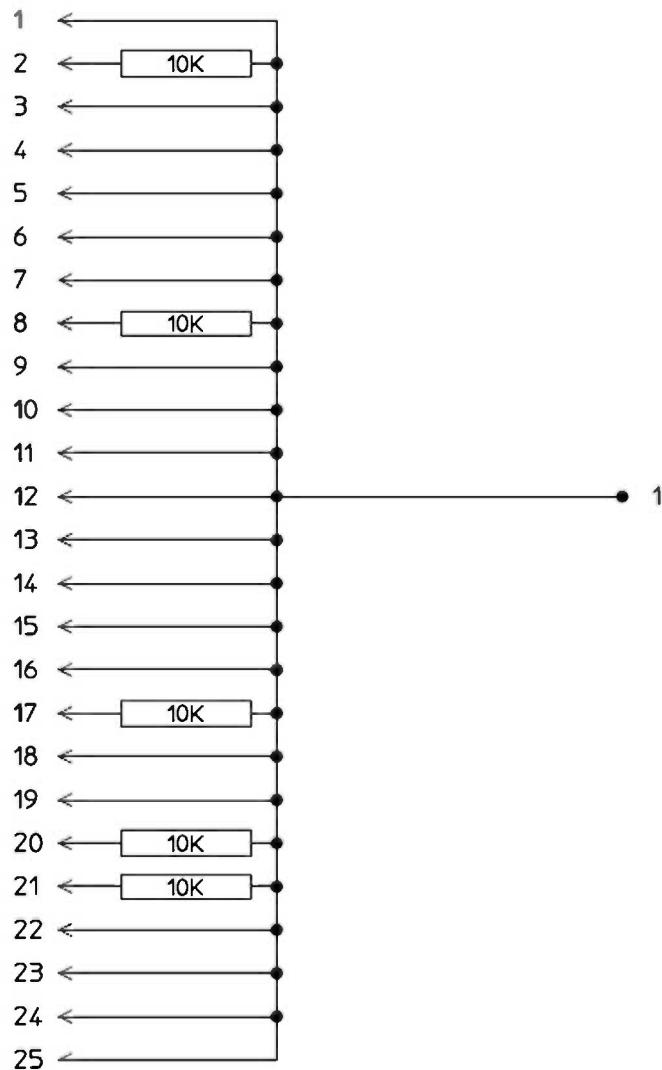


PLUG 8-PIN  
MALE

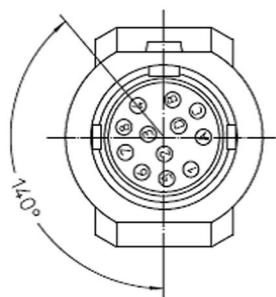
### Wiring Schematic

#### Conductor Coloring



**Masimo rainbow SET (X2/M3001AL #A05, MP2/MP5/MX100/X3/MMX/867191 #SP5)**Wiring SchematicConnector, 25-ContactsPlug Banana

### Invasive Pressure



PLUG 12-PIN

MALE

### Wiring Schematic

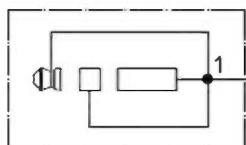


### Invasive Pressure (M1006B #C01)

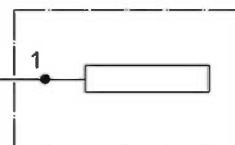
### Wiring Schematic

Phone Jack 1/8"

Stereo



Plug Banana



### Temperature



Plug 2-Contact

Male

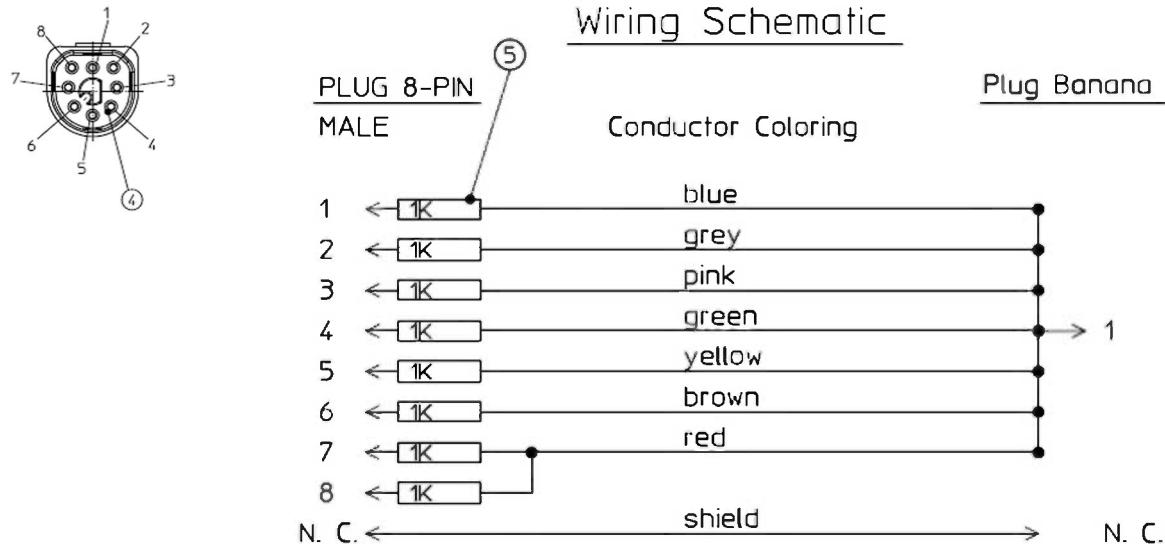
### Wiring Schematic

#### Conductor Coloring

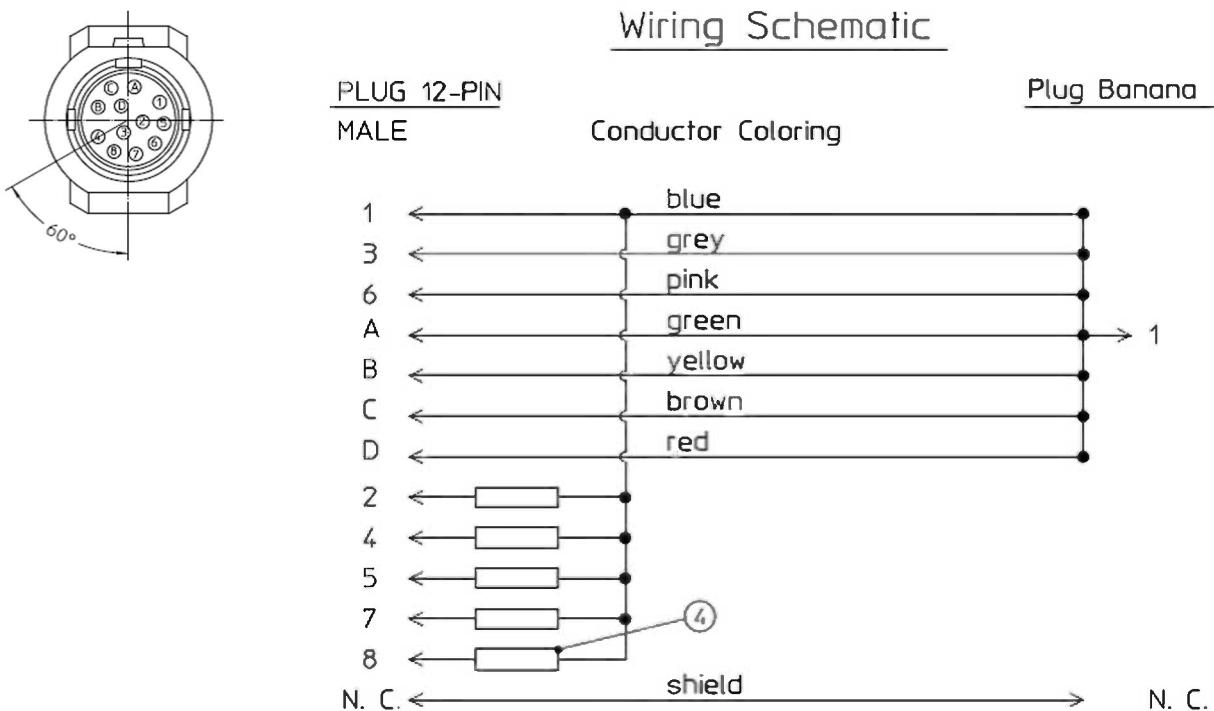


Plug Banana

**CO2 (MP5, M3014A, X2 #C14, X3/MX100 #B03, MMX #B03, MSE 867040)**



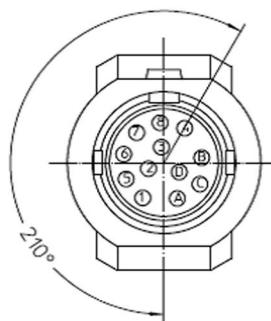
CO2 (M1016A, M3016A)



4 = all resistors 120 KOhm

### 3 Testing and Maintenance

#### Cardiac Output



PLUG 12-PIN  
MALE

Wiring Schematic

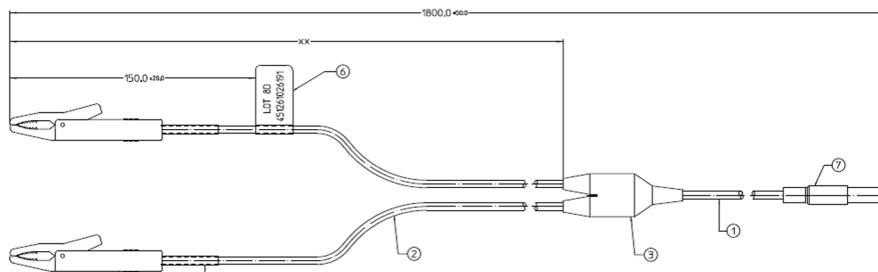
Conductor Coloring



Plug Banana

#### BIS

Use Clamp Adapter Cable and BIS sensor simulator (P/N: M1034-61650, 453563233731).

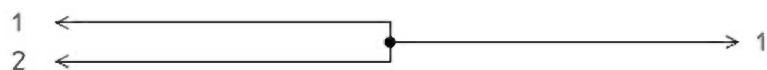


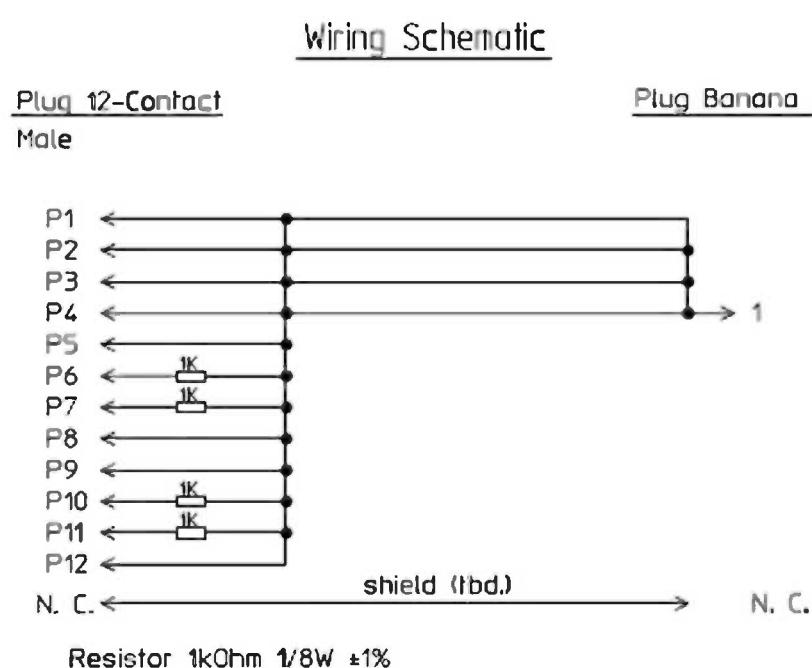
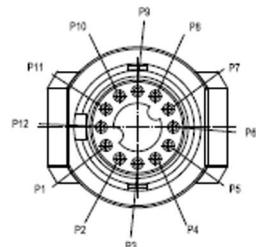
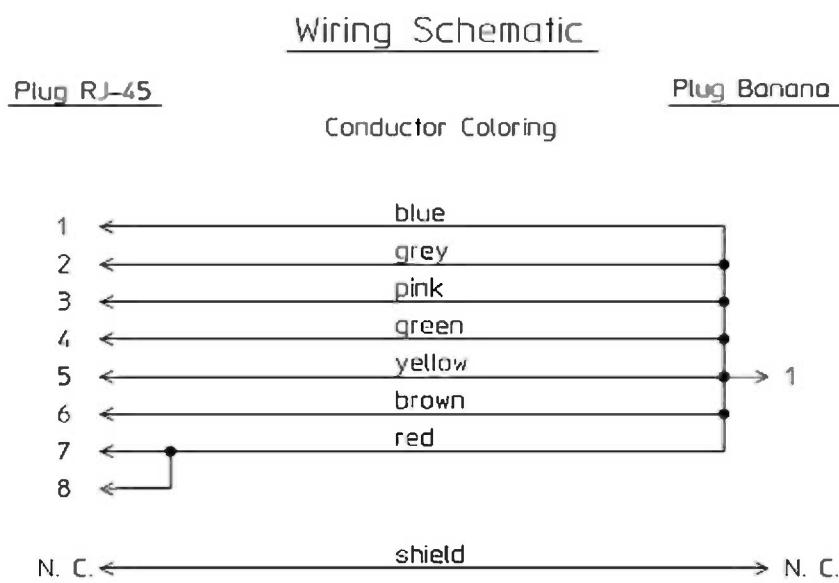
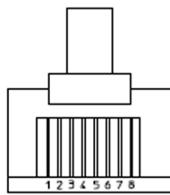
Wiring Schematic

Clamp

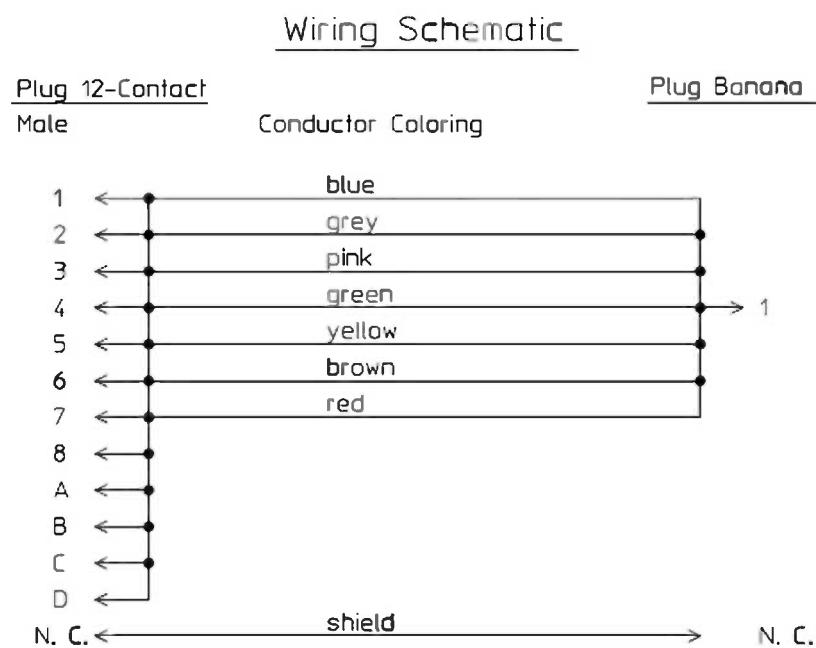
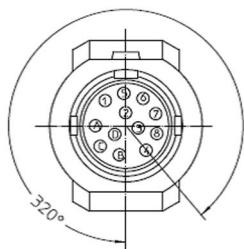
Divider

Plug Banana

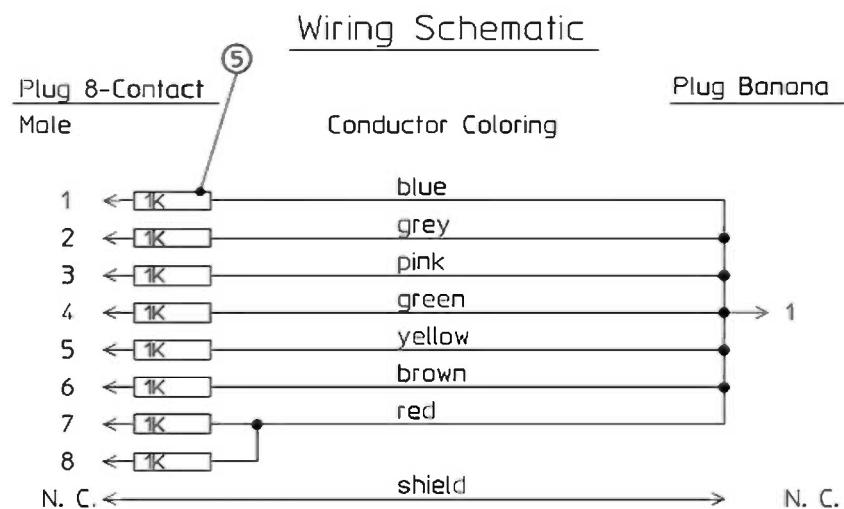
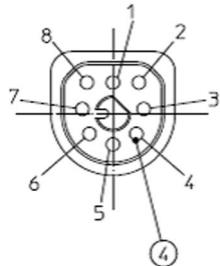


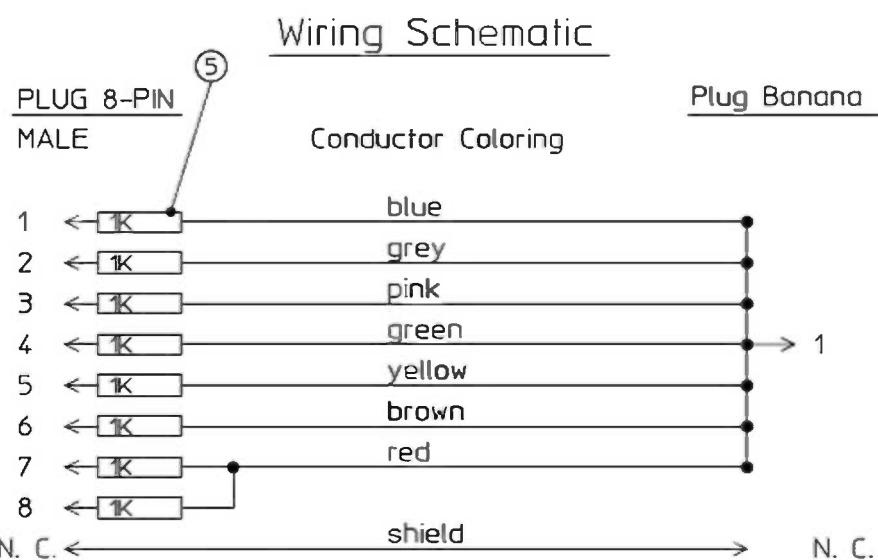
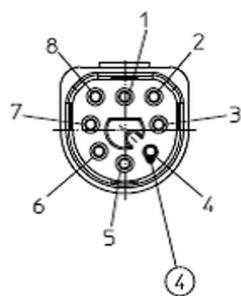
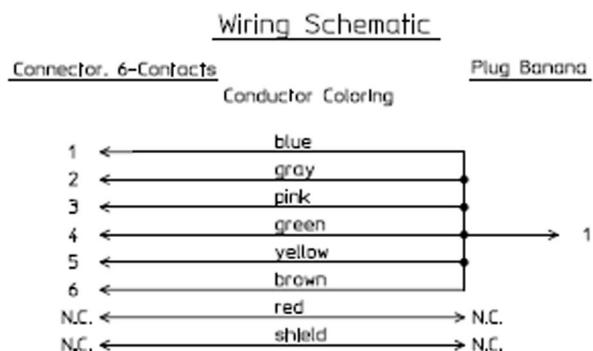
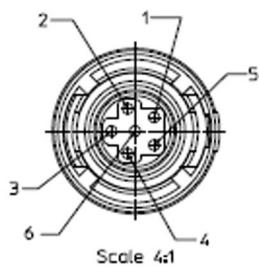
**NMT****IntelliBridge**

## EEG

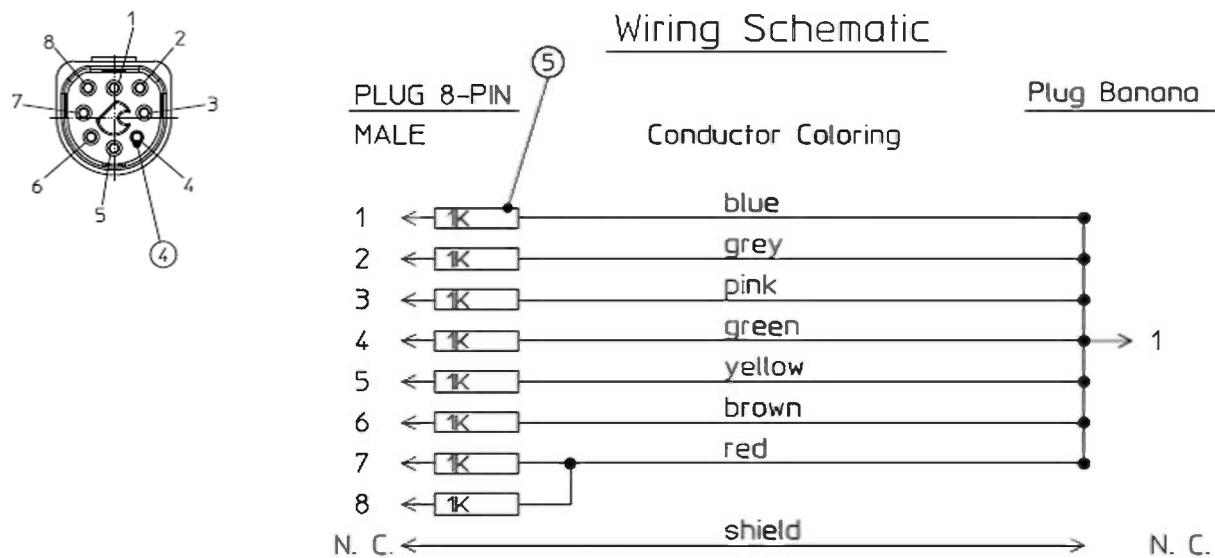


## ScVO<sub>2</sub> (M1011A)

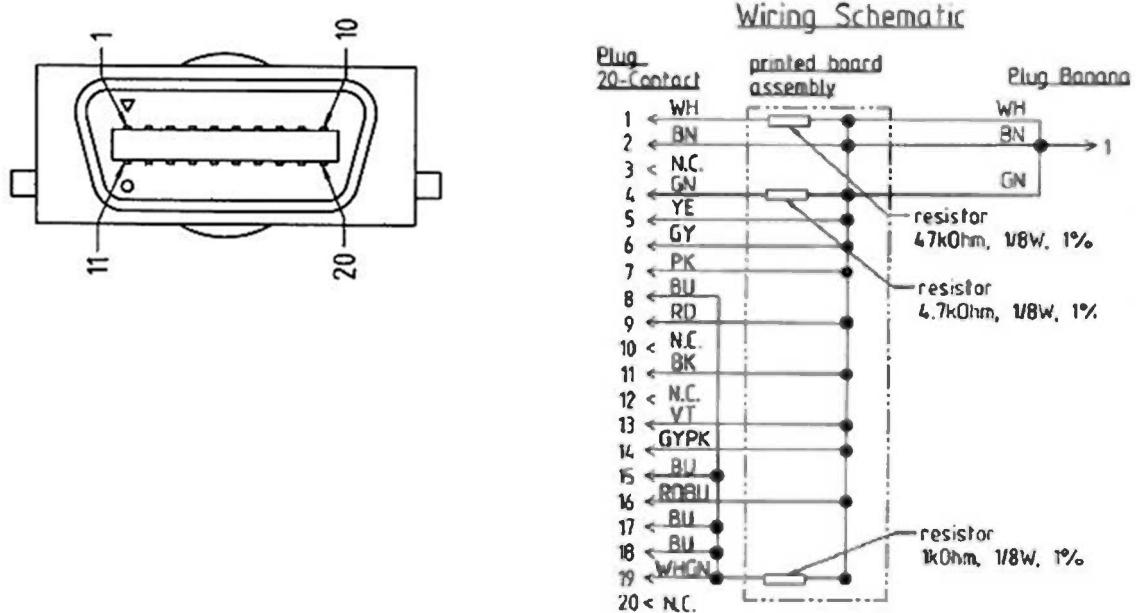


**MP5 Predictive Temperature****Tympanic Temperature**

MP5 TAAP



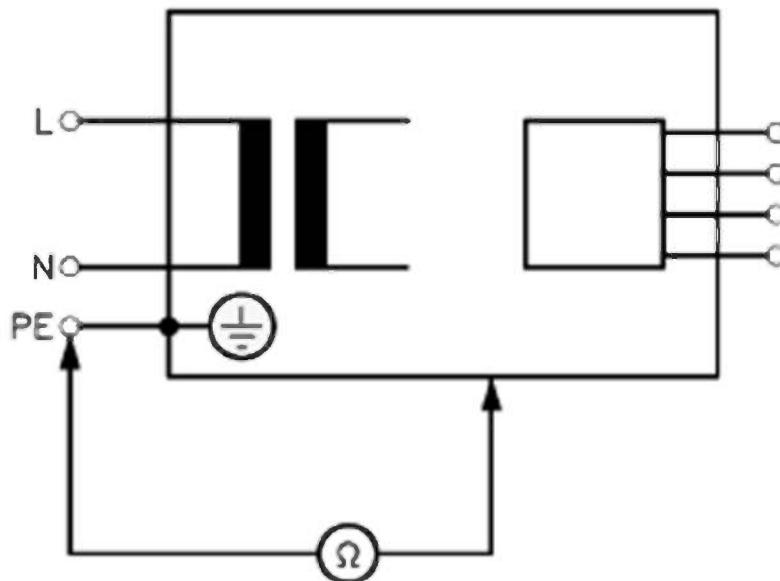
TcG10



## Electrical Safety Testing

### S(1): Protective Earth Resistance Test

Test to perform:



**Measuring circuit for the measurement of Protective Earth Resistance in medical electrical equipment that is disconnected from the supply mains.**

This measures the impedance of the Protective Earth (PE) terminal to all exposed metal parts of the Device under Test (DUT), which are for safety reasons connected to the Protective Earth (PE).

You can find metal parts of the device at the equipotential connector.

Measurements shall be performed using a measuring device capable to deliver a current of at least 200 mA into 500 mOhms with maximum open circuit voltage of 24V

This safety test is based on IEC/EN 62353.

Report the highest value (X1).

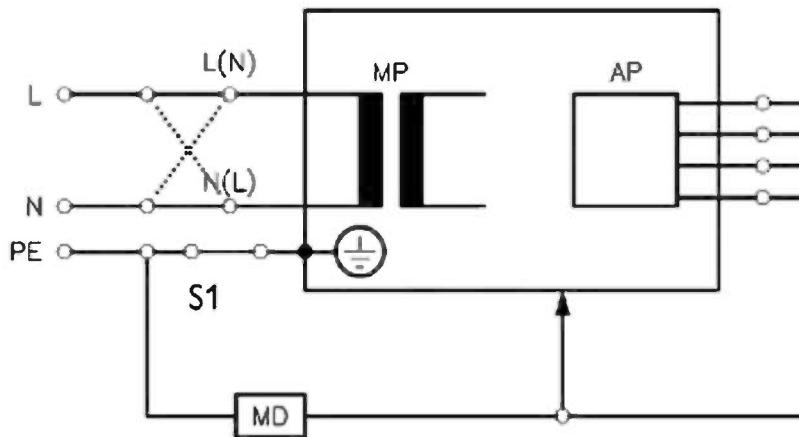
Test	Expected test results
Protective Earth Resistance Test (with mains cable)	X1 <= 300mOhms

#### NOTE

- If the protective earth resistance test fails, testing must be discontinued immediately and the device under test must be repaired or labeled as defective.
- All values for current and voltage are the root mean square (r.m.s.) values, unless otherwise stated.
- Flex the power cord during the protective earth resistance test to evaluate its integrity. If it does not pass the test, exchange the power cord. Then repeat the test. If it still does not pass, follow the instructions in the first bullet point of this note above.

#### S(2): Equipment Leakage Current Test - Normal Condition

Test to perform:



**Measuring circuit for the measurement of Equipment Leakage Current - Direct method according to IEC/EN 62353.**

This test measures leakage current of accessible conductive and non-conductive metal parts of the monitor and the functional earth leakage current. It tests normal and reversed polarity. Perform the test with S1 closed (Normal Condition).

There are no parts of the equipment that are not protectively earthed. Disconnect any data cables and any connections that may provide an extraneous earth path. Test the device under test (DUT) on an insulated surface. Do not touch the DUT during testing.

This safety test is based on IEC/EN 62353.

Report the highest value (X1).

Test	Expected test results
Equipment Leakage Current Test (Normal Condition - with mains cable)	X1 <= 100µA

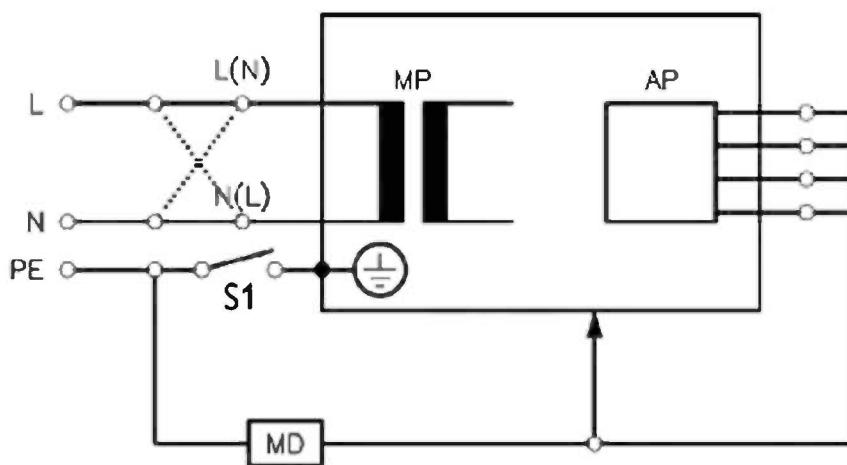
#### NOTE

All values for current and voltage are the root mean square (r.m.s.) values, unless otherwise stated.

In case of an IT-power system, this safety test measurement requires a special measuring circuit, for example with its own integrated TN-system or use of an external isolation transformer attached to the safety test device.

### S(3): Equipment Leakage Current Test - Single Fault Condition

Test to perform:



**Measuring circuit for the measurement of Equipment Leakage Current - Direct method according to IEC/EN 62353.**

This test measures leakage current of accessible conductive and non-conductive metal parts of the monitor and the functional earth leakage current. It tests normal and reversed polarity. Perform the test with S1 open (Single Fault Condition).

There are no parts of the equipment that are not protectively earthed. Disconnect any data cables and any connections that may provide an extraneous earth path. Test the device under test (DUT) on an insulated surface. Do not touch the DUT during testing.

This safety test is based on IEC/EN 62353.

Report the highest value (X2).

Test	Expected test results
Equipment Leakage Current Test (Single Fault Condition - with mains cable)	X2 <= 500µA

#### NOTE

All values for current and voltage are the root mean square (r.m.s.) values, unless otherwise stated.

In case of an IT-power system, this safety test measurement requires a special measuring circuit, for example with its own integrated TN-system or use of an external isolation transformer attached to the safety test device.

#### S(4): Applied Part Leakage Current - Mains on Applied Part

##### NOTE

During measurement of the Applied Part Leakage Current it is possible that the measured current can exceed the allowed limit (per IEC/EN 60601-1 or IEC/EN 62353).

This can occur during the applied leakage current measurement when the safety tester is connected to the (large red) invasive blood pressure and (small brown) temperature connectors at the same time.

The images below show four pairs of invasive blood pressure and temperature connectors. The leakage can occur between any individual invasive pressure connector and its associated temperature connector, NOT from pair to pair.

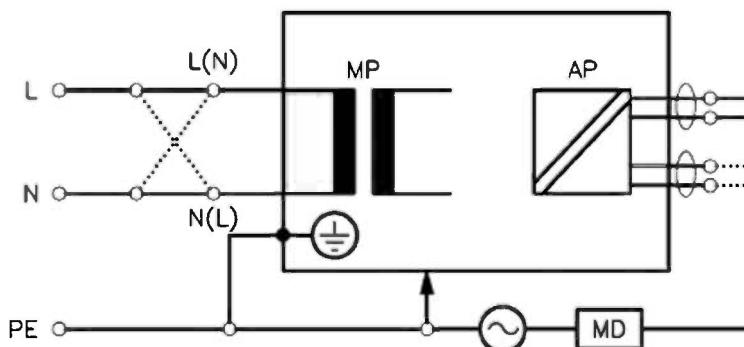
The connectors for the invasive blood pressure and temperature are independently functioning connectors.



Although there are individual connectors on the front end, internally those parameters use the same electrical insulation interface and are hardwired to each other. This results in an electrical short of those connectors during measurement if a test current is applied simultaneously. Therefore this should be avoided.

Due to the combined insulation interface, it is sufficient to connect to only one parameter interface (that is, Invasive Blood Pressure or Temperature) of the invasive blood pressure/temperature measurement block. This avoids a short and the potential of exceeding the limit for the current.

Test to perform:



**Measuring circuit for the measurement of Applied Part Leakage Current - Direct method according to IEC/EN 62353.**

This test measures applied part leakage current from applied part to earth caused by external main voltage on the applied part. Each polarity combination possible shall be tested. This test is applicable to each Applied Part tested and results recorded in turn with all other Applied Parts left floating. Applied Parts with multiple connections (e.g. ECG) are tested with the connections short-circuited.

There are no parts of the equipment that are not protectively earthed.

This safety test is based on IEC/EN 62353.

For measurement limits and test voltage, see Safety (4) test, Test and Inspection Matrix.

Report the highest value. (X1).

Test	Expected Test Results
Applied Part Leakage Current Test (Single Fault Condition - mains on applied part)	X1 <= 50µA (CF)

**NOTE**

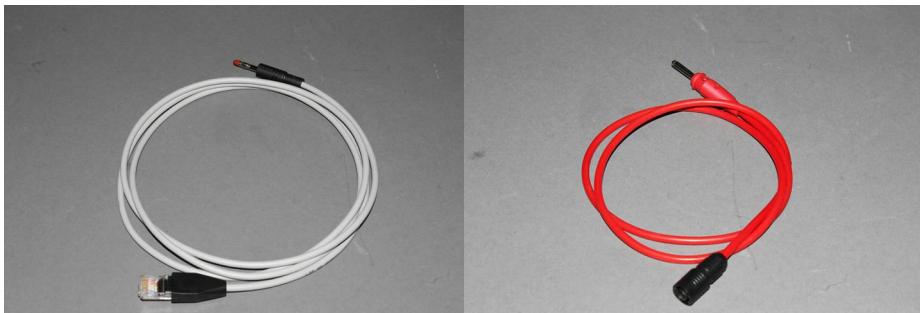
All values for current and voltage are the root mean square (r.m.s.) values, unless otherwise stated.

In case of an IT-power system, this safety test measurement requires a special measuring circuit, for example with its own integrated TN-system or use of an external isolation transformer attached to the safety test device.

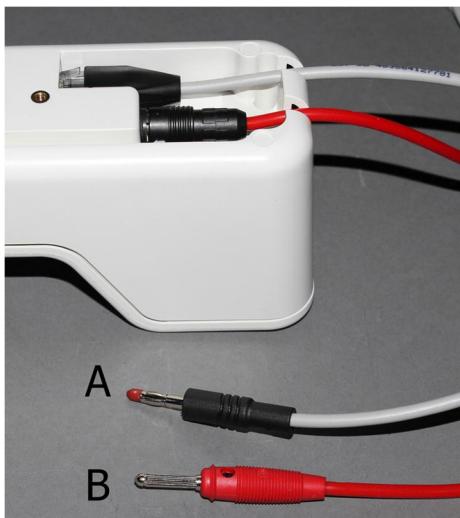
### 3 Testing and Maintenance

#### Applied Part Leakage Current - Mains on Applied Part for Tympanic Thermometer on Standalone Base Station

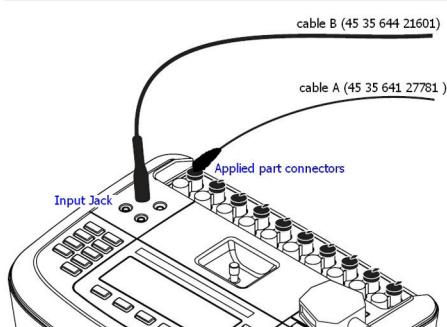
- 1 Remove the interface and the thermometer cable from the base station.
- 2 Insert the two safety test cables as shown below.



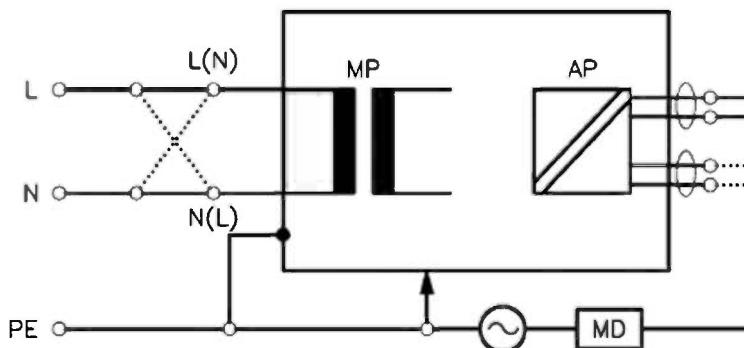
Cable A (IntelliBridge - 453564127781) and Cable B (Tympanic Temperature - 453564421601)



- 3 Connect to an appropriate safety tester (e.g. Fluke ESA 620) as shown below.



**4 Perform the test:**



**Measuring circuit for the measurement of Applied Part Leakage Current - Direct method according to IEC/EN 62353**

This test measures applied part leakage current from applied part to earth caused by external main voltage on the applied part. Each polarity combination possible shall be tested. There are no parts of the equipment that are not protectively earthed. This safety test is based on IEC/EN 62353. Report the highest value. (X1).

Test	Expected Test Results
Applied Part Leakage Current test (Single Fault Condition - mains on applied part)	X1 <= 5000 µA (BF)

**NOTE**

All values for current and voltage are the root mean square (r.m.s.) values, unless otherwise stated.

In case of an IT-power system, this safety test measurement requires a special measuring circuit, for example with its own integrated TN-system or use of an external isolation transformer attached to the safety test device.

**Reference: Allowable Values for IEC/EN 60601-1 and ANSI/AAMI ES60601-1 Measurements**

Protective Earth resistance (between the PROTECTIVE EARTH TERMINAL and any ACCESSIBLE METAL PART which is PROTECTIVELY EARTHED, w/o power cord): 100mOhms

Protective Earth resistance of power cord: 100mOhms

Enclosure leakage current: 100 µA (N.C.)

Enclosure leakage current: 500 µA (S.F.C)

Patient leakage current: 100 µA (N.C.) for BF

Patient leakage current: 500 µA (S.F.C.) for BF

Patient leakage current: 10 µA (N.C.) for CF

Patient leakage current: 50 µA (S.F.C.) for CF

All values for current and voltage are the root mean square (r.m.s.) values, unless otherwise stated.

## Insulation Resistance

Philips does not recommend performing measurements of the insulation resistance. For details for methods of the insulation resistance measurement, see IEC 62353.

## System Test

After mounting and setting up a system, perform system safety tests according to IEC/EN 60601-1.

### What is a Medical Electrical System?

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

- Devices forming a medical electrical system must comply with IEC/EN 60601-1+A1 Ed.3 clause 16.
- Any electrical device such as IT equipment that is connected to the medical electrical equipment must comply with IEC/EN 60601-1+A1 Ed.3 clause 16 and be tested accordingly.
- Non-medical electrical equipment may require connection through a separating device (e.g. an isolation transformer).

### General Requirements for a System

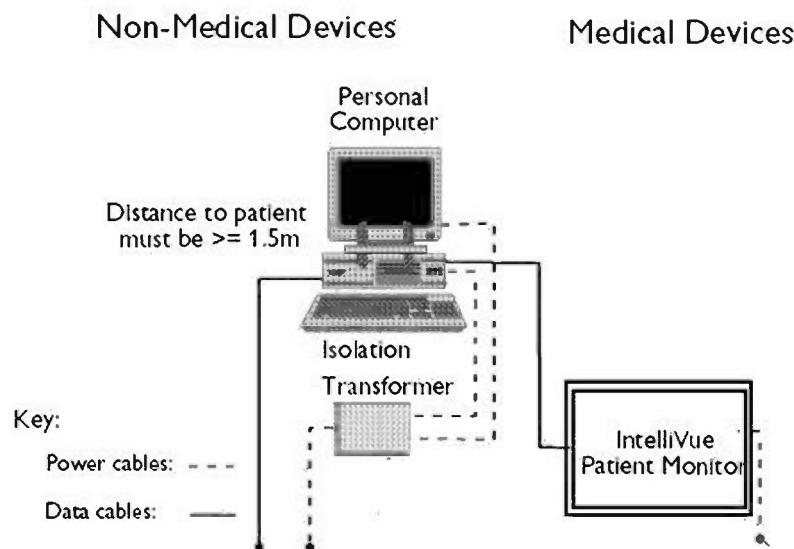
After installation or subsequent modification, a system must comply with the requirements of the system standard IEC/EN 60601-1+A1 Ed.3 clause 16. Compliance is checked by inspection, testing or analysis, as specified in the IEC/EN 60601-1+A1 Ed.3 clause 16 or in this book.

Medical electrical equipment must comply with the requirements of the general standard IEC/EN 60601-1, its relevant particular standards and specific national deviations. Non-medical electrical equipment shall comply with IEC safety standards that are relevant to that equipment.

Relevant standards for some non-medical electrical equipment may have limits for equipment leakage currents higher than required by the standard IEC/EN 60601-1+A1 Ed.3 clause 16. These higher limits are acceptable only outside the patient environment. It is essential to reduce equipment leakage currents to values specified in IEC/EN 60601-1 when non-medical electrical equipment is to be used within the patient environment.

## System Example

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



### WARNING

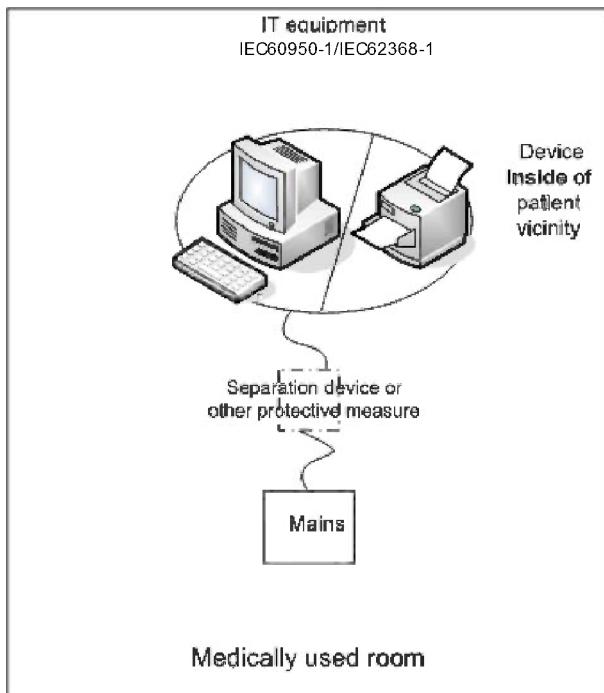
- Do not use additional AC mains extension cords or multiple socket-outlets. If a multiple socket-outlet is used, the resulting system must be compliant with IEC/EN 60601-1+A1 Ed.3 clause 16. Do not place multiple socket-outlets on the floor. Do not exceed the maximum permitted load for multiple socket-outlets used with the system. Do not plug additional multiple socket outlets or extension cords into multiple socket outlets or extension cords used within the medical electrical system.
- Do not connect any devices that are not supported as part of a system.
- Do not use a device in the patient vicinity if it does not comply with IEC 60601-1 edition 3 clause 16. The whole installation, including devices outside of the patient vicinity, must comply with IEC/EN 60601-1+A1 Ed.3 clause 16. Any non-medical device placed and operated in the patient's vicinity must be powered via a separating transformer (compliant with IEC/EN 60601-1+A1 Ed.3 clause 16) that ensures mechanical fixing of the power cords and covering of any unused power outlets.

## System Installation Requirements

- Ensure the medical electrical system is installed such that the user achieves optimal use.
- Ensure the user is informed about the required cleaning, adjustment, sterilization and disinfection procedures listed in the Instructions for Use.
- The medical electrical system must be installed such that the user is able to carry out the necessary cleaning, adjustment, sterilization and disinfection procedures listed in the Instructions for Use.
- Ensure the medical electrical system is installed such that an interruption and restoration of power to any part of the medical electrical system does not result in a safety hazard.
- Philips recommends using fixed mains socket outlets to power the medical system or parts thereof. Avoid using multiple socket-outlets.
- Any multiple socket outlets used must be compliant with IEC 60884-1 and IEC/EN 60601-1+A1 Ed.3 clause 16.
- Ensure any part of the system connected to multiple socket-outlets is only removable with a tool, that is, the multiple socket-outlet provides a locking mechanism to prevent power cords from being plugged or unplugged unintentionally. Otherwise, the multiple socket-outlet must be connected to a separation device. Multiple Socket Outlets used within the medical electrical system must only be used for powering medical electrical equipment which is part of the system.
- Ensure any functional connections between parts of the medical electrical system are isolated by a separation device according to IEC/EN 60601-1+A1 Ed.3 clause 16 to limit increased equipment leakage currents caused by current flow through the signal connections where necessary (for example, leakage current coming from non-medical electrical equipment into medical electrical equipment or building ground voltage differences providing leakage current through grounded data cables). This only works if the equipment leakage current of the respective medical electrical system parts is not exceeded under normal conditions. This isolation is especially important where the non-medical electrical equipment leakage currents can pass to the medical electrical equipment in the system or building ground voltage differences can pass to the medical electrical equipment via ground in a data cable connection in the system.
- Avoid increase of equipment leakage currents when non-medical electrical equipment within the medical electrical system is used. This only applies if/when the equipment leakage current of the respective medical electrical system parts is not exceeded under normal conditions. Use of an additional protective earth connection, separation device or additional non-conductive enclosures are options that can prevent a problem.
- Within the patient environment it is important to limit electrical potential differences between different parts of a system. If necessary, use potential equalization equipment (equipotential cable) or additional protective earth connections.
- Medical electrical equipment used in medical rooms must be connected to potential equalization equipment (equipotential cable) to avoid electrical potential differences. Check your local requirements for details.

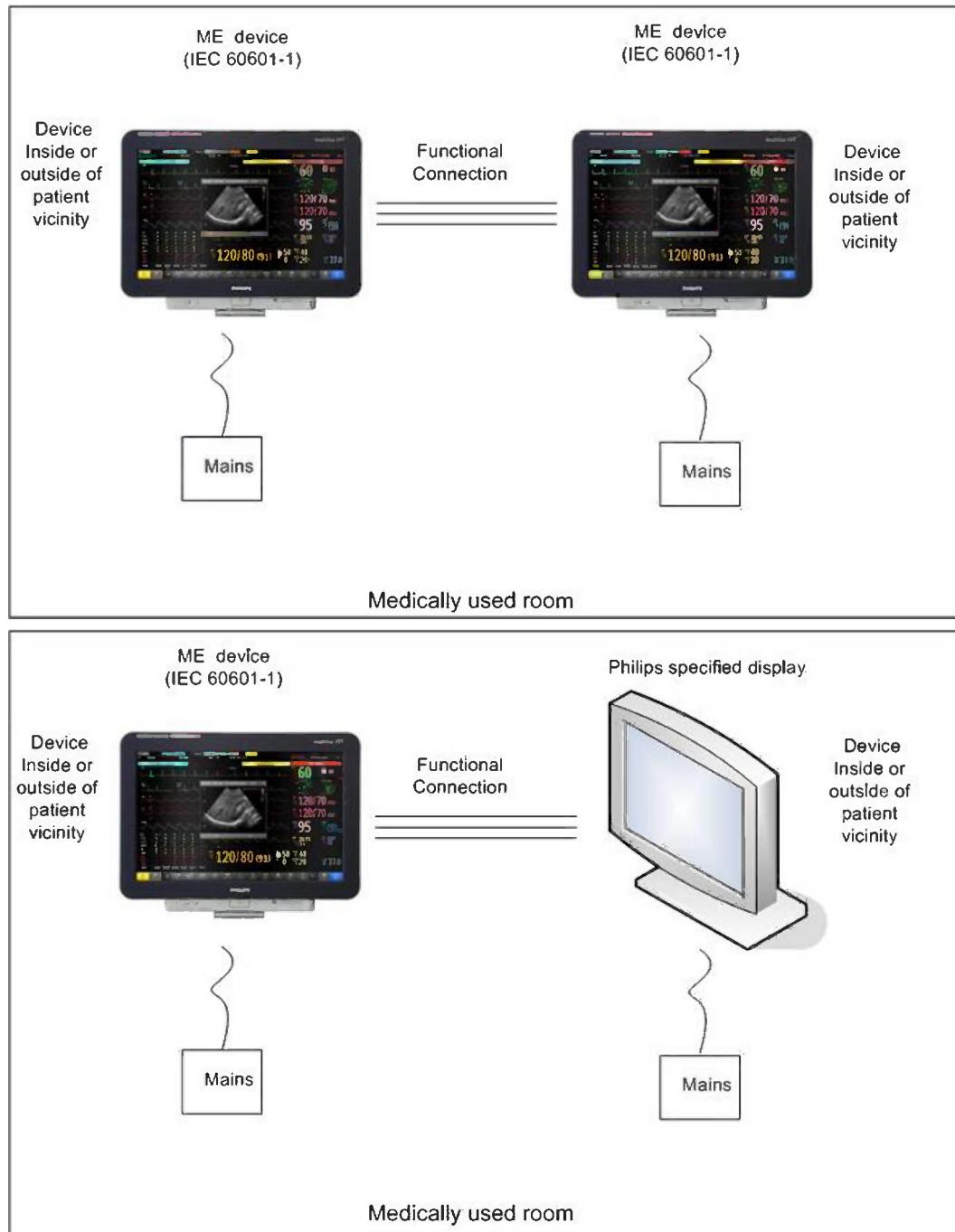
## Required Protective Measures at System Installation

For any IT equipment (IEC60950-1/IEC62368-1) operated in the patient environment ensure that the equipment leakage current does not exceed the limits described in IEC 60601-1. Use a separation device to ensure compliance. After installation of IT equipment in the patient environment, an equipment leakage current test is required.

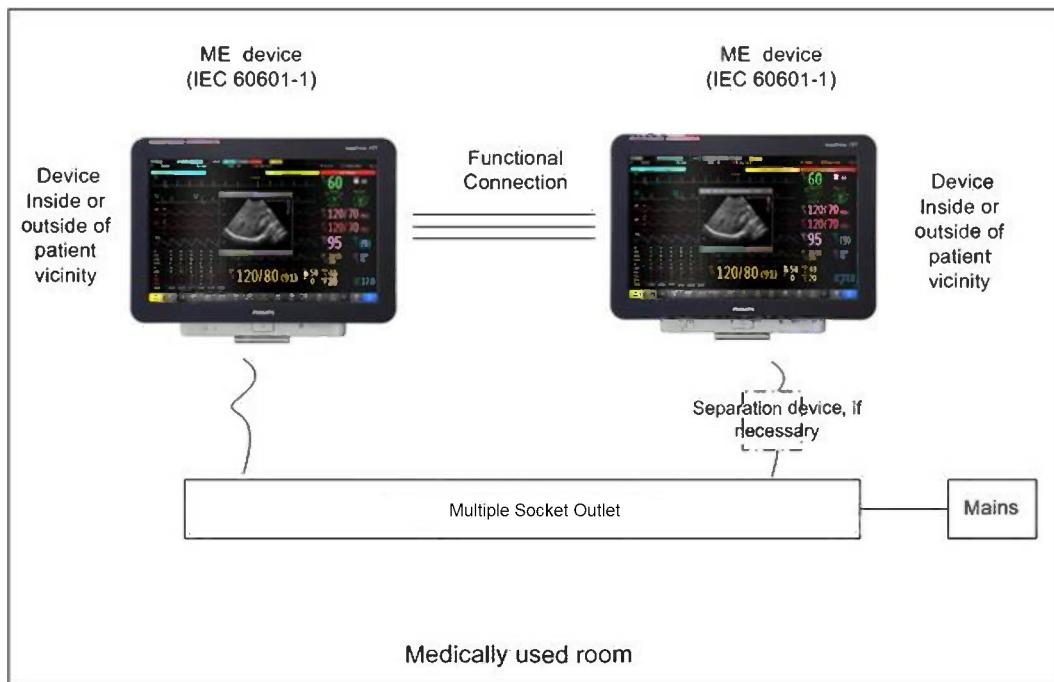


#### Case 1: Medical Device Combined with Medical Device

If you combine a medical device with another medical device (incl. Philips specified displays) to form a medical electrical system according to IEC/EN 60601-1 edition 3 clause 16, no additional protective measures are required. The medical electrical devices may be located in or outside the patient vicinity in a medically used room. This is valid as long as the medical devices are connected to separate mains outlets. No system test is required.

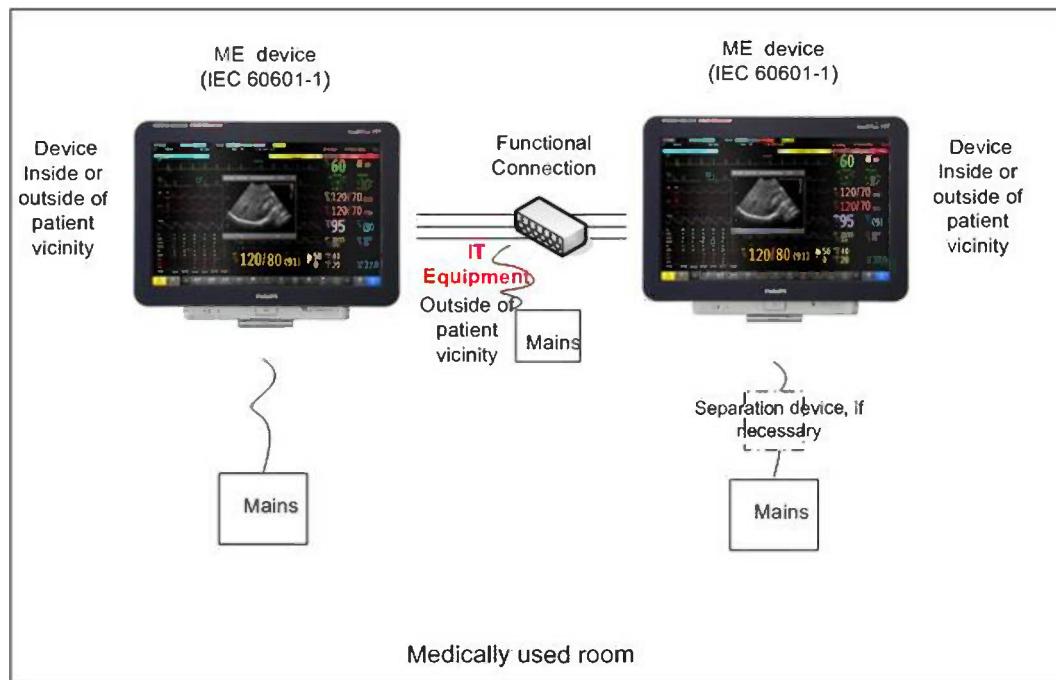


If the combined medical devices are connected to the same multiple socket outlet an enclosure leakage current test of the entire device combination on the multiple socket outlet is required to ensure that the resulting protective earth leakage current and equipment leakage current does not exceed the limits of IEC/EN 60601-1 edition 3 clause 16. Avoid using multiple portable socket outlets. The medical electrical devices may be located in or outside the patient vicinity in a medically used room. If the limits are exceeded, additional protective measures are required, e.g. a separation device or the connection of each device to separate mains.

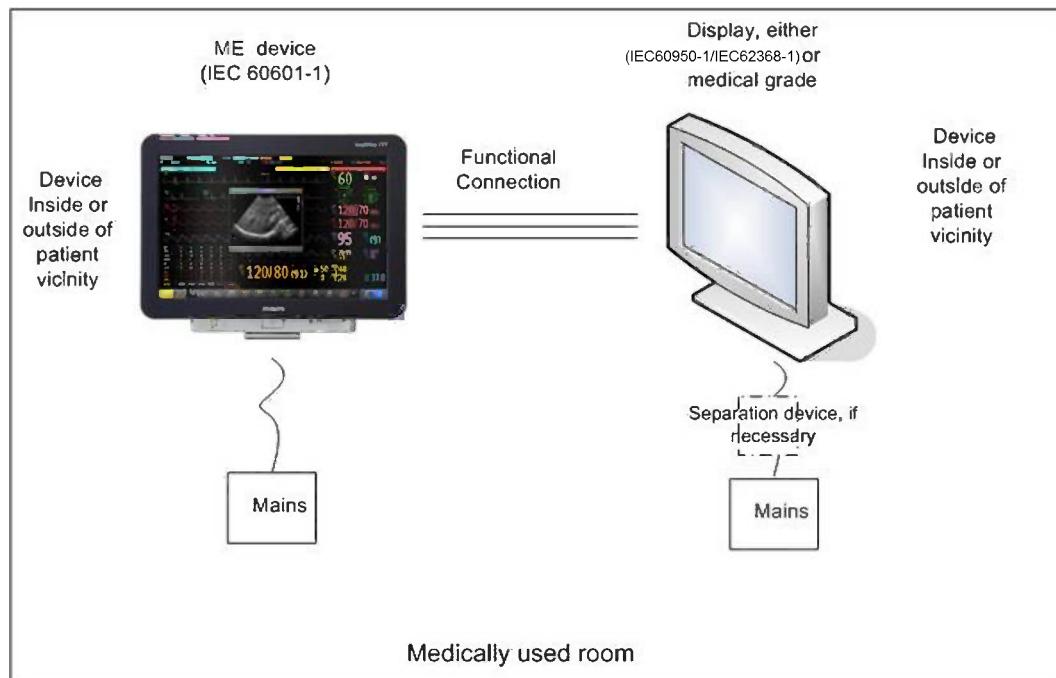
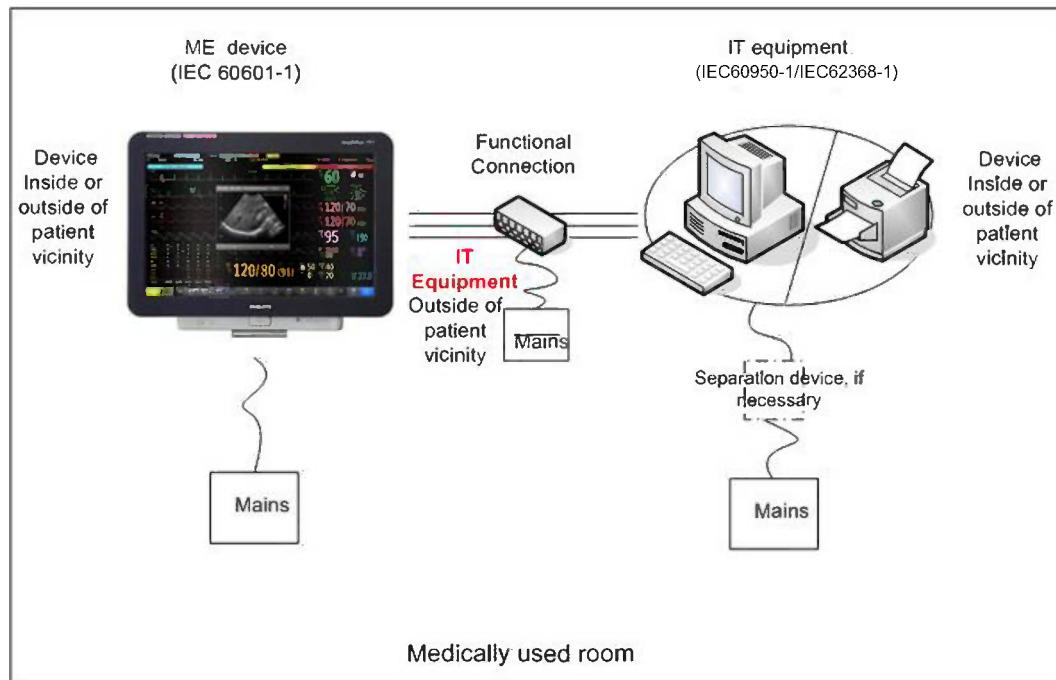


#### Case 2: Medical Device Combined with a Non-Medical Device

If you combine a medical device with a non-medical device to form a medical electrical system according to IEC/EN 60601-1+A1 Ed.3 clause 16, additional protective measures are required, e.g. usage of a separation device. The medical electrical devices or the IT equipment may be located in or outside the patient vicinity in a medically used room. After system installation incl. protective measures, a system test is required to ensure that the resulting equipment leakage current and applied part leakage current does not exceed the limits of IEC/EN 60601-1+A1 Ed.3 clause 16.

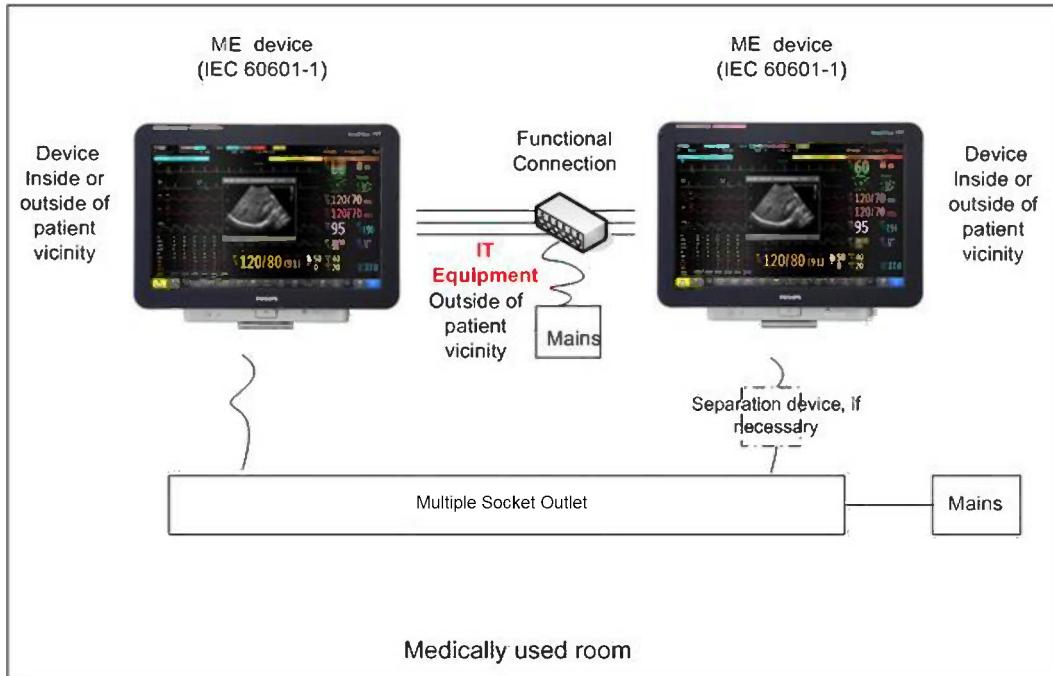


For any IT equipment (IEC60950-1/IEC62368-1) operated in patient vicinity ensure that the equipment leakage current does not exceed the limits described in IEC/EN 60601-1+A1 Ed.3 clause 16. Use a separation device to ensure compliance. After installation of IT equipment in patient vicinity, an equipment leakage current test is required.

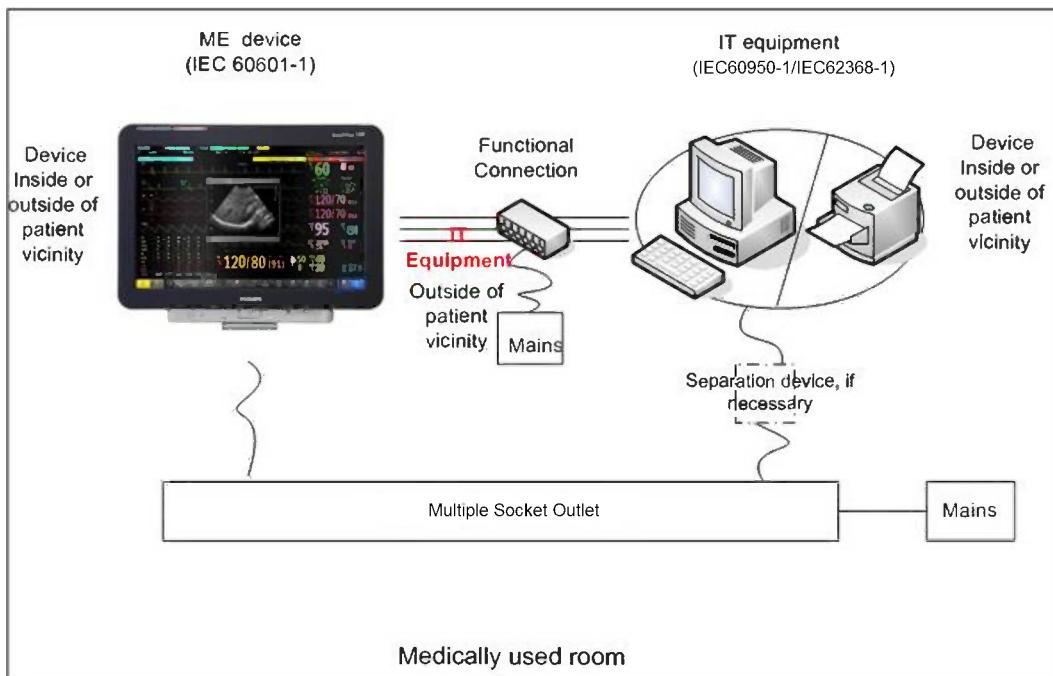


### 3 Testing and Maintenance

If the combined devices forming the medical electrical system are connected to the same multiple socket outlet, ensure that the resulting protective earth leakage current **and** equipment leakage current do not exceed the limits of IEC/EN 60601-1+A1 Ed.3 clause 16. The medical electrical devices or IT equipment may be located in or outside the patient vicinity in a medically used room. Avoid using multiple socket outlets. If the limits of IEC/EN 60601-1+A1 Ed.3 are exceeded, additional protective measures are required, e.g. a separation device or the connection of each device to separate mains.

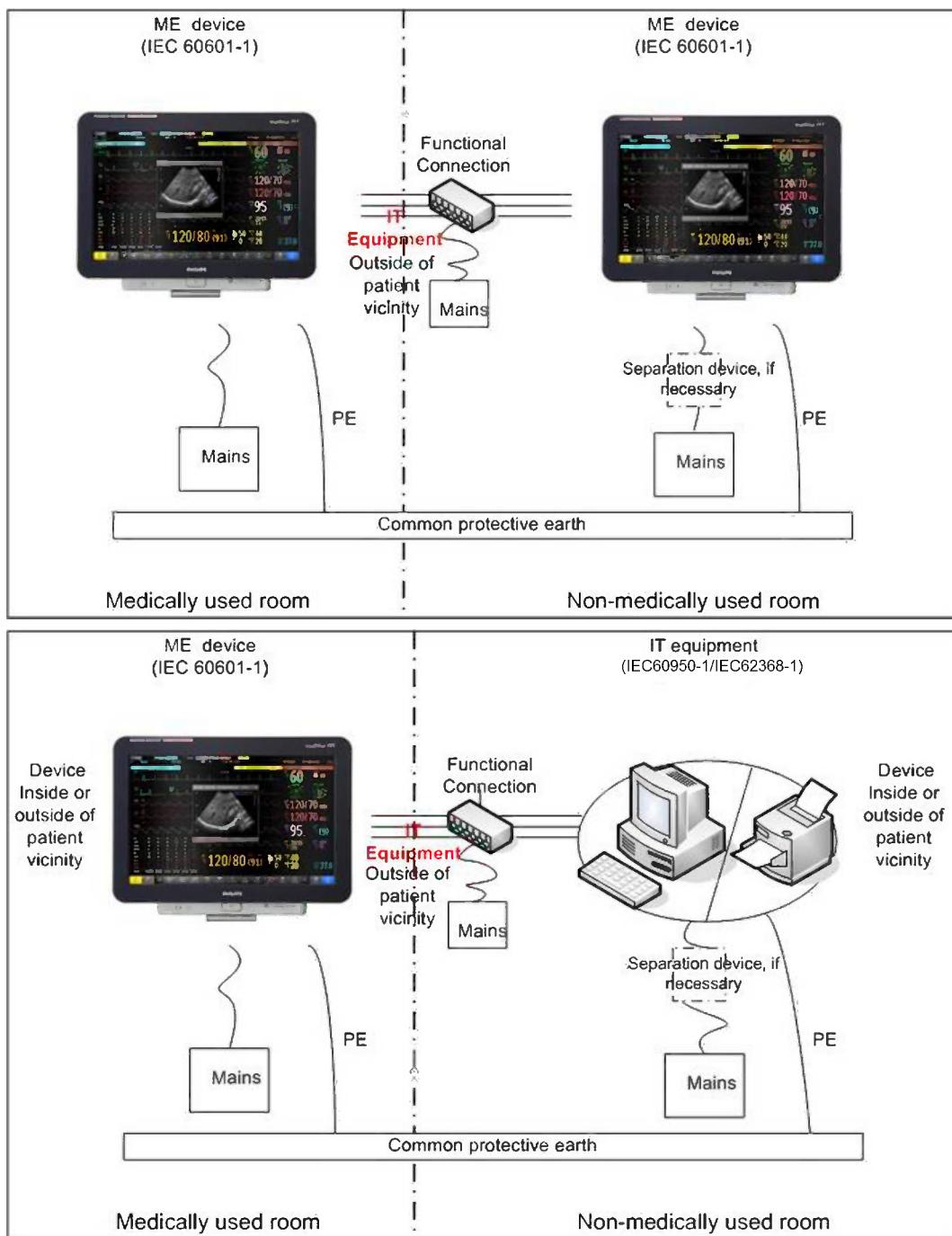


For any IT equipment (IEC60950-1/IEC62368-1) operated in patient vicinity ensure that the equipment leakage current does not exceed the limits described in IEC/EN 60601-1+A1 Ed.3 clause 16. Use a separation device to ensure compliance. After installation of IT equipment in patient vicinity, an equipment leakage current test is required.



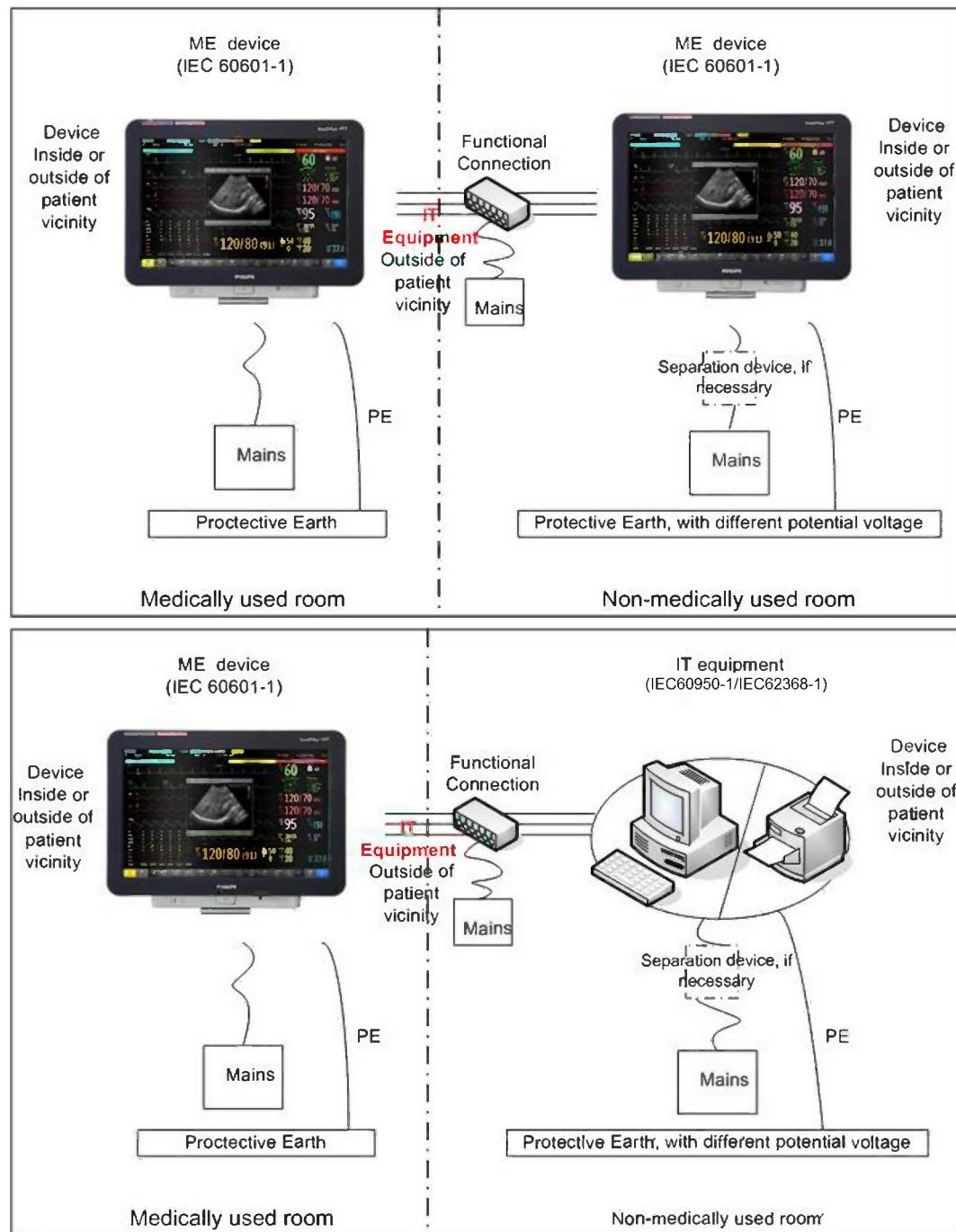
### Case 3: Medical Device Combined with a Medical or Non-Medical Device with one Device in a Non-Medically-Used Room

If you combine a medical device with a medical or non-medical device to form a medical electrical system according to IEC/EN 60601-1+A1 Ed.3 clause 16 using a common protective earth connection and one of the devices is located in a non-medically used room, additional protective measures are required, e.g. usage of a separation device or additional protective earth connection. The medical electrical devices or IT equipment may be located in or outside the patient vicinity. After system installation incl. protective measures, a system test is required to ensure that the resulting equipment leakage current does not exceed the limits of IEC/EN 60601-1+A1 Ed.3 clause 16.



### 3 Testing and Maintenance

If you combine a medical device with a medical or non-medical device to form a medical electrical system according to IEC/EN 60601-1+A1 Ed.3 clause 16 using two separate protective earth connections and one of the devices is located in a non-medically used room creating a potential voltage difference, additional protective measures are required, e.g. usage of a separation device or additional protective earth connection. The medical electrical devices or IT equipment may be located in or outside the patient vicinity. After system installation incl. protective measures, a system test is required to ensure that the resulting equipment leakage current does not exceed the limits of IEC/EN 60601-1+A1 Ed.3 clause 16.



## System Test Procedure

If the medical electrical device has already been tested as a standalone device for example, during factory safety testing, an equipment leakage current test must only be performed once the device is connected to another electrical device/system. If the individual equipment of the medical electrical system has not been tested as a standalone device, the devices have to be tested as of a standalone device (without connection to the system) and as part of the system (with connection to the system).

Connect the detachable power cord of the device under test to the safety analyzer's test mains port. Connect the enclosure test lead of the safety analyzer to the enclosure of the device under test as described in the "Equipment Leakage Test" section. See the documentation that accompanies the safety analyzer for further details on how to set up the test.

Test	Expected Test Results
Equipment Leakage Current Test (Normal Condition)	Sys1 <= 100µA
Equipment Leakage Current Test (Single Fault Condition)	Sys2 <= 500µA

After the testing of the device as a standalone device and as part of the system, ensure the resulting values (without connection and with connection to the system) do not differ by more than +/- 10%.

If the devices in the medical electrical system are connected to a multiple socket outlet, the resulting protective earth leakage current must be determined. All system components must be connected to the multiple socket outlet and be switched on during this measurement.

Test	Expected Test Results
Protective Earth Leakage Current of Multiple Socket Outlets	Sys3 <= 500µA

See the documentation accompanying the safety analyzer for further details on how to set up the test.

## **Preventive Maintenance Procedures**

### **Noninvasive Blood Pressure Measurement Calibration**

Carry out the noninvasive blood pressure measurement performance tests at least every two years , or as specified by local laws (whichever comes first).

### **Microstream CO<sub>2</sub> Calibration**

Carry out the Microstream CO<sub>2</sub> calibration once a year or after 4000 hours of continuous use and following any instrument repairs or the replacement of any instrument parts.

### **Tympanic Temperature Calibration**

To verify the performance of the Tympanic Thermometer:

- 1 Purchase a Covidien calibration device, part number 303097. See the Covidien web site for ordering information ([www.covidien.com](http://www.covidien.com)).
- 2 Follow the instructions provided with the calibration device to perform the test.

#### **NOTE**

The battery compartment in the Tympanic temperature probe is not functional.

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#### **CAUTION**

After performing the calibration, check the body reference site selection of the Tympanic Thermometer to ensure it matches the required settings for your hospital.

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## **G7m Preventive Maintenance Tasks**

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#### **WARNING**

Failure to implement a satisfactory maintenance schedule by the individual, hospital or institution responsible for the operation of this equipment may cause equipment failure and possible health hazards.

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#### **CAUTION**

Take precautions when dealing with potentially contaminated parts, such as tubing and other components of the patient circuit. Wear gloves, mask and gown when handling components that come into contact with the patient's exhalant gas or fluids.

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Here is a list of the PM (Preventive Maintenance) tasks required to ensure satisfactory operation of the gas analyzer within its specified limits and how often they must be performed.

- Check the fan filter for occlusions every six months
- Check the fan in the gas analyzer for proper operation every six months
- Check the gas analyzer's accuracy at least once every 12 months, or whenever the validity of the readings is in doubt
- Replace the fan filter once a year

## Replacing the Fan Filter

The fan filter should be replaced every 12 months.

- 1 Using a screw driver, carefully lift the fan filter out of the G7m housing.



- 2 Replace the fan filter and ensure it snaps into place.

## Performance Assurance Tests

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

If required, open the screen menu in the monitor info line at the top of the screen and select **Service** to access the service screen. This is required particularly for Anesthetic Gas Module testing procedures.

### Basic Performance Assurance Test

This section describes the basic performance test procedure. See for detailed information on when which test procedure is required.

#### Procedure:

Power on the monitoring system and go into demo mode. Ensure each connected parameter (module, Multi-Measurement Module, Gas Analyzer, IntelliBridge connected device) displays values.

### Full Performance Assurance Test

The following sections describe the full performance testing procedures, that is, detailed testing of each parameter with a patient simulator or specified tools. See the section for information on when which testing procedure is required.

### ECG/Resp Performance Test

This test checks the performance of the ECG and respiration measurements.

**Tools required:** Patient simulator.

#### ECG Performance

- 1 Connect the patient simulator to the ECG/Resp connector on the Multi-Measurement Module.
- 2 Configure the patient simulator as follows:
  - ECG sinus rhythm.
  - HR = 100 bpm or 120 bpm (depending on your patient simulator).
- 3 Check the displayed ECG wave and HR value against the simulator configuration.
- 4 The value should be 100 bpm or 120 bpm +/- 2 bpm.

### 3 Testing and Maintenance

#### Respiration Performance

- 1 Change the Patient Simulator configuration to:
  - Base impedance line 1500 Ohm.
  - Delta impedance 0.5 Ohm.
  - Respiration rate 40 rpm or 45 rpm.
- 2 The value should be 40 rpm +/- 2 rpm or 45 rpm +/- 2 rpm.

Test	Expected test results
ECG Performance Test	100 bpm +/- 2 bpm or 120 bpm +/- 2 bpm
Respiration Performance Test	40 rpm +/- 2 rpm or 45 rpm +/- 2 rpm

#### ECG Out Performance Test (not available via SRR)

This test checks the performance of ECG synchronization between the monitor and a defibrillator. It only needs to be performed when this feature is in use as a protocol at the customer site.

##### Tools Required:

- Defibrillator with ECG Input.
  - Patient simulator.
- 1 Connect the patient simulator to the ECG connector of the Multi-Measurement Module and the defibrillator to the ECG Output on the monitor with the ECG Sync cable.
  - 2 Set the patient simulator to the following configuration:
    - HR = 100 bpm or 120 bpm (depending on your patient simulator).
    - ECG sinus rhythm.
  - 3 Switch the defibrillator to simulation mode.
  - 4 Ensure the ECG signal is displayed.

Test	Expected Test Results
ECG Out Performance Test	ECG signal is displayed (pass/fail)

## SpO<sub>2</sub> Performance Test

This test checks the performance of the SpO<sub>2</sub> measurement.

### Procedure for Philips FAST SpO<sub>2</sub> Technology:

**Tools required:** none

- 1 Connect an adult SpO<sub>2</sub> transducer to the SpO<sub>2</sub> connector.
- 2 Measure the SpO<sub>2</sub> value on your finger (this assumes that you are healthy).
- 3 The value should be between 95% and 100%.

Test	Expected test results
SpO <sub>2</sub> Performance Test	between 95% and 100%

### Procedure for Nellcor OxiMax SpO<sub>2</sub> Technology:

Nellcor recommends that the functionality of this parameter be verified using the SRC-MAX.

A possible performance assurance check requiring no tools would be:

- 1 Connect an adult SpO<sub>2</sub> transducer to the SpO<sub>2</sub> connector.
- 2 Measure the SpO<sub>2</sub> value on your finger (this assumes that you are healthy).
- 3 The value should be between 95% and 100%.

Test	Expected test results
SpO <sub>2</sub> Performance Test	between 95% and 100%

### Procedure for Masimo SET SpO<sub>2</sub> Technology:

The end user may verify SpO<sub>2</sub> performance via commercially available SpO<sub>2</sub> simulators specifically designed to work with Masimo Pulse Oximeter technology. Optical simulators are recommended as they use the patient cable and sensor as part of the test setup. Additionally, a test that includes placing the sensor on a healthy subject and confirming the device reads a normal saturation and pulse rate and displays a clean pleth waveform (while the subject is still) may further increase the confidence that the device is functioning properly.

### Procedure for Masimo rainbow SET SpO<sub>2</sub> Technology:

**Tools required:** none

- 1 Connect an adult SpO<sub>2</sub> transducer to the SpO<sub>2</sub> connector.
- 2 Measure the SpO<sub>2</sub> value on your finger (this assumes that you are healthy).
- 3 The value should be between 95% and 100%.

Test	Expected test results
SpO <sub>2</sub> Performance Test	between 95% and 100%

In addition to the SpO<sub>2</sub> Performance Test procedure described above, the following tests are recommended when using Masimo rainbow SET technology after a field repair or if the performance of the Masimo rainbow SET measurement is in question.

### NOTE

The part numbers listed below are subject to change. All parts required for the tests described in this section must be ordered directly from Masimo.

### 3 Testing and Maintenance

#### **SET Tester and RRa Simulator:**

- 1 Connect a dual patient cable (Masimo part number 3503) to the board.
- 2 Connect a Masimo SET tester (Masimo part number 3776) to M15 side of the dual cable.
- 3 Connect one end of an RRa simulator cable (Masimo part number EQ-12070) to M6 side of the dual cable.
- 4 Connect the other end (3.5MM) of the RRa simulator cable (Masimo part number EQ-12070) to a laptop or PC which contains TR19673A\_Appendix\_A.wav wave file.
- 5 Play the wave file and set up the computer per instructions in R-EQ-12070 document.
- 6 Verify that all enabled parameters are within specified range.

#### **Sensor Port Test Tool:**

- 1 Connect a round connector sensor port test tool (Masimo part number 3494) to the board.
- 2 Confirm that each LED turns on one at a time and then all LEDs turn on.

#### **Shield Continuity:**

- 1 Connect a shield continuity test cable (Masimo part number 3854) to the board.
- 2 Using a multimeter, measure the resistance across the red and black banana plugs. Verify that the resistance is less than  $5\Omega$ .

## Measurement Validation

### NOTE

A functional tester cannot be used to assess the accuracy of a pulse oximeter monitor or sensor. It can, however, be used to demonstrate that a particular pulse oximeter monitor reproduces a calibration curve that has been independently demonstrated to fulfill a particular accuracy specification.

### Philips FAST SpO<sub>2</sub> Technology

The SpO<sub>2</sub> accuracy has been validated in human studies against arterial blood sample reference measured with a CO-oximeter. In a controlled desaturation study, healthy adult volunteers with saturation levels between 70% and 100% SaO<sub>2</sub> were studied. The population characteristics for those studies were:

- about 50% female and 50% male subjects
- age range: 19 to 39
- skin tone: from light to dark brown

Pulse rate accuracy has been validated with an electronic pulse simulator.

### Nellcor OxiMax SpO<sub>2</sub> Technology

Accuracy specifications are based on controlled hypoxia studies with healthy non-smoking adult volunteers over the specified saturation SpO<sub>2</sub> range(s). Pulse oximeter SpO<sub>2</sub> readings were compared to SaO<sub>2</sub> values of drawn blood samples measured by hemoxygometry. All accuracies are expressed as  $\pm$  "X" digits. Pulse oximeter equipment measurements are statistically distributed; about two-thirds of pulse oximeter measurements can be expected to fall in this accuracy (ARMS) range. Because scatter and bias of pulse oximeter SpO<sub>2</sub> and blood SaO<sub>2</sub> comparisons commonly increase as the saturation decreases, and accuracy specifications are calculated from data spanning the stated range, different accuracy values may result when describing partially overlapping ranges.

Subjects used to validate SpO<sub>2</sub> measurement accuracies were healthy and recruited from the local population. Comprised of both men and women, subjects spanned a range of skin pigmentations and ranged in age from 18-50 years old.

Oxygen saturation accuracy can be affected by certain environmental, equipment, and patient physiologic conditions (as discussed in the Instructions for Use for the monitor) that influence readings of SpO<sub>2</sub>, SaO<sub>2</sub>, or both. Accordingly, observations of clinical accuracy may not achieve the same levels as those obtained under controlled laboratory conditions.

Pulse rate accuracy has been validated with an electronic pulse simulator.

### Masimo SET SpO<sub>2</sub> Technology

The SpO<sub>2</sub> accuracy (except for LNOP Blue sensors) has been validated in human studies against arterial blood sample reference measured with a CO-oximeter. In a controlled desaturation study, healthy adult volunteers with saturation levels between 70% and 100% SpO<sub>2</sub> were studied.

The population characteristics for those studies were:

- healthy female subjects: 22 to 39 years of age; light to dark skin pigmentation
- healthy male subjects: 19 to 37 years of age; light to dark skin pigmentation

The LNOP Blue SpO<sub>2</sub> accuracy has been validated in human blood studies on neonatal, infant and pediatric patients with congenital cyanotic cardiac lesions in the range of 60%-100% SpO<sub>2</sub> against a laboratory CO-oximeter.

The population characteristics for those studies were:

- female patients: 5 days to 20 months of age; light and dark skin pigmentation
- male patients: 1 day to 13 months of age; light and dark skin pigmentation

Pulse rate accuracy has been validated with an electronic pulse simulator or ECG as reference.

For further information, see the Instructions for Use of the Device and Accessories.

### 3 Testing and Maintenance

#### Masimo rainbow SET SpO<sub>2</sub> Technology:

The Masimo rainbow SET Technology with the designated sensors has been validated by Masimo during motion and no motion conditions in human studies against an arterial blood sample reference measured with a CO-oximeter and an ECG monitor. Pulse oximeter measurements are statistically distributed, only about two-thirds of the measurements can be expected to fall within the specified accuracy compared to CO-oximeter measurements.

SpO<sub>2</sub>, SpCO, and SpMet accuracy was determined by testing on healthy adult volunteers in the range of 60-100% SpO<sub>2</sub>, 0-40% SpCO, and 0-15% SpMet against a laboratory CO-Oximeter. SpO<sub>2</sub> and SpMet accuracy was determined on 16 neonatal NICU patients ranging in age from 7-135 days old and weighing between 0.5-4.25 kg. Seventy-nine (79) data samples were collected over a range of 70-100% SaO<sub>2</sub> and 0.5-2.5% MetHb with a resultant accuracy of 2.9% SpO<sub>2</sub> and 0.9% SpMet.

The Masimo sensors have been validated for motion and no motion accuracy in human blood studies on healthy adult male and female volunteers with light to dark skin pigmentation in induced hypoxia studies in the range of 70-100% SpO<sub>2</sub> against a laboratory CO-oximeter and ECG monitor. This variation equals plus or minus one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.

Masimo SET technology with LNOP, LNCS, and M-LNCS sensors has been validated for motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies while performing rubbing and tapping motions, at 2 to 4 Hz at an amplitude of 1 to 2 cm and a non-repetitive motion between 1 to 5 Hz at an amplitude of 2 to 3 cm in induced hypoxia studies in the range of 70-100% SpO<sub>2</sub> against a laboratory co-oximeter and ECG monitor. This variation equals plus or minus one standard deviation, which encompasses 68% of the population

The Masimo SET Technology with LNOP Neo, LNCS Neo, and M-LNCS Neo sensors has also been validated for neonatal motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies while performing rubbing and tapping motions, at 2 to 4 Hz at an amplitude of 1 to 2 cm and a nonrepetitive motion between 1 to 5 Hz at an amplitude of 2 to 3 cm in induced hypoxia studies in the range of 70-100% SpO<sub>2</sub> against a laboratory CO-oximeter and ECG monitor.

The Masimo SET Technology has been validated for low perfusion accuracy in bench top testing against a Bioteck Index 2 simulator and Masimo's simulator with signal strengths of greater than 0.02% and transmission of greater than 5% for saturations ranging from 70 to 100%. This variation equals plus or minus one standard deviation which encompasses 68% of the population.

The Masimo sensors have been validated for pulse rate accuracy for the range of 25-240 bpm in bench top testing against a Bioteck Index 2 simulator. This variation equals plus or minus one standard deviation which encompasses 68% of the population.

SpHb accuracy has been validated on healthy adult male and female volunteers and on surgical patients with light to dark skin pigmentation in the range of 8-17 g/dl SpHb against a laboratory CO-oximeter. This variation equals plus or minus one standard deviation which encompasses 68% of the population. The SpHb accuracy has not been validated with motion or low perfusion.

For more details, see the sensor's directions for use (DfU).

#### NOTE

A functional tester cannot be used to assess the accuracy of the Masimo rainbow SET measurement or accessories.

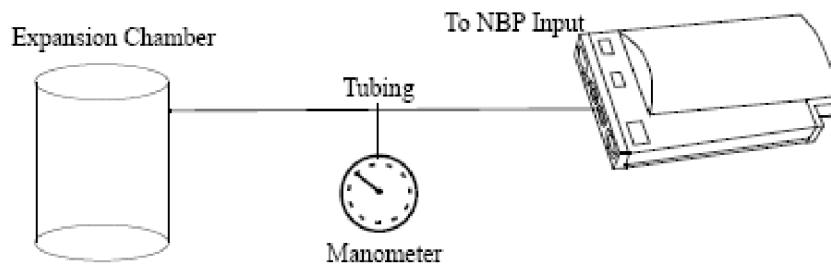
## NBP Performance Test

This section describes NBP test procedures. The monitor must be in service mode and the screen “Service A” must be selected to perform these tests. The NBP Performance Test consists of:

- NBP Accuracy Test
- NBP Leakage Test
- NBP Linearity Test
- Valve Test

### NBP Accuracy Test and Calibration

This test checks the performance of the non-invasive blood pressure measurement. Connect the equipment as shown:



Tools required:

- Reference manometer (includes hand pump and valve), accuracy +/- 0.8mmHg.
- Expansion chamber (volume 250 ml +/- 10%)
- Appropriate tubing.

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

- 1 Connect the manometer and the pump with tubing to the NBP connector on the Multi-Measurement Module and to the expansion chamber.
- 2 In service mode, select the **Setup NBP** menu.
- 3 Select **Close Valves: On**
- 4 Raise the pressure to 280 mmHg with the manometer pump.
- 5 Wait 10 seconds for the measurement to stabilize.
- 6 Compare the manometer values with the displayed values.
- 7 Document the value displayed by the monitor (**x1**).
- 8 If the difference between the manometer and displayed values is greater than 3 mmHg or if the NBP pump assembly has been exchanged, calibrate the Multi-Measurement Module. If not, proceed to the leakage test.
- 9 To calibrate the Multi-Measurement Module, select **Close Valves off** then **Calibrate NBP** and wait for the instrument to pump up the expansion chamber. Wait a few seconds after pumping stops until **EnterPrVal** is highlighted and then move the cursor to the value shown on the manometer. If one of the following prompt messages appears during this step, check whether there is leakage in the setup:
  - NBP unable to calibrate—cannot adjust pressure
  - NBP unable to calibrate—unstable signal
- 10 Press **Confirm**.

### 3 Testing and Maintenance

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

#### NBP Leakage Test

The NBP leakage test checks the integrity of the system and of the valve. It is required once every two years and when you repair the Multi-Measurement Module or X2/X3 or replace parts.

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

2 Watch the pressure value for 60 seconds.

3 Calculate and document the leakage test value ( $x_2$ ).

$$x_2 = P_1 - P_2$$

where  $P_1$  is the pressure at the beginning of the leakage test and  $P_2$  is the pressure displayed after 60 seconds.

The leakage test value should be less than 6 mmHg.

#### NOTE

The leakage test value of 6 mmHg applies for an expansion chamber of 250ml. When using a different size of expansion chamber, the expected test result must be adapted accordingly. For example, for an expansion chamber of 500ml, the leakage test value should be less than 3 mmHg. All other NBP performance tests are independent of the expansion chamber size.

#### NBP Linearity Test

1 Reduce the manometer pressure to 150 mmHg.

2 Wait 10 seconds for the measurement to stabilize.

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

4 Document the value displayed by the monitor ( $x_3$ )

5 If the difference is greater than 3 mmHg, calibrate the Multi-Measurement Module or X2/X3 (see steps 9 to 10 in the accuracy test procedure).

#### Valve Test

1 Raise the pressure again to 280 mmHg.

2 Select **Close valves: Off**.

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

4 Document the value displayed by the monitor ( $x_4$ ).

Test	Expected test results
Accuracy test	$x_1 = 280 \pm 3\text{mmHg}$ Difference $\leq 3\text{mmHg}$
Leakage test	$x_2 = \text{leakage test value}$ $x_2 < 6 \text{ mmHg}$ (with 250ml expansion chamber)
Linearity test	$x_3 = 150 \pm 3\text{mmHg}$ Difference $\leq 3\text{mmHg}$
Valve Test	$x_4 = \text{value} < 10 \text{ mmHg}$

## Invasive Pressure Performance Test

This test checks the performance of the invasive pressure measurement.

**Tools required:** Patient simulator, for dual pressure connectors: Philips Dual IBP Adapter (989803199741).

- 1 If you are testing on a dual pressure connector, connect the Dual IBP Adapter to the pressure connector. If you are testing on a single pressure connector, connect the patient simulator to the pressure connector and proceed to step 3.
- 2 Connect the patient simulator to the Dual IBP Adapter.
- 3 Set the patient simulator to 0 pressure.
- 4 Perform a zero calibration.
- 5 Configure the patient simulator as  $P(\text{static}) = 200 \text{ mmHg}$ .
- 6 Wait for the display.
- 7 The value should be  $200 \text{ mmHg} \pm 5 \text{ mmHg}$ . If the value is outside these tolerances, calibrate the Invasive Pressure measurement. If the measurement was calibrated with a dedicated reusable catheter, check the calibration together with this catheter.
- 8 If you are testing on a dual pressure connector, repeat the test for the second pressure connector.

Test	Expected Test Results
Invasive Pressure Performance Test	$200 \text{ mmHg} \pm 5 \text{ mmHg}$

## Temperature Performance Test

This test checks the performance of the temperature measurement.

Tools required: Patient simulator (with  $0.1^\circ\text{C}$  or  $0.2^\circ\text{F}$  tolerance).

- 1 Connect the patient simulator to the temperature connector.
- 2 Configure the patient simulator to  $40^\circ\text{C}$  or  $100^\circ\text{F}$ .
- 3 The value should be  $40^\circ\text{C} \pm 0.2^\circ\text{C}$  or  $100^\circ\text{F} \pm 0.4^\circ\text{F}$ .

Test	Expected test results
Temperature Performance Test	$40^\circ\text{C} \pm 0.2^\circ\text{C}$ or $100^\circ\text{F} \pm 0.4^\circ\text{F}$

## 867040/M3014A Capnography Extension Performance Tests

The procedures below describe the mainstream and sidestream  $\text{CO}_2$  performance tests for the 867040 and M3014A Capnography Extensions.

### 3 Testing and Maintenance

#### Mainstream CO<sub>2</sub> Accuracy Check

Tools Required:

- three airway adapters
- Verification Gas M2506A
- Gas cylinder regulator M2505A

You also need a local barometric pressure rating received from a reliable local source (airport, regional weather station or hospital weather station) which is located at the same altitude as the hospital.

**Procedure:**

- 1 Attach the M2501A CO<sub>2</sub> sensor to the patient monitor. Attach an airway adapter to the sensor. Ensure the sensor is disconnected from the patient circuit.
- 2 Switch on the patient monitor.
- 3 Enter the monitor's Service Mode.
- 4 Using the sensor status provided in the M2501A Serial protocol, wait for the M2501A sensor to warm up to its operating temperature.
- 5 The default setting for gas temperature is 22°C. If the gas temperature is significantly above or below this value, correct the gas temperature setting.
- 6 Zero the sensor on the airway adapter being used in this test. Ensure Zero Gas is set to Room Air
- 7 Attach a regulated flowing gas mixture of 5% CO<sub>2</sub>, balance N<sub>2</sub> to the airway adapter.
- 8 Set the gas correction to off.
- 9 Allow a few seconds for the gas mixture to stabilize and observe the CO<sub>2</sub> value. The expected value is 5% of the ambient pressure ±2mmHg

**NOTE**

Ensure you follow the above steps correctly. If the sensor fails this check it must be exchanged. The sensor cannot be calibrated.

**Example for an expected test result:**

The expected test result for an altitude of 0 m (sea level) at approximately 760 mmHg ambient pressure is:

Test	Expected test results (x1)	Acceptance Range
Mainstream CO <sub>2</sub> Accuracy Test	5% of 760 mmHg pressure ±2mmHg	36 mmHg - 40 mmHg

**NOTE**

The expected test results will differ depending on the conditions (i.e. altitude or ambient pressure).

## Sidestream CO<sub>2</sub> Accuracy Check

Tools Required:

- Cal gas flow regulator M2267A
- Cal tube 13907A
- Verification Gas M2506A
- Straight Sample Line M2776A

You also need a local barometric pressure rating received from a reliable local source (airport, regional weather station or hospital weather station) which is located at the same altitude as the hospital.

### Procedure:

- 1 Attach the M2741A CO<sub>2</sub> sensor to the patient monitor. Attach the sample line and the cal tube to the sensor. Ensure the sensor is disconnected from the patient circuit.
- 2 Switch on the patient monitor.
- 3 Enter the monitor's Service Mode.
- 4 Using the sensor status provided in the M2741A Serial protocol, wait for the M2741A sensor to warm up to its operating temperature.
- 5 Zero the sensor. Ensure Zero Gas is set to Room Air
- 6 Attach a regulated flowing gas mixture of 5% CO<sub>2</sub>, balance N<sub>2</sub> to the cal tube.
- 7 Set the gas correction to off.
- 8 Allow a few seconds for the gas mixture to stabilize and observe the CO<sub>2</sub> value. The expected value is 5% of the ambient pressure ±2mmHg

### NOTE

Ensure you follow the above steps correctly. If the sensor fails this check it must be exchanged. The sensor cannot be calibrated

### Example for an expected test result:

The expected test result for an altitude of 0 m (sea level) at approximately 760 mmHg ambient pressure is:

Test	Expected test results (x2)	Acceptance Range
Sidestream CO <sub>2</sub> Accuracy Test	5% of 760 mmHg pressure ±2mmHg	36 mmHg - 40 mmHg

### NOTE

The expected test results will differ depending on the conditions (i.e. altitude or ambient pressure).

### 3 Testing and Maintenance

#### Sidestream CO<sub>2</sub> Flow Check

Check the flow rate in the Sidestream CO<sub>2</sub> extension as follows:

- 1 Connect the flowmeter to the sample line
- 2 Check on the flowmeter the flow that the Sidestream CO<sub>2</sub> extension pump draws. It should be 50 ml/min ± 10 ml/min. If the value is not within tolerance check your setup again and perform another flow check. If it fails again, the sensor must be replaced. The sensor cannot be calibrated.

##### Example for an expected test result:

The expected test result for an altitude of 0 m (sea level) at approximately 760 mmHg ambient pressure is:

Test	Expected test results (x3)	Acceptance Range
Sidestream CO <sub>2</sub> Flow Check	50 ml/min ±10 ml/min	40 ml/min - 60 ml/min

##### NOTE

The expected test results will differ depending on the conditions (i.e. altitude or ambient pressure).

## Microstream CO<sub>2</sub> Performance Test

Allow five seconds between individual service procedures to ensure stable equipment conditions. When certain monitor procedures are running, service procedures are not possible and trying to start them will result in a message **Service Operation Failed** in the monitor's status line. Wait until the monitor completes the current operation, then restart the service procedure.

This test checks the performance of the Microstream CO<sub>2</sub> measurement. The Microstream CO<sub>2</sub> performance test is required once per year or after 4000 hours of continuous use and when the instrument is repaired or when parts are replaced.

This test uses calibration equipment that you can order (see the *Parts* section for the part number). The procedure is summarized in the following steps. See the documentation accompanying the equipment for detailed instructions.

Tools Required:

- Standard tools, such as screwdriver, tweezers
- Electronic flowmeter, M1026-60144 or Mass Flowmeter 453564178121
- Digital Barometer  $\pm 2\text{mbar}$  or better
- Gas calibration equipment:
- Cal 1 gas 15210-64010 (5% CO<sub>2</sub>)
- Cal 2 gas 15210-64020 (10% CO<sub>2</sub>)
- Cal gas flow regulator M2267A
- Cal tube 13907A
- Calibration Line M3015-47301
- Leakage Test Kit M1013-64002 (451261014851) (only required for leakage test without M1026-60144 Flowmeter)
- Flexible Connecting Tube

You also need a local barometric pressure rating received from a reliable local source (airport, regional weather station or hospital weather station) which is located at the same altitude as the hospital.

The CO<sub>2</sub> calibration for the Microstream extension consists of the following steps:

- Leakage check, **either** with M1026-60144 Flowmeter **or** with 453564178121 Mass Flowmeter\*
- Barometric pressure check and calibration, if required.\*
- Flow check and calibration, if required
- Noise check
- CO<sub>2</sub> Cal check and calibration, if required
- CO<sub>2</sub> Cal verification

Perform all checks in the same session.

\* Not applicable for all HW Revisions. See individual test sections for details.

### NOTE

The M3015A/B HW Rev C is indicated as HW Rev. Q.xx.xx in the IntelliVue Revision Screen.

### 3 Testing and Maintenance

#### Leakage Check with M1026-60144 Flowmeter (only for M3015A with HW Rev. A and B and Firmware Revision < P.01.32)

The leakage check consists of checking the tubing between:

- the pump outlet and the mCO<sub>2</sub> outlet and
- the pump inlet and calibration line inlet.

Check the user's guide of the flowmeter for details on how to make a correct flow reading.

##### Part 1

- 1 Go into service mode and select **Setup CO<sub>2</sub>** menu.
- 2 Connect a calibration line to the Microstream CO<sub>2</sub> input to start the pump running.
- 3 Check the ambient pressure and the cell pressure shown in the monitor's status line. The cell pressure should be approximately 20 mmHg lower than ambient pressure. (This test is only to check that the pump starts and is running, which is also indicated by the noise generated by the running pump.)
- 4 Connect the flowmeter outlet to the calibration line inlet using a flexible connecting tube.
- 5 Block the mCO<sub>2</sub> outlet using your fingertip and observe the flowmeter display. The value on the flowmeter (**x1**) should decrease to between 0 and 4 ml/min, accompanied by an audible increase in pump noise. If the value is within the tolerance limits, continue with part 2 of the leakage check.
- 6 If the value is outside the tolerance limits, there is a leakage between the pump outlet and the mCO<sub>2</sub> outlet.
- 7 Open the Measurement Extension or MP5 and check the tubing connections at the pump outlet and the extension gas outlet. If the connections are good, then there is a leakage in the tubing and you must exchange the Measurement Extension or the mCO<sub>2</sub> Assembly of the MP5 respectively.

##### Part 2

- 1 Disconnect the flowmeter from the Part 1 setup and connect the flowmeter inlet to the M3015A gas outlet or the MP5 mCO<sub>2</sub> gas outlet.
- 2 Leave the calibration line connected to the M3015A inlet or the MP5 mCO<sub>2</sub> inlet..
- 3 Block the inlet of the calibration line using your fingertip and observe the flowmeter display. The value on the flowmeter (**x2**) should decrease to between 0 and 4 ml/min, accompanied by an audible increase in pump noise. The cell pressure shown in the status line on the display should decrease to between 300 and 500 mmHg. Do not block the inlet for longer than 25 seconds as this will lead to an "Occlusion" INOP. If the value is within the tolerance limits, there are no leakages and the leakage check is completed.
- 4 If the value is not within the tolerance limits, there is a leakage between the calibration line inlet and the pump inlet.
- 5 Check the calibration line connections and open the M3015A or MP5 to check the tubing connections at the pump inlet and the M3015A or MP5 mCO<sub>2</sub> gas inlet. If the connections are good, try replacing the calibration line and repeating the leakage check. If the situation remains, there is a leakage in the tubing and the M3015A or the mCO<sub>2</sub> assembly of the MP5 must be exchanged.

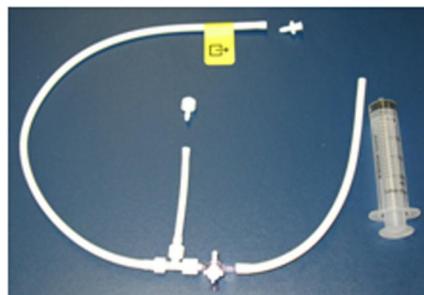
Test	Expected test results
Leakage Check Parts 1 and 2	<p><b>x1</b> = value of part 1 leakage check on flowmeter (<b>x1</b>&lt; 4.0 ml/min)</p> <p><b>x2</b> = value of part 2 leakage check on flowmeter (<b>x2</b>&lt; 4.0 ml/min)</p>

**Leakage Check for 867041, M3015B and M3015A with HW Rev C or M3015A with HW Rev. A/B without M1026-60144 Flowmeter****Preparation of Leakage Test Kit:**

Remove two Luer connectors from the Leakage Test Kit, as shown in the following picture.

**NOTE**

These Luer connectors are not required for the actual Leakage Check. However, you should keep them, as they are required for other tests (e.g. for the kit leak test as documented later in this section).

**Test Setup:**

- 1 Connect the Calibration Line (M3015-47301) to the inlet of the M8105A/867041/M3015A/B (the M8105A/M3015A/B must be switched off, either by disconnecting from the host monitor or by switching off the monitor).
- 2 Connect the leakage test tubing to the outlet of the M8105A/867041/M3015A/B, to the digital barometer, to the calibration line, and the (empty) syringe as shown below. Ensure all connections have a tight fit!



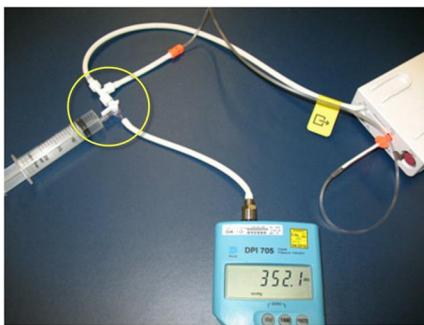
### 3 Testing and Maintenance

#### Test Procedure:

- 1 Open the 3-way stopcock for all three limbs.



- 2 Switch on the digital barometer (the digital barometer should now display the actual ambient pressure).
- 3 Now slowly draw at the syringe, as if filling the syringe, until the pressure (as displayed on the digital barometer) drops to approximately 350 mbar below ambient pressure. Then close the line to the syringe at the 3-way stopcock to syringe (circled in picture below).
- 4 Let the reading on the digital barometer stabilize for a moment and then perform the leakage check: for 30 seconds the change of the pressure reading should be less than 20 mbar.



- 5 If the leakage test is NOT passed, check all connections once more and repeat the test.

Test	Expected Test Results
Leakage Check	Reading on the digital barometer change is less than 20 mbar for 30 seconds (pass/fail)

#### NOTE

To ensure the integrity of the Leakage Test Kit (M1013-64002, 451261014851) the following Kit Leak Test Procedure must be performed:

- Form a loop with the leakage test kit as shown in the picture below.



- Connect the syringe to the 3-way stopcock and the digital barometer to the open tubing.
- Draw at the syringe until the digital barometer shows approximately 350 mbar below ambient pressure.
- Close the 3-way stopcock to the syringe and wait 5 - 10 seconds. In this time, the overall pressure should stabilize.
- After 1 minute, check the pressure. The pressure should not increase more than 8 mbar in 1 minute for the test to pass.
- If this test fails, exchange the leakage test kit.

## Flow Rate Check and Calibration

Check the flow rate in the M3015A/B Measurement Extensions or the MP5 as follows:

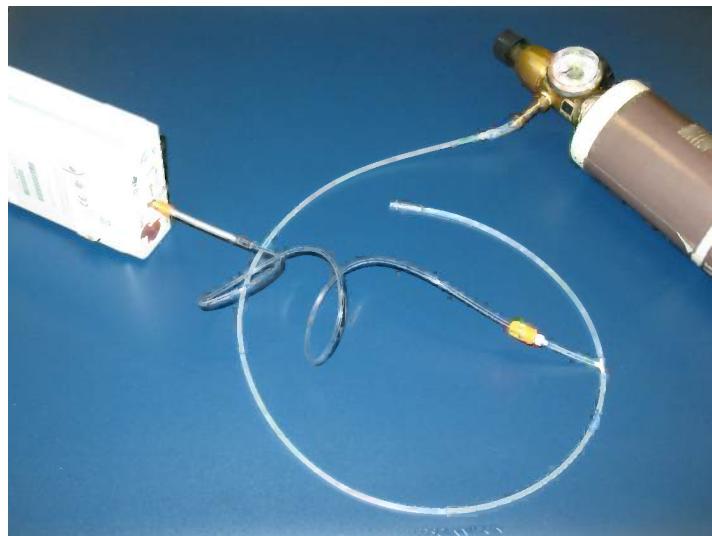
- Connect the calibration line to the mCO<sub>2</sub> inlet and the flowmeter outlet to the calibration line.
- Check on the flowmeter the flow that the M3015A/B Measurement Extension or MP5 mCO<sub>2</sub> pump draws (x5). It should be 50 +15/-7.5 ml/min. If the value is within tolerance, proceed to the CO<sub>2</sub> Gas calibration check.  
If the value is not within tolerance, calibrate as follows.
  - Adjust the flow in the instrument by selecting **Increase Flow** or **Decrease Flow** until it is as close as possible to 50 ml per minute as indicated on the flowmeter gauge.
  - When you are satisfied the flow is set as close as possible to 50 ml per minute, select **Store Flow** and confirm the setting. If you do not store the adjusted flow within 60 seconds of the adjustment, the old flow setting is restored.
  - If you cannot adjust the flow to within tolerance, replace the pump. If you still cannot make the flow adjustment, this indicates a fault in the measurement extension, which must be replaced.

Note that the pump can only be replaced on M3015A with the old hardware Rev. A (i.e. Serial No. DE020xxxx)

Test	Expected Test Results
Flow Rate Check	Flow rate is 50 +15/-7.5 ml/min

#### Noise Check

- 1 With the monitor in service mode, select **Setup CO<sub>2</sub>** menu.
- 2 Connect the calibration line, the cal tube, the flow regulator and the 5% calibration gas to the mCO<sub>2</sub> inlet.



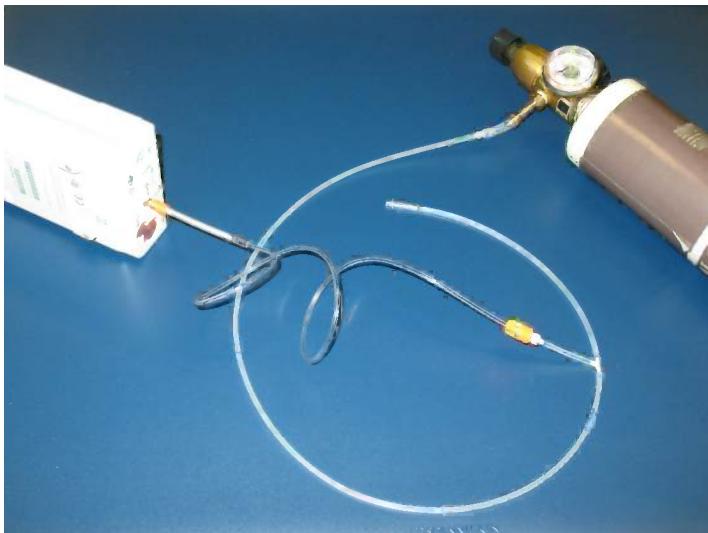
- 3 Open the valve to apply the 5% calibration gas and wait until the value is stable.
- 4 Check the noise index (**x6**) displayed next to the CO<sub>2</sub> value on the display (this indicates the level of noise on the CO<sub>2</sub> wave). If the value exceeds 3 mmHg, replace the measurement extension.

Test	Expected test results
Noise Check	<b>x6</b> = noise index displayed on monitor ( <b>x6&lt;3.0</b> )

## CO<sub>2</sub> Cal Check and Calibration

After switching the measurement extension on, wait at least 20 minutes before checking the calibration. Check the calibration of the CO<sub>2</sub> gas measurement as follows:

- 1 Connect the calibration line, the cal tube, the flow regulator and the 5% calibration gas to the mCO<sub>2</sub> inlet.



- 2 Calculate the expected measurement value in mmHg as follows:

$$0.05 \times (\text{ambient pressure}) = \text{value mmHg}$$

for example  $0.05 \times 736 = 36.8$  mmHg (with an ambient pressure of 736 mmHg)

- 3 Open the valve on the flow regulator to allow 5% CO<sub>2</sub> gas to flow into the extension. Allow the value to stabilize.

- 4 Check that the value on the instrument (measurement value on the main screen, **x7**) matches the calculated mmHg value  $\pm 2.6$  mmHg.

If the value is outside the tolerance, calibrate as described in step 8a to 8e below.

- 5 Disconnect the 5% calibration gas and connect the 10% calibration gas.

- 6 Calculate the expected measurement value and tolerance in mmHg as follows:

$$0.1 \times (\text{ambient pressure}) = \text{value mmHg}$$

$$\pm 0.07 \times (\text{value mmHg}) = \text{tolerance}$$

for example  $0.1 \times 737$  mmHg = 73.7 mmHg (with an ambient pressure of 737 mmHg)

$$\pm 0.07 \times 73.7 \text{ mmHg} = \pm 5.16 \text{ mmHg tolerance}$$

- 7 Open the valve on the flow regulator to allow 10% CO<sub>2</sub> gas to flow into the extension. Allow the value to stabilize.

- 8 Check that the value on the instrument (**x8**) matches the calculated mmHg value within the calculated tolerance. If so, the measurement extension is correctly calibrated.

If the value is outside the tolerance, calibrate as follows.

- a. Keep the same setup and connect the 5% calibration gas.

- b. Select **Cal. CO<sub>2</sub>**.

- c. Select the value for the calibration gas. (The default value is 5.0%).

- d. Open the valve on the calibration gas to allow CO<sub>2</sub> gas to flow into the extension. Allow the value to stabilize before the start of the calibration. Leave the valve open until the instrument gives a prompt that gas can be removed.

### 3 Testing and Maintenance

- e. The extension calibrates and prompts when calibration is successful.

Test	Expected test results
CO2 Cal Check	x7 = calculated mmHg value $\pm 2.6$ mmHg x8 = calculated mmHg value within calculated tolerance

#### Calibration Verification

- 1 Keep the same setup as described in “CO2 Cal Check and Calibration” on page 103.
- 2 Reopen the 5% gas valve and allow the value to stabilize.
- 3 Check that the value displayed on the monitor is correct within the tolerance (see step above).
- 4 Disconnect the 5% calibration gas and connect the 10% calibration gas.
- 5 Open the valve on the flow regulator to allow 10% CO2 gas to flow into the extension. Allow the value to stabilize.
- 6 Check that the value displayed on the monitor is correct within the tolerance (see step above).

If one or both values are not within tolerances, you must exchange the M3015A/B Measurement Extension or the MP5 mCO<sub>2</sub> Assembly.

Test	Expected Test Results
Leakage Check parts 1 and 2*	<b>x1</b> = value of part 1 leakage check on flowmeter ( <b>x1</b> < 4.0 ml/min)  <b>x2</b> = value of part 2 leakage check on flowmeter ( <b>x2</b> < 4.0 ml/min)
Leakage Check without Flowmeter	reading on the digital barometer change is less than 20 mbar for 30 seconds
Flow Check	<b>x3</b> = difference between measured value and 50.0 ml/min ( <b>x3</b> = 50+15/-7.5 ml/min)
Noise Check	<b>x4</b> = noise index displayed on monitor ( <b>x4</b> < 3.0)
CO <sub>2</sub> Gas Calibration Check	<b>x5</b> = difference between measured CO <sub>2</sub> value and calculated value, based on 5% CO <sub>2</sub> cal. gas. ( <b>x5</b> < 2.6 mmHg)
CO <sub>2</sub> Cal Verification	<b>x6</b> = difference between measured CO <sub>2</sub> value and calculated value, based on 10% CO <sub>2</sub> cal. gas. ( <b>x6</b> < $\pm \{0.07 \times \text{value calculated}\}$ )

\* M3015A HW Rev. B and FW Revision < P.01.32 only

#### Spirometry Performance Tests

These tests verify the performance accuracy of the M1014A Spirometry module.

#### Equipment Required

- Leak test kit (Part number: M1014-64100)
- calibrated barometer
- M2785A Pediatric/Adult Flow Sensor
- 500ml calibration syringe, Hans Rudolph model 5550 or equivalent

## Flow Test

- 1 Connect the M1014A Spirometry Module to the host monitor and go into service mode.
- 2 Connect the flow sensor to the module.
- 3 Connect the 500ml calibration syringe to the flow sensor. Ensure the syringe is set to the “empty” position.
- 4 Press the **Setup** key on the module and select **Show all Values** in the **Setup Spirometry** menu.
- 5 Pump the calibration syringe back and forth with a steady motion at a rate of 20 cycles and verify that the readings for TVexp and TVin are  $500 \pm 25$  ml.

If the readings are not within the specified range, try another flow sensor. Ensure that the syringe is calibrated correctly and that the procedure is performed exactly as described above. If the test fails again, replace the module.

Test	Expected test results
Flow Test	TVexp and TVin are $500 \pm 25$ ml

## Leakage Test

- 1 Connect the M1014A Spirometry Module to the host monitor and go into service mode.
- 2 Connect the leak test adapter to the module.
- 3 Press the **Setup** key on the module and then select **Show all Values** in the **Setup Spirometry** menu.
- 4 Press the Purge key on the module and start a purge cycle. At the end of the purge cycle, the values for Paw and Ppeak should both be above 100 cmH<sub>2</sub>O.
- 5 Verify that the pressure difference between Ppeak and Paw remains less than 10 cmH<sub>2</sub>O after 30 seconds.

If the readings are not within the specified range or if an INOP (e.g. SPIRO PURGE FAILED) is issued, check the leak test adapter for any leaks. Disconnect the adapter from the module and start the test procedure from the beginning. If the test fails again, replace the module.

Test	Expected Test Results
Leakage Test	Paw and Ppeak >100 cmH <sub>2</sub> O

### 3 Testing and Maintenance

#### Barometer Check

- 1 Connect the M1014A Spirometry Module to the host monitor and go into service mode.
- 2 Attach any airway adapter to the module.
- 3 Press the Setup key on the module and then select **Show all Values** in the **Setup Spirometry** menu.
- 4 Check that the barometric reading (PB) is within  $\pm 5$  mmHg of a reference barometer.
- 5 If the readings are not within the specified range, check the accuracy of the barometric pressure reference again. If the test fails again, replace the module.

Test	Expected test results
Barometer Check	PB is within $\pm 5$ mmHg of a reference barometer

#### NOTE

The built-in barometer cannot be recalibrated.

#### Cardiac Output (C.O.) Performance Test

These tests check the performance of the cardiac output measurement.

- 1 Connect the patient simulator to the C.O. module using the patient cable.
- 2 Configure the patient simulator as follows:  
Injection temperature: 2 °C  
Computation Const: 0.542  
(Edward's Catheter)  
Flow: 5 l/min
- 3 Check displayed value against the simulator configuration.
- 4 Expected test result: C.O. = 5  $\pm$  1 l/min.

Test	Expected test results
Cardiac Output Performance Test	C.O. = 5 $\pm$ 1 l/min

#### Service Tool Procedure, Version 1

This procedure applies for Service Tool M1012-61601 in combination with C.O. modules without option C10 and M3012A Measurement Extensions with option C05.

- 1 In monitoring mode, connect the C.O. interface cable to the module.
- 2 Connect one side of the service tool to the injectate receptacle of C.O. interface cable and the other side to catheter cable receptacle.
- 3 Enter the **C.O. Procedure** window and check the results. The expected test result is:

Tblood = 37.0°C  $\pm$  0.1°C

Test	Expected Test Results
Cardiac Output Service Tool Procedure Version 1	Tblood = 37.0°C $\pm$ 0.1°C

## Service Tool Procedure, Version 2

This procedure applies only for Service Tool M1012-61601 in combination with C.O. modules with option C10 and for the M3012A Measurement Extensions with option C10.

- 1 In monitoring mode, connect the C.O. interface cable to the module.
- 2 Connect one side of the service tool to the injectate receptacle of the C.O. interface cable and the other side to the catheter cable receptacle.
- 3 Enter **C.O. Procedure** window and check results for:
  - Method of measurement
  - Arterial Catheter constant
  - Tblood
 The expected results are:
  - Transpulmonary
  - 341
  - Tblood = 37.0°C +/- 0.1°C
- 4 Ensure the main alarms are switched on.
- 5 Disconnect the Catheter cable receptacle from the service tool
- 6 Enter the Setup C.O Window and change the method of measurement to “Right Heart”
- 7 Enter the C.O. Procedure window and check the Tinj value. The expected result is:  
 $Tinj = 0.0^\circ\text{C} +/- 0.1^\circ\text{C}$

Test	Expected Test Results
Cardiac Output Service Tool Procedure Version 2	$Tinj = 0.0^\circ\text{C} +/- 0.1^\circ\text{C}$

## BIS Performance Test

These tests check the performance of the BIS measurement.

### BIS Device Test

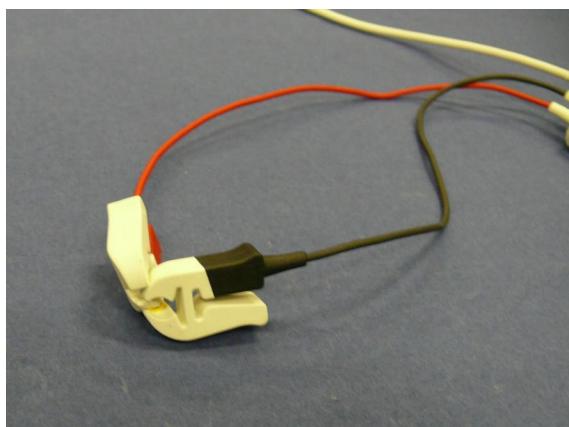
- 1 In monitoring mode connect the BIS sensor simulator (P/N: M1034-61650, 453563233731) (for maximum usage see the documentation delivered with the sensor simulator) to the patient interface cable.
- 2 Enter the BIS menu and select **Show Sensor**.
- 3 Start impedance check by pressing **StartCyclicCheck**. Check the displayed results. Expected results are:

Test	Expected test results
BIS Performance Test	Electrode 1 (+): 4-6 kΩ Electrode 2 (Ref): 8-17 kΩ Electrode 3 (1-): 2-4 kΩ Electrode 4 (2-): 3-5 kΩ

## NMT Performance Test

### NMT Stimulation Output Test

- 1 Short circuit the stimulation cables by connecting the two cable clamps to each other as shown below.

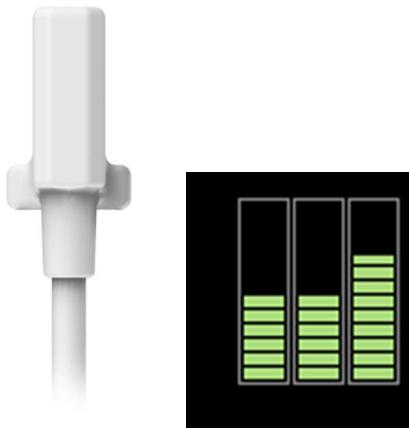


- 2 In service mode, select the **Setup NMT** menu.
- 3 Select **Start Test**.
- 4 Select **Confirm**.

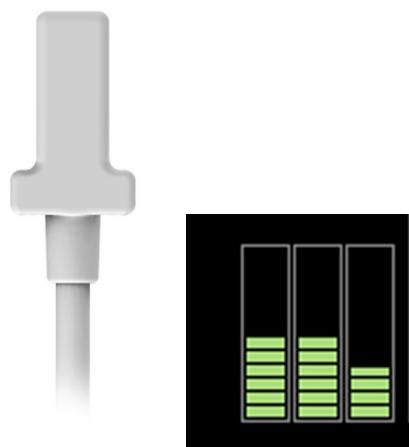
Test	Expected test results
NMT Stimulation Output Test	<b>NMT Stimulation Output Test passed</b> is displayed on the monitor.

## NMT Transducer Test

- 1 Go into Service Mode. In Service Mode the NMT Bar Graph only contains three bars instead of four.
- 2 Place the NMT Transducer on a flat surface with the flat side facing downwards. Two of the three bars in the NMT bar graph should be at the same level and the third one should be higher than the other two.



- 3 Turn the NMT Transducer 180° and place it on a flat surface with the flat side facing upwards. The bar that was higher than the other two before should now be lower than the other two by approximately the same amount.



Test	Expected Test Results
NMT Transducer Test	First two bars in the NMT bar graph are at the same level, third bar is higher when the flat side of the transducer is facing downwards and lower by the same amount when the transducer is facing upwards.

## G7m Performance Test

To ensure the gas analyzer operates within the specified limits, ensure it is checked every 12 months. If values outside the tolerance limits are identified, see the troubleshooting section and repeat all checks.

Whenever the readings are in doubt, perform a gas calibration check.

Service functions of the IntelliVue G7m are accessed with the 866173 Service Software (VISIA2 tool), available on the IntelliVue Documentation DVD shipped with the host monitor.

## Equipment Required

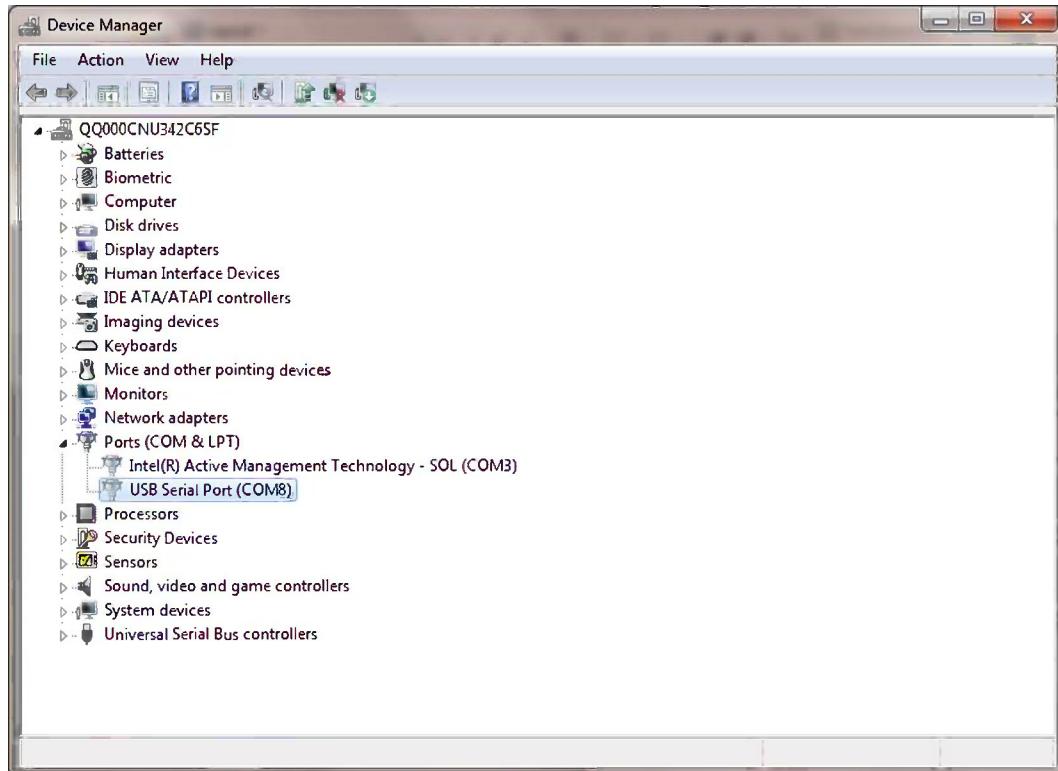
The following equipment is required for checking the gas analyzer. If applicable, part numbers are given in the parts list section of this manual.

Equipment	Philips Part No. or Other Recommendation	Accuracy
IntelliVue G1/G5 PC cable	M1013-61005/451261005001	n/a
Flowmeter TSI	4535 641 78121	±3 ml/min or better
Digital Barometer/ Pressure Indicator	Recommended: DRUCK DPI 705, 2 bar, absolute	±2 mbar or better
Philips Watertrap	989803191081 (Pack of 12)	n/a
Sample Tubing	M1658A/989803104671	n/a
Calibration Gas Reservoir Bag	M1659A/989803104681	n/a
Calibration Gas	M1662A/451261001391	n/a
Gas Exhaust Return Line or Exhaust Tubing	M1655B/989803145671 or M1015-40001/453563227921	n/a
Leakage Test Kit	M1013-64002/451261014851	n/a

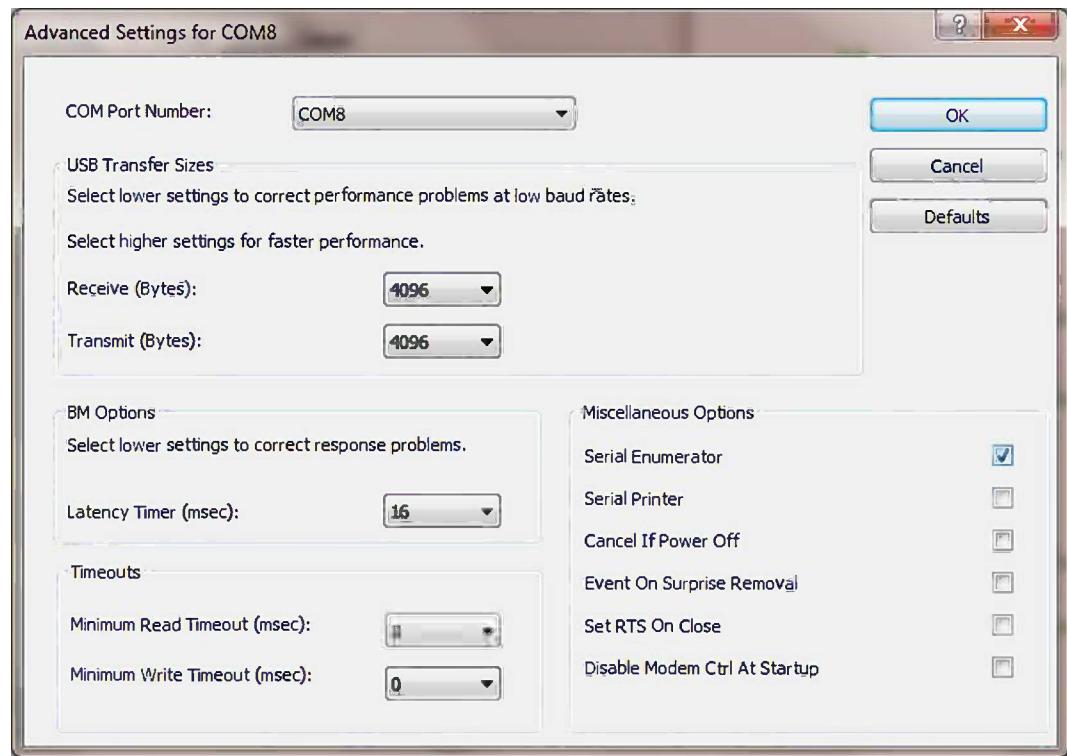
### NOTE

If your PC/Laptop does not have an RS232 serial connector, you can use a USB-to-Serial adapter. To check the USB Serial Port Settings:

- 1 Go to **Control Panel -> System and Security -> Hardware and Sounds -> Device Manager** and select the USB Serial Port (only available when a USB adapter is attached).



- 2 Right-click the USB Serial Port, click **Properties**, select the Port Settings Tab and click **Advanced**.



#### Annual Checks

Perform the following procedure once a year

- 1 Connect a PC/Laptop running the Service Software (VISIA2 tool) to the instrument. Ensure zero mode is switched to Auto - see *Zero Calibration*.
- 2 Ensure there are no reported errors.
- 3 Perform the following checks:
  - a. Visual Check
  - b. Gas Accuracy Check
  - c. Leak Check
  - d. Flow Rate Check
  - e. Pressure Sensor Test

#### Connecting the Gas Analyzer to a PC/Laptop

To set up a computer as a service host for the gas analyzer, a serial connection must be established with the PC cable (451261005001). Connect the RJ45 connector of the cable to the appropriate receptacle on the side of the gas analyzer, and then connect the D-SUB9 connector of the cable to the serial port of your computer.

Go into service mode on the IntelliVue monitor and then start the VISIA2 software on your computer.



RJ45 connection on side of gas analyzer

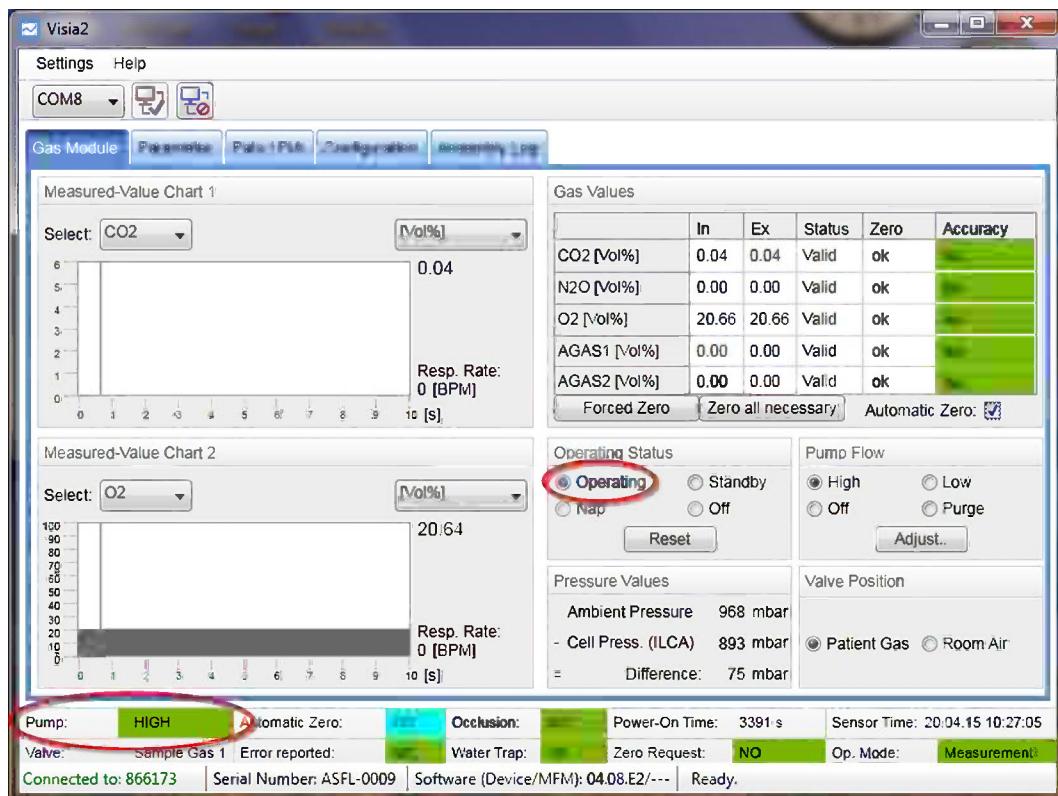
## Getting started with VISIA2 software

### NOTE

- After each use of the VISIA2 tool, the host monitor must be switched off and back on again before being used for patient monitoring.
- The Parameter and Pato/PIA tabs in the VISIA2 tool are not used.

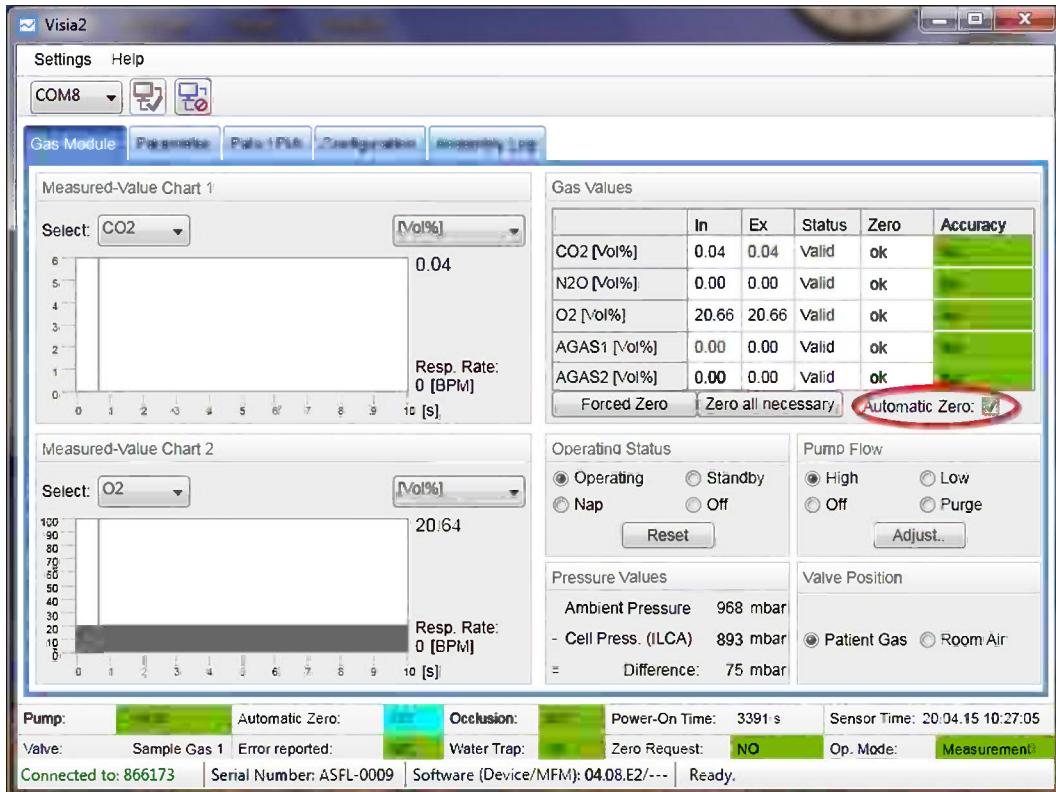
When the VISIA2 tool starts up, the connection should be established automatically, if not, push the  button.

In order to keep the gas analyzer running, ensure the Pump Flow Level is set to **High** and Operating Status to **Operating** (default setting after startup of gas analyzer).



#### Zero Calibration

The IntelliVue G7m requires a periodic zero calibration. Whenever this is due, the instrument sends a zero request command to the host monitor. The Philips patient monitor automatically initiates a zero calibration whenever it receives such a request from the gas analyzer - if you want the VISIA2 tool to do the same, you have to switch the zero mode from Manual to Auto.



Zero requests occur 30 minutes after power on. In a steady state, a normal zero is performed not more than every 24 hours.

#### Zero Calibration Test

Test Procedure:

- Press the **Zero all Necessary** button.

Expected Result: All fields in the **Accuracy** column of the Gas Values table are green and read **Iso**.

If this test fails, check the water trap and sample tubing for occlusions, perform a Leak Check and a Flow Rate Check and rerun the Zero Calibration Test. If it fails again, replace the gas analyzer.

If a Zero Calibration fails in Monitoring Mode, check the monitor's altitude setting.

#### Leak Check

This test ensures the integrity of the pneumatics system, which has a big impact on the quality of the measured values. Ensure the leak check is passed before checking the measurement accuracy.

#### NOTE

Always use a new water trap and new sample tubing to perform a leak check.

## Equipment Required

- M1655B Gas Exhaust Return Line or
- M1015-40001 Exhaust Tubing to measure the flow at the gas analyzer outlet
- 453564178121 Flowmeter TSI
- Watertrap - 989803191081 (pack of 12)
- M1658A Sample Tubing
- M1013-64002 Leakage Test Kit
- Digital Pressure Indicator

## Leak Check Procedure

- 1 Set pump flow to off.
- 2 Ensure the valve setting is set to patient (default setting after startup of gas analyzer).
- 3 Connect digital pressure indicator and the leakage test kit. See the *Instructions for Use* supplied with the leakage test kit for details (M1013-9302B).
- 4 Follow the leakage test kit IfU to apply low pressure and wait until you have a pressure of 200 mbar below ambient.
- 5 Wait until the low pressure has stabilized.

### Expected Result:

After 1 minute, check the pressure. The pressure should not increase more than 80 mbar in 1 minute for the test to pass.

If this test fails, ensure there are no leaks in the setup and rerun the test. If it still fails, the gas analyzer has an internal leakage and requires replacing.

## Pressure Sensor Test

- Trigger a zero procedure (all necessary parameters) via the service host, watch its progress and wait until it is finished (zero successful).
- Measure ambient pressure with independent digital barometer.
- Compare the ambient pressure measured with the digital barometer with the ambient pressure measured by IntelliVue G7m as shown by the VISIA2 tool.
- Expected result: The deviation between the two measured values is < 10 mbar.

Test	Expected test results
Pressure Sensor Test	Deviation between the two measured values is < 10 mbar

## Flow Rate Check

### WARNING

For this check, always measure the gas analyzer flow rate at the sample gas inlet. Measuring at the outlet may lead to incorrect flow readings due to ripple on the gas flow.

Test Procedure:

- Connect sample line to the watertrap
- Connect a flowmeter to the sample line

Expected Result: Sampling rate is  $200 \pm 20$  ml/min

### NOTE

During warm up or zero the flow rate may be higher than 200 ml/min. Wait until the flow stabilizes.

If the pump flow is out of the specified limits (e.g. 225 ml/min), adjust it as described in "Flow Rate Adjustment". A pump flow of, for example, 215 ml/min is **not** out of range and does not require a Flow Rate Adjustment.

Test	Expected Test Results
Flow Rate Check	Sampling rate is $200 \pm 20$ ml/min

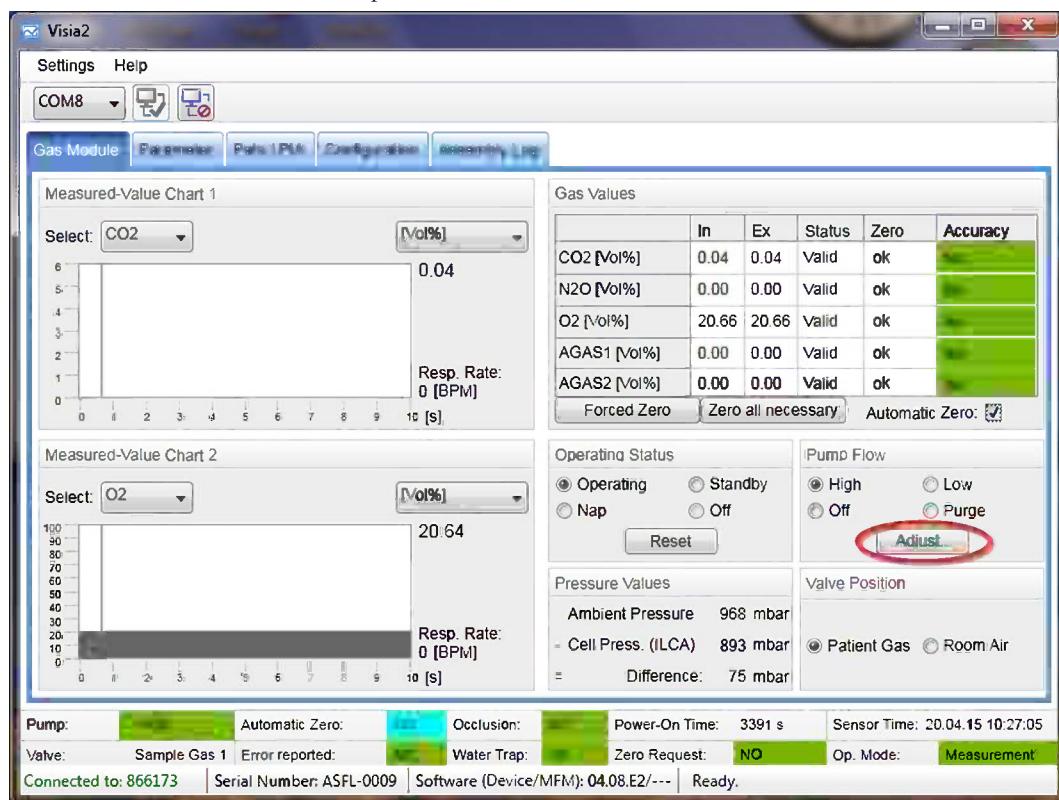
## Flow Rate Adjustment

### CAUTION

For this adjustment, always measure the gas analyzer flow rate at the gas sample inlet. Measuring at the outlet may lead to incorrect flow readings due to ripple on the gas flow.

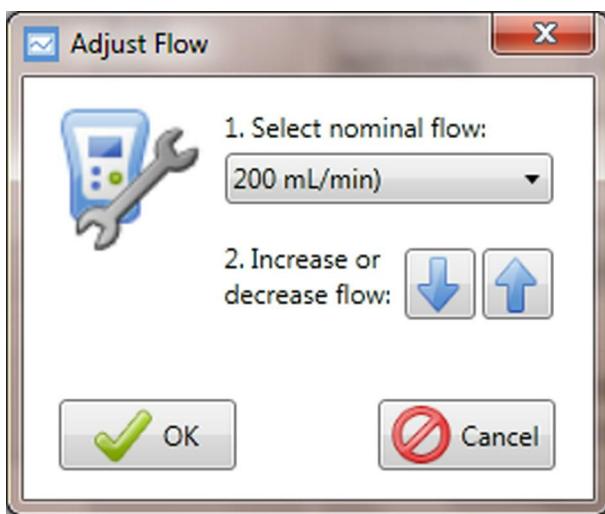
If the gas analyzer flow rate is outside the tolerance limits, it can be adjusted according to the following procedure:

- 1 Ensure you measure the flow at the gas analyzer's inlet.
- 2 Select **High** in the Pump Flow Settings section of the Gas Module screen in the VISIA2 tool.
- 3 Connect the flowmeter to the sample line.
- 4 Click the **Adjust** button in the Pump Flow section.



### 3 Testing and Maintenance

- 5 Use the ↑ and ↓ buttons to decrease or increase the flow to 200 ml/min or until it is inside the tolerance limits.



- 6 Press the **OK** button to store the new flow rate setting.
- 7 Switch the **Pump Flow Level** to **Off** and then **High** again and check the flow in the flowmeter and in the **Adjust Flow** window in the VISIA2 tool. Check the flow again in normal Monitoring Mode.

If the flow rate cannot be brought inside the tolerance limits, replace the gas analyzer.

#### NOTE

Once a new flow rate has been saved, the old ones are overwritten.

## Gas Accuracy Check

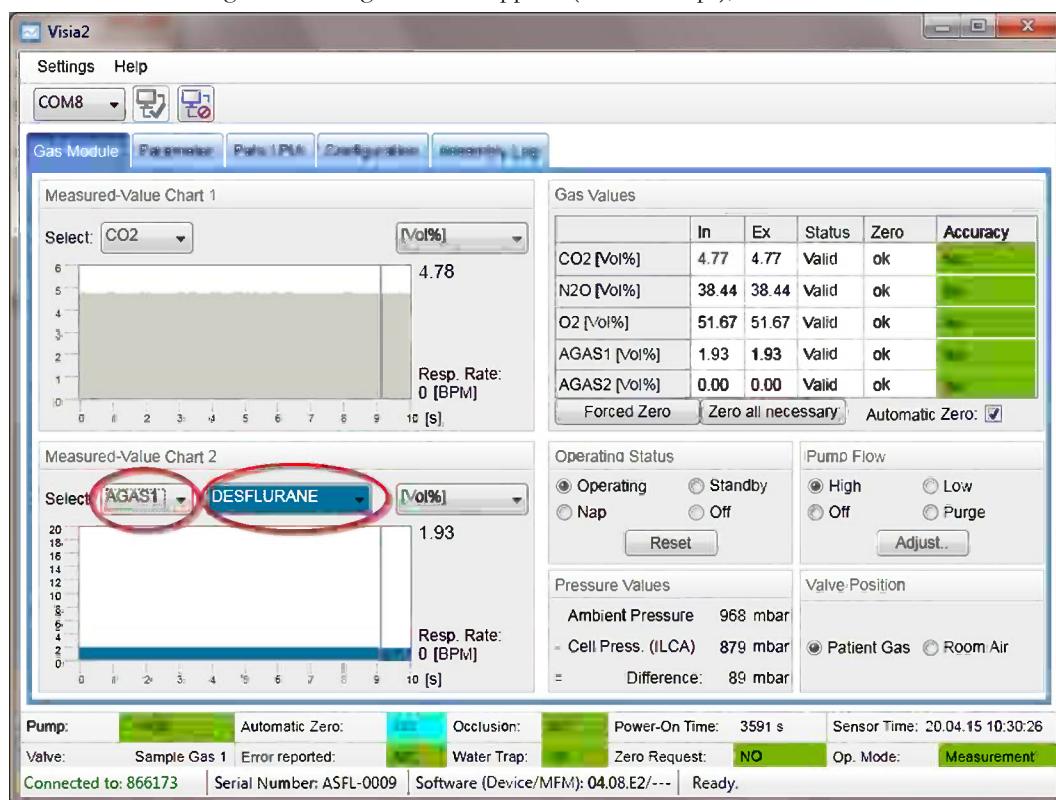
The gas analyzer should run for at least six minutes until the Accuracy column in the Gas Values table of the VISIA2 tool is green and reads **Iso** for each value before continuing with the following procedures. This is to allow the module to reach ISO accuracy.

Before performing Gas Accuracy Check, you must first:

- pass the Leak Check,
- pass a Zero Calibration,
- ensure that there is enough gas in the check gas bottle,
- check tubing assembly and reservoir bags for leaks or damage.

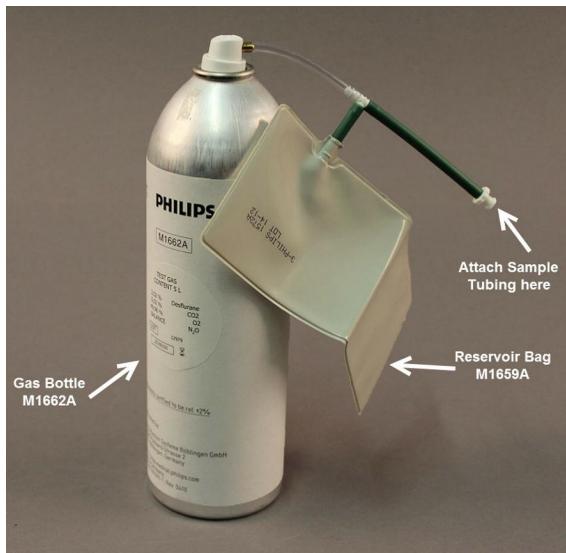
The procedure to check the gas accuracy is as follows:

- 1 Set the Measured-Value Chart 1 to **CO2** (ensure the unit is set to Vol%) and the Measured-Value Chart 2 to **AGAS1**.
- 2 After the calibration gas from the gas bottle is applied (see next steps), ensure **DESFLURANE** is detected.



### 3 Testing and Maintenance

- 3 Ensure the pump is off, then connect the calibration gas bottle, the reservoir bag and the sample line as shown below.



- 4 Switch on the pump. Wait until the reservoir bag is empty. Wait for another 10 seconds to let the gas analyzer completely evacuate the reservoir bag. The INOP Occlusion may be issued but will disappear again as soon as the gas flow is restored.
- 5 Now fill the reservoir bag with gas.

---

#### CAUTION

Do not pressurize the reservoir bag.

Do not attempt the check process if there are any visible leaks in the bag or tubing.

Prevent the bag from emptying before the gas calibration test is complete.

---

- 6 Set the pump flow level to **High**.
- 7 Wait until the gas concentration reaches a stable plateau.
- 8 Verify that the values measured by the gas analyzer are within the specified limits for Check Gas No. M1662A.

Gas Type	Allowed Tolerance
Anesthetic Agent	$\pm 0.5$ vol%
CO <sub>2</sub>	$\pm 0.7$ vol%
N <sub>2</sub> O	$\pm 6.2$ vol%
O <sub>2</sub>	$\pm 3$ vol%

## Disposal of Empty Gas Cylinder

- 1 Empty cylinder completely by pushing in the pin of the valve.
- 2 Once the cylinder is empty, drill a hole in the cylinder.

### **CAUTION**

Be careful to assure that the cylinder is completely empty before you try to drill the cylinder.

- 3 Write "Empty" on the cylinder and place it with your scrap metal or, if you do not collect scrap metal for recycling, dispose of the cylinder according to local regulations.

## IntelliBridge Performance Test

This test checks the performance of the IntelliBridge EC10 & EC5 modules.

**Tools Required:** None/external device (i.e. ventilator) and the required IntelliBridge EC5 Module

- 1 Plug the IntelliBridge EC10 module into the Philips patient monitor.
- 2 Connect the Service PC to the IntelliBridge EC10 module and ensure the correct drivers for the external devices are installed. (See [for details](#)).
- 3 Depending on your external device, connect the appropriate EC5 ID module (indicated on the EC5 label) to the external device.
- 4 Connect the EC5 to the EC10 module using the supplied cable.
- 5 Switch the external device on. The connection status LED flashes green until it has correctly identified the external device and started communication. Ensure the connection status LED then lights green continuously indicating that communication has been established. Information from the external device should now be available on the Philips patient monitor.
- 6 Select **Main Setup -> Measurements -> <External Device Name>** to enter the setup menu for the connected device.
- 7 Select **Setup Waves** or **Setup Numerics** and make any required changes.
- 8 Close the setup menu.
- 9 Select the wave segment on the screen, in which you want the waves to be displayed. In the pop-up menu, select Change Wave, and then select WAVE.
- 10 Philips recommends you confirm with the user that waves and numerics required from the external device are being accurately received. If the external device has a demo mode, use this.

Test	Expected Test Results
IntelliBridge Performance Test	Numerics are visible on screen (pass/fail)

## Recorder Performance Test - M1116C

This test checks the performance of the recorder module M1116C.

- 1 Load paper into the recorder (for paper loading instructions, see your monitor's Instructions for Use).
- 2 Start a recording, e.g. an Alarm Limits Recording.
- 3 If no print-out appears, the paper may be loaded backwards or the wrong paper may be inserted.
- 4 Try reloading the paper. Ensure you are using the correct paper.

Test	Expected test results
Recorder Performance Test	Recording is printed correctly

1

## EEG and SO<sub>2</sub> Performance Tests

The EEG and SO<sub>2</sub> parameters do not require performance tests because the modules perform internal self-tests regularly. These tests suffice for performance testing of these three parameters.

## Nurse Call Relay Performance Test

The nurse call relay performance test can be performed at the Modular Jack 6P6C connector.

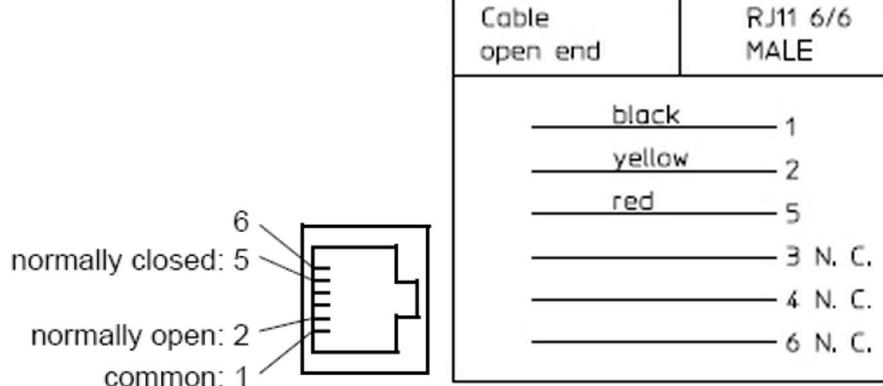
This test checks the operation of the Nurse Call Relay. The Nurse Call Relay test is recommended for customer sites where the nurse call is in use. The Nurse Call relay functions as follows:

- Standard Operation—connector contact 1-2 open; 1-5 closed.
- Alarm Condition—connector contact 1-2 closed; 1-5 open.

**Tools Required:** Ohmmeter.

- 1 Plug a 6P6C Modular Plug into the Nurse Call Relay connector.
- 2 Connect the ohmmeter.
- 3 When no alarm occurs, connector contacts 1-2 are open and connector contacts 1-5 are closed. When an alarm occurs, connector contacts 1-2 are closed and connector contacts 1-5 are open.

**WIRING DIAGRAM**

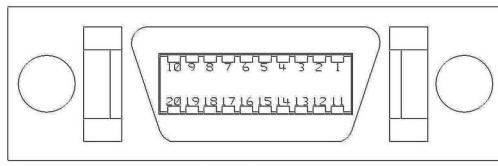


- 4 The expected test result is: Alarm condition - Connector contacts 1-2 are closed and connector contacts 1-5 are open.

Test	Expected Test Results
Nurse Call Relay Performance Test	Alarm Condition— Connector contacts 1-2 are closed and Connector contacts 1-5 are open

### Multi-Port Nurse Call Connector Test (Flexible Nurse Call)

This test checks the operation of the Flexible Nurse Call Relay. The Nurse Call Relay test is recommended for customer sites where the nurse call is in use. The following diagram and table show the pins and relay identifiers of the connector:



Front View

Pin	Cable Color Coding	Relay
1	black	R2-closure
2	brown	R2-middle
3	red	R2-opener
4	orange	R3-closure
5	yellow	R3-middle
6	green	R3-opener
7	blue	n/a
8	purple	n/a
9	gray	n/a
10	white	n/a
11	pink	R1-closure
12	light green	R1-middle
13	black/white	R1-opener
14	brown/white	n/a
15	red/white	n/a
16	orange/white	n/a
17	blue/white	R_failure_closure
18	purple/white	R_failure_middle
19	green/white	R_failure_opener
20	red/black	n/a

The Nurse Call relay functions as follows:

- During standard operation R1,R2,R3\_opener are closed; R1,R2,R3\_closure are open.
- During alarm condition—R1,R2,R3\_opener are open; R1,R2,R3\_closure are closed.

### 3 Testing and Maintenance

**Tools Required:** Ohmmeter.

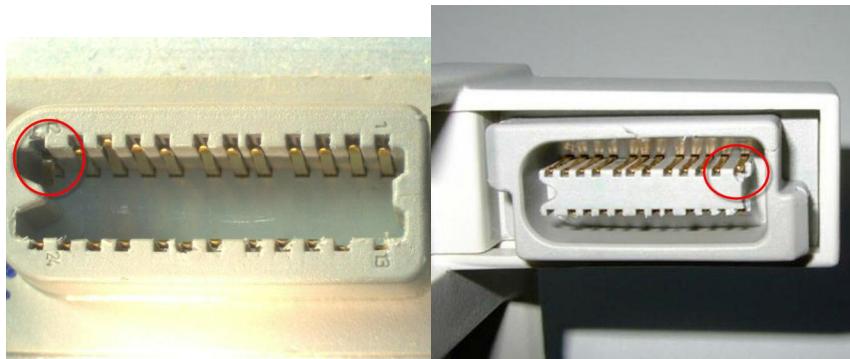
- 1 Plug an M8087-61001 cable into the Nurse Call Relay connector.
- 2 Connect the ohmmeter and measure the pins as indicated in the diagram and table.
- 3 Ensure the relay contacts behave as described above. The behavior may vary depending on configuration choices. See the *Configuration Guide* for details of Alarm Relay settings.
- 4 The expected test results depend on the relay contact used. Ensure the correct relay activity is initiated during alarm condition.

Test	Expected Test Results
Multi-Port Nurse Call Connector Test	Correct relay activity is initiated during alarm condition (pass/fail)

### MSL Assurance Test

Visually inspect all MSL connector sockets (cable/monitor/Module Rack/Multi-Measurement Module/X2/X3).

- 1 Ensure the pins of the connectors are not jolted.
- 2 Ensure no pin is bent inwards or outwards.
- 3 Exchange connectors that show any evidence of damage or breakage.



*Examples of damaged connectors*

Test	Expected Test Results
MSL Assurance Test	Pins of connector not jolted/bent (pass/fail)

## Power Loss Alarm Buzzer Performance Test

- 1 Switch on the monitor.
- 2 Disconnect the monitor from AC power.
- 3 The Power Loss Alarm Buzzer should beep for about one minute.
- 4 To switch off the alarm sound, either press the power button or connect the monitor to AC power

Test	Expected Test Results
Power Loss Alarm Buzzer Performance Test	Beep for one minute

If the Power Loss Alarm Buzzer Test fails:

- In configuration mode, check whether the power loss sound is enabled (**Main Setup -> Global Settings -> Power Loss Sound**).
- If the power loss sound is enabled, check cable connections between power supply and main board.
- If the cable connections are correct and the problem persists, exchange main board.

## IntelliVue 802.11 Bedside Adapter Communication Test

- 1 Ensure the LAN cable is disconnected from the rear of the monitor, then switch on the monitor.
- 2 Go into Service Mode and select **Main Setup -> Network -> Setup WLAN**. In the **Setup WLAN** menu:
  - Set **Mode** to either **802.11Ah**, **802.11G**, **802.11Bg** (not recommended), **Auto** (not recommended) or **None** (this setting disables the wireless LAN functionality permanently), to match your wireless infrastructure installation.
  - Set **SSID** to match your installation.
  - Set the **Country** code to “1000”. Setting the country code to this value automatically adjusts the regulatory domain to match the configuration of the infrastructure. Do not set the country code to values other than “1000” unless otherwise instructed.
  - Set the **Security Mode** to match your installation.
  - Enter the required keys/passwords.
- 3 Select **Main Setup -> Network -> WLAN Diagnostic** to access the WLAN Diagnostic window.
- 4 Proper installation of the IntelliVue 802.11 Bedside Adapter is assured by connecting to an access point over the wireless link. Place the monitor with the IntelliVue 802.11 Bedside Adapter installed in close proximity to the access point (for example, if the access point is mounted on the ceiling, place the monitor directly below). There should be no walls or other obstacles between the monitor and the access point. The following should apply:
  - The wireless link should be active, that is, the **Conn.Status** field should be *Authenticated* (for Rel. C.0 monitors) or *Connected* (for Rel D.0 or higher), and the other fields should contain values. If the **RSSI** value is significantly lower, check the distance to the access point and the antenna orientation at the monitor. The antenna orientation should be vertical, but the physical placement of the monitor or other equipment within its vicinity as well as walls or other obstacles may influence the antenna orientation required to receive the best RSSI value.
- 5 If this test fails, retry in a different physical area with a different access point and/or check the credential settings in the monitor.

Test	Expected Test Results
IntelliVue 802.11 Bedside Adapter Performance Test	Monitor connects to access point

## IIT Communication Test (Rev H.0 or higher)

- 1 Ensure the LAN cable is disconnected from the rear of the monitor, then switch on the monitor.
- 2 Go into Service mode and, select **Main Setup** -> **Network** -> **Setup IIT**. In the Setup IIT menu, set the **RF Access Code** in each profile to match your installation.
- 3 Go into Service Mode. Select **Main Setup** -> **Network** -> **IIT Diagnostic** to access the Instrument Telemetry Diagnostic window.
- 4 Proper installation of the IIT module is assured by connecting to an access point over the wireless link. Place the monitor with the IIT module installed in close proximity to the access point (e.g. if the access point is mounted on the ceiling, place the monitor directly below). Wait until the **Conn.Status** field in the Instrument Telemetry Service window shows *Active*. *Take the monitor approximately 5 m away from the access point. There should be no walls or other obstacles between the monitor and the access point. The following should apply:*
  - Observe the **RSSI** (Received Signal Strength Indicator) value for at least 5 - 10 seconds. The **RSSI** value should be around  $-50 \pm 10$  in a 5 m distance from the access point used and the IIT link should be active, i.e. the **Conn.Status** field should be *Active* and the other fields should contain values. If the **RSSI** value is significantly lower, check the distance to the access point and the antenna orientation at both the monitor and the access point (both should be vertical).
  - Remove the antenna. The **RSSI** value should be around  $-90 \pm 10$ . The IIT link may be active but the connection could be unreliable. The **Conn. Status** field may toggle between *Inactive* and *Seeking*. If the difference between the **RSSI** values measured with and without antenna is significantly lower, check the antenna and the antenna connector for damage and verify that the cable from the IIT adapter to the antenna connector plate is connected properly.
- 5 If this test fails, retry in a different physical area with a different access point.

### Error Conditions:

- The field **MAC IIT** should show a value **unequal to** 0000 0000 0000. If it does not, there is a communication problem between the monitor and the IIT adapter.
  - With an incorrect RF Access Code or an incorrect or defective antenna installation, the fields **IP Address, Server IP, Subnet Mask**, and **RSSI** in the Instrument Telemetry Service window will stay blank. The field **Conn. Status** will slowly toggle between *Inactive* and *Seeking*.
- 6 Perform the Access Point Controller (APC) test blocks as described in the Philips IntelliVue Wireless Network Installation and Configuration Guide.

Test	Expected test results
IIT Communication Test	IIT Communication without interference

## Short Range Radio (SRR) Performance Test

- 1 Ensure the short range radio interface is configured as follows: SRR On and appropriate channel selected.
- 2 Assign a wireless remote control to the monitor as described in “[Installing the Wireless Remote Control](#)” on page 391.
- 3 Check that you can operate the monitor with the remote control.

Test	Expected test results
SRR Performance Test	Wireless Remote Control functions correctly. Monitor can be operated with Remote Control

## Mounting Integrity Test

- 1 Remove the monitor from the mount and ensure that all quick mount screws are tight (1.3 Nm).
- 2 Ensure that the threading of the MX800 is not damaged or separated from the chassis. If the quick mount is damaged, exchange the quick mount.
- 3 On the completely reassembled monitor, test the quick mount by pressing the quick release button. If it comes back out gradually and regularly, the quick mount is inserted correctly. If it gets stuck, the quick mount is not centered and must be reinserted correctly.
- 4 Reposition the monitor on the mount and ensure that it is securely locked. To confirm, try lifting the monitor off the mount, without pressing the quick release button. If you can separate the monitor from the mount the Mounting Integrity Test has failed.

If you notice any damage to the threading of the MX800 chassis, send the MX800 in for bench repair.

Test	Expected test results
Mounting Integrity Test	All quick mount screws are tight. No damage to quick mount. No damage to threading of MX800. Quick release button comes back out gradually and regularly.

## Reporting of Test Results

Philips recommends all test results are documented in accordance with local laws. Authorized Philips personnel report the test result back to Philips. While hospital personnel (biomedical engineers or technicians) do not need to report results to Philips, Philips recommends they record and store the test results in accordance with local laws.

The following table lists what to record after completing the tests in this chapter. Record the results in the empty column in the Test and Inspection Matrix.

The following is a guide as to what your documentation should include:

- Identification of the testing body (for example, which company or department carried out the tests).
- Name of the person(s) who performed the tests and the concluding evaluation.
- Identification of the device(s) and accessories being tested (serial number, etc.).
- The actual tests (incl. visual inspections, performance tests, safety and system tests) and measurements required
- Date of testing and of the concluding evaluation.
- A record of the actual values of the test results, and whether these values passed or failed the tests.
- Date and confirmation of the person who performed the tests and evaluation.

The device under test should be marked according to the test result: passed or failed.

## Carrying Out and Reporting Tests

### Test Report

Testing Organization:	(Check one of the following three options)
Name of testing person:	Test before putting into service (reference value)
Date:	Recurrent Test Test after Repair
Responsible Organization:	
Device Under Test:	ID-Number
Product Number:	Serial No.:
Accessories:	
Measurement Equipment (Manufacturer, Type, Serial No., Calibration Date):	
Safety Test Method used	
Functional Test (parameters tested):	
Mains voltage and frequency used during safety testing:	

## Test and Inspection Matrix

Test	Test or Inspection to be Performed	Expected Test Results	Record the Results (mandatory for Philips Personnel only)	
			What to record	Actual Results
Visual Inspection	Perform Visual Inspection	Pass or Fail	V:P or V:F	
Power On	Power on the unit. Does the self-test complete successfully	If Yes, Power On test is passed	PO:P or PO:F	
Noninvasive Blood Pressure Performance Tests	Perform the Accuracy Test	X1 = value displayed by monitor Difference <= 3mmHg	PN:P/X1 or PN:F/X1	
	Performance Leakage Test	X2 = leakage test value X2 < 6 mmHg	PN:P/X2 or PN:F/X2	
	Performance Linearity Test	X3 = value displayed by monitor Difference <= 3mmHg	PN:P/X3 or PN:F/X3	
	Performance Valve Test	X4 = value < 10 mmHg	PN:P/X4 or PN:F/X4	
Temperature Performance Test	Perform the Temperature Performance Test	X1= 40°C ± 0.2°C or 100°F ± 0.4°F	PT: P/X1 or PT: F/X1	
All other performance tests	Perform the remaining parameter performance tests, if applicable	See expected results in test procedures	P: P or P: F	
Safety (1)	Perform Safety Test (1): Protective Earth Resistance	With mains cable: Maximum impedance (X1):<=300 mOhms	S(1):P/X1 or S(1):F/X1	*
Safety (2)	Perform Safety Test (2): Equipment Leakage Current - Normal Condition.	With mains cable: Maximum leakage current (X1):<= 100 µA	S(2): P/X1 or S(2): F/X1	*
Safety (3)	Perform Safety Test (3): Equipment Leakage Current - Single Fault Condition (Open Earth)	With mains cable: Maximum leakage current (X2):<= 500 µA	S(3): P/X2 or S(3): F/X2	*
Safety (4)	Perform Safety Test (4): Applied Part Leakage Current - Single Fault Condition, mains on applied part.	Maximum leakage current (X1):<=50 µA (CF)	S(4): P/X1 or S(4): F/X1	*

### 3 Testing and Maintenance

Test	Test or Inspection to be Performed	Expected Test Results	Record the Results (mandatory for Philips Personnel only)	
			What to record	Actual Results
System (Sys 1-2)	Perform the system test according to IEC/EN 60601-1+A1 Ed.3 clause 16, if applicable, after forming a system	Equipment Leakage Current: Sys1 <= 100 µA (Normal Condition) Sys2 <= 500µA (Single Fault Condition)	Sys: PSys1/PSys2 or Sys: FSys1/Fsys2	*
System (Sys 3)	Perform the system test according to IEC/EN 60601-1+A1 Ed.3 clause 16, if applicable, after forming a system	Protective Earth Leakage Current if medical electrical system components are connected to the same Multiple Socket Outlet: Sys3 <= 300 µA	Sys: PSys3 or Sys: FSys3	*
Key: P = Pass, F = Fail, X or Sys = test value to be recorded, * = Record the worst-case results and the associated switch positions (e.g. normal/reverse polarity)				

#### NOTE

All values for current and voltage are the root mean square (r.m.s.) values, unless otherwise stated.

### Evaluation

	Yes	No
Safety and Functional Test passed		
Repair required at a later date, safety and functional test passed		
Device must be taken out of operation until repair and passed tests		
Device failed and must be taken out of operation.		

#### Notes:

#### Next Recurrent Test:

Name: \_\_\_\_\_

Date/Signature: \_\_\_\_\_

## Evaluation of Test Results

The evaluation of the test results must be performed by appropriately trained personnel with sufficient product, safety testing and application knowledge.

If any test results are between 90% and 100% of the respective expected result, the previously measured reference values must be taken into consideration for the assessment of the electrical safety of the device under test. If no reference values are available, you should consider shorter intervals between upcoming recurrent tests.

### NOTE

If any single test fails, testing must be discontinued immediately and the device under test must be repaired or labeled as defective. Be sure to inform the user about the test failure in writing.

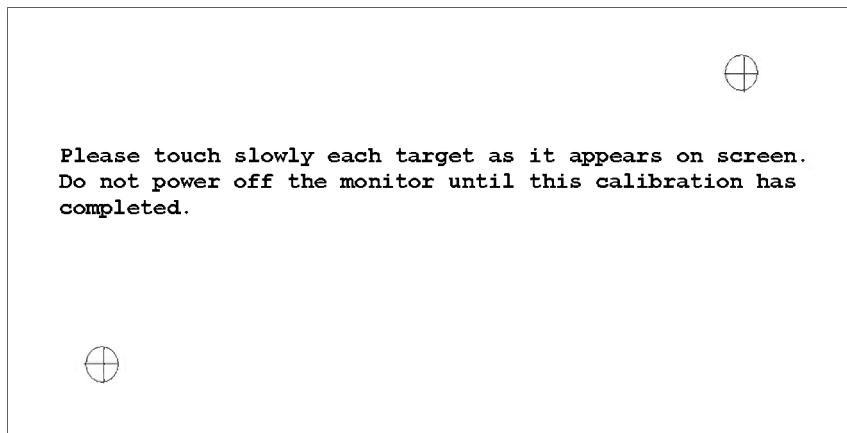
## Other Regular Tests

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

## Touchscreen Calibration

To access the touchscreen calibration screen:

- 1 Enter service mode
- 2 Select **Main Setup**
- 3 Select **Hardware**
- 4 Select **Touch Calibration**



### *Touchscreen Calibration Screen*

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

If the touchscreen is accidentally mis-calibrated by selecting the wrong spot, you must use another input device to re-enter calibration mode. If you have the Support Tool, you can initiate a touch calibration from there.

For further details on touchscreen calibration procedures, see the documentation shipped with your selected display.

### **NOTE**

If a touchscreen calibration is started on a multiple display system, the calibration is started for all displays at the same time.

## Disabling/Enabling Touch Operation

There are two ways to disable/enable touchscreen operation:

- 1 To *temporarily* disable touchscreen operation of the monitor, press and hold the **Main Screen** key. A padlock symbol will appear on the key. Press and hold the **Main Screen** key again to re-enable touchscreen operation.
- 2 To *permanently* disable touchscreen operation:
  - a. Enter Service Mode.
  - b. Select **Main Setup**
  - c. Select **User Interface**
  - d. Change the **Touch Enable** selection to **no**.

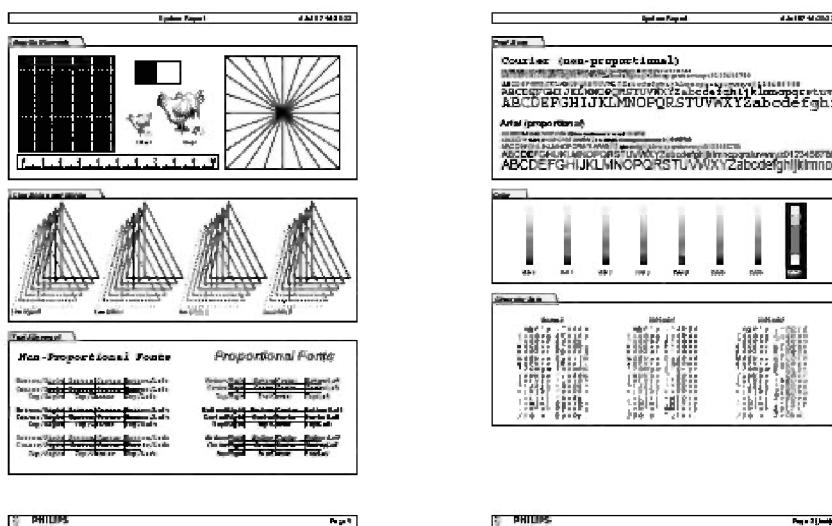
To re-enable touchscreen functionality change the **Touch Enable** selection to **yes**.

## Printer Test Report

To verify your printer configuration you may want to print a test report.

To print a test report select **Main Setup** -> **Reports** -> **Setup Printers** -> **Print Test Rep.**

Your test report should look like this:



## After Installation, Testing or Repair

Before handing the patient monitor over to the end-user, ensure it is configured appropriately and that it is in monitoring mode. Ensure that the user receives the current revision of the monitor documentation.

### **3 Testing and Maintenance**

# Troubleshooting

## Introduction

This section explains how to troubleshoot the monitor if problems arise. Links to tables that list possible monitor difficulties are supplied, along with probable causes, and Philips recommended actions to correct the difficulty.

## How To Use This Section

Use this section in conjunction with the sections *Testing and Maintenance* and *Parts*. To remove and replace a part you suspect is defective, follow the instructions in the section *Repair and Disassembly*. The *Theory of Operation* section offers information on how the monitor functions.

## Who Should Perform Repairs

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

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### WARNING

High Voltage - Voltages dangerous to life are present in the instrument when it is connected to the mains power supply. Do not perform any disassembly procedures (other than Multi-Measurement Module and extension removal) with power applied to the instrument. Failure to adhere to this warning could cause serious injury or death.

---

## Replacement Level Supported

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

# Software Revision Check

Some troubleshooting tasks may require the identification of the your monitor's Software Revision. This, and other information such as the system serial number, is located in the monitor revision screen. To access the monitor revision screen:

- 1 Enter the Main Setup menu and select **Revision**
- 2 Select **Product**
- 3 Select **Software Revision**
- 4 Select the pop-up key for the device to be checked (for example, **M8004A** or **M3001A**)

### NOTE

The part numbers listed in the monitor revision screen do not necessarily reflect the part numbers required for ordering parts. See the *Parts* section for the ordering numbers.

### NOTE

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

# Software Compatibility Matrix

For a detailed software compatibility matrix, see the IntelliVue Compatibility Matrix on InCenter or in the Service Bulletin SB86202000x, where x is the latest revision.

For further information on 867036/M3001A/AL HW/SW compatibility, see the *Parts* section.

# Obtaining Replacement Parts

See *Parts* section for details on part replacements.

# Troubleshooting Guide

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

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

## Checks for Obvious Problems

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

- 1 Is the power switch turned on?
- 2 Is the AC power cord connected to the instrument and plugged into an AC outlet?
- 3 Is the MSL cable connected correctly?
- 4 Are the Module Rack and, if present, the Measurement Extension connected correctly?
- 5 Are the cables connected properly to the Module Rack?
- 6 Are the parameter modules plugged into the Module Rack correctly?

## Checks Before Opening the Instrument

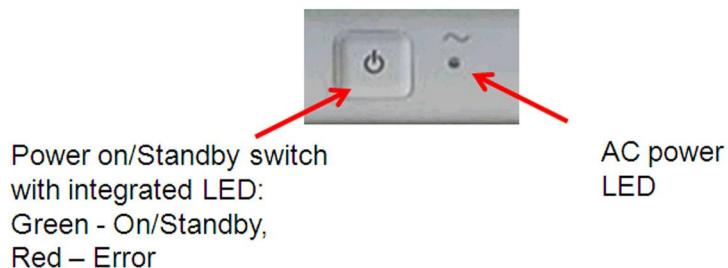
You can isolate many problems by observing indicators on the instrument before it is necessary to open the instrument.

### Checks with the Instrument Switched Off

- AC connected:
  - AC Power LED is on (green).
- No AC connected:
  - All LEDs are off.

### Checks with the Instrument Switched On, AC Connected

When the monitor is first switched on, all the front-panel LEDs the Power on/Error LED and the AC Power LED light up momentarily. The location of the front-panel LEDs is shown in the following photograph:



### Initial Instrument Boot Phase

The following tables describe the regular initial boot phase of the monitor and its components. If the boot phase does not proceed as described below go to “[Boot Phase Failures](#)” on page 139 for Troubleshooting information.

#### Monitor Boot Phase:

For these steps it is assumed that the Monitor is powered correctly. This is indicated by the green Power On LED.

Time (sec.) after Power On	Event
0	AC Power LED is always on when monitor is connected to AC Power. When the Power On/Off button is pressed the red error LED switches on immediately.
3	The alarm LEDs are switched on with low intensity. Colors: Left LED: cyan; Middle LED: red; Alarm Suspend LED (right): red. The red error LED is switched to green On/Standby LED.
4	Boot Screen with the Philips Logo appears on the display. Test Sound is issued.
5	All Alarm LEDs are switched off.
6	Alarm LEDs are tested in the following sequence: Cyan on-off (left LED only) Yellow on-off (left & middle LED) Red on-off (all LEDs)
8	Boot Screen with the Philips Logo disappears Fixed screen elements (for example smart keys, alarm fields) appear on the screen.
15-30	First measurement information appears on the screen, user input devices (for example Mouse, Touch) are functional

#### Module Rack Boot Phase

For these steps it is assumed that the Module Rack is connected via MSL-cable to the monitor.

Time (sec.) after Monitor Power On	Event
0	Red Error LED switches on immediately
1	Green “Ready” LED switches on
3	Red Error LED is switched off
5	Module Power is switched on
5-8	Module Status LEDs blink once or twice (Module dependent)

#### NOTE

The boot phase times may vary depending on the hardware and software revision of your monitor.

### Troubleshooting Tables

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

## Boot Phase Failures

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
AC LED does not light up	AC Connection not ok	Check that the AC-Mains are powered and the power cord is ok and connected
	LED defective	Try to switch on the monitor. If it operates normally , the LED is defective => exchange Power Switch board
	Power Switch board not connected to the main board	Check if power switch board is connected correctly to the Main Board
	Power supply defective	Check if output voltage is within the specifications (23.5V - 24.5V), for procedure see " <a href="#">Testing the Functionality of the Power Supply</a> " on page 180. Exchange power supply if defective
	iPC defective	Disconnect Power Cable to iPC and check again
	I/O board defective	Remove I/O board and check again
	Connector board defective	Remove connector board and check again
	Panel adapter board defective	Remove panel adapter board and check again
	Mixer board defective	Remove mixer board and check again
	Main Board defective	Exchange Main Board
Green Power On LED <b>and</b> Red Error LED remain off after pressing power on button:	Power Switch Micro Controller hung	Unplug AC Mains and replug after 10 seconds. Try to switch on the monitor again.
	Power switch board not connected to the main board	Check if power switch board is connected correctly to the main board.
	Power Switch Board defective	Exchange Power Switch Board and try to switch the monitor on again.
	I/O Board defective	Remove all I/O boards and try to switch the monitor on again
	Connector board defective	Remove connector board and check again
	Mixer board defective MSL2 board defective WLAN board defective Panel adapter board defective Alarm LED board defective	Disconnect all cables and boards (except Power Cable to the main board and Power Switch cable): - mixer board - MSL2 - WLAN - panel adapter - Alarm LED then try to switch the monitor on again
	Main board defective	Exchange main board.Add boards in reverse order and try again with each board.

## 4 Troubleshooting

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Red Error LED stays on continuously	External connected device defective	disconnect all external cables (except AC) and switch the monitor on again
	I/O Board defective	Remove all I/O boards and switch the monitor on again.
	Connector board defective	Remove connector board and check again.
	Mixer board defective MSL2 board defective WLAN board defective Panel adapter board defective Alarm LED board defective	Disconnect all cables and boards (except Power Cable to the main board and Power Switch cable): - mixer board - MSL2 - WLAN - panel adapter - Alarm LED then try to switch the monitor on again
	Main board defective	Exchange Main board
	Hardware or Software Failure	connect Support Tool directly to monitor with crossover cable and start “search for defective devices”  If no device is detected, proceed as described above in section “Red error LED stays on continuously”
Red Error LED blinks (indicating cyclic reboots)	Software Fault	If the Support Tool can detect the device and it indicates the Operating Mode is ‘Boot’, download and store the status log. Reload software and re-clone the monitor. If this fixes the problem e-mail the status log to your local response center
	Hardware Failure	If this does not rectify the problem follow instructions under “Red Error LED stays on continuously”.
	Alarm LEDs remain off:	Check for INOPS and follow instructions Exchange Alarm LED board
No Test Sound issued	Main board defective	Exchange Main board
	Speaker defective	exchange speaker
	Main board defective	exchange main board

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Green Power On LED <b>and</b> Red Error LED remain off after pressing power on button:	Power Switch Micro Controller hung	Unplug AC Mains and replug after 10 seconds. Try to switch on the monitor again.
	Power switch board not connected to the main board	Check if power switch board is connected correctly to the main board.
	Power Switch Board defective	Exchange Power Switch Board and try to switch the monitor on again.
	I/O Board defective	Remove all I/O boards and try to switch the monitor on again
	Connector board defective	Remove connector board and check again
	Mixer board defective MSL2 board defective WLAN board defective Panel adapter board defective Alarm LED board defective	Disconnect all cables and boards (except Power Cable to the main board and Power Switch cable): - mixer board - MSL2 - WLAN - panel adapter - Alarm LED then try to switch the monitor on again
	Main board defective	Exchange main board. Add boards in reverse order and try again with each board.
Red Error LED stays on continuously	External connected device defective	Disconnect all external cables (except AC) and switch the monitor on again
	I/O Board defective	Remove all I/O boards and switch the monitor on again.
	Connector board defective	Remove connector board and check again.
	Mixer board defective MSL2 board defective WLAN board defective Panel adapter board defective Alarm LED board defective	Disconnect all cables and boards (except Power Cable to the main board and Power Switch cable): - mixer board - MSL2 - WLAN - panel adapter - Alarm LED then try to switch the monitor on again
	Main board defective	Exchange Main board

## 4 Troubleshooting

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Red Error LED blinks (indicating cyclic reboots)	Hardware or Software Failure	connect Support Tool directly to monitor with crossover cable and start “search for defective devices” If no device is detected, proceed as described above in section “Red error LED stays on continuously”
	Software Fault	If the Support Tool can detect the device and it indicates the Operating Mode is ‘Boot’, download and store the status log. Reload software and re-clone the monitor. If this fixes the problem e-mail the status log to your local response center
	Hardware Failure	If this does not rectify the problem follow instructions under “Red Error LED stays on continuously”.
Alarm LEDs remain off:	Alarm LED board is defective	Check for INOPS and follow instructions Exchange Alarm LED board
	Main board defective	Exchange Main board
No Test Sound issued		check for INOPs and follow instructions
	Speaker defective	exchange speaker
	Main board defective	exchange main board
Green Power On LED <b>and</b> Red Error LED remain off after pressing power on button:	Power Switch Micro Controller hung	Unplug AC Mains and replug after 10 seconds. Try to switch on the monitor again.
	Power switch board not connected to the main board	Check if power switch board is connected correctly to the main board.
	Power Switch Board defective	Exchange Power Switch Board and try to switch the monitor on again.
	I/O Board defective	Remove all I/O boards and try to switch the monitor on again
	Connector board defective	Remove connector board and check again
	Mixer board defective MSL2 board defective WLAN board defective Panel adapter board defective Alarm LED board defective	Disconnect all cables and boards (except Power Cable to the main board and Power Switch cable): - mixer board - MSL2 - WLAN - panel adapter - Alarm LED then try to switch the monitor on again
	Main board defective	Exchange main board. Add boards in reverse order and try again with each board.

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Red Error LED stays on continuously	External connected device defective	disconnect all external cables (except AC) and switch the monitor on again
	I/O Board defective	Remove all I/O boards and switch the monitor on again.
	Connector board defective	Remove connector board and check again.
	Mixer board defective MSL2 board defective WLAN board defective Panel adapter board defective Alarm LED board defective	Disconnect all cables and boards (except Power Cable to the main board and Power Switch cable): - mixer board - MSL2 - WLAN - panel adapter - Alarm LED then try to switch the monitor on again
	Main board defective	Exchange Main board
	Hardware or Software Failure	connect Support Tool directly to monitor with crossover cable and start “search for defective devices”  If no device is detected, proceed as described above in section “Red error LED stays on continuously”
Red Error LED blinks (indicating cyclic reboots)	Software Fault	If the Support Tool can detect the device and it indicates the Operating Mode is ‘Boot’, download and store the status log. Reload software and re-clone the monitor. If this fixes the problem e-mail the status log to your local response center
	Hardware Failure	If this does not rectify the problem follow instructions under “Red Error LED stays on continuously”.
	Alarm LEDs remain off:	Check for INOPS and follow instructions Exchange Alarm LED board
No Test Sound issued	Main board defective	Exchange Main board
	Speaker defective	exchange speaker
	Main board defective	exchange main board

## 4 Troubleshooting

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Green Power On LED <b>and</b> Red Error LED remain off after pressing power on button:	Power Switch Micro Controller hung	Unplug AC Mains and replug after 10 seconds. Try to switch on the monitor again.
	Power switch board not connected to the main board	Check if power switch board is connected correctly to the main board.
	Power Switch Board defective	Exchange Power Switch Board and try to switch the monitor on again.
	I/O Board defective	Remove all I/O boards and try to switch the monitor on again
	Connector board defective	Remove connector board and check again
	Mixer board defective MSL2 board defective WLAN board defective Panel adapter board defective Alarm LED board defective	Disconnect all cables and boards (except Power Cable to the main board and Power Switch cable): - mixer board - MSL2 - WLAN - panel adapter - Alarm LED then try to switch the monitor on again
	Main board defective	Exchange main board. Add boards in reverse order and try again with each board.
Red Error LED stays on continuously	External connected device defective	Disconnect all external cables (except AC) and switch the monitor on again
	I/O Board defective	Remove all I/O boards and switch the monitor on again.
	Connector board defective	Remove connector board and check again.
	Mixer board defective MSL2 board defective WLAN board defective Panel adapter board defective Alarm LED board defective	Disconnect all cables and boards (except Power Cable to the main board and Power Switch cable): - mixer board - MSL2 - WLAN - panel adapter - Alarm LED then try to switch the monitor on again
	Main board defective	Exchange Main board

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Red Error LED blinks (indicating cyclic reboots)	Hardware or Software Failure	connect Support Tool directly to monitor with crossover cable and start “search for defective devices” If no device is detected, proceed as described above in section “Red error LED stays on continuously”
	Software Fault	If the Support Tool can detect the device and it indicates the Operating Mode is ‘Boot’, download and store the status log. Reload software and re-clone the monitor. If this fixes the problem e-mail the status log to your local response center
	Hardware Failure	If this does not rectify the problem follow instructions under “Red Error LED stays on continuously”.
Alarm LEDs remain off:	Alarm LED board is defective	Check for INOPS and follow instructions Exchange Alarm LED board
	Main board defective	Exchange Main board
No Test Sound issued		check for INOPs and follow instructions
	Speaker defective	exchange speaker
	Main board defective	exchange main board

### Integrated Display is Blank

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Integrated display is blank or brightness is reduced (The information listed in this table is only valid if the boot phase has completed without error. See “Boot Phase Failures” on page 139 table for a description of the Boot phase.)	Display brightness is reduced when room temperature, or instruments placed near patient monitor, causes the monitor display to overheat.	Instrument should be placed in an environment that does not exceed 40 degrees C or below 5 degrees C.  If you have an external display, connect it to the video port. If the external display works, you can eliminate the connector board and the main board as the cause of failure.
	Backlight Inverter Cable not connected	Check cable connection of Panel Adapter Board to Backlight Inverter Board
	Backlight tubes defective	Replace backlight tubes
	Backlight Inverter board defective	If backlight tubes have already been replaced, replace backlight inverter board.
	Panel Adapterboard defective	Replace panel adapter board
	LCD Flat panel defective	Replace LCD Flat panel
	Main board defective	Replace main board

### Integrated Touch Screen not Functioning

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Touch Screen not functioning	Touchscreen functionality has been temporarily disabled	Check if touchscreen functionality has been temporarily disabled (padlock symbol on Main Screen key). If yes, press and hold the Main Screen key to re-enable touchscreen operation.
	Touchscreen functionality has been permanently disabled	In service mode, select Main Setup -> User Interface and change the “Touch Enable” selection to “yes”.
	Touch screen not connected	Check connection from touch screen to panel adapter board
	Panel adapter board defective	Replace panel adapter board
	Touch screen defective	Replace touch screen assembly
	Main board defective	Replace main board
Touch Position invalid	Touch not calibrated	Perform touch calibration: 1. Enter the Main Setup Menu 2. Select Hardware 3. Select Touch Calibration

## External Display is blank (Slave Display)

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
External Display is blank		If integrated display is also blank proceed as described under "Integrated Display is blank"
	Video cable to external display not connected	Check video cable connection to external display
	External display has no power	Check electricity supply of external display
	External display is defective	Check external display and video cable on another monitor or PC
	Connector Board defective	Replace Connector board
	Main board defective	Replace main board

## External Display Connected to Independent Display Interface is Blank

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
External Display is blank		If integrated display is also blank proceed as described under "Integrated Display is blank"
	Video cable to external display not connected	Check video cable connection to external display
	External display has no power	Check electricity supply of external display
	External display is defective	Check external display and video cable on another monitor or PC
	Independent Display Interface defective	Replace Independent Display Interface

### External Display Connected to iPC

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
External Display is blank		If integrated display is also blank proceed as described under “Integrated Display is blank”
	Video cable to external display not connected	Check video cable connection to external display
	External display has no power	Check electricity supply of external display
	External display is defective	Check external display and video cable on another monitor or PC
	iPC defective	Replace iPC

### External Touch Display not Functioning

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Touchscreen not functioning	Touchscreen functionality has been temporarily disabled	Check if touchscreen functionality has been temporarily disabled (padlock symbol on Main Screen key). If yes, press and hold the Main Screen key to re-enable touchscreen operation.
	Touchscreen functionality has been permanently disabled	In service mode, select Main Setup -> User Interface and change the “Touch Enable” selection to “yes”.
	External Touch cable not connected	Check cable connection from external touch to connector board
	External Touch driver configuration	Check connector configuration: 1. Enter Main Setup menu 2. Select Monitor 3. Select Hardware 4. Reconfigure RS232/MIB drivers 5. if problem persists, proceed to the next step
	Connector board defective	Replace connector board
	External touch defective	Replace external touch
	Main board defective	Replace Main board
Touch position invalid	Touch not calibrated	Perform touch calibration: 1. Enter Main Setup menu 2. Select Hardware 3. Select Touch Calibration

## General Monitor INOP Messages

INOP Message	Possible Causes of Failure	Failure Isolation and Remedy
Check Monitor Func	Problem with too low voltages (5V, 12V) in the monitor. Alarm lamps, display or interfaces may not function correctly.	Remove all I/O boards, connector board, MSL2 board, iPC, and put them back in and reconnect cables one at a time to isolate any defective board. If this does not resolve the problem, replace the main board
Check Monitor Temp	The temperature inside the monitor is too high	Check the environment for possible causes
	Monitor ventilation obstructed	Clean the monitor ventilation internally and then cool monitor down for 8 hours
	Main Board defective	replace Main Board
Settings Malfunction	Problem during cloning process.	Reclone configuration file
	Memory space in which the settings are stored has been corrupted	Reclone configuration file. This will reload the memory space.
	Main board defective	Replace Main board
Internal Comm.Malf.	Problem with the I2C Bus communication in the monitor	Disconnect the external display and try another one
	Connector board defective	Replace connector board
	Main board defective	Replace Main board
MCC Unsupported	An MSL coupling cable has been connected to a device which does not support MSL coupling.	Use the MSL coupling cable only when connecting Dual CPU MP90 monitors to a D80 Intelligent display.
Check Passwords	Technical or network defect has led to the loss of the password settings block	Set up a new Admin password and then either manually enter new passwords for the operating modes or copy them onto the monitor in a configuration using the Support Tool Mark2.

## Remote Control (Wired)

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Remote Control not recognized by monitor	Connector Board defective	Replace connector board
	Remote Control not plugged according to USB connection rules	See “ <a href="#">Connection of USB Devices</a> ” on <a href="#">page 421</a> for the correct connection of USB devices
	Remote Control defective	Exchange Remote Control

### Remote Control (Wireless)

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Remote Control not functioning	SRR option not enabled	Ensure the SRR option is built in and enabled. See also “ <a href="#">Short Range Radio Interface Problems</a> ” on page 161
	Low battery	Exchange battery
	Remote Control defective	Exchange Remote Control
Remote Control cannot be assigned to a monitor	Another remote control is assigned to the monitor	Remove any other remote control before assigning a new remote control to a monitor

### Remote Alarm Device

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Alarm LEDs illuminate, but no alarm sound is issued, <b>Rem.AlarmDev. Malf.</b> INOP may be issued	Speaker defective	Replace remote alarm device
	Remote device I/F defective	Replace I/O board
Alarm occurs on screen, but no LED or alarm sound on the alarm device	Cabling not connected	Check cabling
	Cabling defective	Replace cable
	I/O board defective	Replace I/O board
	Remote Alarm Device defective	Replace Remote Alarm Device
Alarm sound is issued, but no LEDs light up	LED failure	Replace Alarm Device
<b>ChkAudioSettings</b> INOP is issued	Incorrect Audio Settings, e.g. multiple speakers are set up in Audio Settings, but Remote Alarm device is not connected.	Check Audio Settings under <b>Main Setup -&gt; Hardware -&gt; Multiple Speaker</b> Check cable connection of Remote Alarm Device

## iPC

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
iPC menu not available	iPC is not connected correctly	Check all cable connections to the iPC
Prompt Message "PC HW Malfunction" is issued (See also " <a href="#">Troubleshooting Power-On Test Errors</a> " on page 506 for details)	Battery empty PC temperature is too high PC defective	Exchange the battery of the iPC Let the PC cool off and then try again Exchange iPC
PC does not start automatically and/or cannot be started manually (See also " <a href="#">Troubleshooting Power-On Test Errors</a> " on page 506 for details)	HW setting incorrect Flat ribbon cable to iPC not connected correctly iPC defective (See also " <a href="#">Troubleshooting Power-On Test Errors</a> " on page 506 for details)	Check Global Settings and set to Autostart PC if Auto Start is desired. Check flat ribbon cable connection to iPC Exchange iPC
iPC does not show up on patient monitor screen after start of iPC		Connect an external display, mouse (which illuminates, when connected) and/or a keyboard (which illuminates, when NumLock is pressed) and check whether something is displayed on the external display and/or the input devices illuminate.
	Power cable/cable connection defective	If no picture is shown on the external display and the devices do not illuminate: Check internal Power Cable from mainboard to iPC. Exchange IV2-STAT CBL MB-AC/DC (Part of Basic Cable Kit 453564204501). Otherwise, see " <a href="#">Troubleshooting Power-On Test Errors</a> " on page 506 for iPC defects.
	The cable/cable connection between iPC and Video Mixer Board is not working.	If there is a picture and the input devices illuminate: Check/replace cable connection/cable between iPC and Video Mixer Board.
	The Video Mixer Board is defective.	Replace Video Mixer Board
PC Operating System does not start up	Cable connection to hard disk loose Hard disk defective	Check cable connections to hard disk Exchange hard disk
Operating System crashes during startup	Windows Installation malfunction	Perform a windows recovery by pressing F8 while the Philips Logo appears on the monitor screen. This will open the boot menu. Use regular windows recovery procedures

## 4 Troubleshooting

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
No sounds from PC		Verify that the patient monitor sounds are functioning correctly
	PC sounds disabled	Check Global Settings and set to PC Audio On
	Flat ribbon cable to iPC not connected correctly	Check flat ribbon cable connection to iPC
	No sounds issued from PC	Check windows control panel settings. If you are using Windows XP, install the correct Audio drivers. Ensure the PC volume is not set to "0".
Undesired PC sounds from internal speaker	Incorrect HW setting	Set PC Audio to "Off"
DVI, VGA, DisplayPort or USB connections not functioning	iPC defective	Exchange iPC
PC is unstable or shows colors incorrectly	RAM faulty	Exchange RAM
LAN connection not functioning	Flat ribbon cable to iPC not connected correctly	Check flat ribbon cable connection to iPC
	iPC defective	Exchange iPC
Date and Time not displaying correctly	Windows settings not synchronized with patient monitor.	Check windows settings
Display Resolution incorrect	Incorrect settings	Change the display resolution settings to match the patient monitor display resolution

For additional troubleshooting information, see “[Troubleshooting the iPC](#)” on page 506.

## Keyboard/Mouse not Functioning

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Keyboard/Mouse attached directly to the monitor not functioning	Keyboard/Mouse not connected properly	Check cabling
	Keyboard/Mouse defective	Replace Keyboard/Mouse
	Connector board defective	replace connector board
Keyboard/Mouse connected to the iPC not functioning	Keyboard/Mouse not connected properly	Check cabling
	Keyboard/Mouse defective	Replace Keyboard/Mouse
	iPC defective	replace iPC

## Barcode Scanner

Symptoms	Cause of Failure	Failure Isolation and Remedy
The barcode scanner does not function. (No lights, no sound; scanner cannot read barcodes)	The scanner is not plugged into the USB port of the monitor.  The system does not recognize the scanner.	Check the scanner's physical connection to the monitor's USB port.  Use only barcode scanners approved by Philips.
	The scanner has a mechanical problem.	Replace the scanner
The barcode scanner cannot read barcodes. (Lights and sounds function, but scanner cannot read barcodes.)	The scanner is held too close or too far from the barcode.  The scanner window is not clean or is blocked.	The scanner must be held between 15 and 30 cm (6 and 12 inches) from the barcode.  Clean the barcode scanner.
	The system does not recognize the barcode format.	Barcodes must be written in a recognizable format.  If the barcode is written in a recognizable format, and the scanner cannot read the barcode, reset the scanner
	The system does not recognize the scanner.	Use only barcode scanners approved by Philips.
	The scanner has a mechanical problem.	Replace the scanner.

### Bedside Network Status Icons

The following table shows the icons displayed on the monitor when network related issues occur.

Wireless Icon	Wired Icon	Inverse Video	Blinks	Icon Comments	INOP Message	What does it mean?
No Icon	No Icon	-	-	-	-	MONITOR does not have a LAN connection (Wireless MONITOR cannot find an access point to talk to, wired Monitor cannot hear anything on its LAN connection)
		Yes	Yes	Central - outline only	"Unsupported LAN" (after 1 minute)	MONITOR has a LAN connection but does not have an IP address assignment (Wireless MONITOR has found an access point to talk to, wired MONITOR hears traffic on the LAN)
		No	No	Central - outline only	"No Central Monitoring"	MONITOR is connected to the LAN and has an IP address assignment, but the bed is not being monitored at the central 1. MONITOR is not assigned to a sector 2. There is another monitor on the network with the same "Equipment Label"
		No	No	Central - outline only, Client - filled	"No Central Monitoring"	MONITOR is connected to the LAN and has an IP address assignment, but the bed is not being monitored at the central 1. MONITOR is not assigned to a sector 2. There is another monitor on the network with the same "Equipment Label" However, Management Association is available.
		No	No	Central - solid box, edge clipped		MONITOR assigned to a sector and is being monitored by a central, but no Time Service detected.
		No	No	Central - solid box	-	Normal Operation - MONITOR assigned to a sector and is being monitored by a central
		No	No	Central - solid box, network line extended	-	Normal Operation MONITOR assigned to a sector and is being monitored by a central. This monitor also has OVERVIEW functionality on other beds.

Wireless Icon	Wired Icon	Inverse Video	Blinks	Icon Comments	INOP Message	What does it mean?
	-	No	Yes	Central - solid box	"Wireless Out Of Range"	Wireless MONITOR that currently is being monitored by a central is losing contact with the access point and cannot find another to talk to.
		Yes	Yes	Central - outline only, line for broken connection to central	"No Central Monitoring"	Monitor lost connection to the Information Center: 1. LAN cable was disconnected 2. Information Center was disconnected 3. Network infrastructure failure (switch, etc.) 4. Out of range (wireless MONITOR)
 *	 *	Yes	Yes	Central - outline only, Client - filled	"No Central Monitoring"	MONITOR assigned to a sector and is being monitored by a central, but Management Association is available

\* Only for Software Release  $\geq$  M.0

### Network related problems

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Prompt Message “no central assigned to this bed” is issued	The monitor label is not set in the monitor (if the beds are “monitor labeled” in the Philips Information Center)  Problem with the Philips Information Center to Switch communication (if the beds are “port mapped” in the Philips Information center)	Set Monitor Label in Config Mode  Check PIC to Switch communication, Switch configuration and Firmware status
INOP “Unsupported LAN” is issued	Network failure  Monitor connected to wrong network  IP address conflict after infrastructure re-installation  IIT is enabled but no IIT infrastructure can be found	Check if switches, Philips Information Center and Database Server are all running and connected to the network  Check if monitor has been connected for example to a different hospital network instead of the Philips Clinical Network  Reboot Database Server and Philips Information Center  Move the monitor into the range of the IIT infrastructure or disable IIT in the <b>Setup IIT</b> menu if no IIT infrastructure is available.
No connectivity to PIC, no prompt or error message on monitor	Hardware Defect  Configuration problem	Check LAN cable connection  Check NGN Connector board in Monitor  Check Switch  Check switch configuration and firmware revision
Status Message “Incompatible SW Revision versions” is issued	Monitor and PIC software are not compatible	Check Software compatibility and upgrade to compatible software

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Other Bed Overview not available	Configuration Problem	<p>Check configuration in PIC regarding other bed overview (care group assignment)</p> <p>Verify configuration of switch (setting of multicast filters)</p>
	This function is not available for IntelliVue Instrument Telemetry and, in combination with earlier IntelliVue Information Center (IIC) revisions, for WLAN (IntelliVue 802.11 Bedside Adapter).	If you are using an IntelliVue 802.11 Bedside Adapter, check the software revision of the IntelliVue Information Center (IIC) to ensure it is compatible. If the software revision of the IIC is incompatible or you are using IIT, switch to a wired configuration
“Other Bed” Alarms are not appearing	Configuration problem	Verify configuration in PIC, in Monitor (Config Mode) and check that the feature is not temporarily disabled by the user (Bed Info Window)

## 4 Troubleshooting

### IntelliVue 802.11 Bedside Adapter Problems

Symptoms	Cause of Failure	Failure Isolation and Remedy
No Network icon or Network icon flashes. No association to central station.	Communication problem between the monitor and the IntelliVue 802.11 Bedside Adapter or RSSI value below 30.	<p>Ensure the network infrastructure is functioning properly. See the <i>Troubleshooting tables</i> in the <i>IntelliVue 802.11 a/g Infrastructure Installation and Configuration Guide</i> for details.</p> <p>Check the antenna cable connection on the IntelliVue 802.11 Bedside Adapter.</p> <p>Check that the IntelliVue 802.11 Bedside Adapter is correctly connected to the panel adapter board.</p> <p>Check that the indicator behind the RSSI value (Main Setup -&gt; Network -&gt; WLAN Diagnostic -&gt; RSSI) is rotating. If it is not, check IntelliVue 802.11 Bedside Adapter hardware.</p> <p>Replace antenna or IntelliVue 802.11 Bedside Adapter if necessary.</p>
	IntelliVue 802.11 Bedside Adapter not yet operational	<p>Check menu line 'Wireless LAN' ( Main Setup -&gt; Network -&gt; WLAN Diagnostic -&gt; Wireless LAN). If it shows 'Off', the wireless adapter is not yet operational. This does NOT indicate that WLAN has been disabled by a setting.</p> <p>If problem persists, check for an installed wired LAN cable.</p>
	Configuration problem using WEP, WPA(PSK), WPA2(PSK).	Ensure the Mode, SSID, Country and Security settings in the Setup WLAN menu match your installation
	Configuration problem using WPA Enterprise or WPA2 Enterprise	<ol style="list-style-type: none"><li>1. Check the connection status.(Main Setup -&gt; Network -&gt; WLAN Diagnostics -&gt; Conn.Status)</li></ol> <p>If the state only shows 'Scanning', ensure the Mode, SSID, Country and Security settings in the Setup WLAN menu match your installation.</p>

Symptoms	Cause of Failure	Failure Isolation and Remedy
		<p>2. Check the connection status. If the device shows the state ‘Authenticating’, your SSID, Mode, Country and Security settings are correct.</p> <p>You already have a WLAN connection to your Access Point, but the device fails to authenticate, check your authentication server and WLAN controller error log.</p> <p>3. As an investigation step, disable the CertificateCheck. (Main Menu -&gt; Network -&gt; WLAN Setup -&gt; CertificateCheck) If authentication is now possible, proceed with step 4.</p> <p>Otherwise double check your authentication server configuration, WLAN controller configuration and the user credentials (User Name, Password, Anonymous Identity).</p> <p>Note: If the previously used credential settings were wrong, the device is perhaps on the exclude list of your WLAN Controller. Resolve this issue on your WLAN controller.</p> <p>Note: <b>Do not forget to re-enable the certificate check.</b></p>
		<p>4. Check the time setting of the device (Main Setup -&gt; Date, Time). If not correctly set, the used certificates are detected as invalid. Adjust to the correct time.</p> <p>5. Check the installed CA certificate using the support tool. - Task -&gt; Clone from Medical Device - Open the cloned file using Configuration -&gt; Configuration Editor - In Configuration Editor check Configuration -&gt; Hardware -&gt; Network -&gt; Certificate 1 for validity(Valid from, Valid until)</p> <p>6. Ensure the installed CA certificate is the root certificate of your authentication server certificate chain.</p>

### IIT-related Problems

Symptoms	Cause of Failure	Failure Isolation and Remedy
No Network icon or Network icon flashes. No association to central station.	Communication problem between the monitor and the IIT adapter. MAC Instr. Tele. field in Instrument Telemetry Service Window is 0000 0000	Check that RF Access Code is set correctly and the network is correctly set up. Check the cable connection to the IIT module. Check the antenna cable connection between the IIT module and the antenna. Replace cable, antenna or IIT module if necessary.
	Incorrect RF Access Code. No IP Address.	Ensure: <ul style="list-style-type: none"><li>RF Access Code is set correctly.</li><li>Network is set up correctly.</li></ul>

## Short Range Radio Interface Problems

Symptoms	Cause of Failure	Failure Isolation and Remedy
Measurement selection icon does not change to SRR.	Assignment of SRR device to monitor not possible	Check SRR Configuration Settings. Replace defective SRR interface or cable, if necessary. Ensure SRR interface is installed.
	SRR interface of telemetry transceiver defective or incompatible	Ensure the telemetry transceiver SRR interface is compatible and functional.
Measurement selection icon changes to SRR but Assignment of SRR device to monitor fails. <b>SRR Interference</b> INOP is issued	RF Interferences	Check location for RF interferences and free frequencies by performing a site survey (e.g. with air magnet tool).
Communication Dropouts or gaps in parameter waves. <b>SRR Interference</b> INOP may be issued	RF Interferences	Check location for RF interferences and free frequencies by performing a site survey (e.g. with air magnet tool).
	Too many SRR devices allocated to one SRR channel	Up to two SRR connections can be established per channel. Check SRR Configuration Settings.
SRR communication aborted. <b>SRR Interference</b> or <b>SRR Invalid Chan</b> INOP may be issued.	RF Interferences	Check location for RF interferences and free frequencies by performing a site survey (e.g. with air magnet tool).
	Too many SRR devices allocated to one SRR channel	Up to two SRR connections can be established per channel. Check SRR Configuration Settings.
	SRR device out of range (either monitor or Telemetry Transceiver)	Position the SRR devices closer to each other. Check SRR signal quality indicator for signal strength.
Telemetry Device using SRR not recognized by the monitor.	Telemetry Device not supported by the SRR adapter	Ensure you use a telemetry device which is compatible with SRR.

### Multi-Measurement Module (MMS/MMX)

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
INOP message “Msmt Ext. Unsupp” is issued	An unsupported Measurement Extension has been connected	Disconnect the Measurement Extension
	Measurement Extension is defective	Replace Measurement Extension
	Multi-Measurement Module defective	Replace Multi-Measurement Module
INOP Message “MSL Device Unsupp” is issued	Wrong Software Revision	Upgrade monitor and/or Multi-Measurement Module to a matching software version. See for a list of compatible Multi-Measurement Modules
	Too many Multi-Measurement Modules connected	Disconnect unsupported Multi-Measurement Modules for proper operation
	Unsupported type of Multi-Measurement Modules (for example M3000A) connected	Disconnect the unsupported Multi-Measurement Modules. See for a list of compatible Multi-Measurement Modules
	Module Rack connected to a monitor that does not support a Module Rack (for example, MX400-550)	Disconnect the Module Rack
INOP Message “Bad MSL” is issued	Measurement Extension is defective	Replace Multi-Measurement Module
	Too many Multi-Measurement Modules connected	Disconnect unsupported Multi-Measurement Modules for proper operation
	Incorrect connections or cable damage	Ensure all connections are correct and no cables are damaged
	Parameter board defective	Check if all measurements are displayed in the measurement selection window. Exchange parameter board, if necessary

## MSL-related Problems

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Multi-Measurement Module does not start up (no LEDs active), no INOP or prompt displayed	No Power	<p>Check MSL cable and replace if necessary</p> <p>If the Multi-Measurement Module is not functioning on both the MSL connector of the connector board AND on the MSL connector, replace the connector board. If the Multi-Measurement Module is not functioning on the MSL connector only, replace the MSL board.</p>
Multi-Measurement Module does not start but LEDs are normal	Communication lines in MSL cable or MSL connector broken	Check MSL cable and MSL connectors
	Connector board, MSL2 board or main board defective	Check connector board and replace if necessary. Check MSL2 board and replace if necessary. If problem persists, replace main board.
MSL Power High INOP is issued  Note: if this condition persists for longer than 15 minutes, the INOP MSL Power Off will appear (see below)	Attached devices drawing too much power from the monitor. Too many Module Racks and Multi-Measurement Modules connected to the monitor	Reduce to a limit of two Module Racks and one Multi-Measurement Module connected to the monitor

## 4 Troubleshooting

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
MSL Power Off INOP is issued	Attached devices drawing too much power from the monitor. Too many Module Racks and Multi-Measurement Modules connected to the monitor	<p>Disconnect all Module Racks and Multi-Measurement Modules from the monitor</p> <p>Cycle power to restore power to the MSL devices.</p> <p>If the message disappears, reconnect the Module Rack and Multi-Measurement Modules one at a time, waiting 15 minutes between each device to see if message reoccurs. If yes, the respective Multi-Measurement Module or Module Rack is faulty. See <a href="#">“Multi-Measurement Module (MMS/MMX)”</a> on page 162 for troubleshooting tasks. If no, add front-end modules one at a time, waiting 15 minutes between each module to see if message reappears, Replace module if faulty.</p> <p>Note: If an individual defective device is connected the MSL Power High or MSL Power Overload INOPs will appear initially. The MSL Power Off INOP will not occur for at least 15 minutes.</p>
MSL Power Overload INOP is issued	Short Circuit within MSL system	Disconnect all MSL connections and reconnect devices one at a time. If message persists, replace connector board.
INOP Bad Server Link is issued	Unexpected data detected on MSL	Check cable and power cycle the monitor
	A Module Rack or Multi-Measurement Module with an incompatible software revision is connected to the monitor	Connect the Module Rack or Multi-Measurement Module with compatible software revision
	Communication between the components not functioning	Check software versions and model number of devices for compatibility
INOP Message Serverlink Malf is displayed, audible indicator: a beep every two seconds	The hardware for communicating with the Multi-Measurement Module is faulty	<p>Check MSL cable, replace if necessary.</p> <p>Check connector board and MSL2 board. Replace if necessary</p>

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
A measurement supported by a server does not come up on the monitor	Label conflict	A parameter label from this measurement is already in use in the monitor. Check the conflict window to select the measurement.
Prompt message “Too many <label> modules connected” is issued	There are more modules of the type <label> connected than supported by the software	Remove the unsupported module or use the label manager application in the monitor to disable the module.
The ECG Out function does not function	Hardware problem	<p>Check MSL cable</p> <p>Check ECG Out Hardware in the monitor (Power Switch Board)</p> <p>Check the MSL connector in the Multi-Measurement Module.</p>

## Alarm Lamps

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
INOP Message Check Alarm Lamps is issued	Alarm LED board cable disconnected	Reconnect Alarm LED board to mainboard
	Alarm LED board defective	Replace Alarm LED board
	Main board defective	Replace Main board
Alarm occurs, but no LED lights up	Environmental lighting too bright	Place monitor in a darker environment
	Alarm LED board cable disconnected	Reconnect Alarm LED board to mainboard
	Alarm LED board defective	Replace Alarm LED board
	Main Board defective	Main board

## 4 Troubleshooting

### Alarm Tones

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
INOP Message <b>Speaker Malfunction</b> is displayed	Speaker cable disconnected	Reconnect speaker cable
	Speaker defective	Replace speaker
	Sound amplifier on main board defective	Replace main board
Alarm occurs but no alarm sound is issued	Audible alarm indicators have been switched off	Switch audible alarm indicators back on
	Volume set to 0	Increase volume
	Speaker defective	Replace speaker
	Sound amplifier on main board defective	Replace main board

### Alarm Behavior

If your monitor did not alarm as end user expected, see the Instructions for Use for possible setup issues or configuration settings which could affect alarm behavior.

### Power Loss Alarm Buzzer

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Power Loss Alarm Buzzer not working. Power Loss Alarm Buzzer Test fails.	Power loss sound is disabled	Enable power loss sound. ( <b>Main Setup -&gt; Global Settings -&gt; Power Loss Sound</b> )
	Cable connections between power supply and main board	Check cable connections between power supply and main board.
	Main board defective	Exchange main board

## Individual Parameter INOPS

If any of the following parameter INOP messages are issued try the respective parameter in another device. If the INOP message persists replace the parameter module, the Multi-Measurement Module or other indicated device.

- **CO2 Equip Malf**
- **ECG Equip Malf**
- **NBP Equip Malf**
- **<Pressure Label> Equip Malf**
- **RESP Equip Malf**
- **SpO2 Equip Malf**
- **SpO2 Transduc Malf**
- **tcpO2 (or tcpCO2) Equip Malf**
- **<Temp Label> Equip Malf**
- **BIS Equip Malfunc**
- **BISx Malfunction**
- **NMT Equip Malfunct**
- **NMT Incompatible**
- **NMT Cal Failed**
- **<EC10 / EC40> Equip Malf**

### Tympanic Temperature Problems

Symptoms	Possible Cause of Failure	Failure Isolation and Remedy
The Tympanic Thermometer does not function.	There is no connection either between the base station and the thermometer, or the base station and the host monitor.	Verify the: <ul style="list-style-type: none"><li>• Interface cable between the base station and the host monitor is connected correctly.</li><li>• Thermometer cable is connected to the base station, and that its connector is not damaged. If the problem persists, replace the thermometer.</li></ul>
The Tympanic Thermometer display is blank.	The thermometer is defective.	
The temperature reading is unusually high.	The probe cover is damaged, or not attached correctly.	Verify the probe cover is not torn, and the probe is inserted into the cover completely. If the problem persists, use a new probe cover.
The temperature reading is unusually low.	The probe, probe cover, or the ear canal is obstructed.  Site Mode configured to 'Ear'.	Remove any obstructions from the probe cover, the probe tip, and the patient's ear canal.  Configure Site Mode to 'Core' or 'Rectal'.*
Error 12 displayed.  	Site Mode is corrupted.	Allow the device to power down and enter Biotech Mode to reset Site Mode. Save the Biotech settings before using the device again.
Any other system error displayed.	N/a	Reset the thermometer by installing a probe cover. If the problem persists, contact service personnel.

\* The factory default settings are as follows:

Temperature Mode: Degrees C (unlocked)

Site Mode: Ear

Site Text: On

- **Ear:** In ear (EAR) mode, the display indicates the absolute temperature without adjustment.
- **Oral:** In oral (ORL) mode, the tympanic temperature is adjusted to display an oral temperature equivalent. Oral Mode = Ear Mode + 0.60 degrees C.
- **Core:** In core (CORE) mode, the tympanic temperature is adjusted to display the core temperature equivalent. Core Mode = Ear Mode + 1.04 degrees C.
- **Rectal:** In rectal (REC) mode, the tympanic temperature is adjusted to display the rectal temperature equivalent. Rectal Mode = Ear Mode + 1.16 degrees C

**Masimo rainbow SET SpO2-related Problems**

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
INOP <SpO2 label> <b>Upgrade</b> is issued	An upgrade tool is connected and a firmware upgrade was started in service mode, but the monitor is no longer in service mode	Return the monitor to service mode to continue the upgrade
INOP <SpO2 label> <b>Unkn. Sensor</b> is issued	Demo tool is connected but monitor is not in demo mode	Put the monitor in demo mode

### G7m Gas Analyzer Problems

- This section provides a recommended procedure for locating and identifying faults on the gas analyzer. It details how to identify hardware problems and how to proceed when measurement related INOPs occur. It details how to proceed when errors are flagged for:
- Failed calibration checks and procedures
  - Failed diagnostic checks

See “[Equipment Required](#)” on page 110 for a list of equipment required for troubleshooting procedures.

Check the water trap and sample line first before performing any other troubleshooting activities.

#### Technical Alarm Messages (INOPs)

INOP Message, Indication	What to do
<b>Agent Calculating</b>	The gas analyzer is calculating the agent concentration. Wait until the calculation is finished.
<b>&lt;Agent Label&gt; Change Scale</b>	The wave of the agent shown is clipped (DES/ENF/HAL/SEV/ISO). Select a more appropriate wave scale to display the whole wave.
<b>&lt;Agent Label&gt; Overrange</b> INOP tone	The <AGT> value is higher than the measurement range. If you suspect a false high value, follow the troubleshooting procedure described in the following section.
<b>&lt;Agent Label&gt; Unable To Meas</b> Numerics replaced by -?- , INOP tone	The gas analyzer currently cannot measure <GAS>. If this INOP persists, follow the troubleshooting procedure described in the following section..
<b>&lt;Agent Label&gt; Unable To Meas</b> Numerics replaced by -?- , INOP tone	The gas analyzer currently cannot measure the agent shown (DES/ENF/HAL/SEV/ISO). If this INOP persists, follow the troubleshooting procedure described in the following section.
<b>Agent Mixture</b> Anesthetic agent mixture detected	There are three possible situations:  The gas analyzer has detected more than two agents in the gas sample. The agent data is invalid, shown by -?- in place of the numerics.  The gas analyzer has detected two agents in the gas sample. Both agents could be identified and the agent data is valid. In this case there is no INOP tone and the INOP message is for information only.  The gas analyzer has detected two agents in the gas sample. There is a problem with the identification or the measurement accuracy. As measurement accuracy may be reduced, the numerics are displayed with a ? and an INOP tone will sound..
<b>AGT Meas Malfunc</b> Numerics replaced by -?- , INOP tone	There is a problem with the agent measurement. Unplug the gas analyzer from the monitor and then plug it in again. If this INOP persists, follow the troubleshooting procedure described in the following section.
<b>awRR Overrange</b> Numerics shown with ?, INOP tone	The measured respiration rate is higher than the maximum measurable range.
<b>Check Watertrap</b> INOP tone	Check if the water trap is full or the sample line and/or water trap is not connected.

INOP Message, Indication	What to do
<b>CO<sub>2</sub> Change Scale</b> INOP tone	The CO <sub>2</sub> wave is clipped. Select a more appropriate wave scale to display the whole wave.
<b>CO<sub>2</sub> Overrange</b> INOP tone	The CO <sub>2</sub> value is higher than the measurement range. If you suspect a false high value, follow the troubleshooting procedure described in the following section.
<b>CO<sub>2</sub> Unable To Meas</b> Numeric is replaced by -?- , INOP tone	The gas analyzer currently cannot measure CO <sub>2</sub> . If this INOP persists, follow the troubleshooting procedure described in the following section..
<b>&lt;Gas Analyzer&gt; Occlusion</b> Numerics replaced by -?- , INOP tone	Ensure the sample line and exhaust line tubing is not kinked. Check the airway adapter for a build up of fluid. Empty the fluid and reposition the adapter if necessary. Ensure that the airway adapter port is facing upwards. Try replacing the sample line, water trap, or exhaust line. If this INOP persists, follow the troubleshooting procedure described in the following section.
<b>&lt;Gas Analyzer&gt; Zero Failed</b> Numerics shown with ?	A gas analyzer zero calibration failed. Check the exhaust tube for an occlusion or kinking and replace if necessary. If the zero has failed more than once, follow the troubleshooting procedure described in the following section.  <b>Note:</b> The gas analyzer tries up to three zeros before the INOP appears..
<b>GM Accuracy?</b> Numerics shown with ?	Gas analyzer measurement accuracy may be reduced. Check that the gas inlet, water trap, and gas outlet tubing are not occluded. If this INOP persists, follow the troubleshooting procedure described in the following section.
<b>GM Alarm Suppress</b>	Gas analyzer alarms will be paused until breathing activity is first detected.
<b>GM Align Watertrap</b>	The watertrap is not in the correct - vertical- position. Rotate the water trap to the vertical position.
<b>GM Component Malf</b>	A gas analyzer component is in not functioning. Some parameters may be unavailable or measured with reduced accuracy. Switch the gas analyzer off and then on again. If the INOP persists, follow the troubleshooting procedure described in the following section.
<b>GM Incompatible</b> INOP tone	This version of the gas analyzer is not supported. Contact your service personnel.
<b>GM Malfunction</b> Numerics replaced by -?- , INOP tone, Gas Analyzer Setup LED may be blinking	There is a problem with the gas analyzer hardware. Unplug the gas analyzer from the monitor and then plug it in again, or switch the monitor off and then on again. If this INOP persists, follow the troubleshooting procedure described in the following section..
<b>GM No Breath</b> et and in numerics show the same value	No breath detected. Check tubing and patient connections.
<b>GM Standby</b>	The gas analyzer is in standby. To resume gas monitoring, select <b>GM Exit Standby</b> in the <b>Setup GM</b> menu, or press the "Standby" key on the gas analyzer module.

## 4 Troubleshooting

INOP Message, Indication	What to do
<b>GM Switched Off</b> INOP tone	The gas analyzer has switched off all possible internal components due to overheating. Allow gas analyzer to cool down before resuming monitoring. If INOP persists, follow the troubleshooting procedure described in the following section.
<b>GM Unplugged</b>	All gas measurements have been deactivated by unplugging a module. The measurements automatically disappear from the display. To switch the measurements on again, plug the module in again.
<b>GM Warmup</b>	The gas analyzer has not yet reached operating temperature and the measurement accuracy may be reduced.
<b>GM Zero Running</b> numerics shown with ? Second/Third zero: numerics are unavailable, INOP tone	Automatic zero calibration in progress. If a Zero calibration fails, one or two additional Zero calibration attempts may be performed automatically. If the last Zero attempt fails, a <b>&lt;Gas Analyzer&gt; Zero Failed</b> INOP becomes active.
<b>MAC Check Sources</b> INOP tone may appear	Either not all measurements or values required to perform the calculation are available or some of the required values are questionable. Check the measurement sources and ensure they are all switched on and that none of them are invalid or questionable.
<b>MAC Correction?</b>	Enhanced MAC correction is on, but values for patient age and/or temperature are not available. Enter these values.
<b>N<sub>2</sub>O Change Scale</b>	The N <sub>2</sub> O wave is clipped. Select a more appropriate wave scale to display the whole wave.
<b>N<sub>2</sub>O Overrange</b> INOP tone	There is a problem with the N <sub>2</sub> O measurement. If this INOP persists, follow the troubleshooting procedure described in the following section..
<b>N<sub>2</sub>O Unable To Meas</b> Numerics replaced by -?- , INOP tone	The gas analyzer currently cannot measure N <sub>2</sub> O. If this INOP persists, follow the troubleshooting procedure described in the following section..
<b>O<sub>2</sub> Change Scale</b>	The O <sub>2</sub> wave is clipped. Select a more appropriate wave scale to display the whole wave.
<b>O<sub>2</sub> Overrange</b> INOP tone	There is a problem with the O <sub>2</sub> measurement. If this INOP persists, follow the troubleshooting procedure described in the following section..
<b>O<sub>2</sub> Unable To Meas</b> Numerics replaced by -?- , INOP tone	The gas analyzer currently cannot measure O <sub>2</sub> . If this INOP persists, follow the troubleshooting procedure described in the following section..
<b>O<sub>2</sub> Zero Failed</b> Numerics replaced by -?- , INOP tone	An O <sub>2</sub> zero calibration failed. Follow the troubleshooting procedure described in the following section..

## Troubleshooting

If the measurement accuracy is in doubt or if an INOP indicates a technical problem, perform the following tests in the order shown. They are described in detail in the Testing and Maintenance Chapter.

- 1** Zero Calibration
- 2** Leak Check
- 3** Flow Rate Check
- 4** Pressure Sensor Test
- 5** Gas Accuracy Check

If the flow rate cannot be adjusted or if any of the other tests fail more than twice, exchange the gas analyzer.

### Module Rack

Symptoms	Cause of Failure	Failure Isolation and Remedy
Prompt Message “Unrecognized Measurement Module in slot s” is issued	An unsupported module has been plugged into the Module Rack	Unplug the unsupported module
Prompt message “Measurement Module in slot n is currently ignored” is issued	Too many modules of the same kind have been plugged into the Module Rack	Unplug module in slot n
Red Error LED stays on	Unrecoverable hardware selftest error:	Try to attach the Multi-Measurement Module directly to the MSL cable. If the measurements show up on the screen, the fault is in the Module Rack
	MSL cable defective	If the measurements do not show up when the Multi-Measurement Module is connected directly to the MSL cable, then replace MSL cable
	Flex connector from main board to MSL defective	Replace connector
	CPU module defective	Replace CPU module
Red Error LED flashes	Hardware selftest error	If system comes up, check status log. Otherwise see above
Module Rack LEDs ok, Front End Measurement Module not recognized (no prompt or INOP)	Measurement Module or Measurement Module Connector defective	Replace Measurement Module
	No Front-End power because MSL voltage from the monitor is too high or too low	Try a new MSL cable. Replace if failure is rectified.  Replace mother board
	Mother board or connector on Mother Board defective	If the voltage is in range, or there is obvious damage to a connector, replace mother board

## Printer

Symptoms	Cause of Failure	Failure Isolation and Remedy
Prompt message “Print job could not be queued” is issued. No print device is found.	Printer is disabled in the Setup Printers menu Paper size of printer does not match paper size of report	Enable the correct printer in the Setup Printers menu Change paper size of the printer in the Setup Printers menu or change paper size of the report in the Setup Reports menu.
Status message “Print device Local 1 (Local 2) unavailable” is issued. Printer job is stalled.	Printer not switched on Printer paper tray empty Cabling not connected correctly Connector board defective	Switch on printer power fill printer paper tray Check cabling replace connector board
Status message “Print device Remote 1 (Remote 2, Remote 3) unavailable” is issued. Printer job is stalled	Print error on Philips Information Center  Network Connection to Philips Information Center not functioning	Print a test report on the Philips Information center. If this fails, see Philips Information Center documentation  Check that the network connection between the monitor and the Philips Information Center is working
Status message “Printing on device Remote 1... (Remote 2, Remote 3)” is issued but no report is printed	Print queue on Philips Information Center is full. Reasons for this may be: - Printer is not switched on - Printer paper tray is empty	Switch on printer power Fill printer paper tray
Printouts are not as expected	Printer paper size is not correctly configured  Printer resolution is not correctly configured  Printer color support is configured to “On” although the printer does not support color  Printer not compatible	Configure the paper size according to the inserted print media  Configure the printer resolution according to the printer capabilities  Configure the printer color support to “Off”  Check specifications

### Recorder

Symptom	Possible Cause	Corrective Action
System thinks that door is open when it is not.	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 Module 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.
	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 Module Rack.	Locking plates defective.	Remove and exchange the locking plates.

**Recorder M1116C**

Symptom	Possible Cause	Corrective Action
Prompt "Local recorder out of paper" when it is not	Paper-out sensor dirty	Pull paper out a little bit and straighten it to ensure it is fixed tightly in the recorder. Ensure the paper has been loaded correctly and that the correct paper has been used.
Prompt "Local recorder door open" when it is not	Defective door switch	Exchange Recorder
Recorder does not lock into rack	Snap-lock defective	Exchange snap locks
Paper not feeding properly	Paper roll off center	Center paper roll
	Defective roller	Exchange Roller
Poor print quality	Paper not inserted correctly	Check that paper is inserted correctly
	Print-head failure	Exchange Recorder
Content of recording is not as expected	Monitor not configured properly	Check the configuration of the monitor
Recorder not communicating with system, not printing	Poor connection to rack	Unplug the module. Plug it back and try again in a few seconds (Wait that the LED flashes)
	Only one recorder module may be used with each monitor	Remove one of the recorder modules
	Monitor not configured properly	Check the configuration of the monitor
	Recorder defective	Exchange Recorder

## 4 Troubleshooting

### MIB / RS232

Symptoms	Cause of Failure	Failure Isolation and Remedy
AGM connected to an RS232 port not functioning	The MIB/RS232 board is in a wrong slot (slot has been changed after software configuration or an additional board has been plugged in)	Verify correct placement of the I/O boards
	The MIB/RS232 board or the connector board (depending on which RS232 port is used) is defective	Check board and replace if necessary
External device not receiving data	The MIB/RS232 port is not configured for data export	Check configuration of the MIB/RS232 ports in configuration mode
	The wrong data export protocol driver is configured in the monitor	Check the export protocol required by the attached device and configure the monitor accordingly
	The cable between the external device and the monitor is not connected correctly or defective	Check cable and replace if necessary
	The external device does not support the version of the data export protocol used in the monitor	Check if the device supports the version of the data export protocol. Upgrade device or monitor if necessary (if matching versions exist).
	A terminal concentrator is used in between the device and the monitor and a protocol with dynamic speed negotiation is used	Some terminal concentrators do not support changing the transmission speed (baud rate) dynamically. Check if the connection works without the concentrator
	The MIB/RS232 board is in a wrong slot (slot has been changed after software configuration or an additional board has been plugged in)	Verify correct placement of the I/O boards
	The MIB/RS232 board or the connector board (depending on which RS232 port is used) is defective	Check board and replace if necessary
Detailed Protocol Problem		Consult the Data Export Protocol document.

## USB

Symptoms	Cause of Failure	Failure Isolation and Remedy
None of the connected devices are functioning.	The USB port in the monitor is defective.	Depending on location of USB port, exchange either side USB connector, standard system interface board, or advanced system interface board.
	An invalid combination of connected devices is present, or the connected devices are defective.	Ensure the combination of the connected devices is valid. Replace the defective devices if necessary.

## Nurse Call Relay

Symptoms	Cause of Failure	Failure Isolation and Remedy
INOP message Check Nurse Call Relay is issued	Connector board defective	Replace connector board
Monitor alarmed, Nurse Call did not activate	Incorrect configuration (Relay latency, Relay trigger)	Check monitor configuration (see the <i>Configuration Guide</i> for details)
	Connection of cable to monitor or nurse call system not correct	Check cable connection
	Connector board is defective	Replace connector board

## Flexible Nurse Call Relay

Symptoms	Cause of Failure	Failure Isolation and Remedy
The INOP message Check Nurse Call Relay is issued	The Flexible Nurse Call Relay I/O board is defective	Replace the Flexible Nurse Call Relay I/O board
The monitor alarmed, and the Nurse Call is not activated	There is an incorrect configuration present (Relay latency, Relay trigger)	Check the monitor configuration (see the <i>Configuration Guide</i> for details)
	The connection of the cable to the monitor, or the nurse call system is defect	Check the cable connections
	The Flexible Nurse Call Relay I/O board is defective	Replace the Flexible Nurse Call Relay I/O board

### Troubleshooting the ECG OUT

Symptoms	Cause of Failure	Failure Isolation and Remedy
INOP EcgOut Equip Malf is issued	Communication Problem or Power Switch/ECG OUT board defective.	Check that the ECG OUT cable is securely connected and that all MSL connections are properly made. Check that the MSL cable and the MSL connectors are not defective. If the problem persists, replace the Power Switch/ECG OUT board.
No ECG-OUT signal to the Defib		Check the Defib cable and the cable connection from the Power Switch/ECG Out board to the main board. Exchange Power Switch/ECG Out Board if necessary. If problem persists exchange main board.

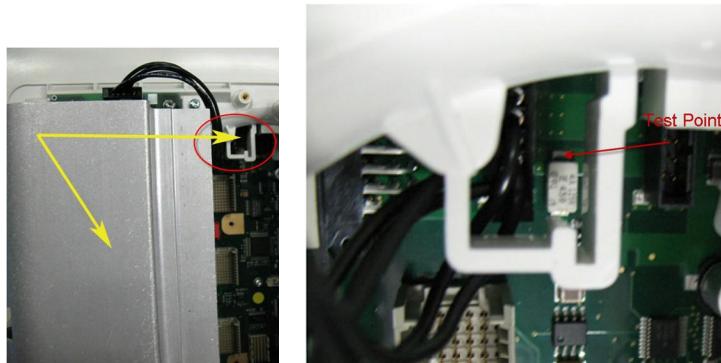
### Image Sticking

If a static image is displayed for a long time on an LCD display, image sticking, that is, a temporarily retained image, may occur. To eliminate image sticking, switch off the display and switch it back on again. Philips recommends using the moving image in standby mode.

### Testing the Functionality of the Power Supply

If you are unsure whether the power supply or the main board is defective, perform the following test, to check whether the power supply is faulty.

Place one multimeter probe on the power supply housing and the other at the test point of the fuse (see picture below). If the measured voltage is 24V ( $\pm 5\%$ ) the power supply is functioning correctly.



#### **WARNING**

High Voltage - Voltages dangerous to life are present in the instrument when it is connected to the mains power supply.

## Status Log

Many events that occur during start-up or regular monitoring are logged in the Status Log. The Status Log can be printed and cleared. Not all entries in the Status Log are errors.

<b>Monitor</b>				
H	1720	20050	1	4 Apr 02 16:37
C	1721	21050	1	4 Apr 02 15:37

The window title is either **Monitor** or **MeasServ**, dependent on which system component's status log is currently displayed.

The Status Log window shows logged events which caused a reboot of the system component (monitor or Multi-Measurement Module).

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

The following pop-up keys overlay the SmartKeys:

<b>Clear StatLog</b>	<b>Revision</b>		<b>865240</b>	<b>M8048A</b>	<b>M3001A/ M3001AL</b>
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### **Clear StatLog**

This key clears the currently displayed Status Log

### **Revision**

This key switches to the Revision Screen of the currently displayed system component

### **865240**

This key switches to the Monitor Revision Window

### **M8048A**

This key switches to the Module Rack Revision Window

### **M3001A/M3001AL/867036**

This key switches to the Multi-Measurement Module Revision Window

### **NOTE**

- If an event occurs repeatedly, contact your Philips Service Representative.
- It is possible, using the support tool, to download the status log and send it to your Philips Service Representative as a file (for example via e-mail).
- Log files generated by the monitors and measurement modules are used for system troubleshooting and do not contain protected health information.

## Troubleshooting with the Support Tool

Using the support tool you can:

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

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

### Troubleshooting the Individual Measurements or Applications

For problems isolated to an individual parameter or application such as event review, see the Instructions for Use and configuration information.

If the instructions for use did not resolve an individual parameter problem, see another module or Multi-Measurement Module.

If you are getting questionable readings for individual measurements, perform the Performance Verification tests in the *Testing and Maintenance* section.

The performance of the individual applications (event review, arrhythmia, trending) are affected by the configuration of the monitor. When contacting Philips support, have to hand your monitor's configuration in order to expedite any troubleshooting.

# Repair and Disassembly

The following section describes the disassembly and reassembly procedures for the monitor and its components to the extent required to remove and replace faulty assemblies. Do not further disassemble the product past the point described in these procedures.

## **WARNING**

High Voltage - Voltages dangerous to life are present in the instrument. Do not perform any disassembly or reassembly procedures (other than Multi-Measurement Module, Measurement extension or parameter module removal) with power applied to the instrument. Failure to adhere to this warning could cause serious injury or death.

Before doing any disassembly, turn power off, disconnect the Local Distribution Cable, **AC power cable**, MSL cable, Defib sync' cable and RS232 cable (where appropriate), disconnect the Multi-Measurement Module and Module Rack.

## Tools Required

- Torx screwdrivers (T6, T8, T10, T20)
- Torque wrench
- Allen wrench (size 6)
- 1 small flat head screwdriver
- Needle Nose Pliers
- ESD mat and wrist strap
- 1 small Pozi or Philips head screwdriver (PH0 x 60)

## Monitor Disassembly

### NOTE

- The reassembly procedures are the reverse procedures of the disassembly procedures unless otherwise noted.
- Your monitor may look slightly different than on the pictures in this chapter, depending on the options ordered.

### Removing the Cable Cover

- 1 Push in the release lever of the cable cover housing and remove the cable cover.

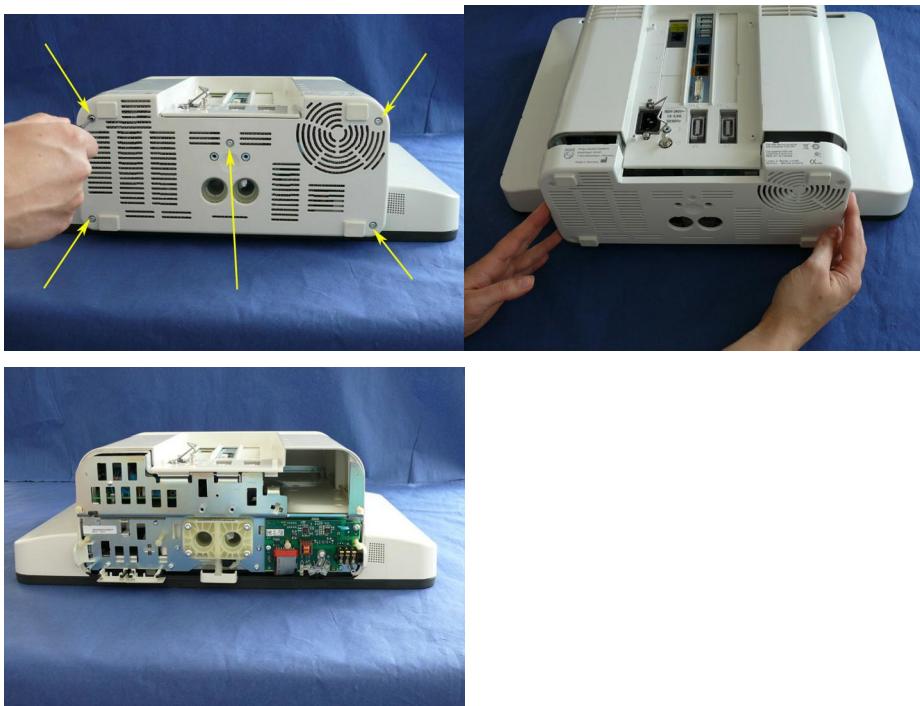


- 2 Remove the four screws and pull off the cable cover housing.



## Removing the Bottom Housing

- 1 Remove the five screws and pull off the bottom housing.

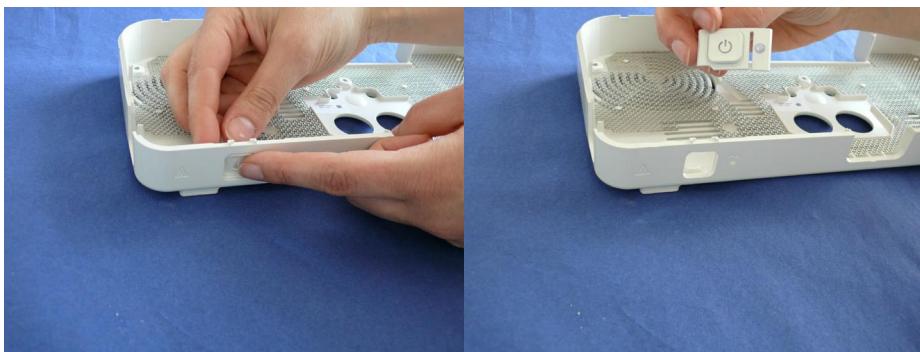


## Removing the Power Button

- 1 Remove the bottom housing as described in the section
- 2 Remove the two self-cutting screws inside the bottom housing and pull off the tappet guide.



- 3 Remove the power button.

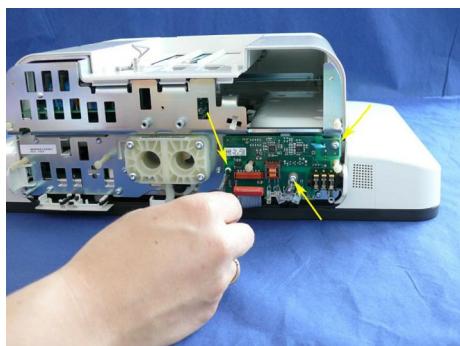


## Removing the Power Switch/ECG Sync Out Board

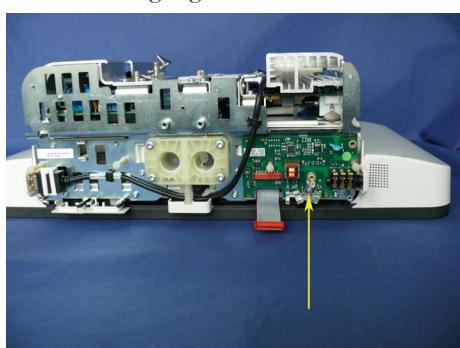
- 1 Remove the bottom housing as described in “[Removing the Bottom Housing](#)” on page 185.
- 2 Unplug the flat ribbon cable from the Power Switch/ECG Sync Out Board.



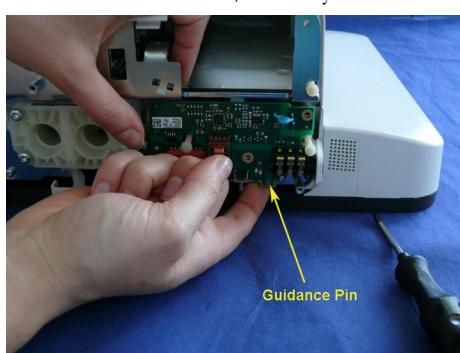
- 3 Remove the three screws from the Power Switch/ECG Sync Out Board.



- 4 Remove the light guide from the Power Switch/ECG Sync Out Board.

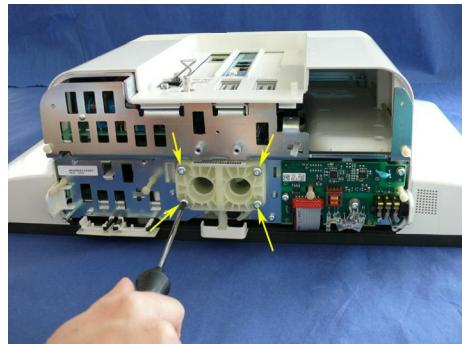


- 5 Pull the Power Switch/ECG Sync Out board off its guidance pin and remove the board.



## Removing the Quick Mount

- 1 Remove the bottom housing as described in the section “[Removing the Bottom Housing](#)” on page 185.
- 2 Remove the four screws from the quick mount.



- 3 Remove the quick mount.

## Removing the Housing Rear

- 1 Remove the bottom housing as described in the section “[Removing the Bottom Housing](#)” on page 185.
- 2 Pull out the two white plastic pins.



- 3 Remove the housing rear.



### Removing the I/O Cards

- 1 Remove the bottom housing as described in the section “[Removing the Bottom Housing](#)” on page 185.
- 2 Remove the housing rear.
- 3 Remove all I/O cards and blank I/O slot covers by pushing the release lever and pulling them out at the same time.



### Removing the MSL2 Board

- 1 Remove the bottom housing as described in the section “[Removing the Bottom Housing](#)” on page 185.
- 2 Remove the housing rear as described in the section “[Removing the Housing Rear](#)” on page 187.
- 3 Remove the screw from the MSL2 board.

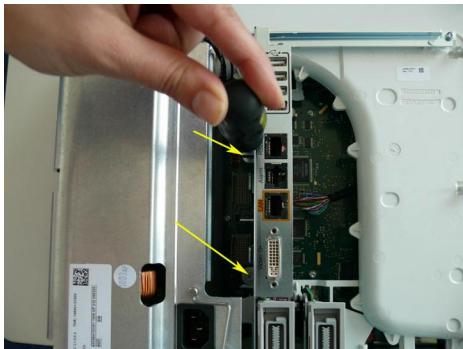


- 4 Pull out the MSL2 board.



## Removing the Connector Board

- 1 Remove the bottom housing as described in the section “[Removing the Bottom Housing](#)” on page 185.
- 2 Remove the housing rear as described in the section “[Removing the Housing Rear](#)” on page 187.
- 3 Remove the I/O cards as described in the section “[Removing the I/O Cards](#)” on page 188.
- 4 Loosen the two captive screws on the connector board assembly.



- 5 Remove the two screws holding the connector board.



- 6 Remove the connector board.



### Removing the AC/DC Power Supply

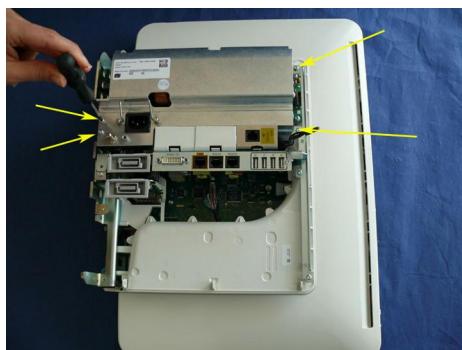
- 1 Remove the bottom housing as described in the section “[Removing the Bottom Housing](#)” on page 185.
- 2 Remove the housing rear as described in the section “[Removing the Housing Rear](#)” on page 187.
- 3 Unplug the AC/DC power supply cable by pressing the two latches on the side of the connector.



#### NOTE

To unplug the power supply cable, press the latches on the side of the connector all the way in and **carefully** pull out the connector, so the connector on the board does not get damaged.

- 4 Remove the four screws.



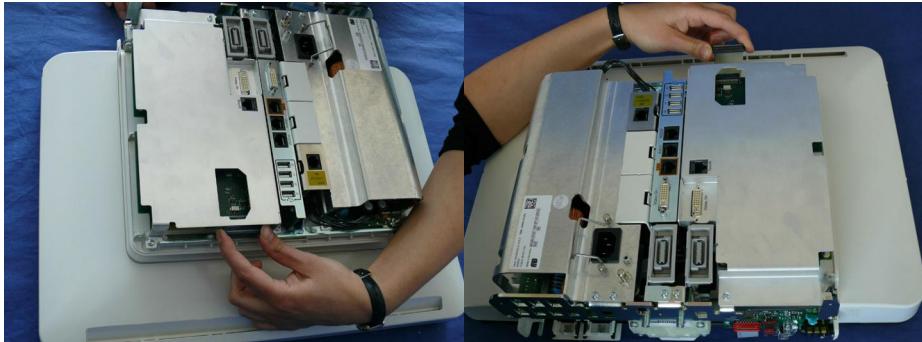
- 5 Remove the AC/DC power supply.



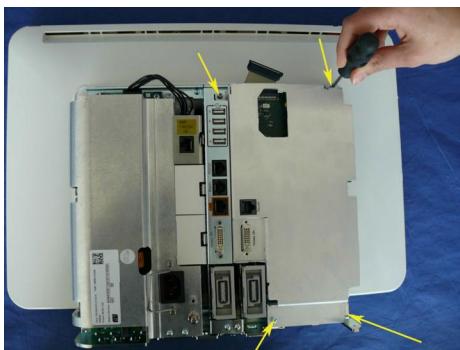
## Removing the Independent Display Interface

This procedure only applies if the Independent Display Interface is installed.

- 1 Remove the bottom housing as described in the section “[Removing the Bottom Housing](#)” on page 185.
- 2 Remove the housing rear as described in the section “[Removing the Housing Rear](#)” on page 187.
- 3 Unplug the independent display cable from the independent display interface main board.



- 4 Remove the four screws from the independent display interface.



- 5 Remove the independent display interface.



### Removing the iPC

This procedure only applies if the iPC is installed.

- 1 Remove the bottom housing as described in the section “[Removing the Bottom Housing](#)” on page 185.
- 2 Remove the housing rear as described in the section “[Removing the Housing Rear](#)” on page 187.
- 3 Unplug the three iPC cables from the iPC main board (Video, USB, Power).



**NOTE**

To unplug the power cable from the iPC (fourth picture above), press the latches on the side of the connector all the way in and **carefully** pull out the connector, so the connector on the board does not get damaged.

- 4 Remove the four screws from the iPC.



- 5 Remove the side USB cable from the iPC housing.



- 6 Remove the iPC.



### Separating the Front and Back Half of the Monitor

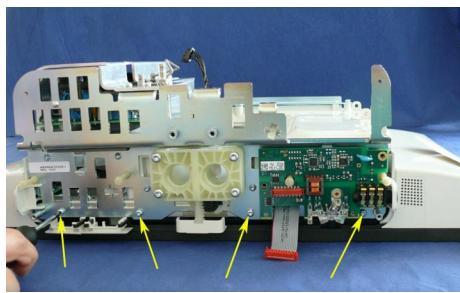
- 1 Remove the bottom housing as described in the section “[Removing the Bottom Housing](#)” on page 185.
- 2 Unplug the flat ribbon cable from the Power Switch/ECG Sync Out board.



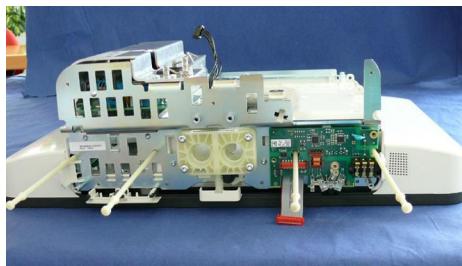
- 3 Remove the housing rear as described in the section “[Removing the Housing Rear](#)” on page 187.
- 4 Remove the I/O Boards as described in the section “[Removing the I/O Cards](#)” on page 188.
- 5 Remove the connector board as described in the section “[Removing the Connector Board](#)” on page 189.
- 6 Remove the MSL2 board as described in the section “[Removing the MSL2 Board](#)” on page 188.
- 7 Unplug the AC/DC power supply cable.



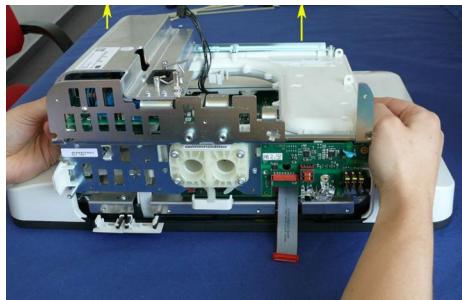
- 8 If installed, unplug the independent display interface cable or the three iPC cables as described in the sections “[Removing the Independent Display Interface](#)” on page 191 and “[Removing the iPC](#)” on page 192
- 9 With the display facing downwards, remove the bottom row of screws (four screws).



- 10 Remove the four pins.

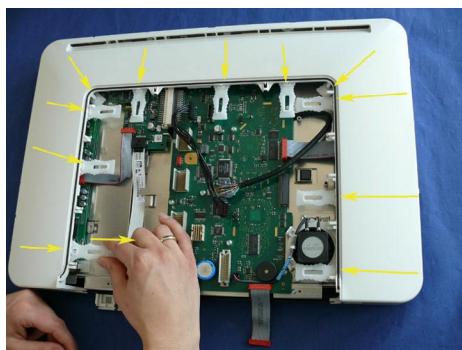


- 11 Remove the arched element of the housing containing the AC/DC power supply and, if installed, the independent display interface board or the iPC.



## Removing the Rear Display Housing

- 1 Separate the front and back half of the monitor as described in the section “[Separating the Front and Back Half of the Monitor](#)” on page 194.
- 2 Pull out the 11 release clasps until you hear a click and the padlock symbol on the release clasp is visible.



- 3 Remove the rear display housing.



### Reassembling the Rear Display Housing

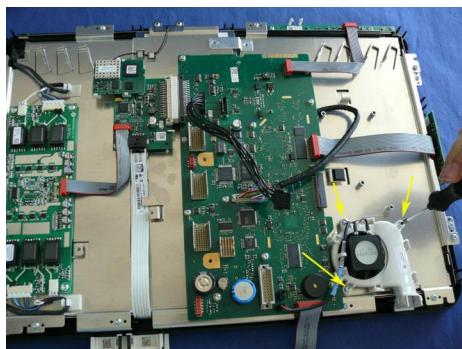
- 1 Push the nine release clasps back in before repositioning the rear display housing.
- 2 Reinsert the rear display housing and press it down carefully.

### Removing the Loudspeaker

- 1 Separate the front and back half of the monitor as described in the section “[Separating the Front and Back Half of the Monitor](#)” on page 194.
- 2 Remove the rear display housing as described in the section “[Removing the Rear Display Housing](#)” on page 195
- 3 Unplug the loudspeaker cable..



- 4 Remove the three screws from the loudspeaker.

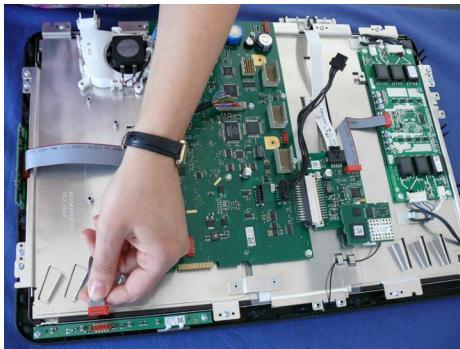


- 5 Remove the loudspeaker.

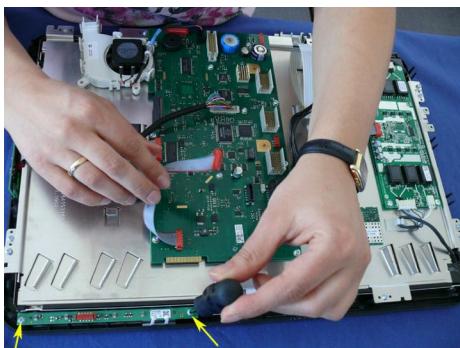


## Removing the Alarm LED Board

- 1 Separate the front and back half of the monitor as described in the section “[Separating the Front and Back Half of the Monitor](#)” on page 194.
- 2 Remove the rear display housing as described in the section “[Removing the Rear Display Housing](#)” on page 195.
- 3 Unplug the alarm LED cable.



- 4 Remove the two self-cutting screws.

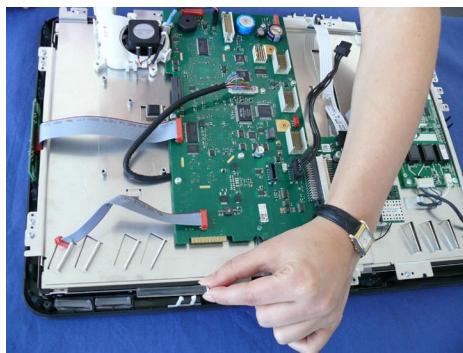


- 5 Remove the alarm LED board.



### Removing the Light Pipes

- 1 Separate the front and back half of the monitor as described in the section “[Separating the Front and Back Half of the Monitor](#)” on page 194.
- 2 Remove the rear display housing as described in the section “[Removing the Rear Display Housing](#)” on page 195.
- 3 Remove the Alarm LED board as described in the section “[Removing the Alarm LED Board](#)” on page 197.
- 4 Remove the light pipes.



## Removing the Video Mixer Board

This procedure only applies if an iPC is installed.

- 1 Separate the front and back half of the monitor as described in the section “[Separating the Front and Back Half of the Monitor](#)” on page 194.
- 2 Remove the Rear Display Housing as described in the section “[Removing the Rear Display Housing](#)” on page 195
- 3 Unplug the three cables from the video mixer board.



- 4 Remove the four screws from the video mixer board.

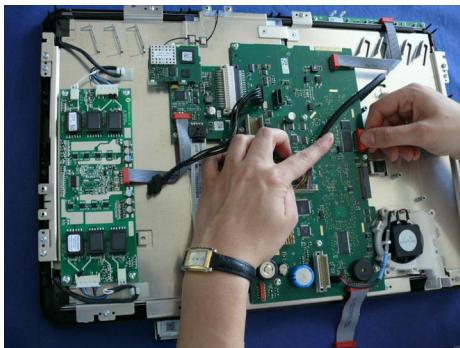


- 5 Remove the video mixer board.

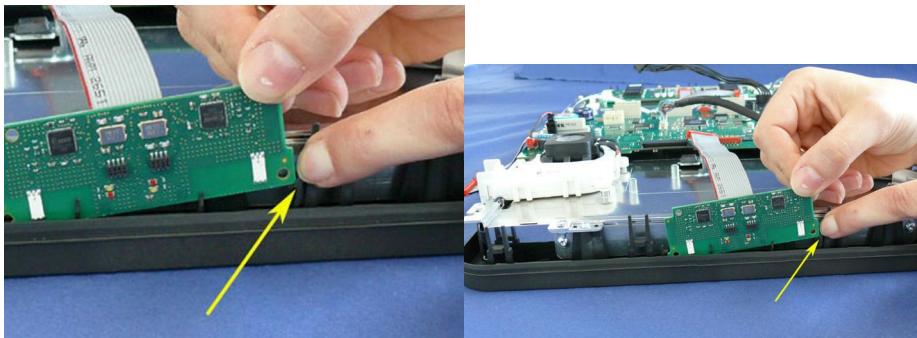


### Removing the SRR Board

- 1 Separate the front and back half of the monitor as described in the section “[Separating the Front and Back Half of the Monitor](#)” on page 194.
- 2 Remove the rear display housing as described in the section “[Removing the Rear Display Housing](#)” on page 195.
- 3 If an iPC is installed, unscrew the screws on the video mixer board, unplug the video mixer board from the main board and lift up the video mixer board from the housing, leaving all other cable connections to the video mixer board plugged. Be careful not to damage the cable connectors on the video mixer board.
- 4 Unplug the SRR cable from the main board.



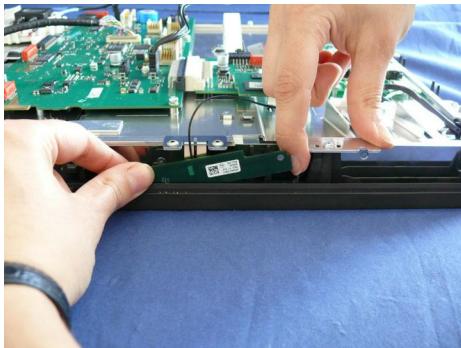
- 5 Release and remove the SRR board by pushing the latch in the monitor housing outwards.



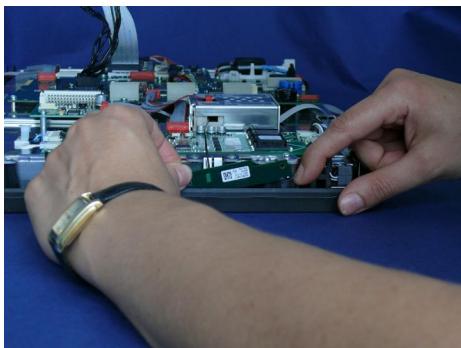
## Removing the WLAN/IIT Antenna

This procedure only applies if WLAN or IIT are installed.

- 1 Separate the front and back half of the monitor as described in the section “[Separating the Front and Back Half of the Monitor](#)” on page 194.
- 2 Remove the rear display housing as described in the section “[Removing the Rear Display Housing](#)” on page 195.
- 3 Unplug the WLAN/IIT antenna from the WLAN board or IIT module.
- 4 Remove the antenna by pushing the latch in the housing outwards as shown below.



*WLAN Antenna Removal*

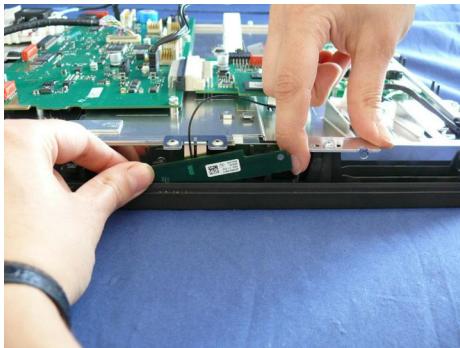


*IIT Antenna Removal*

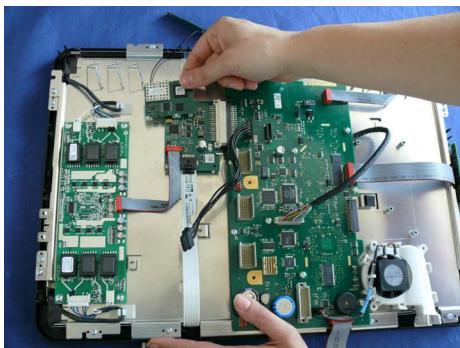
### Removing the WLAN board

This procedure only applies if WLAN is installed.

- 1 Separate the front and back half of the monitor as described in the section “[Separating the Front and Back Half of the Monitor](#)” on page 194.
- 2 Remove the rear display housing as described in the section “[Removing the Rear Display Housing](#)” on page 195.
- 3 Remove the WLAN antenna by pushing the latch in the housing outwards as shown below.



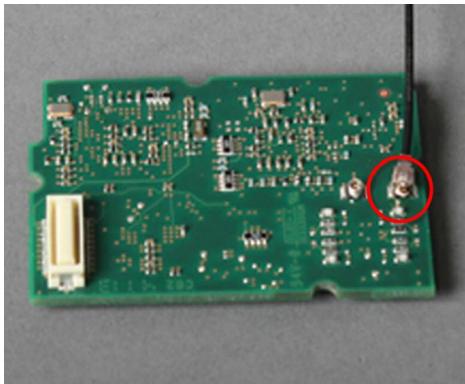
- 4 Unplug the WLAN board including its holder from the panel adapter board.



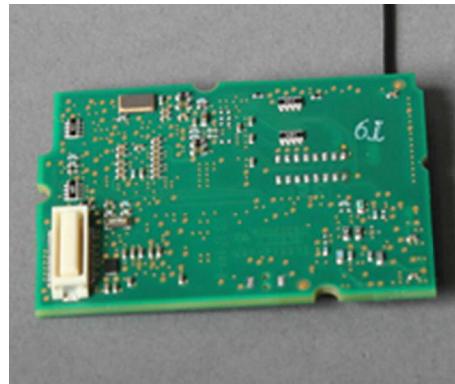
- 5 Reassemble the WLAN board by performing the above steps in reverse order.

**NOTE**

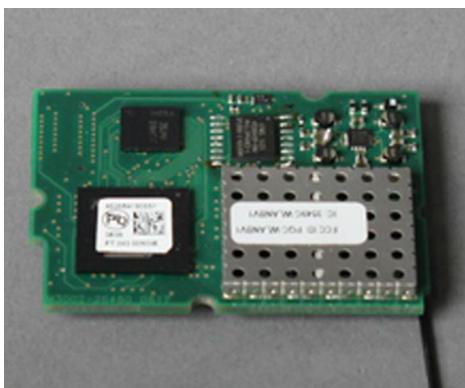
Ensure you use the appropriate antenna connector depending on the installed WLAN version (see pictures below):



WLAN Version 1 Bottom



WLAN Version 2 Bottom



WLAN Version 1 Top



WLAN Version 2 Top

### Removing the IIT Module

This procedure only applies if IIT is installed.

- 1 Separate the front and back half of the monitor as described in the section “[Separating the Front and Back Half of the Monitor](#)” on page 194.
- 2 Remove the rear display housing as described in the section “[Removing the Rear Display Housing](#)” on page 195.
- 3 Remove the IIT/WLAN antenna incl. cable as described in the section “[Removing the WLAN/IIT Antenna](#)” on page 201.
- 4 Remove the IIT cable from the main board.



- 5 Remove the two screws from the IIT module.



- 6 Remove the IIT module by pulling it towards you as shown below.

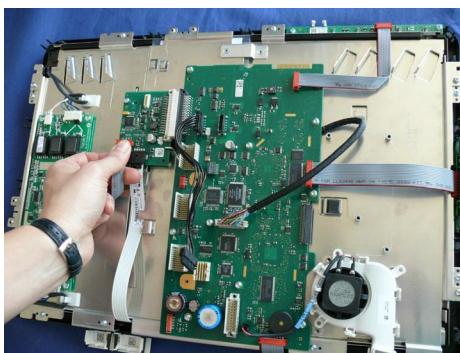


## Removing the Panel Adapter Board (Version 1)

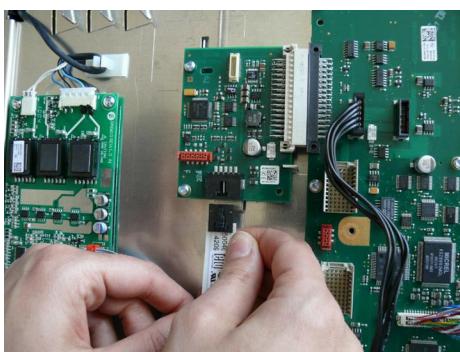
### NOTE

This procedure applies if you have a monitor with serial number prefix <DE345. If you have a monitor with serial number prefix >DE345, see “[Removing the Panel Adapter Board \(Version 2\)](#)” on page 209.

- 1 Separate the front and back half of the monitor as described in the section “[Separating the Front and Back Half of the Monitor](#)” on page 194.
- 2 Remove the rear display housing as described in the section “[Removing the Rear Display Housing](#)” on page 195.
- 3 If installed, remove the WLAN board and WLAN board holder as described in the section “[Removing the WLAN board](#)” on page 202.
- 4 Unplug the flat ribbon cable from the panel adapter board.



- 5 Unplug the touch cable from the panel adapter board by pressing the connector latch down and pulling out the cable.

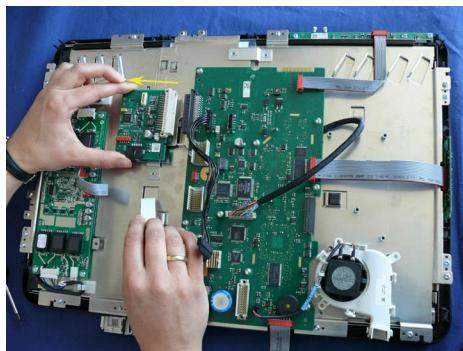


- 6 Remove the two screws from the panel adapter board.



## 5 Repair and Disassembly

- 7 Remove the panel adapter board.



## Removing the Backlight Inverter Board

### NOTE

This procedure applies if you have a monitor with serial number prefix <DE345.

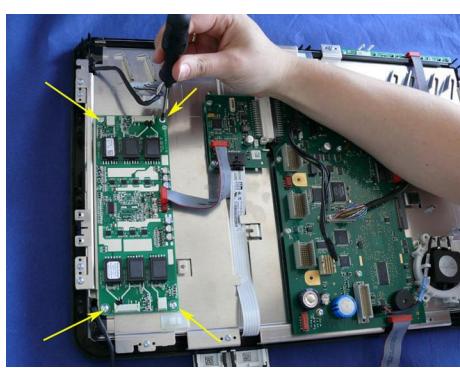
- 1 Separate the front and back half of the monitor as described in the section “[Separating the Front and Back Half of the Monitor](#)” on page 194.
- 2 Remove the rear display housing as described in the section “[Removing the Rear Display Housing](#)” on page 195.
- 3 Unplug the cable between the panel adapter board and the backlight inverter board.



- 4 If IIT is installed, remove the IIT antenna as described in the section “[Removing the WLAN/IIT Antenna](#)” on page 201.
- 5 Unplug the four backlight cables.



- 6 Remove the four flat-head screws from the backlight inverter board.



## 5 Repair and Disassembly

- 7 Remove the backlight inverter board.



## Removing the Panel Adapter Board (Version 2)

### NOTE

This procedure applies if you have a monitor with serial number prefix ≥DE345.

- 1 Separate the front and back half of the monitor as described in the section "Separating the Front and Back Half of the Monitor".
- 2 Remove the rear display housing as described in the section "Removing the Rear Display Housing".
- 3 If installed, remove the WLAN board and WLAN board holder as described in the section "Removing the WLAN board".
- 4 Unplug the cable connecting the display and the panel adapter board.



- 5 Unplug the touch cable from the panel adapter board by pressing the connector latch down and pulling out the cable.



- 6 Remove the two screws from the panel adapter board.



- 7 Remove the panel adapter board.



### Removing the Main Board

- 1 Separate the front and back half of the monitor as described in the section “[Separating the Front and Back Half of the Monitor](#)” on page 194.
- 2 Remove the rear display housing as described in the section “[Removing the Rear Display Housing](#)” on page 195.
- 3 If an iPC is installed, remove the video mixer board as described in the section “[Removing the Video Mixer Board](#)” on page 199.
- 4 If IIT is installed, unplug the IIT cable from the main board.
- 5 Unplug the multi-colored display cable, the loudspeaker cable, the SRR cable, the power supply cable and the alarm led board cable from the main board.



**NOTE**

To unplug the power supply cable from the main board, press the latches on the side of the connector all the way in and **carefully** pull out the connector, so the connector on the board does not get damaged.



- 6 Remove the panel adapter board as described in the section “[Removing the Panel Adapter Board \(Version 1\)](#)” on page 205.
- 7 If installed, unplug the independent display interface cable from the main board.
- 8 Remove the 11 screws from the main board.



- 9 Remove the main board.

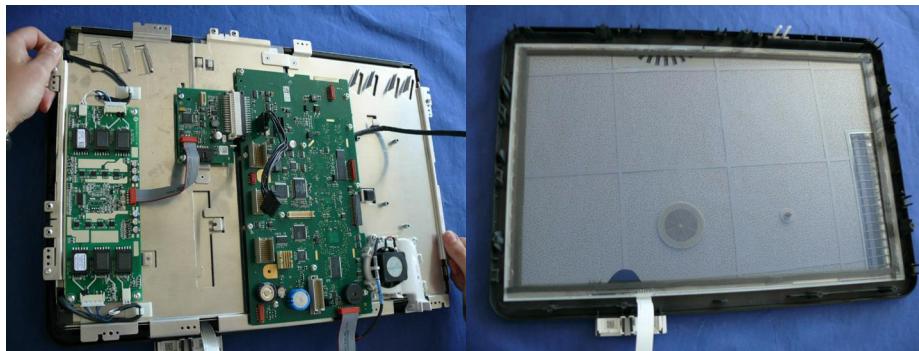


### Removing the Touch Bezel Assembly

- 1 Separate the front and back half of the monitor as described in the section “[Separating the Front and Back Half of the Monitor](#)” on page 194.
- 2 Remove the rear display housing as described in the section “[Removing the Rear Display Housing](#)” on page 195.
- 3 If the IIT module is installed, remove the IIT module incl. antenna as described in the section “[Removing the IIT Module](#)” on page 204.
- 4 Unplug the touch cable from the panel adapter board and remove it from the guidance latches in the display chassis assembly.
- 5 Remove the Alarm LED board as described in the section “[Removing the Alarm LED Board](#)” on page 197.
- 6 Remove the three light pipes as described in the section “[Removing the Light Pipes](#)” on page 198.
- 7 Remove the SRR board as described in the section “[Removing the SRR Board](#)” on page 200.
- 8 If WLAN is installed, remove the WLAN board as described in the section “[Removing the WLAN board](#)” on page 202.
- 9 Remove the ten self-cutting screws from the touch bezel assembly.



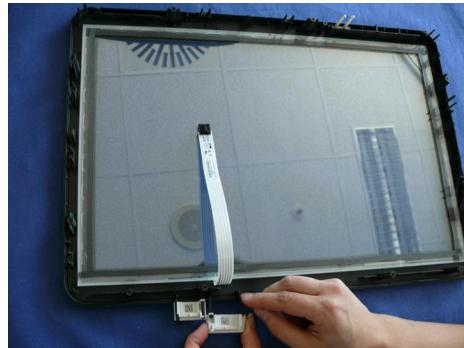
- 10 Remove the display chassis assembly by pulling it up out of the touch bezel assembly.



**NOTE**

Place the display chassis assembly on a flat, smooth surface after removal to avoid scratching the LCD panel.

- 11 Remove the serial number plate and the feature plate.



### Removing the LCD Panel (Version 1)

#### NOTE

This procedure applies if you have a monitor with serial number prefix <DE345. If you have a monitor with serial number prefix >DE 345, see “[Removing the LCD Panel \(Version 2\)](#)” on page 218.

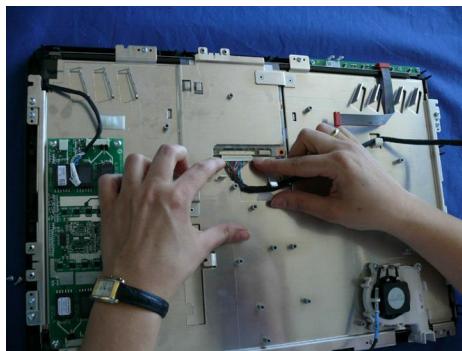
- 1 Separate the front and back half of the monitor as described in the section “[Separating the Front and Back Half of the Monitor](#)” on page 194.
- 2 Remove the rear display housing as described in the section “[Removing the Rear Display Housing](#)” on page 195.
- 3 If the IIT module is installed, remove the IIT module incl. antenna as described in the section “[Removing the IIT Module](#)” on page 204.
- 4 Unplug the touch cable from the panel adapter board.
- 5 Unplug the alarm LED board cable from the main board.



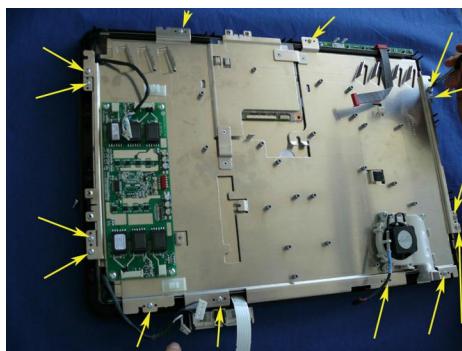
- 6 Unplug the SRR cable and remove the SRR board as described in the section “[Removing the SRR Board](#)” on page 200.
- 7 If WLAN is installed, unplug the WLAN antenna cable.
- 8 Unplug the backlight cables from the backlight inverter board.
- 9 Unplug the multi-colored display cable from the main board.
- 10 Unplug the cable between the backlight inverter board and panel adapter board from the backlight inverter board.
- 11 Remove the main board together with the panel adapter board and, if an iPC is installed, the video mixer board.



- 12 Remove the display cable from the display chassis assembly.



- 13 Remove the fourteen screws from the display chassis assembly.



- 14 Remove the display chassis assembly and remove the display.



## 5 Repair and Disassembly

- 15 Remove the four screws on the sides of the display chassis assembly (two screws on each side) and remove the angled metal sheets from the sides of the lcd panel.

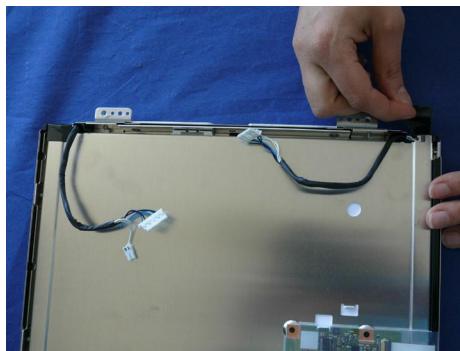


## Removing the Backlights

### NOTE

This procedure only applies if you have a monitor with serial number prefix <DE345.

- 1 Remove the LCD Panel as described in the section “[Removing the LCD Panel \(Version 1\)](#)” on [page 214](#).
- 2 Remove and discard the tape from the backlight ends.



- 3 Remove the screws from the individual backlights (PH0 x 60).



- 4 Pull out the backlights using needle nose pliers on the metal latch.



### Removing the LCD Panel (Version 2)

#### NOTE

This procedure applies if you have a monitor with serial number prefix ≥DE345.

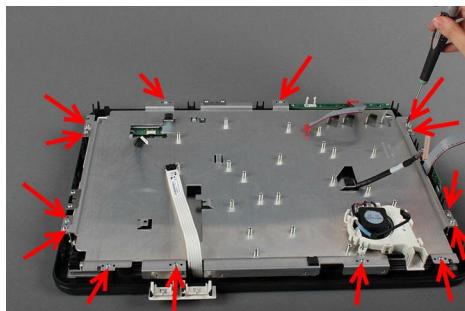
- 1 Separate the front and back half of the monitor as described in the section "Separating the Front and Back Half of the Monitor".
- 2 Remove the rear display housing as described in the section "Removing the Rear Display Housing".
- 3 If the IIT module is installed, remove the IIT module incl. antenna as described in the section "Removing the IIT Module".
- 4 Unplug both cables from the panel adapter board.
- 5 Unplug the alarm LED board cable from the main board.



- 6 Unplug the SRR cable and remove the SRR board as described in the section "Removing the SRR Board".
- 7 If WLAN is installed, unplug the WLAN antenna cable.
- 8 Unplug the multi-colored display cable from the main board.
- 9 Unplug the loudspeaker cable from the main board.
- 10 Remove the 11 screws from the main board.
- 11 Remove the main board together with the panel adapter board and, if an iPC is installed, the video mixer board.



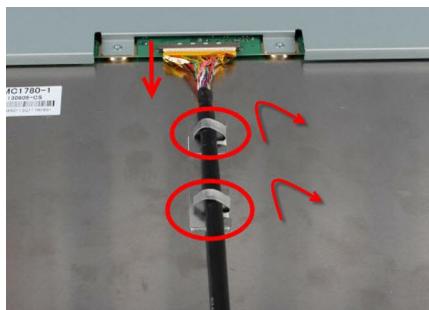
- 12 Remove the fourteen screws from the display chassis assembly.



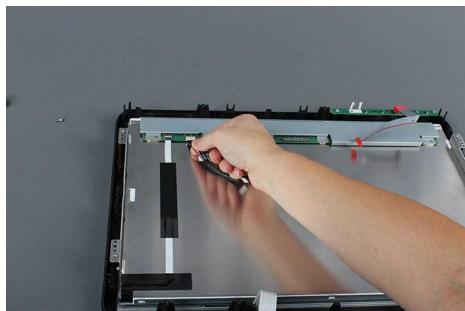
- 13 Remove the metal sheet from the display chassis assembly.



- 14 Bend open the display cable holders and unplug the display cable



- 15 Unplug the panel adapter cable.



## 5 Repair and Disassembly

- 16 Remove the lcd panel assembly.



- 17 Remove the four screws on the sides of the display chassis assembly (two screws on each side) and remove the angled metal sheets from the sides of the lcd panel.



## Assembling the Display Exchange Kit

### NOTE

This procedure applies if you have a monitor with serial number prefix <DE 345 and order a display version 1 replacement kit.

Your display assembly kit is shipped in several parts and should look like this:



- 1 Attach the display cable as shown below.



- 2 Insert the display cable into the display cable holders and bend them closed so the cable stays inside.



- 3 Attach the panel adapter cable as shown below.

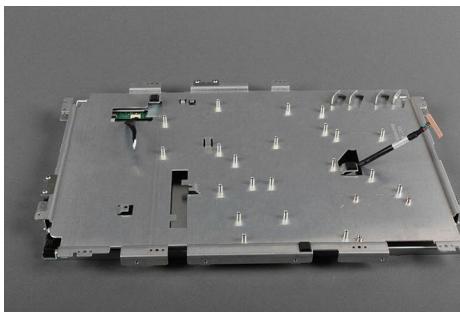
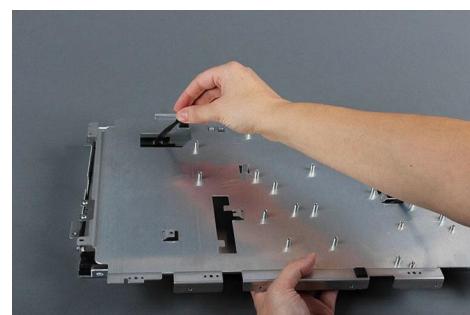
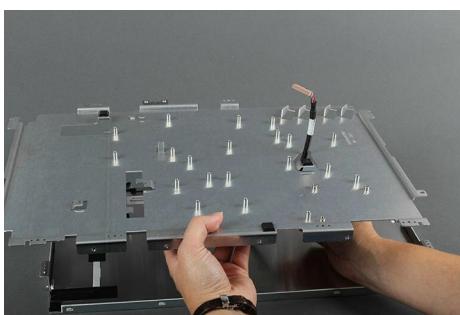


## 5 Repair and Disassembly

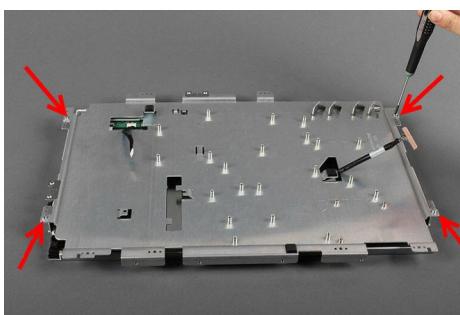
- 4 Assemble the two metal sheets, one on each side of the LCD panel assembly using two screws for each.



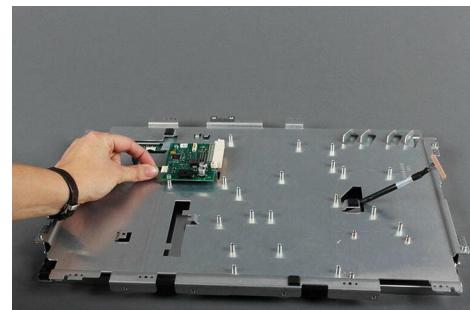
- 5 Route the two cables through the provided holes in the large metal sheet as shown below.



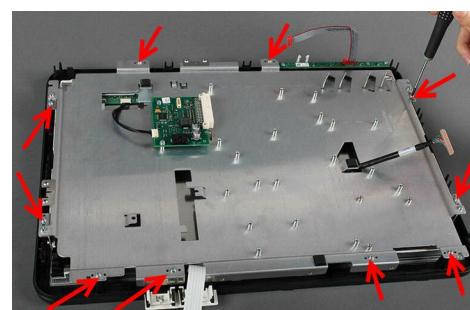
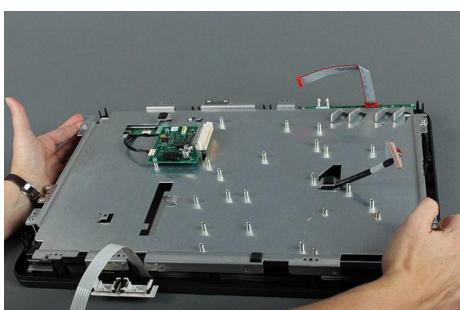
- 6 Insert the four screws to secure the metal sheet.



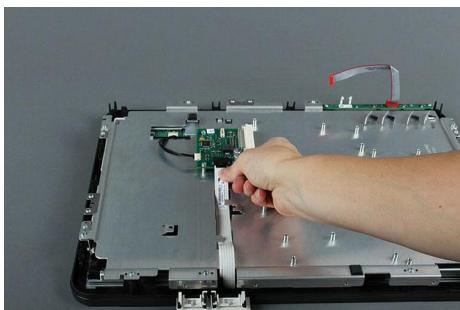
- 7 Attach the panel adapter board to the assembly with two screws and then insert the cable into the connector on the board as shown below.



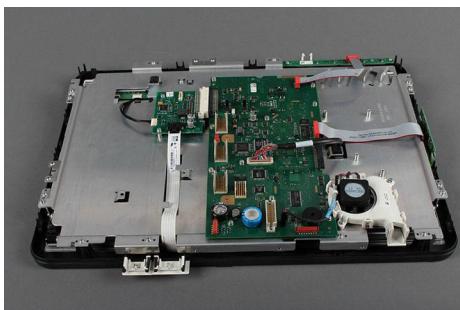
- 8 Remove the protective foil from the new LCD panel.  
9 Insert the new assembly into your existing MX800 touch bezel and secure it with ten self-cutting screws.



- 10 Insert the touch cable into the panel adapter board as shown below.



- 11 Attach all the components from your old LCD panel assembly (except the backlight inverter board) to the new LCD panel assembly - main board, speaker, etc. - and connect all cables as appropriate.



- 12 Reassemble the monitor as described in your service guide.

### Removing the Blank Side Cover or USB Side Cover

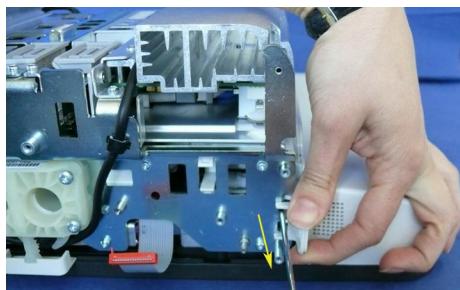
If you have iPC installed you will have a USB side cover. If not, you will have a blank side cover.

- 1 Remove the bottom housing as described in the section “[Removing the Bottom Housing](#)” on page 185.
- 2 Remove the housing rear as described in the section “[Removing the Housing Rear](#)” on page 187.
- 3 Remove the side cover or the USB side cover from the bottom housing using a screwdriver. The covers are attached to a hook. Press the hook with the screwdriver and pull out the cover.



### Removing the ECG Sync Side Plate

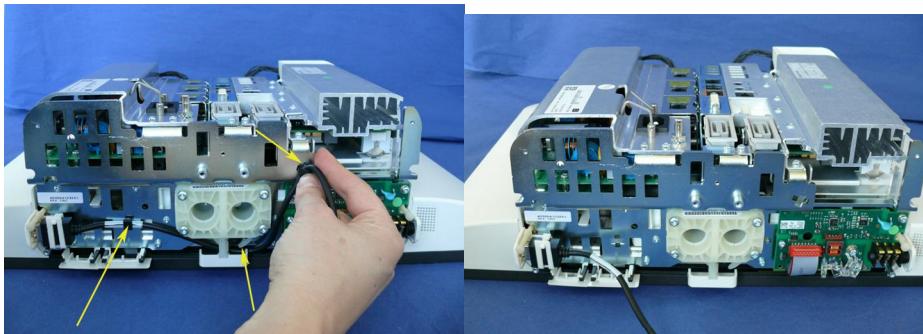
- 1 Remove the bottom housing as described in the section “[Removing the Bottom Housing](#)” on page 185.
- 2 Remove the Power Switch/ECG Sync Out Board.
- 3 Remove the housing rear.
- 4 Remove the ECG Sync side plate from the bottom housing using a screwdriver. The ECG Sync side plate is attached to a hook. Press the hook with the screwdriver and pull out the side plate slightly right-wards.



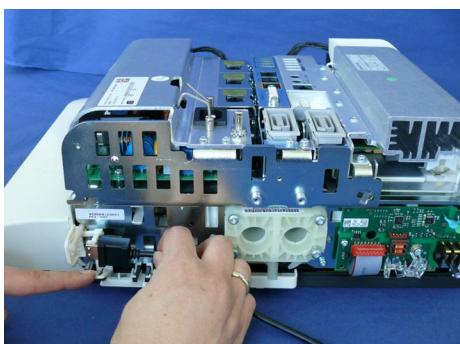
## Removing the Side USB Cable

This procedure applies only if iPC is installed.

- 1 Remove the bottom housing as described in the section “[Removing the Bottom Housing](#)” on page 185.
- 2 Remove the housing rear as described in the section “[Removing the Housing Rear](#)” on page 187.
- 3 Remove the side cover or the USB side cover from the bottom housing as described in the section “[Removing the Blank Side Cover or USB Side Cover](#)” on page 224.
- 4 Remove the two cable holders by pulling on the cable.



- 5 Unplug the USB Cable.



### NOTE

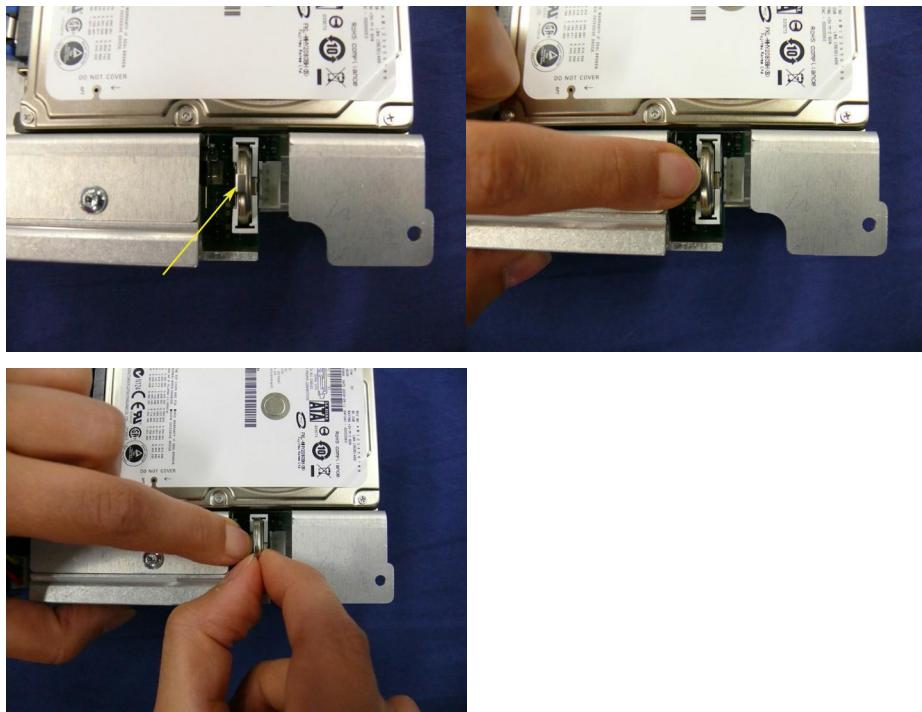
When reinserting the USB cable, ensure it is reassembled in exactly the same way it was before, otherwise the monitor cannot be reassembled.

## iPC (Version 1/#PC0) Disassembly

The procedures in this section only apply if an iPC (Version 1/#PC0) is installed.

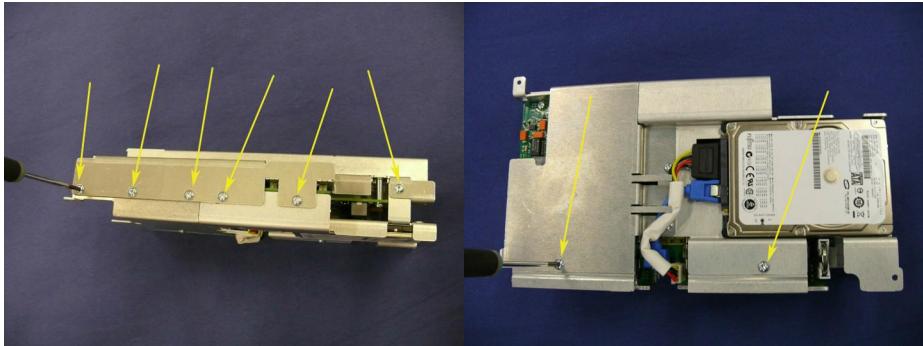
### Removing the Battery

- 1 Remove the iPC from the monitor as described in the section “[Removing the iPC](#)” on page 192.
- 2 Pull back the latch holding the battery and remove the battery.



## Accessing the iPC Main Board

- 1 Remove the iPC from the monitor as described in the section “[Removing the iPC](#)” on page 192.
- 2 Remove the eight screws from the iPC (six on the side, two on the back).

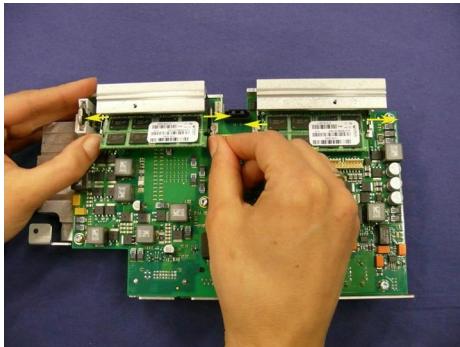


- 3 Unplug the two cables coming from the hard disk and separate the main board assembly from the hard disk assembly.

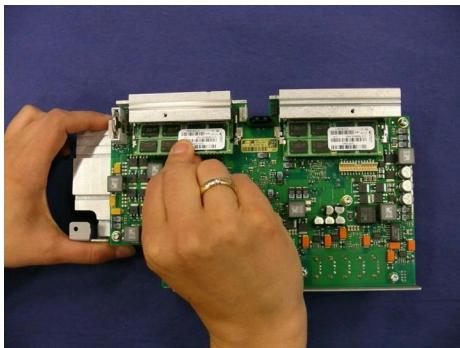


### Removing the RAM

- 1 Remove the iPC main board assembly as described in the section “[Accessing the iPC Main Board](#)” on page 227.
- 2 Press the latches holding the RAM boards to the side.

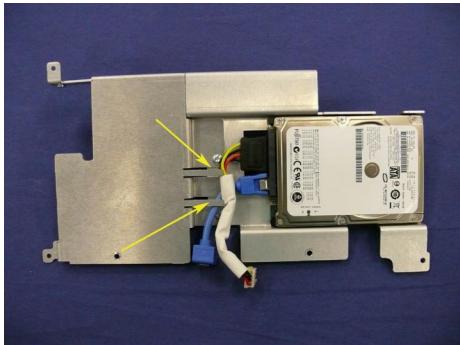


- 3 Pull out the RAM boards carefully.

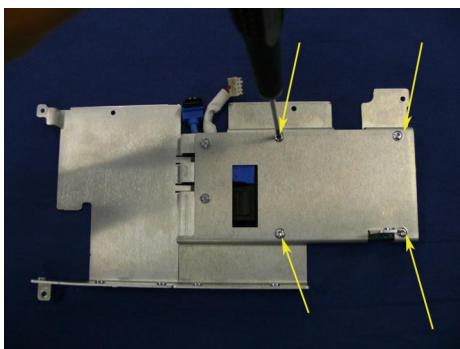


## Removing the Hard Drive

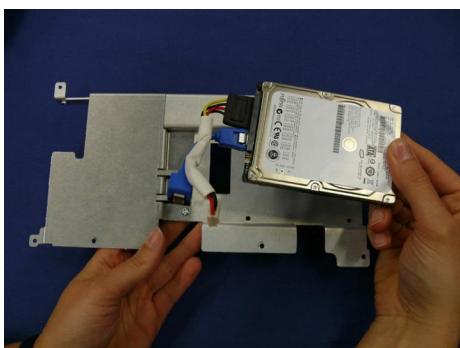
- 1 Remove the iPC main board assembly as described in the section “[Accessing the iPC Main Board](#)” on page 227.
- 2 Pull the two cables out of the metal latches.



- 3 Turn the hard drive assembly around so the hard drive is facing downwards. Then remove the four screws from the chassis.



- 4 Remove the hard drive.



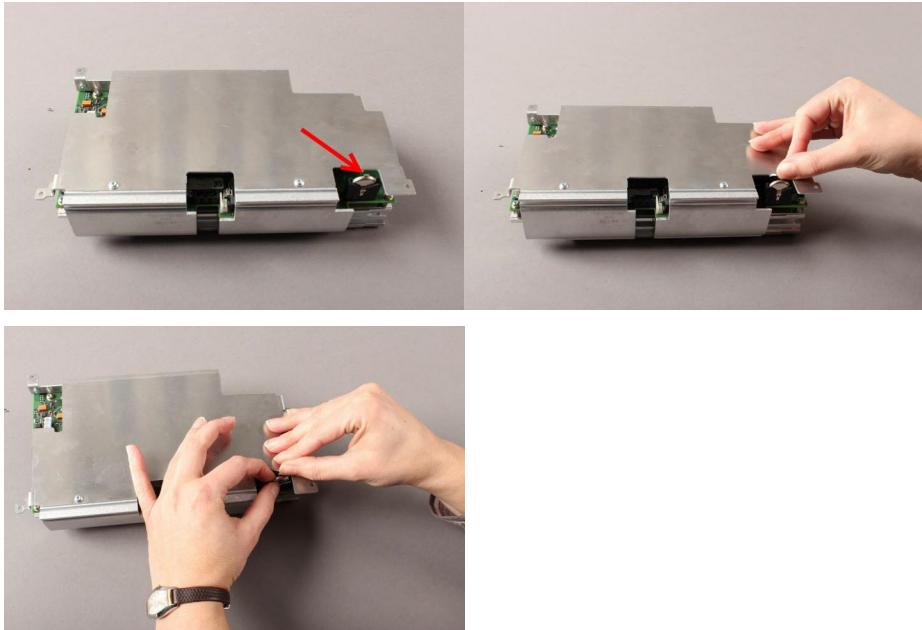
- 5 When the new hard drive is installed, install the operating system (OS). For details on the installation of the OS, see the XDS documentation.

## iPC (Version 2/#PC1) Disassembly

The procedures in this section only apply if an iPC (Version 2/#PC1) is installed.

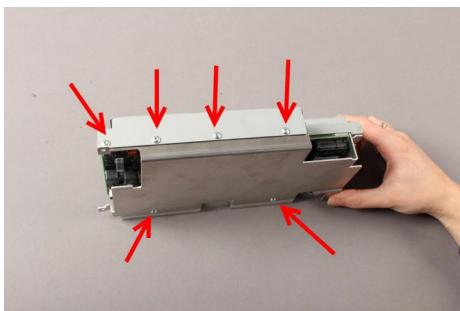
### Removing the Battery

- 1 Remove the iPC from the monitor as described in the section “[Removing the iPC](#)” on page 192.
- 2 Pull back the latch holding the battery and remove the battery.

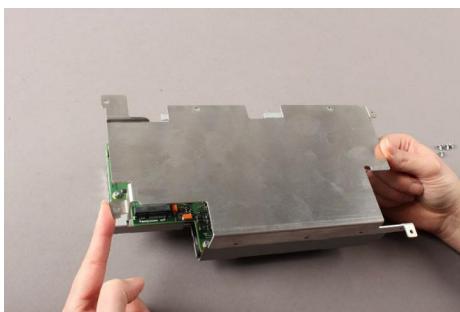


### Accessing the iPC Main Board

- 1 Remove the iPC from the monitor as described in the section “[Removing the iPC](#)” on page 192.
- 2 Remove the six screws from the iPC (four on the side, two on the back).

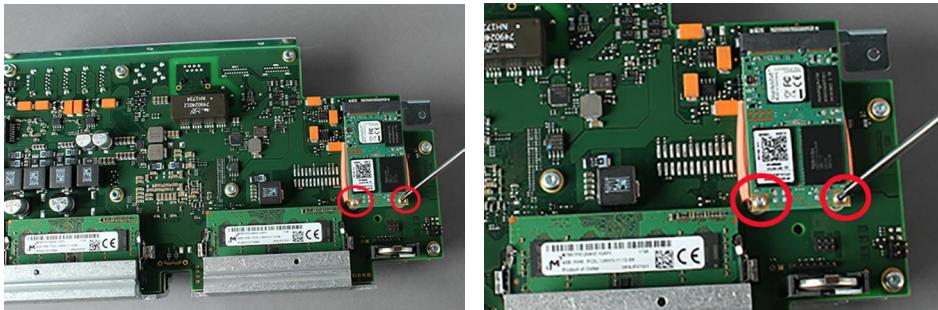


- 3 Lift the metal sheet off the main board assembly.

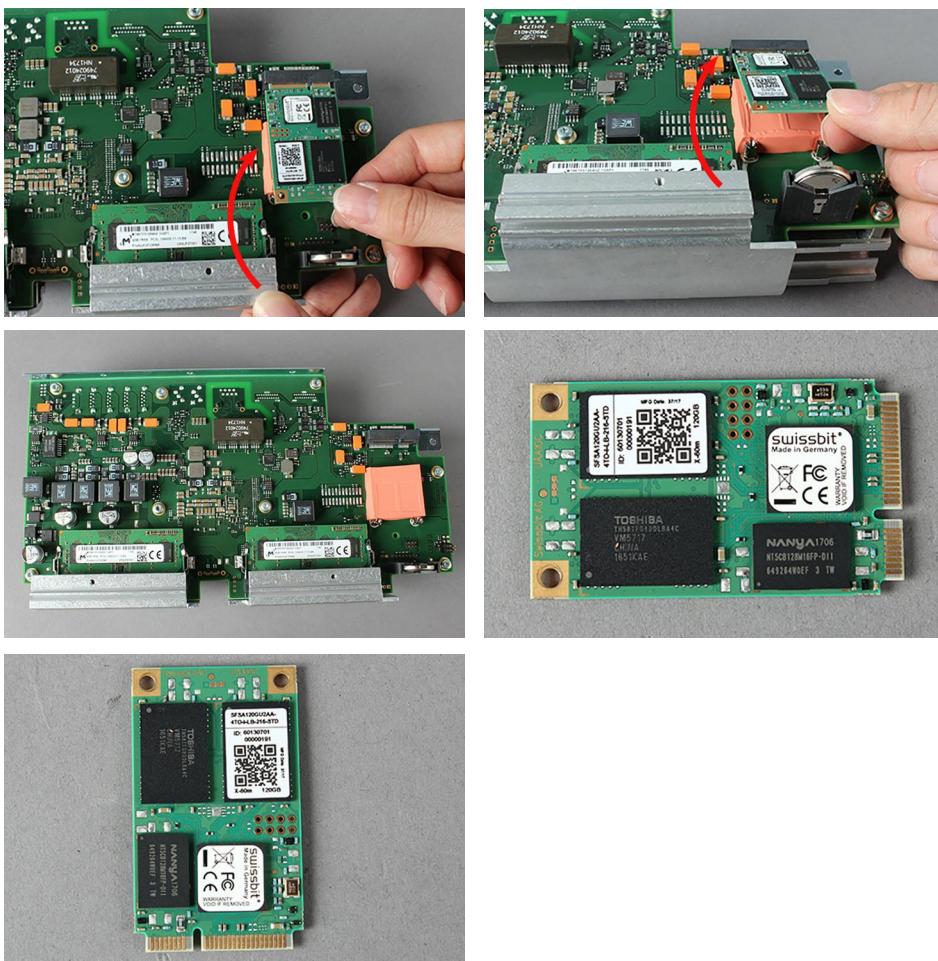


## Removing the SSD Hard Drive

- 1 Remove the iPC from the monitor.
- 2 Remove the metal sheet.
- 3 Remove the two (T6) screws securing the SSD hard drive to the main board.



- 4 Disconnect the SSD hard drive, carefully lift it up, and detach it from the thermal conductive pad.



- 5 When the new SSD hard drive is installed, install the operating system (OS). For details on the installation of the OS, see the “[Appendix - IntelliVue iPC](#)” on page 497.

### NOTE

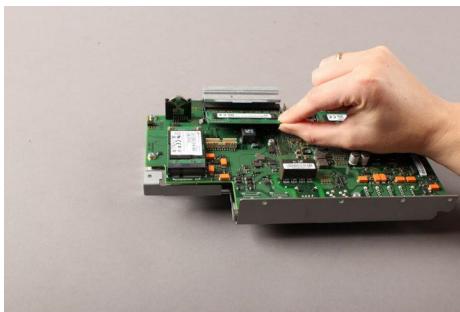
**Reinstall** the SSD hard drive by performing the above steps in reverse order, ensuring the thermally conductive foam is positioned correctly under the SSD hard drive. When using the foam shipped with the SSD replacement part, ensure the cover foil is removed from both sides of the foam.

### Removing the RAM

- 1 Remove the iPC main board assembly as described in the section “[Accessing the iPC Main Board](#)” on [page 227](#).
- 2 Press the latches holding the RAM board to the side.



- 3 Pull out the RAM board carefully.



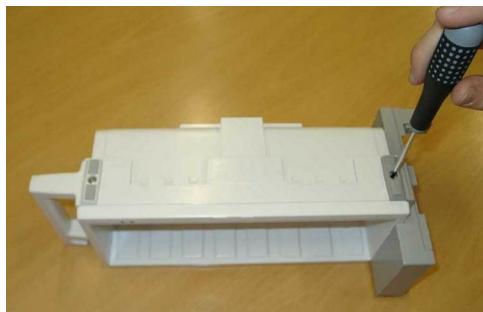
- 4 If necessary, repeat for the second RAM board.

## 8-Slot Module Rack (FMS-8) Disassembly

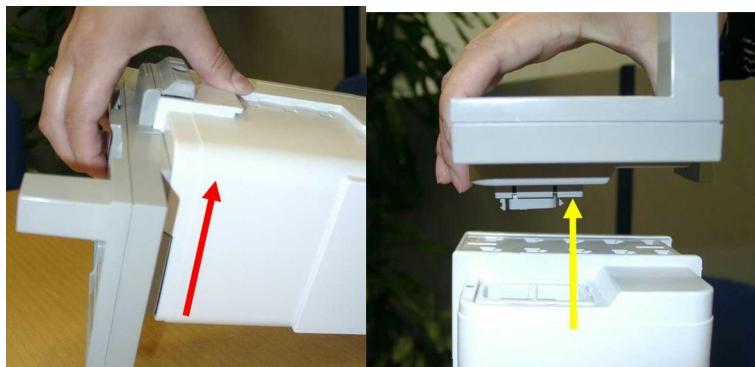
### Removing the Handle and the Multi-Measurement Module Mount

Note that any combination of handles and mounts is possible.

- 1 Remove the two (T20) screws on the bottom.

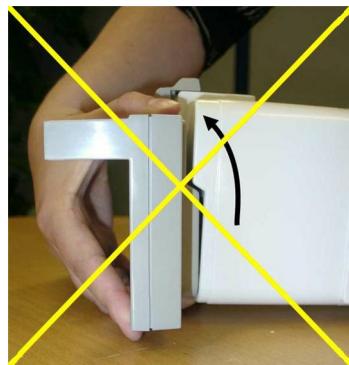


- 2 Slide the handle up and pull it out.
- 3 Remove the Multi-Measurement Module if connected. Slide the Multi-Measurement Module mount up and remove it by pulling directly perpendicular to the Module Rack.



### NOTE

There is a connector located on the Multi-Measurement Module mount. If you tilt the Multi-Measurement Module mount as you remove it, you may damage the connector.



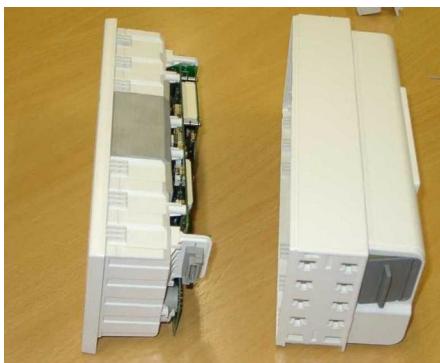
- 4 Remove the connector housings on each side of the Module Rack by compressing the cover slightly using two screwdrivers.



- 5 Remove the two white pins on each side with a small screwdriver.



- 6 Take off the rear housing.



- 7 If you are exchanging the rear housing, check the information on the old housing label:
- Product Number (behind REF),
  - Serial Number (SN),
  - Service Number (If existent – Service#)
  - Date of Manufacturing (DOM; under the factory icon in the format YYYY-MM or old MM/YY) or, if on the existing label: Date of Refurbishment (DOR; under the factory icon in the format YYYY-MM, and additionally Date of Refurbishment transferred under the date).
- Locate the appropriate position on the new rear housing label.

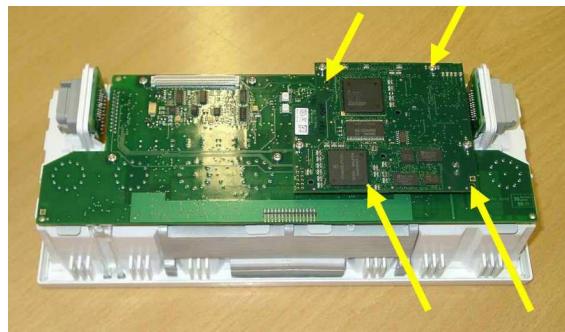


Copy all information onto the new Rear Housing label from the old Rear Housing Label using a water-resistant pen.

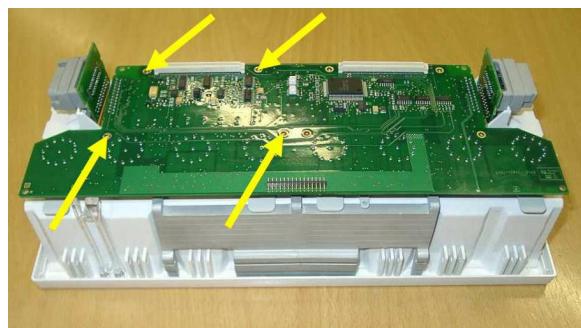
Paste the additional adhesive clear blank label on top of the updated replacement rear housing over REF, SN, Service#, and DOM to avoid smearing and provide protection.

## 5 Repair and Disassembly

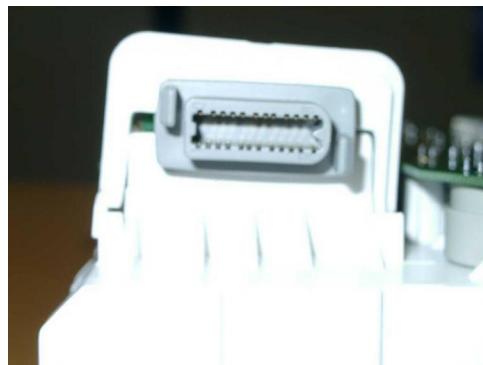
- 8 Remove the four screws on the CPU board, pull it gently off the mother board, unplugging the connector at the same time.



- 9 Remove the four remaining screws on the main board.

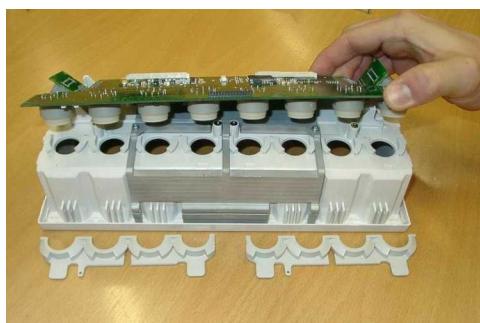


- 10 Pull off side connector brackets by pulling them gently away from the housing on each side and lifting carefully.



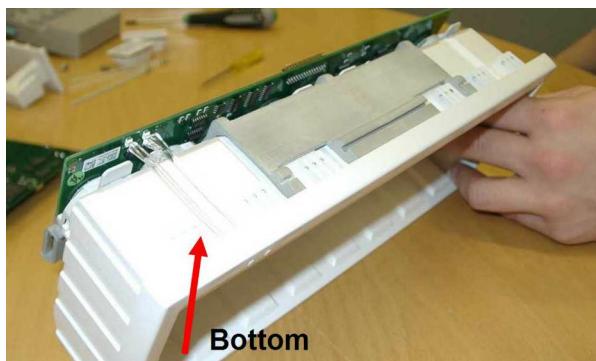
- 11 Lift up and pull on the tabs to remove the connector holders.

**Reassembly Note:** The connector holders are side specific.



- 12 Unsnap the lightpipe.

**Reassembly Note:** Snap the lightpipe bottom into place before inserting the top into the tab.



## 5 Repair and Disassembly

- 13 Pull off the main board.



**Reassembly Note:** Ensure the rubber seal around the module connectors is inserted properly into the front housing.



Set the exchange part data (serial number) with the support tool after reassembly. For more details refer to the support tool Instructions for Use.

## 4-Slot Module Rack (FMS-4) Disassembly (without Multi-Measurement Module Mount)

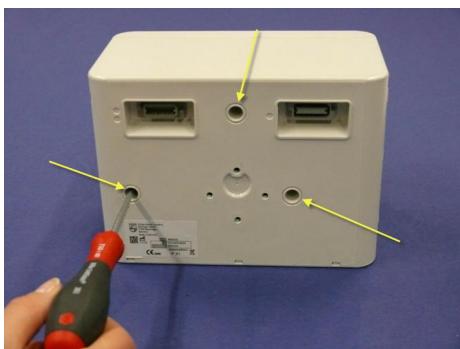
### Separating the Front and Back of the 4-Slot Module Rack

- 1 If the Universal Mounting Clamp is installed, remove the two (T20) screws from the Universal Mounting Clamp and remove the clamp.

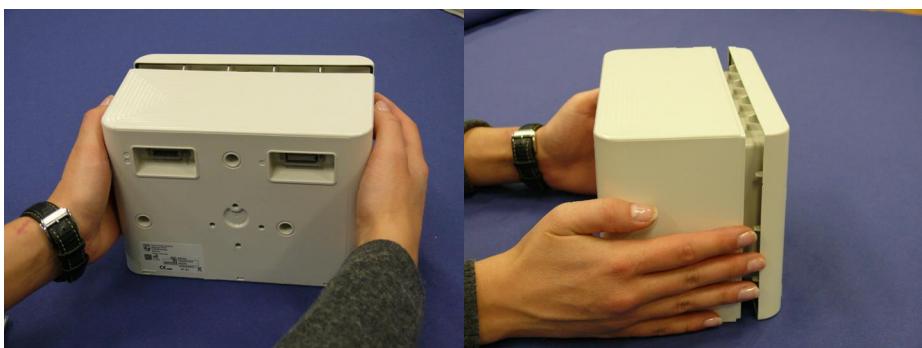


If any other mounting bracket is installed, remove it.

- 2 Remove the three (T10) screws from the back of the Module Rack.



- 3 Push the front housing off with your hands.



## 5 Repair and Disassembly

- 4 If you are exchanging the rear housing, check the information on the old housing label:
  - Product Number (behind REF),
  - Serial Number (SN),
  - Service Number (If existent – Service#)
  - Date of Manufacturing (DOM; under the factory icon in the format YYYY-MM or old MM/YY) or, if on the existing label: Date of Refurbishment (DOR; under the factory icon in the format YYYY-MM, and additionally Date of Refurbishment transferred under the date).

Locate the appropriate position on the new rear housing label.



Copy all information onto the new Rear Housing label from the old Rear Housing Label using a water-resistant pen.

Paste the additional adhesive clear blank label on top of the updated replacement rear housing over REF, SN, Service#, and DOM to avoid smearing and provide protection.

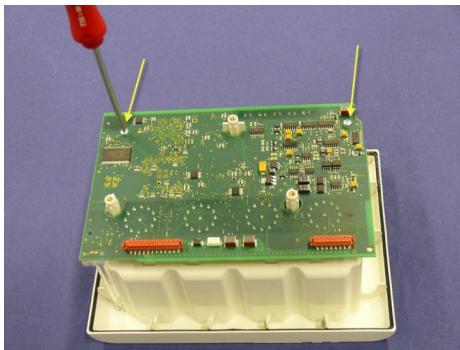
- 5 Flip the back of the Module Rack down, resting the front of the Module Rack on the rear housing as shown below. Then unplug the two cables from the main board.
- 6 Reassemble the Module Rack by performing the above steps in reverse order. When reassembling the front and back of the Module Rack, ensure the cables are inserted into the main board as shown below.



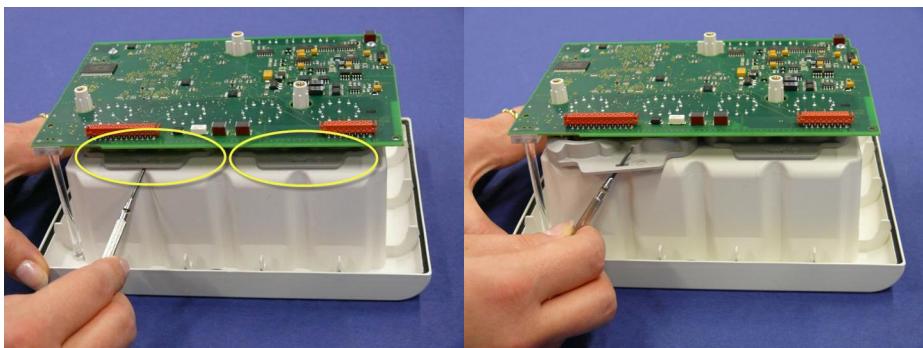
Carefully tighten the screws in the rear cover of the Module Rack so the Module Rack is properly sealed.

## Removing the Main Board

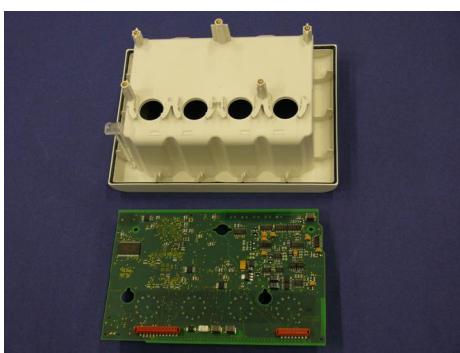
- 1 If installed, remove the Universal Mounting Clamp.
- 2 Separate the front and back of the Module Rack as described in “[Separating the Front and Back of the 4-Slot Module Rack](#)” on page 239.
- 3 Remove the two (T10) screws from the main board.



- 4 Pull out the two connector holders with a flathead screwdriver.

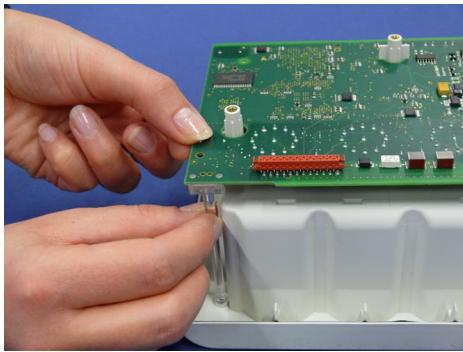


- 5 Remove the main board.



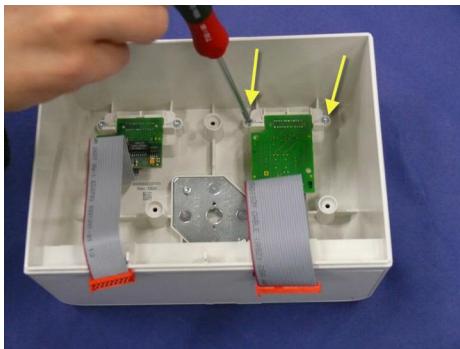
## 5 Repair and Disassembly

- 6 Reassemble the Module Rack by performing the above steps in reverse order. Ensure the light guide is in its correct position (see picture below) and reinsert the connector holders by pushing them in until you hear a click.

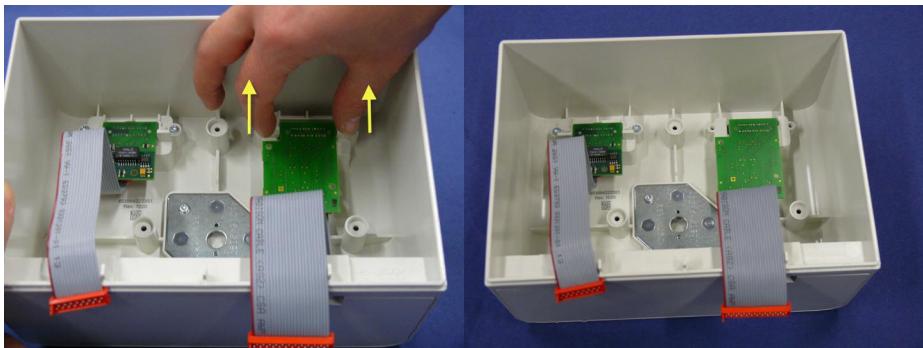


## Removing the MSL Boards

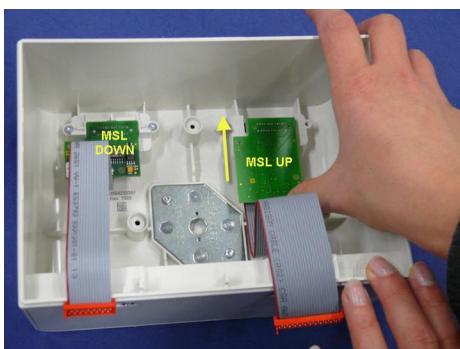
- 1 Separate the front and back of the Module Rack as described in “[Separating the Front and Back of the 4-Slot Module Rack](#)” on page 239
- 2 Remove the two screws from the MSL holder.



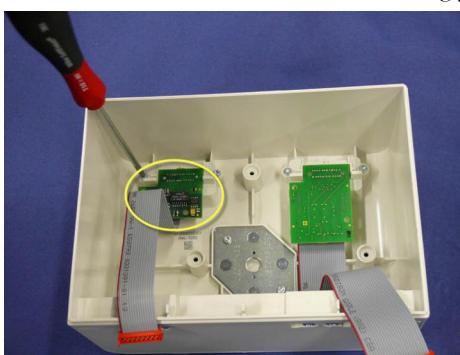
- 3 Push the MSL Holder forwards to remove it.



- 4 Push the MSL UP board forwards to remove it.

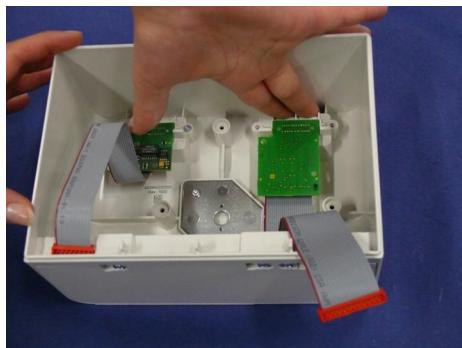


- 5 Remove the MSL DOWN board accordingly by performing the above steps for the other MSL board.



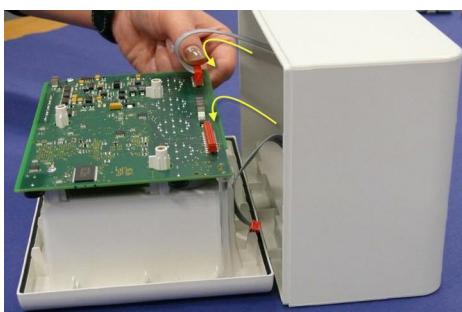
## 5 Repair and Disassembly

- 6 Reassemble the MSL boards by performing the above steps in reverse order. When reassembling, push down MSL holder before tightening screws.



### Reassembling the Front and Back

Ensure the cables are inserted as shown below:



## 4-Slot Module Rack (FMS-4) Disassembly (with Multi-Measurement Module Mount)

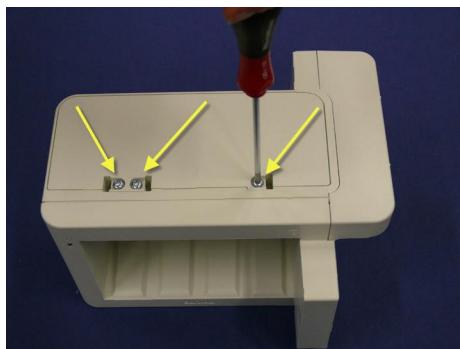
### Removing the Universal Mounting Clamp

- 1 If the Universal Mounting Clamp is installed, remove the two (T20) screws from the Universal Mounting Clamp, followed by the clamp itself. If any other mounting bracket is installed, remove it.



## Removing the MSL DOWN Board in Multi-Measurement Module Mount

- 1 Remove the three (T20) screws from the bottom cover.



- 2 Remove the bottom cover. If cable management hooks are installed, remove them.

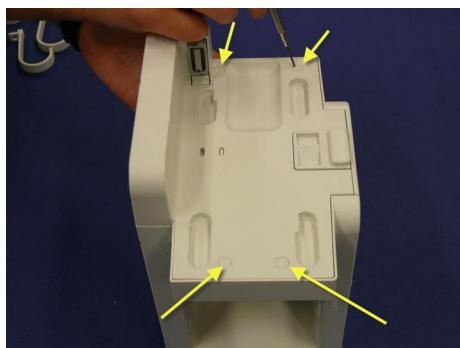


- 3 Remove the two pins as shown below.

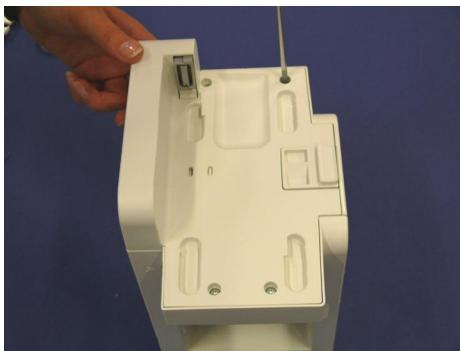


- 4 Position the Module Rack with the Multi-Measurement Module Mount pointing upwards.

- 5 Remove the four silicone screw covers as shown below.

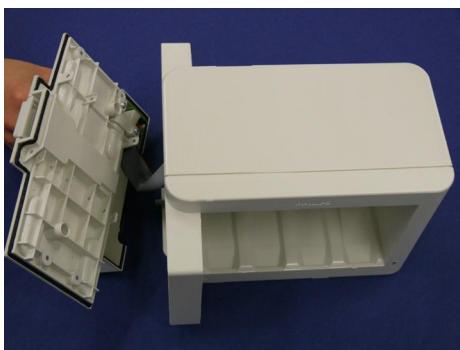


- 6** Remove the four (T10) screws from the Multi-Measurement Module Mount.

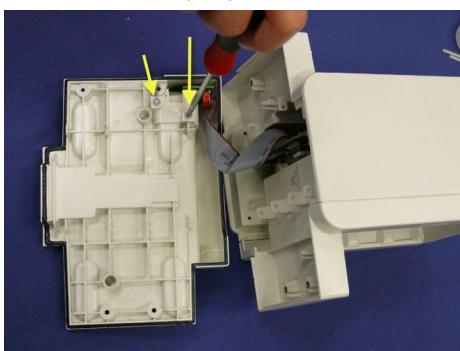


- 7** Flip the Module Rack so it is positioned right side up.

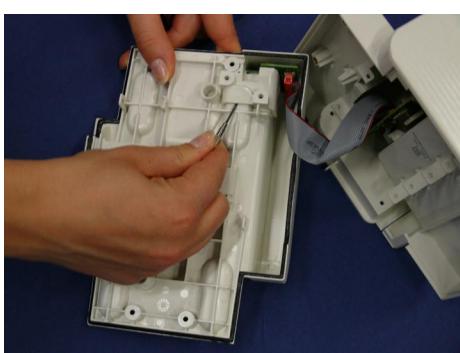
- 8** Pull off the Multi-Measurement Module Mount.



- 9** Remove the two (T10) screws from the MSL holder.

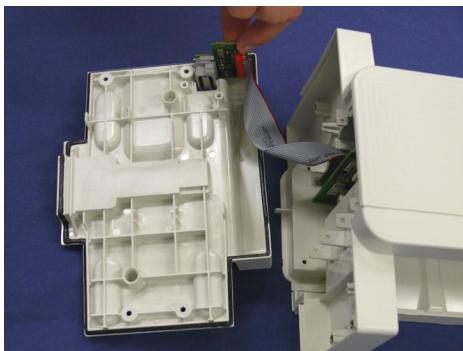


- 10** Remove MSL holder as shown below.

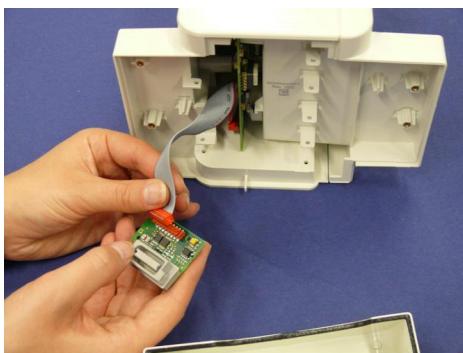


## 5 Repair and Disassembly

- 11 Remove the MSL Down board.



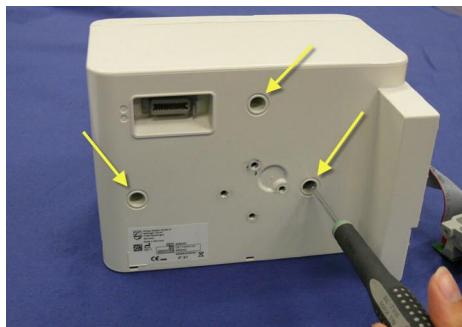
- 12 Remove the MSL cable from the board.



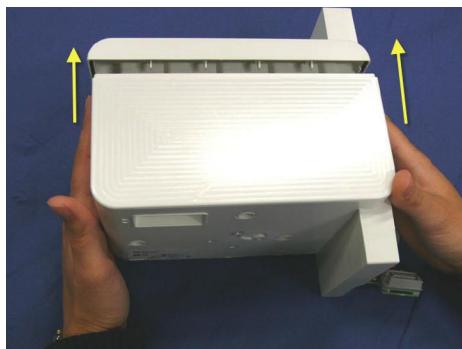
- 13 Reassemble the Module Rack by performing the above steps in reverse order, remembering to insert the silicone screw covers with the holes pointing towards the bottom.

## Separating the Front and Back of the 4-Slot Module Rack with Multi-Measurement Module Mount

- 1 Remove the Universal Mounting Clamp or any other mounting bracket as described in “[Removing the Universal Mounting Clamp](#)” on page 245.
- 2 Remove the Multi-Measurement Module Mount as described in steps 1 to 11 of the section “[Removing the MSL DOWN Board in Multi-Measurement Module Mount](#)” on page 246.
- 3 Remove the three (T10) screws from the back of the Module Rack.



- 4 Push the front housing off with your hands as shown below.



- 5 If you are exchanging the rear housing, check the information on the old housing label:
    - Product Number (behind REF)
    - Serial Number (SN)
    - Service Number (If existent – Service#)
    - Date of Manufacturing (DOM; under the factory icon in the format YYYY-MM or old MM/YY) or, if on the existing label: Date of Refurbishment (DOR; under the factory icon in the format YYYY-MM, and additionally Date of Refurbishment transferred under the date)
- Locate the appropriate position on the new rear housing label.

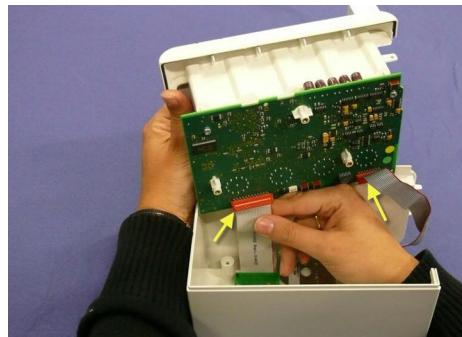


## 5 Repair and Disassembly

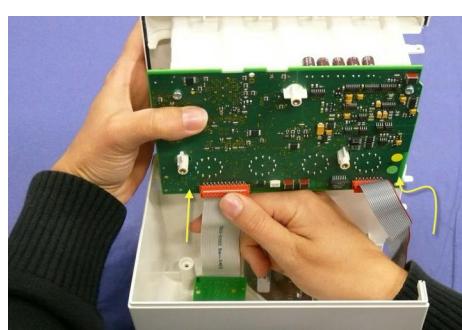
Copy all information onto the new Rear Housing label from the old Rear Housing Label using a water-resistant pen.

Paste the additional adhesive clear blank label on top of the updated replacement rear housing over REF, SN, Service#, and DOM to avoid smearing and provide protection.

- 6 Unplug the cables from the main board.



- 7 **Reassemble** the Module Rack by performing the above steps in reverse order. When reassembling the front and back of the Module Rack, ensure the cables are inserted into the main board as shown below.



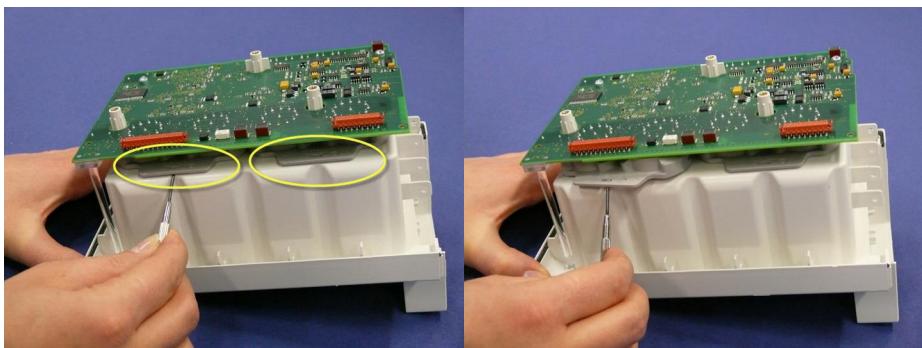
- Carefully tighten the screws in the rear cover so the Module Rack is properly sealed.
- Ensure the silicone screw covers in the Multi-Measurement Module mount are inserted with the hole facing downwards.

## Removing the Main Board

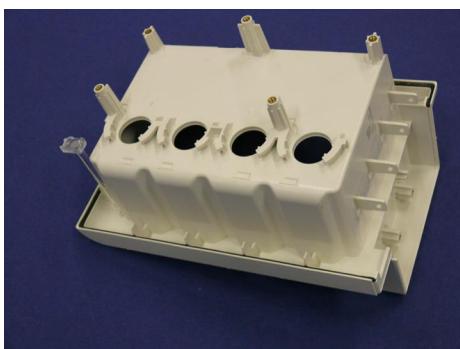
- 1 Separate the front and back of the 4-Slot Module Rack as described in “[Separating the Front and Back of the 4-Slot Module Rack with Multi-Measurement Module Mount](#)” on page 249.
- 2 Remove the two (T10) screws from the main board.



- 3 Pull out the two connector holders with a flathead screwdriver.

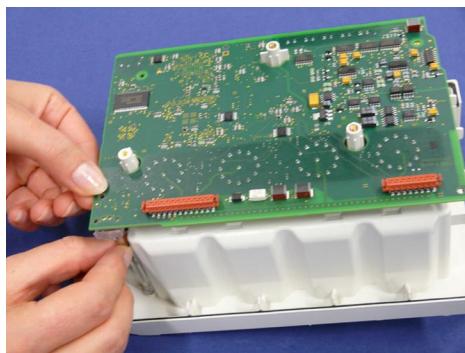


- 4 Remove the main board.



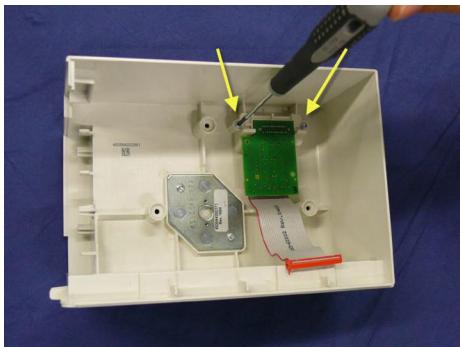
## 5 Repair and Disassembly

- 5 Reassemble the Module Rack by performing the above steps in reverse order. Ensure the light guide is in its correct position (see picture below) and reinsert the connector holders by pushing them in until you hear a click.

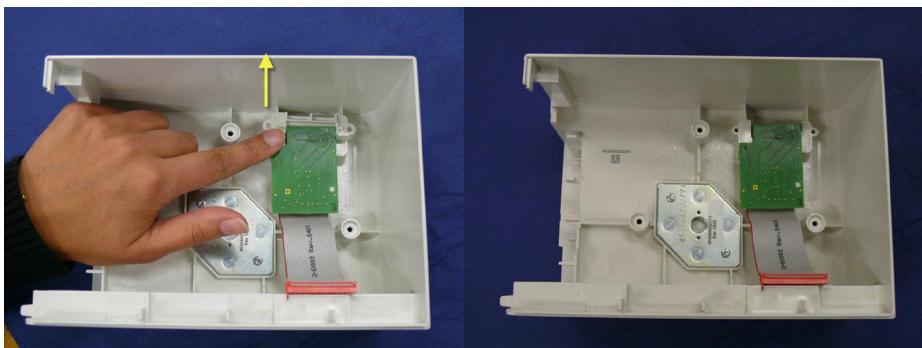


## Removing the MSL UP Board

- 1 Separate the front and back of the Module Rack as described in “[Separating the Front and Back of the 4-Slot Module Rack with Multi-Measurement Module Mount](#)” on page 249.
- 2 Remove the two screws from the MSL holder.



- 3 Push the MSL Holder forwards to remove it.



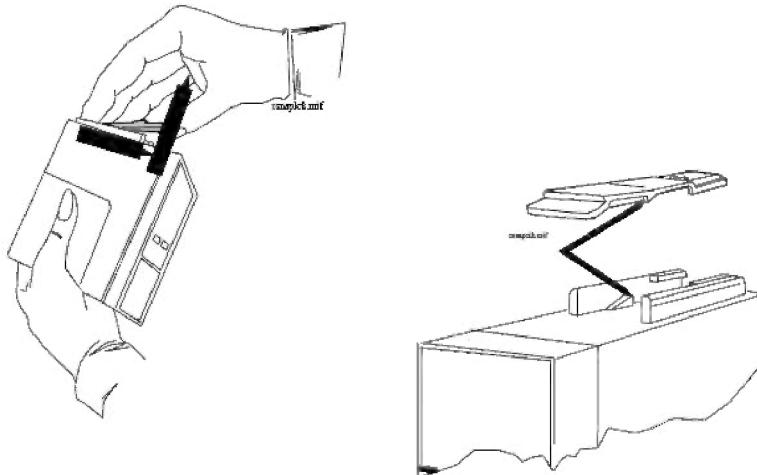
- 4 Push the MSL board forwards to remove it.



- 5 Reassemble the MSL UP board by performing the above steps in reverse order. When reassembling, push down MSL holder before tightening screws.

## Plug-in Modules

The snap lock holds the plug-in module in the Module Rack.



To remove the snap lock:

- 1 Grip the module firmly in one hand and using your thumb, pull the front edge of the snap lock away from the plug-in module so that the lug on the snap lock clears the retaining edge of the module.
- 2 Push on the rear edge of the snap lock to move the snap lock through the slot toward the front of the module until it is clear.

To replace the snap lock:

- 1 Locate the snap lock into the slot on the bottom of the module.
- 2 Slide the snap lock toward the rear of the module until the lock snaps into position.

## Plug-In Module Disassembly

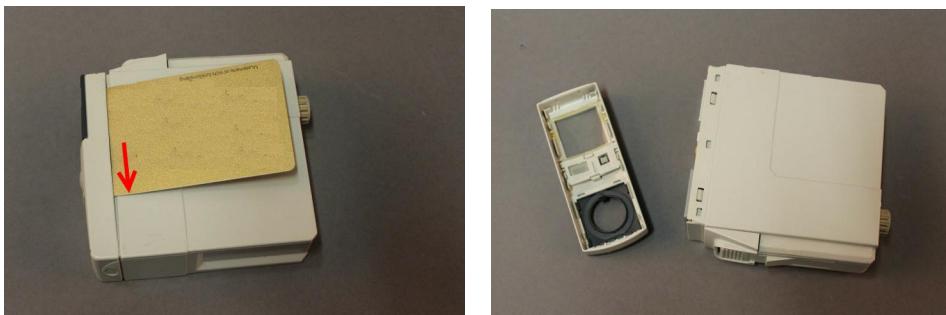
Disassembly of the parameter module enables replacement of the front assembly and rear housing.

### **WARNING**

When you disassemble/assemble a plug-in module an applied part leakage current test must be performed before it is used again for monitoring.

### **Removing the Front Housing**

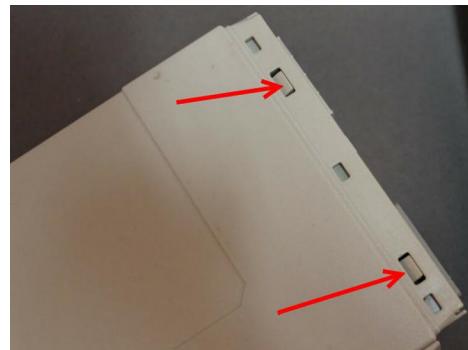
- 1 Place the module on a flat surface and insert a card (similar to a credit or cheque type card) into one side of the module to disengage the three tabs securing the front housing to the module housing.



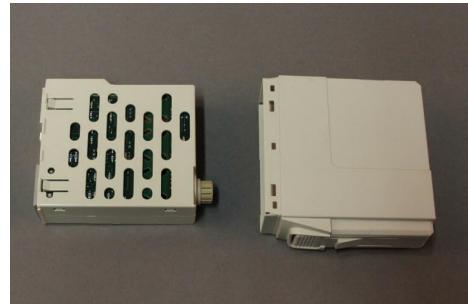
- 2 Pull the edge of the front housing away from the module housing.
- 3 Carefully turn the module over so the free edge does not reengage and repeat the first two steps on the other side of the module. The front housing should now be free of the module housing.

### Removing the Rear Housing

- 1 Use a small flat head screwdriver to release the snap-fit locks which hold the rear housing to the chassis. For easier release of the snap-fit locks, gently push on the socket connector at the rear so that the locks cannot reengage.
- 2 Carefully turn the module over so the free edge does not reengage and repeat the first step on the other side of the module. The rear housing should now be free of the module chassis.

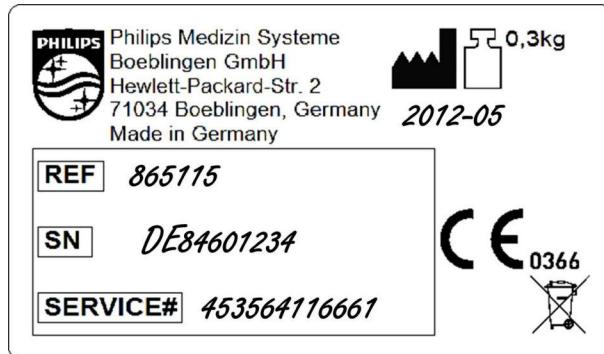


- 3 Pull out the chassis from the rear housing.



### Reassembling a Plug-in Module

- 1 Carefully push the chassis into the rear housing until the snap-fit locks engage. The socket connector must fit into the opening in the back of the rear housing. If it does not, turn the chassis around.
- 2 Transcribe the following information from the label on the back of the old rear housing onto the adhesive label delivered with the new rear housing:
  - Date of Manufacturing (below the Factory Icon)
  - PMS/Part Number (REF)
  - Serial Number (SN)
  - Service Number (Service #)



- 3 Use a water-resistant pen for transcribing, and then place the adhesive plastic lid over the writing. Stick the whole adhesive label on the back of the rear housing.
- 4 Snap-fit the front housing onto the front of the module case so the openings in the front housing match the LEDs and keys.

### Recorder Module Disassembly (M1116C)

Follow the disassembly procedures below, and do **not** disassemble the recorder past the point described.

#### Disassembly of the Roller

- 1 Open the recorder door and remove the paper roll. In order to exchange the roller, you must remove the paper guide first.



- 2 Carefully remove the paper guide from its position by pulling the gray holder to the left and the paper guide to the right.



- 3 Lift up the paper guide on the left side and remove it.



- 4 Pull the roller towards you and remove it.



**Assembly of the Roller**

- 1 Assemble both parts by performing the above steps in reverse order.
- 2 Ensure all parts click into place.

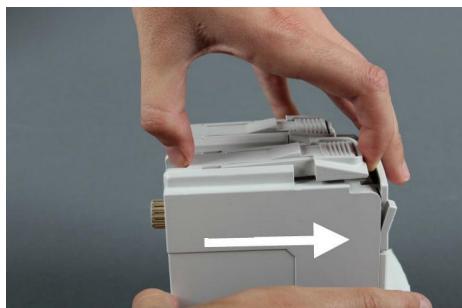
**Disassembly of the Snap Lock****NOTE**

Use **only** snap lock kit 453564456791 for the M1116C recorder. Any other snap lock will render the recorder door permanently closed.

- 1 Turn the recorder upside down, with the snap locks facing upwards.
- 2 Lift the release lever up a few millimeters.



- 3 While lifting up, push the snap lock once with your thumb in the direction of the door in order to release it from its rail. Then slide it all the way out.



- 4 Lift the snap lock up in order to remove it.



### Assembly of the Snap Lock

- 1 Hold the new snap lock perpendicular to the recorder, as shown in the pictures below.



- 2 Lay the snap lock down on its guiding rail and push into its position.
- 3 Slide until you hear a click that indicates a proper fit.

### G7m Repair Strategy

#### NOTE

Before exchanging the G7m Gas Analyzer Module, check the water trap, sample line and Gas Exhaust Return Line and /or Gas Exhaust return Filter for overfilling, occlusions or leakages and then perform all checks listed in the troubleshooting section. In addition, check the CO<sub>2</sub> absorber on the anesthesia machine.

The repair strategy for the G7mgas analyzer module is unit exchange. Before exchanging the unit, you must remove the used water trap and apply a new one as protection. If the water trap is still within its "reusable life" it can be reused, if not, dispose of the water trap.

- 1 Prior to repackaging clean and disinfect the gas analyzer.
- 2 Return the gas analyzer to Philips for exchange, see “[Repackaging for Shipment or Storage](#)” on page 375.

## Multi-Measurement Module (Current Generation - MMX) Disassembly

Follow the disassembly and reassembly steps below closely. Do not disassemble the MMX past the point described in the procedures below.

### NOTE

There are three current generation MMX Multi-Measurement Modules as shown in the table below. While the modules may look slightly different, the disassembly procedure is identical for all.

Philips FAST SpO <sub>2</sub>	Masimo rainbow SpO <sub>2</sub>	Nellcor OxiMax SpO <sub>2</sub>
		

### WARNING

- Do not open the MMX while it is connected to a monitor.
- Parts inside the instrument may be contaminated with bacteria. Protect yourself from possible infection by wearing examination gloves during this procedure.

### Removing the Front Bezel

1. Position the MMX as shown below.



2. Remove the front bezel by gently pulling it away from the MMX until it snaps off. There may be a slight resistance when doing this.



3. When replacing a front bezel, check the labeling on its front and apply the respective replacement labels to the front of the new front bezel.

#### NOTE

The label sheet is not shipped with the front bezel. It must be ordered separately.

## Removing/Exchanging the NBP Inlet

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 262.
- 2 Slowly turn the connector counterclockwise with an Allen wrench until it is released.



### NOTE

When releasing the connector be careful not to remove its transparent cover or the metal balls may fall out.

3. Ensure the connector contains all four metal balls in the transparent cover. If a ball is missing, it may have fallen into the NBP connector chamber.



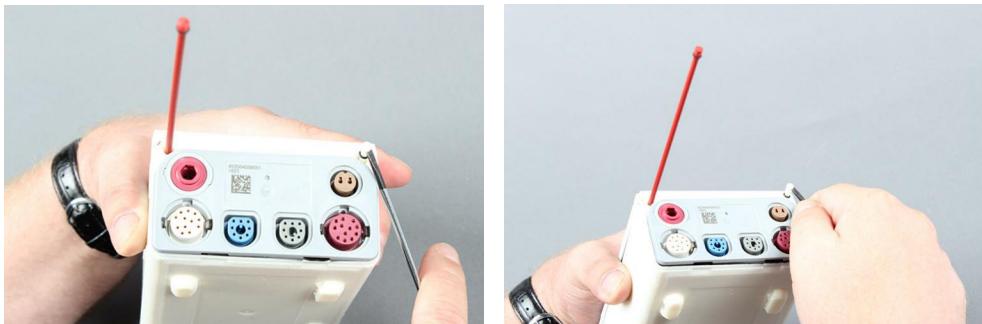
4. Insert the new connector using the same wrench, turn it clockwise and tighten the connector carefully.



5. Perform a visual check of the new connector once it is assembled. Ensure the hole in the silicone cover is round and not oval or otherwise deformed as this can cause leakage. Perform the NBP Performance test as described in “[Testing and Maintenance](#)” on page 41.

### Removing the Housing Pins

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 262.
- 2 Position the MMX with the connectors facing towards you, and identify the two long housing pins threaded into the MMX on the housing top cover.
- 3 Use the thin-bladed screwdriver to gently lift the housing pins out, far enough that they can be removed manually.



- 4 Remove the two housing pins and set them aside for refitting.



#### NOTE

Without these long housing pins, the MMX will not function properly

## Removing the Housing Top Cover

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 262.
- 2 Remove the housing pins as described in “[Removing the Housing Pins](#)” on page 264.
- 3 Gently pull the housing top cover away from the MMX. The housing top cover is press-latched at the MMX connector. There may be a slight resistance. Remove the cover slowly, without hitting or touching the inside of the MMX.



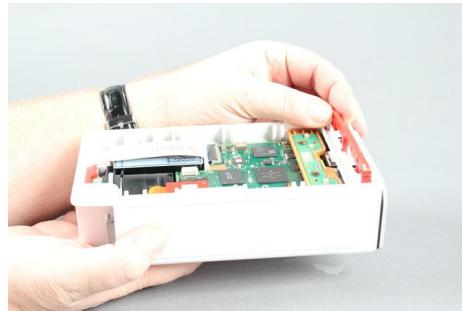
### Removing the MMX from its Housing

Before removing the MMX from its housing:

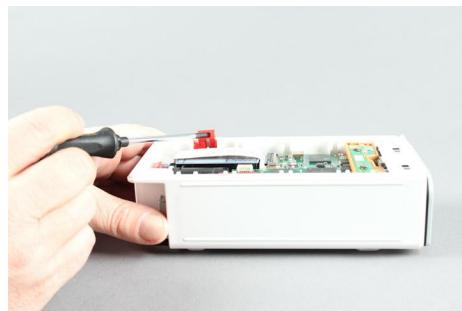
- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 262.
- 2 Remove the housing pins as described in “[Removing the Housing Pins](#)” on page 264.
- 3 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 265.

Follow the instructions below to remove the MMX from its housing:

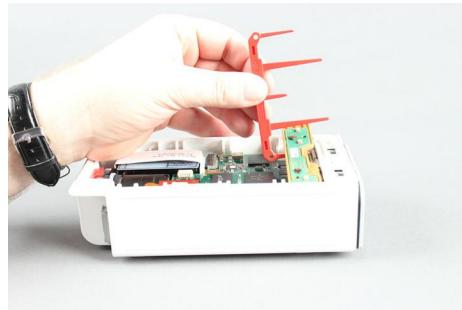
- 1 Lightly grip the connector block holder at the front of the MMX and slowly pull it up and out of the housing. Note that some force may be required.



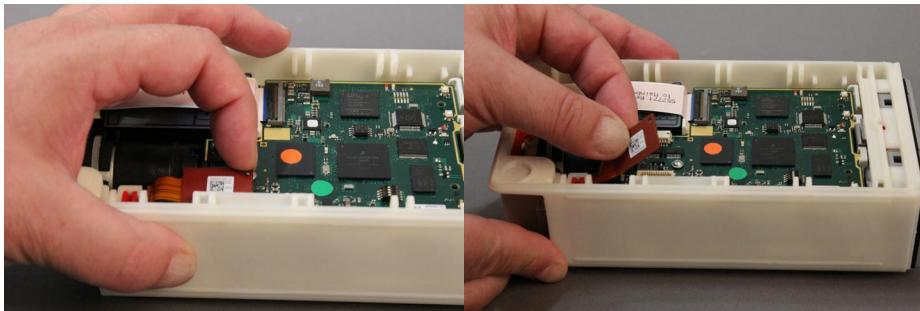
- 2 Insert a screwdriver into the top of the red holder and gently raise it from its slot.



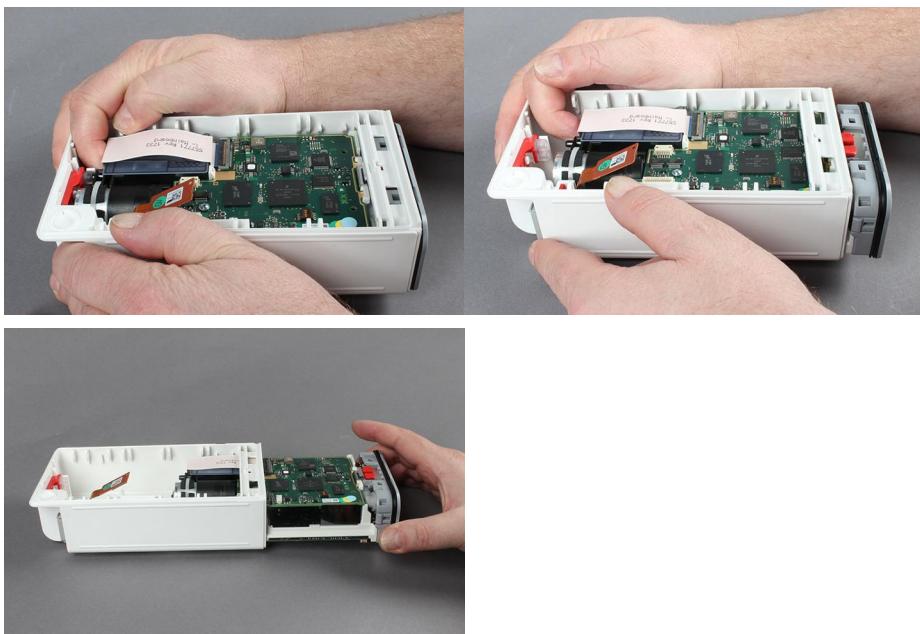
- 3 Take the connector block holder, slide it beneath the switchboard and gently lift/remove it.



- 4 Identify the brown MSL flex connector by the side of the housing and gently pull its front upwards to release it.



- 5 Place your finger immediately behind the MMX measurement block and gently push it from its housing. Note that some force may be required.



#### NOTE

**Reassemble** the MMX by performing the above steps in reverse order.

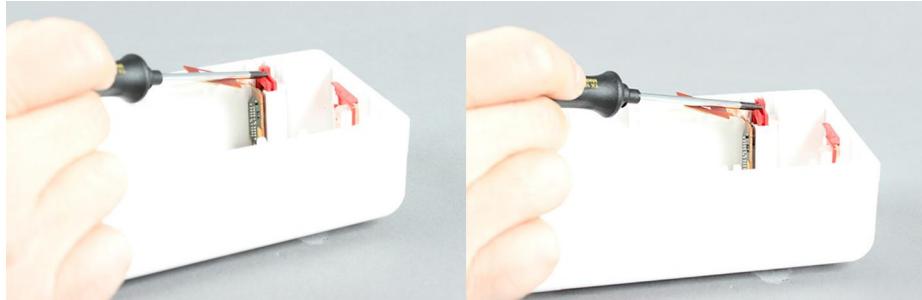
### Removing the MSL Board Assembly

Before removing the MMX MSL Board Assembly:

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 262.
- 2 Remove the housing pins as described in “[Removing the Housing Pins](#)” on page 264.
- 3 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 265.
- 4 Remove the MMX from its housing as described in “[Removing the MMX from its Housing](#)” on [page 266](#).

Follow the instructions below to remove the MMX MSL board assembly:

- 1 Lift up and remove the red MSL board holder.



- 2 Push the MSL connector inwards and remove the MSL board assembly.



#### NOTE

**Reassemble** the MMX by performing the above steps in reverse order. Ensure the red MSL board holder is reinserted into the correct position. Note that it only fits when it is correctly oriented.

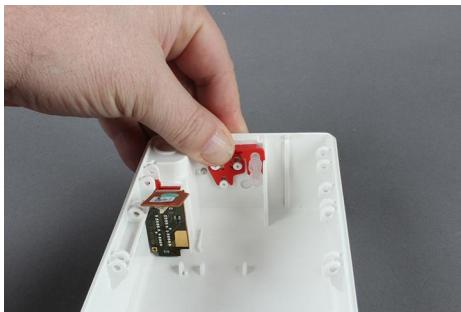
## Removing the Serial Number Plate

Before removing/exchanging the serial number plate:

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 262.
- 2 Remove the housing pins as described in “[Removing the Housing Pins](#)” on page 264.
- 3 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 265.
- 4 Remove the MMX from its housing as described in “[Removing the MMX from its Housing](#)” on [page 266](#).
- 5 Remove the MSL board assembly as described in “[Removing the MSL Board Assembly](#)” on page 268.

Follow the instructions below to remove/exchange the serial number plate:

- 1 Pull the serial number plate holder up to release it, and remove it.



- 2 Pull off the serial number plate.



### NOTE

It is not necessary to remove the connector block before removing the serial number plate. For the pictures above, the connector block has only been removed to improve the visualization of the procedure.

### Replacing the Rear Housing

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 262.
- 2 Remove the housing pins as described in “[Removing the Housing Pins](#)” on page 264.
- 3 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 265.
- 4 Remove the MMX from its housing as described in “[Removing the MMX from its Housing](#)” on page 266.
- 5 Remove the MSL board assembly as described in “[Removing the MSL Board Assembly](#)” on page 268.
- 6 Remove the serial number plate as described in “[Removing the Serial Number Plate](#)” on page 269.
- 7 Reassemble the MMX by performing the above steps in reverse order.



- 8 Check the labeling on the old rear housing and apply the respective labels to the new rear housing.



#### NOTE

The label sheet is not shipped with the rear housing. It must be ordered separately.

## Removing/Exchanging the Main Board

Before removing/exchanging the MMX main board:

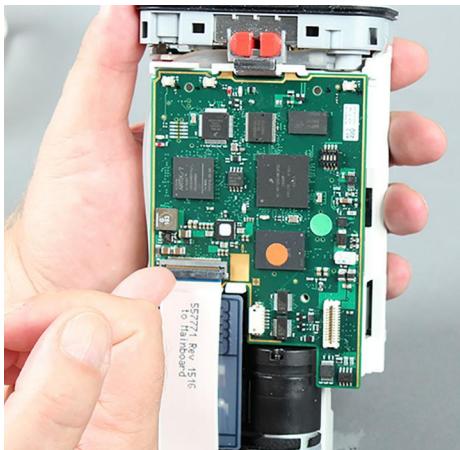
- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 262.
- 2 Remove the housing pins as described in “[Removing the Housing Pins](#)” on page 264.
- 3 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 265.
- 4 Remove the MMX from its housing as described in “[Removing the MMX from its Housing](#)” on [page 266](#).
- 5 Remove the MSL board assembly as described in “[Removing the MSL Board Assembly](#)” on page 268.

Follow the instructions below to remove/exchange the main board:

- 1 Unscrew and remove the screw from the center of the main board.



- 2 Lift up the black flex connector holding the main board flex cable to the main board. Do NOT use a screwdriver for this operation.

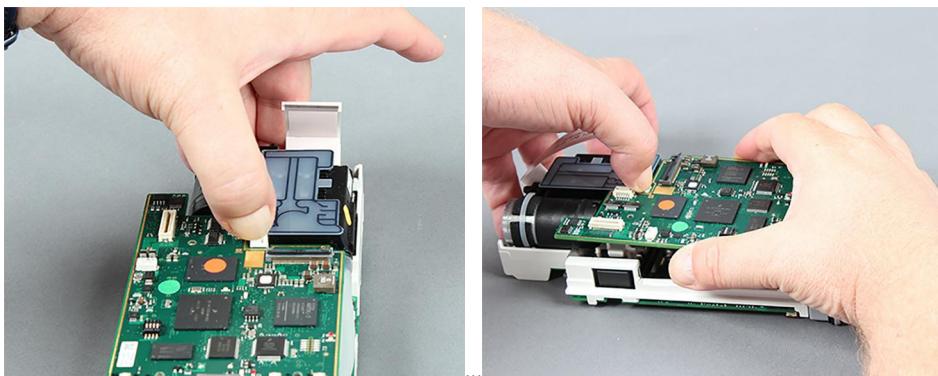


## 5 Repair and Disassembly

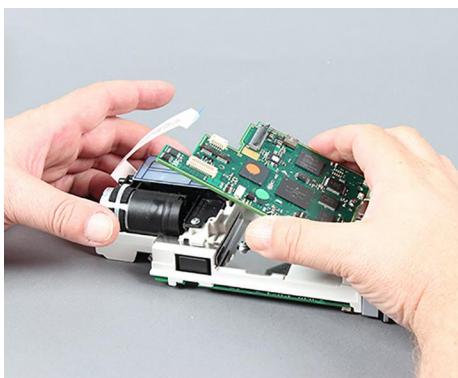
- 3 Gently lift up and release the main board flex cable. Do NOT use a screwdriver for this operation.



- 4 Gently push the white plastic latch towards the NBP pump assembly. Do NOT use a screwdriver for this operation.



- 5 Lift the end of main board nearest to the NBP pump assembly up and away from the MMX chassis.



### NOTE

**Reassemble** the MMX by performing the above steps in reverse order.

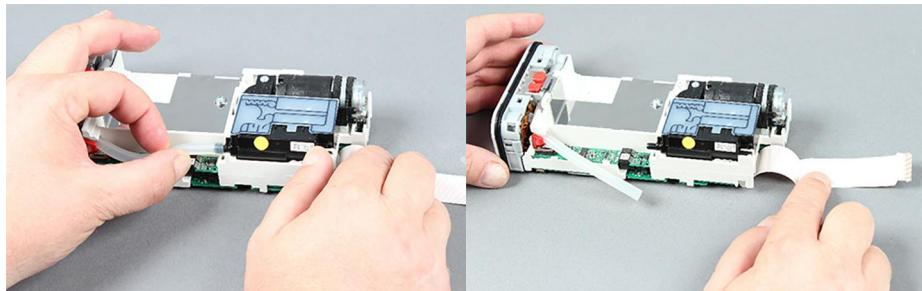
## Removing the NBP Pump Assembly

Before removing the MMX NBP pump assembly:

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 262.
- 2 Remove the housing pins as described in “[Removing the Housing Pins](#)” on page 264.
- 3 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 265.
- 4 Remove the MMX from its housing as described in “[Removing the MMX from its Housing](#)” on [page 266](#).
- 5 Remove the MSL board assembly as described in “[Removing the MSL Board Assembly](#)” on page 268.
- 6 Remove/exchange the main board as described in “[Removing/Exchanging the Main Board](#)” on [page 271](#).

Follow the instructions below to remove the MMX NBP pump assembly:

- 1 Disconnect the NBP pump tubing from the NBP pump assembly nozzle.



- 2 Gently remove the cable connector from the NBP pump.



- 3 Unscrew and remove the screw attaching the NBP pump assembly to the Multi-Measurement Module chassis.

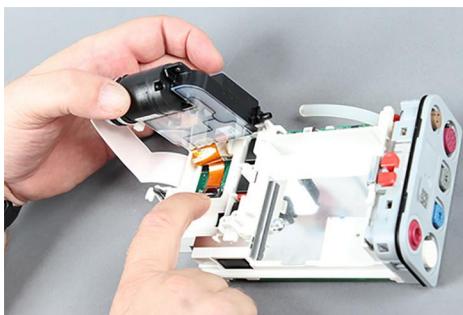


## 5 Repair and Disassembly

- 4 Raise the pump of the NBP pump assembly against the pivot/hinge.



- 5 Disconnect the flex cable from the NBP pump casing and lift the NBP pump assembly from the Multi-Measurement Module chassis.



### NOTE

**Reassemble** the MMX by performing the above steps in reverse order.

## Removing the Temperature Board

Before removing the MMX temperature board:

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 262.
- 2 Remove the housing pins as described in “[Removing the Housing Pins](#)” on page 264.
- 3 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 265.
- 4 Remove the MMX from its housing as described in “[Removing the MMX from its Housing](#)” on [page 266](#).
- 5 Remove the MSL board assembly as described in “[Removing the MSL Board Assembly](#)” on page 268.
- 6 Remove/exchange the main board as described in “[Removing/Exchanging the Main Board](#)” on [page 271](#).
- 7 Remove the NBP pump assembly as described in “[Removing the NBP Pump Assembly](#)” on page 273.
- 8 Follow the instructions below to remove the MMX temperature board:
- 9 Push in the plastic latch holding the temperature board in place.



- 10 Gently lift up the temperature board, and remove it.



### NOTE

**Reassemble** the MMX by performing the above steps in reverse order.

### Removing the Connector Block

Before removing the MMX connector block:

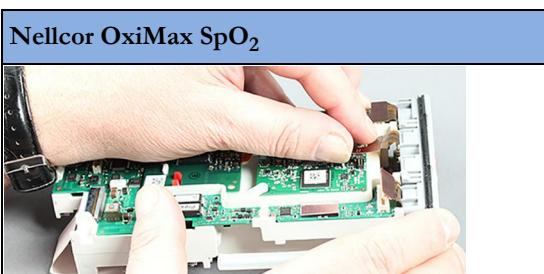
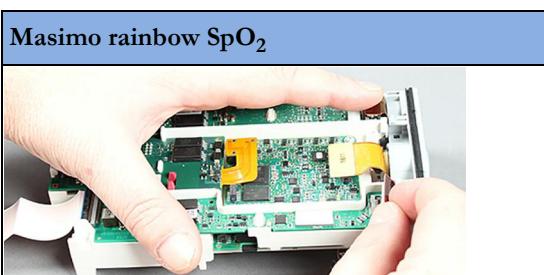
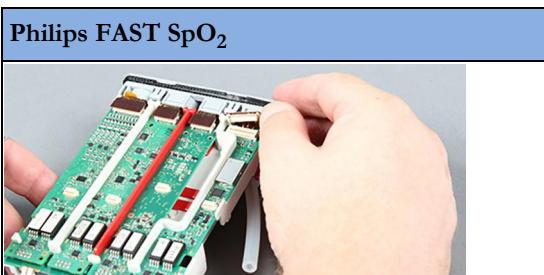
- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 262.
- 2 Remove the housing pins as described in “[Removing the Housing Pins](#)” on page 264.
- 3 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 265.
- 4 Remove the MMX from its housing as described in “[Removing the MMX from its Housing](#)” on [page 266](#).
- 5 Remove the MSL board assembly as described in “[Removing the MSL Board Assembly](#)” on page 268.
- 6 Remove/exchange the main board as described in “[Removing/Exchanging the Main Board](#)” on [page 271](#).
- 7 Remove the NBP pump assembly as described in “[Removing the NBP Pump Assembly](#)” on page 273.
- 8 Remove the temperature board as described in “[Removing the Temperature Board](#)” on page 275.

#### CAUTION

Handle the thin flex cable connectors with care as they can easily be damaged. Do not pull on the cable itself.

Follow the instructions below to remove the MMX connector block:

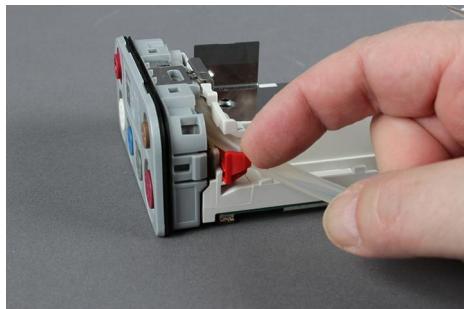
- 1 Carefully release the flex cables from the measurement boards and disconnect them.



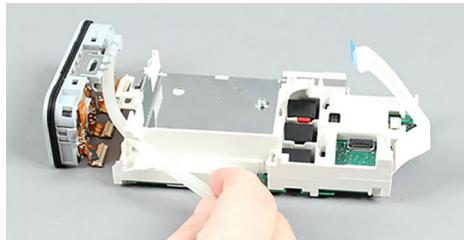
2. Turn the MMX over (180 degrees, as shown), push the ends of the red connector block holder together and remove it.



3. Pull the red latch (NBP tube catcher) backwards to unlock the NBP pump tubing, and remove the latch.



4. Pull off the connector block.



#### NOTE

**Reassemble** the MMX by performing the above steps in reverse order.

### Removing the Measurement Boards

Before removing the MMX measurement boards:

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 262.
- 2 Remove the housing pins as described in “[Removing the Housing Pins](#)” on page 264.
- 3 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 265.
- 4 Remove the MMX from its housing as described in “[Removing the MMX from its Housing](#)” on [page 266](#).
- 5 Remove the MSL Board Assembly as described in “[Removing the MSL Board Assembly](#)” on page 268.
- 6 If necessary/required:
  - remove the NBP pump assembly as described in “[Removing the NBP Pump Assembly](#)” on page 273.
  - remove the temperature board as described in “[Removing the Temperature Board](#)” on page 275.

#### CAUTION

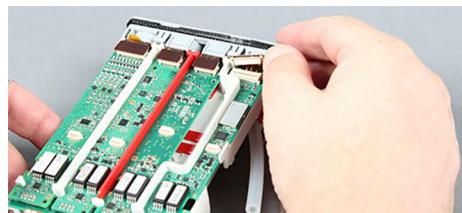
Handle the thin flex cable connectors with care as they can easily be damaged. Do not pull on the cable itself.

Follow the instructions below to remove the measurement boards:

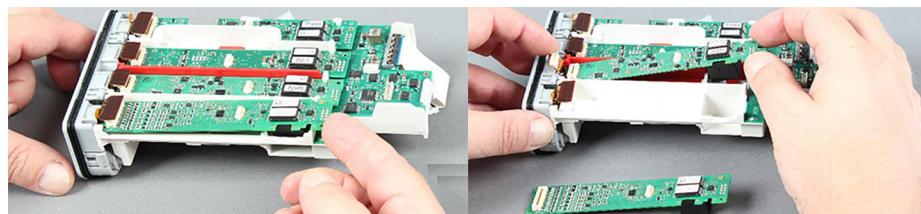
#### NOTE

For specific procedures related to Masimo rainbow SpO<sub>2</sub>/Nellcor OxiMax SpO<sub>2</sub> see: “[Removing the Masimo rainbow SpO<sub>2</sub>/Nellcor OxiMax SpO<sub>2</sub> Boards](#)” on page 279.

- 1 Carefully release the flex cable connectors from the measurement boards, and disconnect them.



- 2 Remove the measurement boards to be replaced by simply lifting them gently as shown.



**Reassemble** the MMX by performing the above steps in reverse order.

## Removing the Masimo rainbow SpO<sub>2</sub>/Nellcor OxiMax SpO<sub>2</sub> Boards

Before removing the Masimo rainbow SpO<sub>2</sub>/Nellcor OxiMax SpO<sub>2</sub> boards:

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 262.
- 2 Remove the housing pins as described in “[Removing the Housing Pins](#)” on page 264.
- 3 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 265.
- 4 Remove the MMX from its housing as described in “[Removing the MMX from its Housing](#)” on [page 266](#).
- 5 Remove the MSL Board Assembly as described in “[Removing the MSL Board Assembly](#)” on page 268.
- 6 If necessary/required:
  - remove the NBP pump assembly as described in “[Removing the NBP Pump Assembly](#)” on page 273.
  - remove the temperature board as described in “[Removing the Temperature Board](#)” on page 275.

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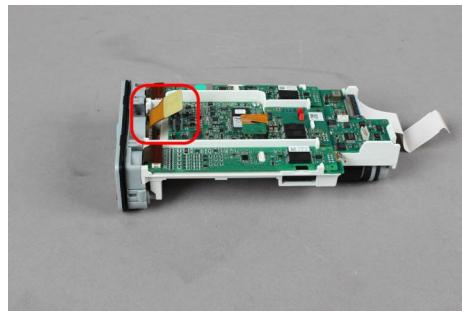
### CAUTION

Handle the thin flex cable connectors with care as they can easily be damaged. Do not pull on the cable itself.

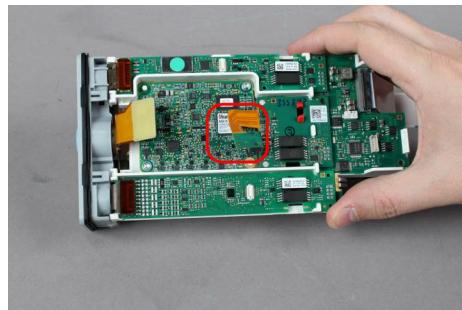
---

Follow the instructions below to remove the Masimo rainbow SpO<sub>2</sub>/Nellcor OxiMax SpO<sub>2</sub> boards:

- 1 Remove the flex connector from the connector block to the Masimo rainbow SpO<sub>2</sub>/Nellcor OxiMax SpO<sub>2</sub> board.

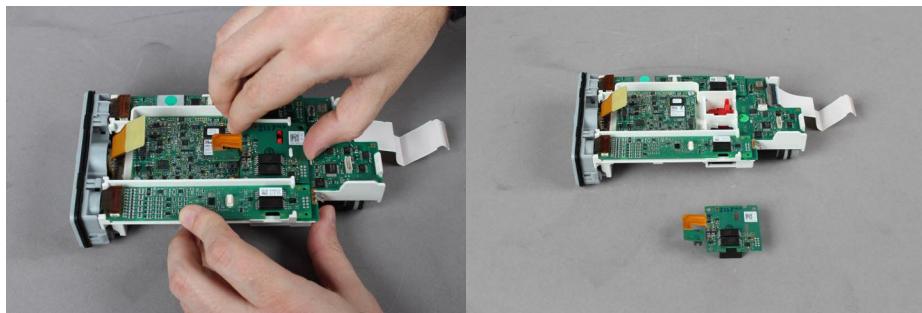


- 2 Remove the other flex connector from the Masimo rainbow SpO<sub>2</sub>/Nellcor OxiMax SpO<sub>2</sub> board

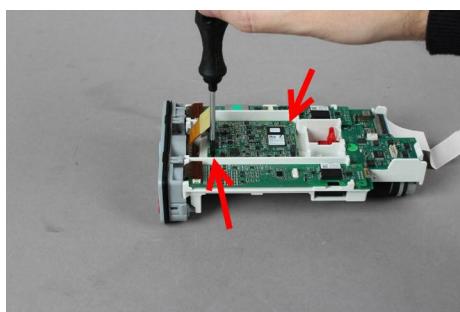


## 5 Repair and Disassembly

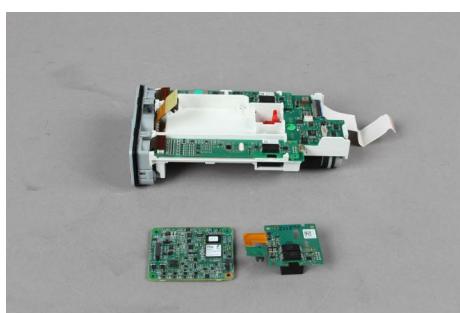
- 3 Remove the adapter board.



- 4 Remove the two screws from the Masimo rainbow SpO<sub>2</sub>/Nellcor OxiMax SpO<sub>2</sub> board.



- 5 Remove the Masimo rainbow SpO<sub>2</sub>/Nellcor OxiMax SpO<sub>2</sub> board.



**Reassemble** the MMX by performing the above steps in reverse order.

### NOTE

The Masimo rainbow SpO<sub>2</sub>/Nellcor OxiMax SpO<sub>2</sub> boards look slightly different. The procedure above shows the Masimo rainbow SpO<sub>2</sub> board but it is identical for both.



Masimo rainbow SpO<sub>2</sub> board incl. adapter board



Nellcor OxiMax SpO<sub>2</sub> board incl. adapter board,  
and Nellcor OxiMax SpO<sub>2</sub> board holder (circled  
in red)

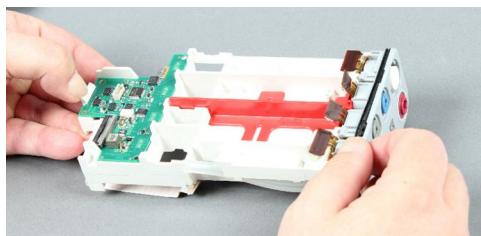
## Removing the Front End Adapter Board

Before removing the MMX front end adapter board:

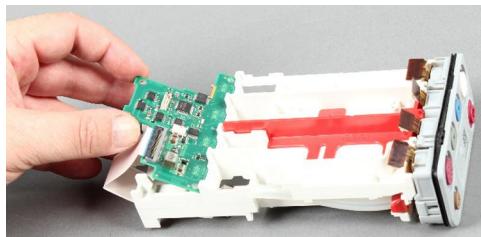
- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 262.
- 2 Remove the housing pins as described in “[Removing the Housing Pins](#)” on page 264.
- 3 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 265.
- 4 Remove the MMX from its housing as described in “[Removing the MMX from its Housing](#)” on [page 266](#).
- 5 Remove the MSL board assembly as described in “[Removing the MSL Board Assembly](#)” on page 268.
- 6 Remove/exchange the main board as described in “[Removing/Exchanging the Main Board](#)” on [page 271](#).
- 7 Remove the NBP pump assembly as described in “[Removing the NBP Pump Assembly](#)” on page 273.
- 8 Remove the connector block as described in “[Removing the Connector Block](#)” on page 276.
- 9 Remove the measurement boards as described in “[Removing the Measurement Boards](#)” on page 278.

Follow the instructions below to remove the MMX front end adapter board:

- 1 Identify the white latch at the back of the front end adapter board and gently pull it back.



- 2 Lift up and remove the front end adapter board.



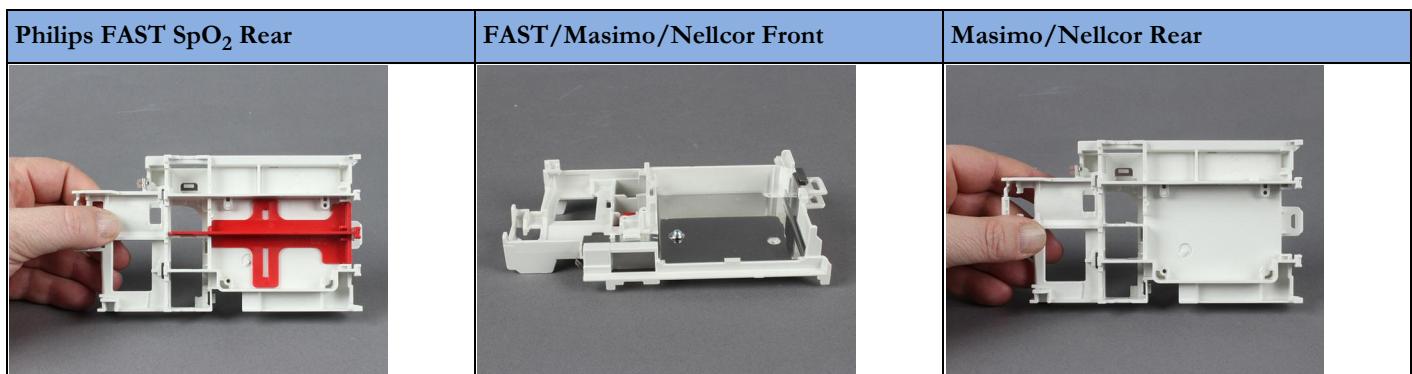
### NOTE

**Reassemble** the MMX by performing the above steps in reverse order.

### Exchanging the Chassis

Follow the instructions below to exchange the MMX chassis:

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 262.
- 2 Remove the housing pins as described in “[Removing the Housing Pins](#)” on page 264.
- 3 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 265.
- 4 Remove the MMX from its housing as described in “[Removing the MMX from its Housing](#)” on [page 266](#).
- 5 Remove the MSL board assembly as described in “[Removing the MSL Board Assembly](#)” on page 268.
- 6 Remove/exchange the main board as described in “[Removing/Exchanging the Main Board](#)” on [page 271](#).
- 7 Remove the NBP pump assembly as described in “[Removing the NBP Pump Assembly](#)” on page 273.
- 8 Remove the temperature board as described in “[Removing the Temperature Board](#)” on page 275.
- 9 Remove the connector block as described in “[Removing the Connector Block](#)” on page 276.
- 10 Remove the measurement boards as described in “[Removing the Measurement Boards](#)” on page 278.
- 11 Remove the front end adapter board as described in “[Removing the Front End Adapter Board](#)” on [page 281](#).



The images above show the chassis ready for exchange.

#### NOTE

**Reassemble** the MMX by performing the above steps in reverse order.

## Multi-Measurement Module (Previous Generation - MMS) Disassembly

Follow the disassembly and reassembly steps below closely. Do not disassemble the MMS past the point described in the procedures below.

### Tools Required

- Thin-bladed screwdriver
- Allen wrench (size 6)
- ESD mat and wrist strap

---

#### WARNING

- Do not open the MMS while it is connected to a monitor.
  - Parts inside the instrument may be contaminated with bacteria. Protect yourself from possible infection by wearing examination gloves during this procedure.
-

### Removing/Exchanging the NBP Inlet

- 1 Position the MMS as shown in the picture below.



- 2 Slowly turn the connector counterclockwise with an Allen wrench until it is released.



#### NOTE

When releasing the connector be careful not to remove its transparent cover.

- 3 Verify that the connector contains all four metal balls in the transparent cover. If a ball is missing, it may have fallen into the NBP connector chamber.



- 4 Insert the new connector using the same wrench, turn it clockwise and tighten the connector carefully



- 5 Perform a visual check of the new connector once it is assembled. Verify that the hole in the silicone cover is round and not oval or otherwise deformed because this can cause leakage. Perform the NBP Performance test as outlined in chapter "Testing and Maintenance".

## Removing the Front Cover

- 1 Position the thin-bladed screwdriver in the small slot provided for this purpose. Remove the front cover by pulling it away from the MMS until it snaps off. There may be a slight resistance when removing the front cover.



### Removing the Housing Pin

- 1 Position the MMS with the connectors facing towards you. There are four long housing pins threaded into the MMS in each of the four corners under the cover. Locate the heads of the two long housing pins on the housing top cover and only remove these.
- 2 Use the thin-bladed screwdriver to lift the pins gently out, far enough that they can be removed manually.



- 3 Remove the two pins and set them aside for refitting.



#### NOTE

Without these long housing pins, the MMS will not function properly

### Removing the Housing Top Cover

Begin by gently pulling the housing top cover away from the MMS. The housing top cover is press-latched at the MMS connector. There might be a resistance due to the rubber sealing. Remove the cover slowly, without hitting or touching the inside of the MMS.



## Removing/Exchanging the DC/DC Board

### NOTE

The HW Rev C MMS (S/N prefix DE610xxxx) no longer has a separate DC/DC board.

The DC/DC board is connected to the main board. Loosen the pin connection to the main board and remove the DC/DC board by gently lifting it up. Avoid touching the surface of the board. Set it aside where it is ESD protected.

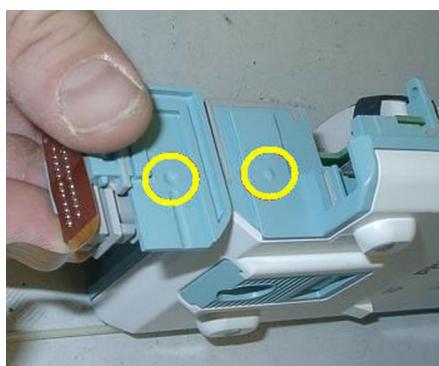


### Removing the MSL Flex Assembly

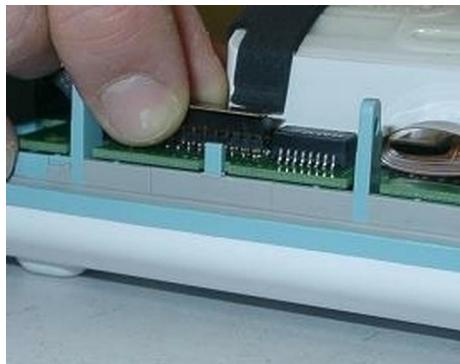
- 1 After the DC/DC board is removed, lift up the MSL frame connector to which the MSL Flex is attached.



At the beginning there might be resistance due to the special fixing mechanism shown in the picture below.



- 2 Lift up the flex connector carefully. Do not bend the connector pins on the main board.



## Removing the NBP pump

- 1 Remove the pump by lifting it up. Set the pump aside. Also remove the old silicon tubes.

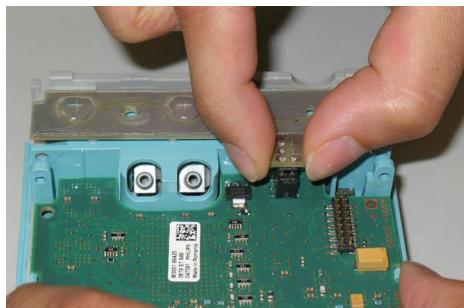


- 2 Remove the connector of the NBP pump assembly. The connector may sit tightly. Gently loosen the connector.

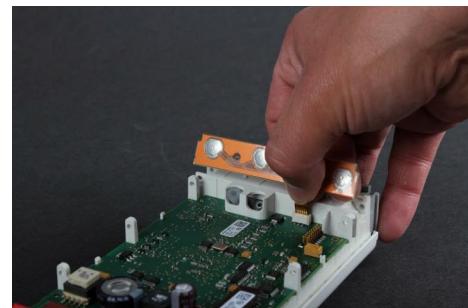


### Removing the Keypad

- 1 Remove the keypad by lifting it straight up.



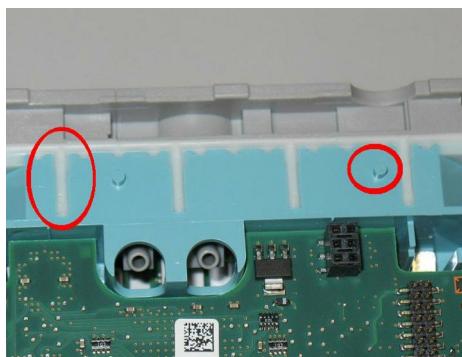
*Rigid Keypad Connection*



*Flexible Keypad Connection*

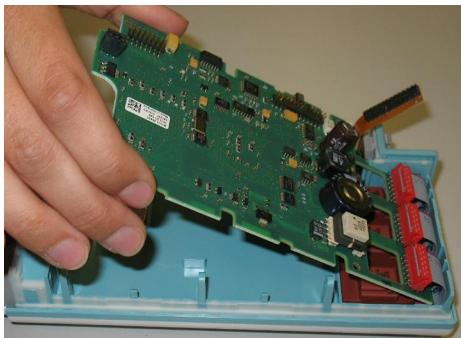
#### NOTE

The rubber sealing and the guides (marked with red circles) may hold the keypad firmly in place. Therefore it may be necessary to loosen the keypad first. Do this carefully to avoid any damage.

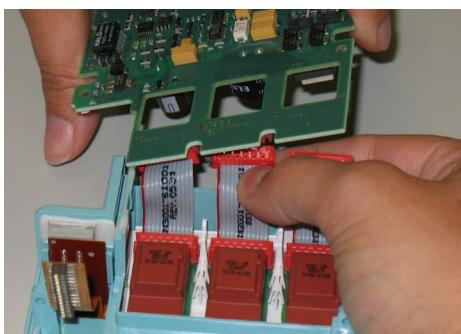


## Removing the Main Board

- 1 Lift up the main board as shown below. Then turn it over and continue with step 2.



- 2 Remove the connectors to the main board starting from the right side.

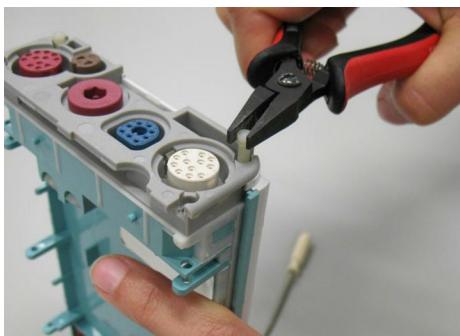


### Removing the Measurement Board

- 1 Position the MMS with the connectors facing towards you. There are four long housing pins threaded into the MMS in each of the four corners under the cover. Locate the heads of the two long housing pins on the bottom cover. Only these need to be removed.
- 2 Use a thin-bladed screwdriver to gently lift the pins out far enough so they can be removed with pliers.



- 3 Remove the two pins and set them aside for refitting.



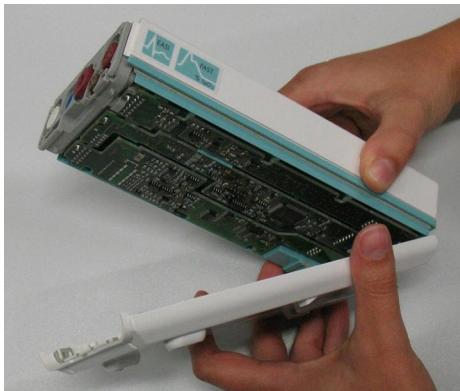
#### NOTE

Without these long housing pins, the MMS will not function properly.

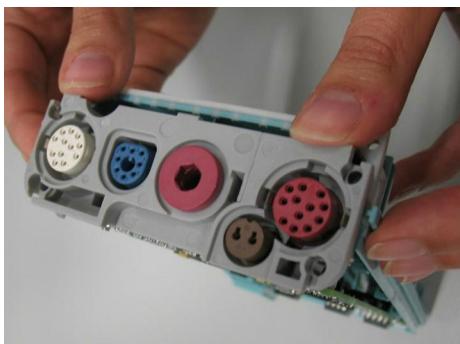
- 4 Loosen the bottom cover gently. Use the screwdriver and position it in the gap between bottom cover and measurement block, then twist the screwdriver. **Do not push the screwdriver into the device as you may damage electronic components inside.**



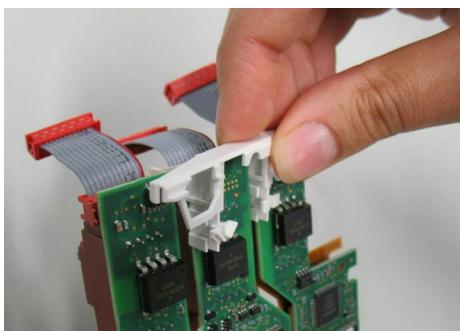
- 5 Remove the bottom cover. There may be a slight resistance when opening the cover.



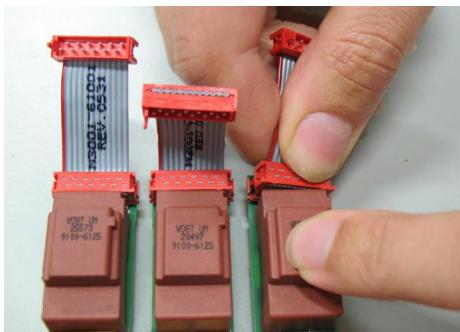
- 6 Loosen the measurement block by pushing the block forward while holding plastic chassis. Then remove the measurement block.



- 7 The spacer keeps the measurement boards in place. Remove the spacer by lifting it up.

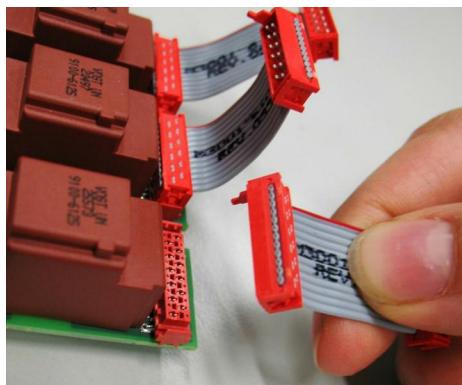


- 8 Remove the measurement ribbon cable. Twist the cable slightly in order to loosen it.

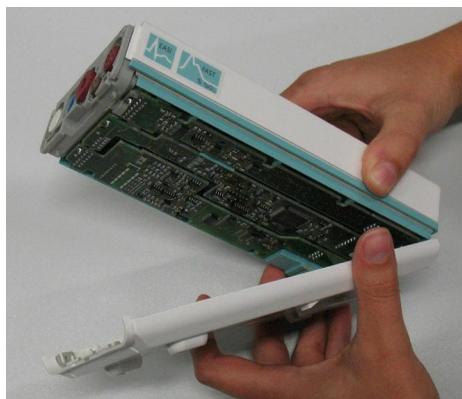


### Reassembling the Measurement Block

- 1 Insert the spacer to keep the measurement block in place.
- 2 Ensure the measurement cable is inserted correctly. See the picture below for the appropriate orientation. A cable inserted incorrectly may cause a <Measurement>Malfunction INOP.



- 3 Ensure the measurement block is inserted as shown below. Also ensure there is no gap between the chassis and the bottom.

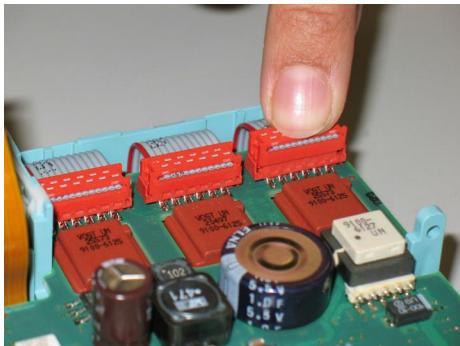


## Refitting the Main Board

- 1 Insert the new main board, ensuring it is seated correctly.

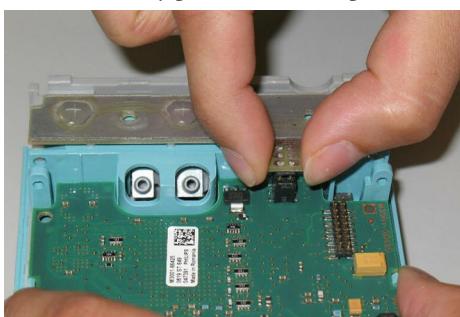


- 2 Re-establish the connection to the measurements, ensuring they are tight. If it is not connected correctly, a corresponding measurement malfunction INOP may occur.



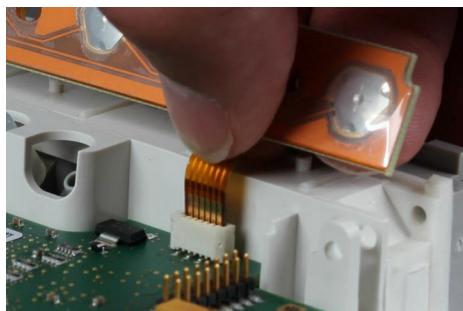
## Refitting the Keypad - Rigid Keypad Connection

- 1 Reinsert the key pad. Ensure it is positioned correctly.

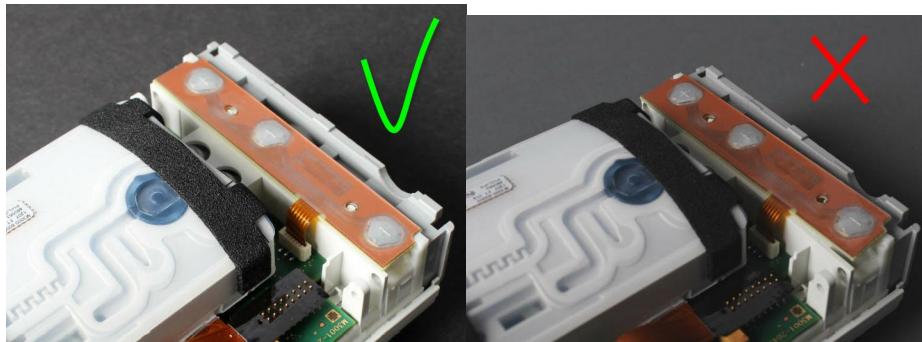


## Refitting the Keypad - Flexible Keypad Connection

- 1 Reinsert the keypad with flex cable. Ensure the flex cable is inserted as shown below.

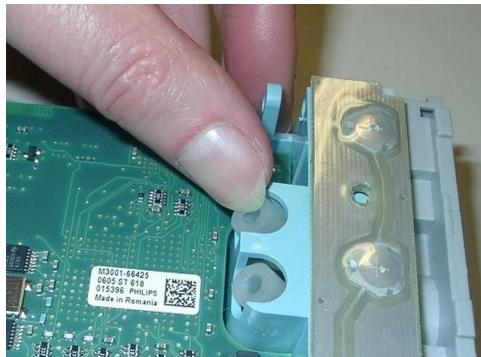


- 2 Ensure the keypad is correctly positioned in the guiding rails.



## Refitting the new NBP Pump

- 1 Insert new silicon tubes. Ensure they are seated correctly by pressing them into their position.



- 2 Insert the new pump assembly. Lift up the back and press the airways onto the silicon tubes.

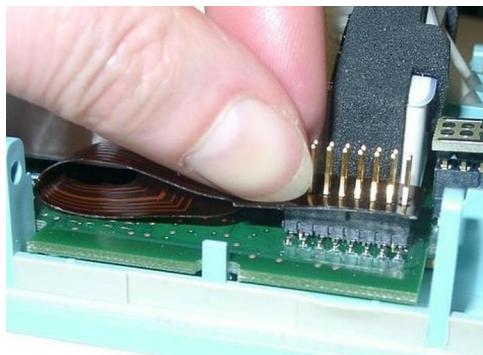


- 3 Ensure the airways have a tight connection to the silicon tubes.



## 5 Repair and Disassembly

- 4 Insert the connector of the NBP assembly into the connector on the main board. Do not crease the flex cable. M3001A HW A/B and M3000A have a post connector with long pins. Press down the connector until there is no gap between the connectors.

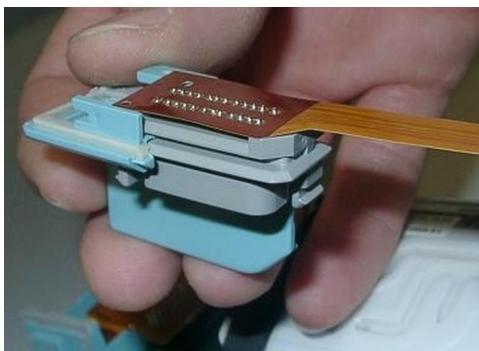


### NOTE

If the NBP pump is replaced, perform an NBP Performance Test and Calibration afterwards.

## Reassembling the MSL Flex Assembly

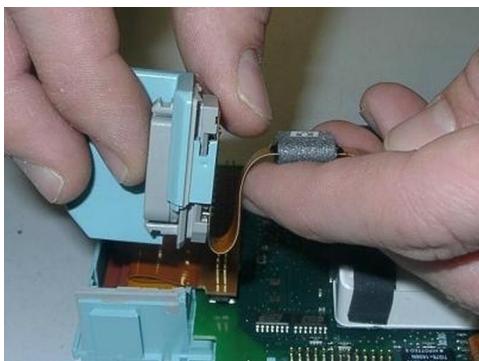
- 1 Insert the MSL Flex layer into the frame connector as shown below by moving it into the appropriate dove tail.



- 2 To insert the MSL Flex into the MMS, it must bent carefully. Bend the MSL Flex in a 180 degree angle as shown below. Do not crease the flex.

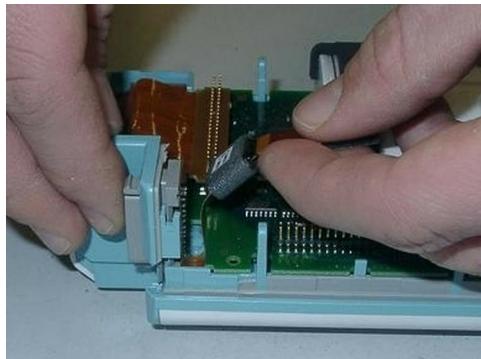


- 3 The second bend must be done as shown below. To be able to connect the MSL flex to the main board afterwards, bend the flex to a 90 degree angle as shown in the picture. Do not crease the flex.

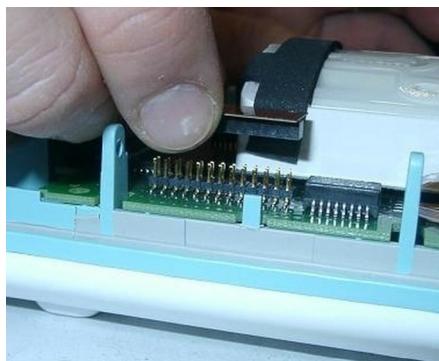


## 5 Repair and Disassembly

- 4 Insert the frame connector with the attached and bent MSL Flex. Be careful not to damage the MSL flex when pushing the frame connector downwards.



- 5 Position the connector correctly and push it into place.



### Refitting the DC/DC board

#### NOTE

This step only has to be done on HW A/B

Position the DC/DC board and press it down gently. Ensure it is connected properly to both connectors indicated in the picture.



## Refitting the Housing Top Cover

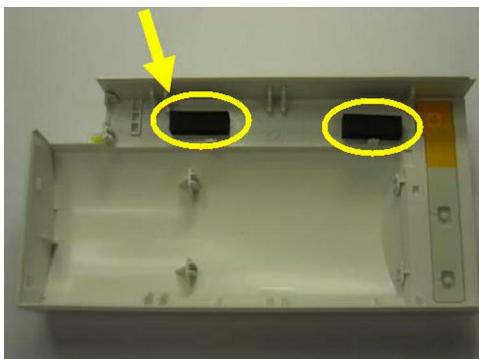
### NOTE

To change the housing top cover of a HW Rev C MMS (S/N prefix DE610xxxx) you have to attach the two cushions which are part of the Housing Top Cover Assembly. These two cushions secure the connection of the MSL Flex and the NBP Flex.

### NOTE

Perform the following two steps only on an MMS HW Rev C

- 1 Stick the two cushions onto the marked positions inside the housing top cover.



- 2 Position the housing top cover, then press it back into place until you hear a click or there is no longer a gap between the two covers.
- 3 The cover has a rubber seal, press the cover firmly together.



- 4 Holding the bottom cover firmly in place, slide the two long housing pins completely back into the MMS. Ensure there is no gap between the top and bottom cover.



## 5 Repair and Disassembly

- 5 Check the labeling on your old housing top cover and apply the respective labels to your new housing top cover. Use the appropriate label from the label sheet.

### Refitting the Front Bezel

To refit the front bezel, press it back into place over the measurement connector hardware until you hear a click.



### Final Inspection

Perform a final inspection to ensure:

- The MSL connector is positioned correctly
- There are no gaps between the MSL connector and the cover
- There is no gap between the top and bottom cover

### Testing

To ensure the Multi-Measurement Module is functioning correctly, perform safety tests and a performance check. See the "Testing and Maintenance" chapter of this service guide.

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#### **WARNING**

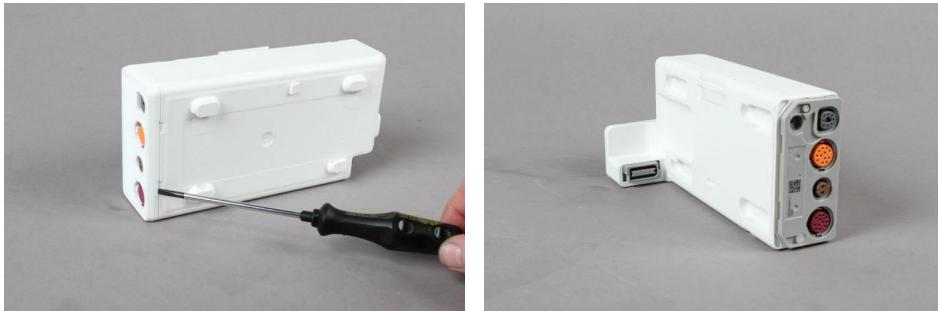
When disassembling/assembling an MMS, an applied part leakage current test **must** be performed before it is used again for monitoring.

---

## Measurement Extensions (Current Generation - 867039, 867040, 867041) Disassembly Procedures

### Removing the Front Bezel

- 1 Position the thin-bladed screwdriver in the small slot provided for this purpose. The front bezel then clicks away from the extension. Remove the bezel.

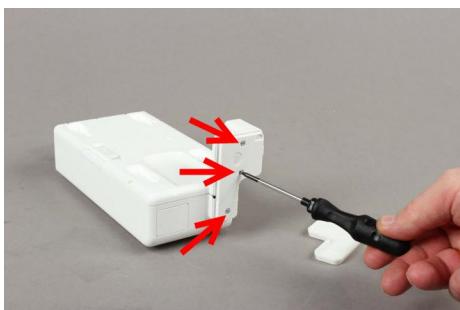


## Removing the Housing Top Cover

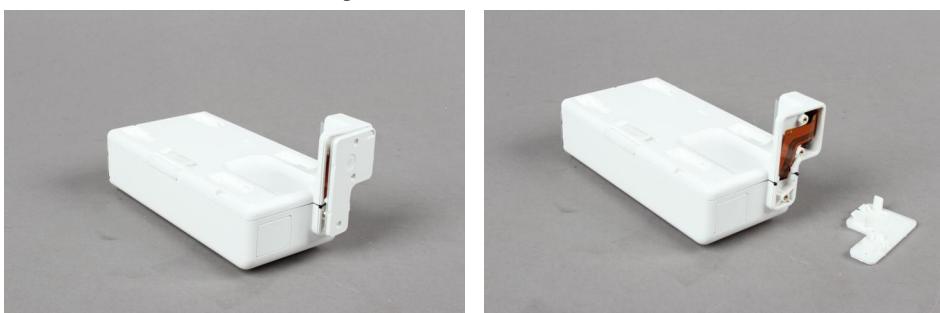
- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 303.
- 2 Use a thin-bladed screwdriver to pry off the MSL Link bar back cover.



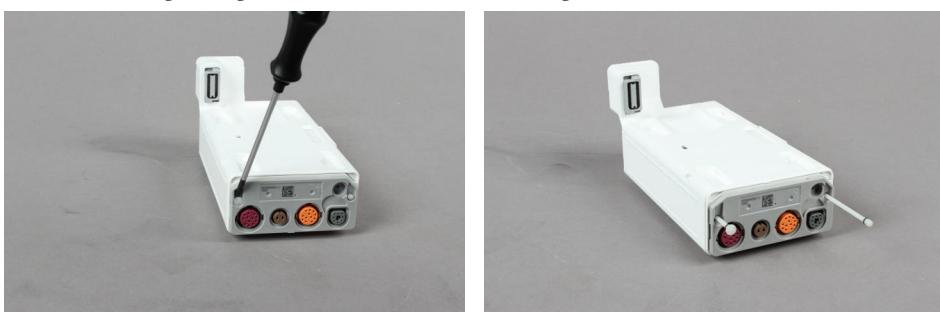
- 3 Remove the three T6 screws securing the MSL Link Bar back plate.



- 4 Remove the MSL Link Bar back plate.



- 5 Locate the two plastic pins on the connector side and pull them out.



**NOTE**

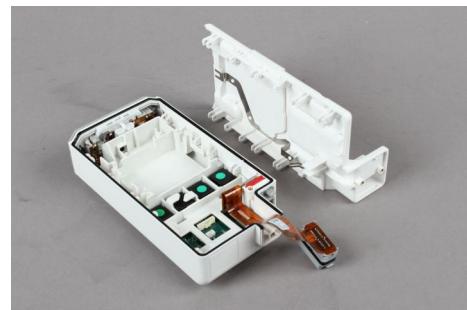
The pins have two different lengths and must be reinserted in their designated slots when reassembling the monitor.



- 6 Push the MSL connector out of the MSL Link Bar housing to release it.



- 7 Carefully remove the housing top cover from the Extension by pulling the housing top cover off with a slight rotating movement.



- 8 **Reassemble** the extension by performing the above steps in reverse order. Be careful not to damage the flex connector and remember that the pins have two different lengths and must be inserted into the correct slot.



### Removing the Serial Number Plate

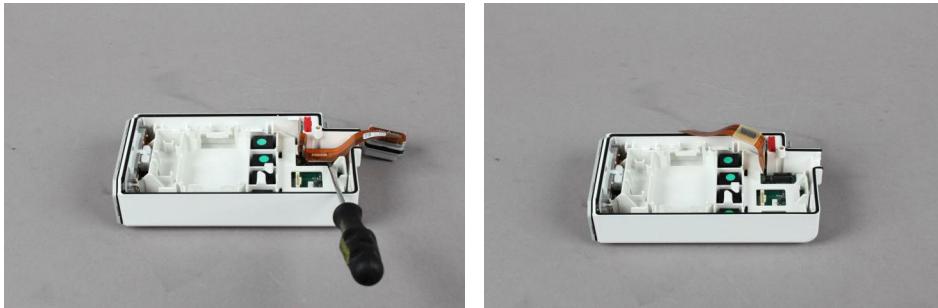
- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 303.
- 2 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 304.
- 3 Lift up and remove the plastic serial number plate holder and then push out the serial number plate.



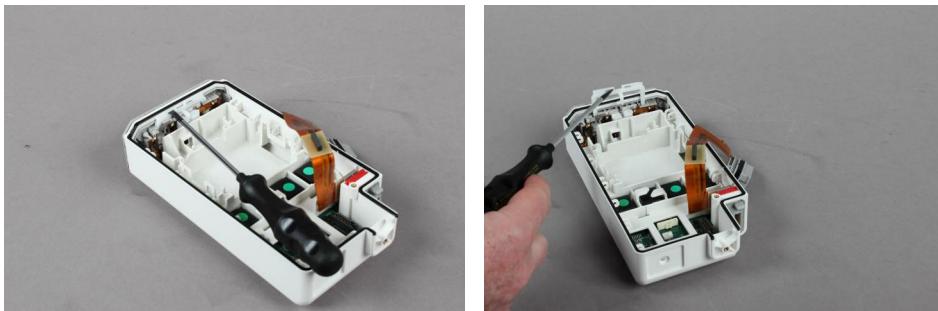
- 4 **Reassemble** the extension by performing the above steps in reverse order.

## Removing the Chassis Sled

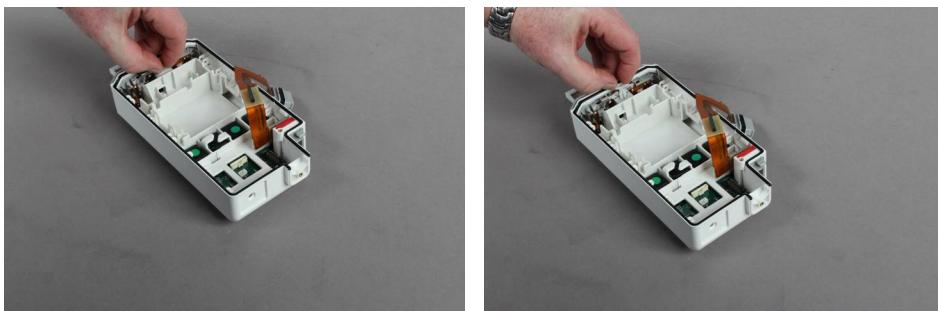
- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 303.
- 2 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 304.
- 3 Disconnect the MSL Flex Connector from the Power Board.



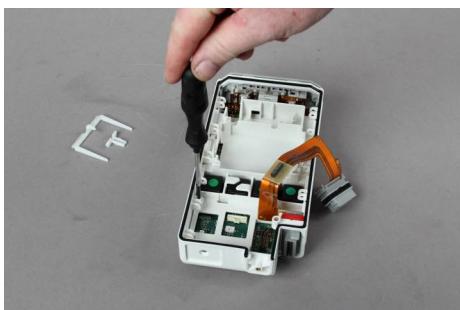
- 4 Remove the Connector Block holder by positioning a thin-bladed screwdriver in the small slot provided for this purpose and then lifting the holder upwards.



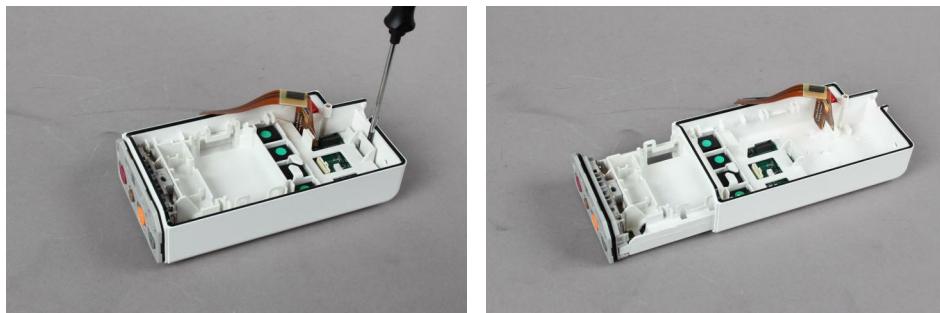
- 5 Press the ends of the plastic holder clamp together and pull out the clamp.



- 6 Remove the screw securing the Chassis Sled to the housing.



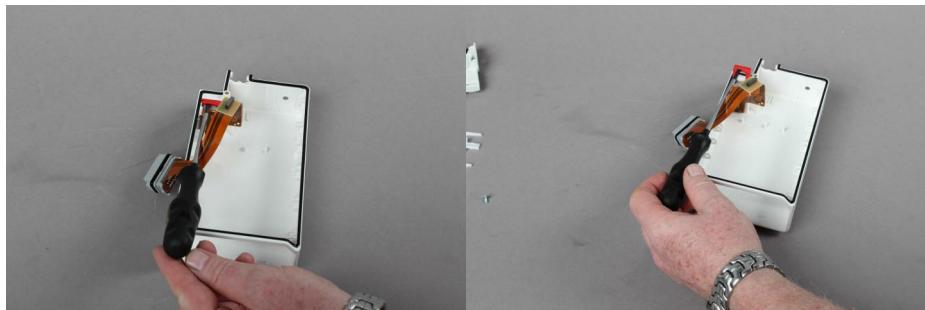
- 7 Release the Chassis Sled with a screwdriver and pull it out.



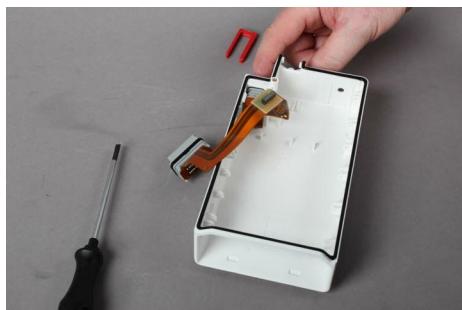
- 8 **Reassemble** the extension by performing the above steps in reverse order. Ensure the Connector Block holder, the holder clamp and the screw are reinserted into the correct positions.

### Removing the MSL Board Assembly

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 303.
- 2 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 304.
- 3 Remove the Chassis Sled as described in “[Removing the Chassis Sled](#)” on page 307.
- 4 Lift up and remove the red MSL Board Holder.



- 5 Push the MSL connector inwards and remove the MSL Board Assembly.



- 6 **Reassemble** the extension by performing the above steps in reverse order. Ensure the red MSL Board Holder is reinserted into the correct position. Note that it only fits when it is correctly oriented.

## Removing the Measurement Boards

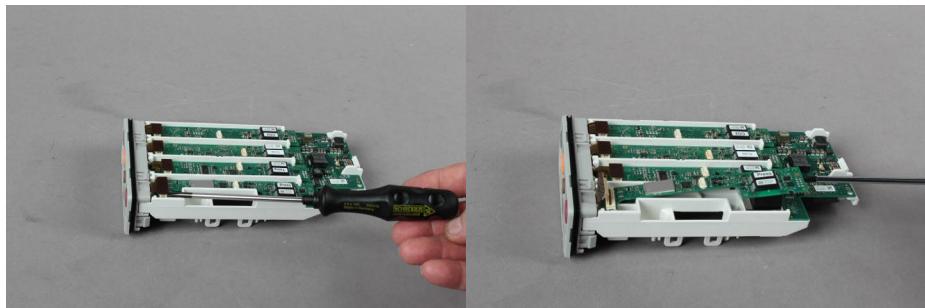
- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 303.
- 2 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 304.
- 3 Remove the Chassis Sled as described in “[Removing the Chassis Sled](#)” on page 307.
- 4 Release the flex cables from the measurement board you wish to replace carefully with a screwdriver and disconnect it.

---

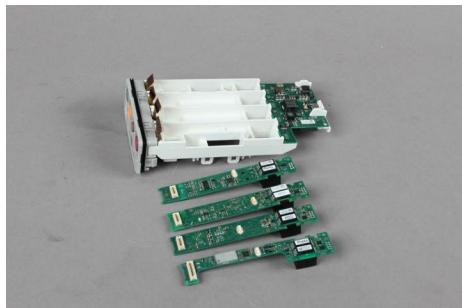
### CAUTION

Handle these thin flex cable connectors with care, as they can easily be damaged. Do not pull on the cable itself.

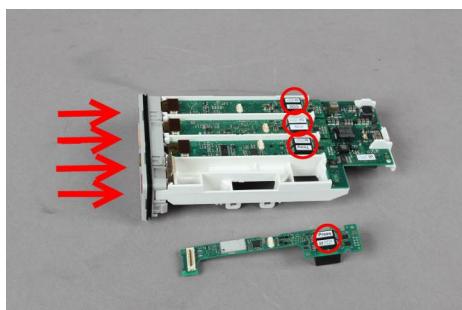
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- 5 Apply the same procedure to all or any other measurement board you wish to replace.

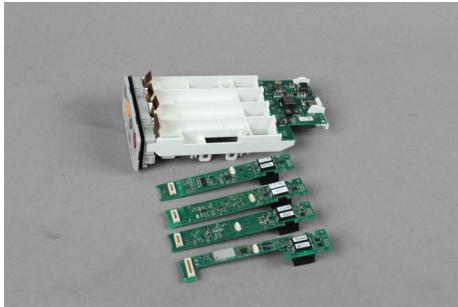


- 6 **Reassemble** the extension by performing the above steps in reverse order. Ensure each board is reinserted into its correct slot. The parameter label on each board must correspond with the parameter input connector. Be careful not to damage the connectors.



### Removing the Power Board

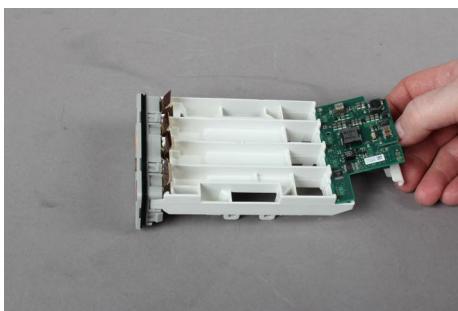
- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 303.
- 2 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 304.
- 3 Remove the Chassis Sled as described in “[Removing the Chassis Sled](#)” on page 307.
- 4 Remove all Measurement Boards as described in “[Removing the Measurement Boards](#)” on page 309.



- 5 If Microstream CO<sub>2</sub> is installed, remove the connector to the Microstream CO<sub>2</sub> measurement unit as described in “[Removing the Microstream CO<sub>2</sub> Measurement Unit](#)” on page 313.
- 6 Push the white lever outwards to release the Power Board.



- 7 Remove the Power Board.



- 8 **Reassemble** the extension by performing the above steps in reverse order. When connecting the cable from the Microstream measurement unit to the power board, ensure the cable is correctly inserted into the guiding latches.

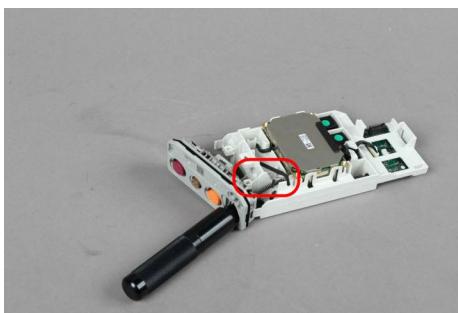


**NOTE**

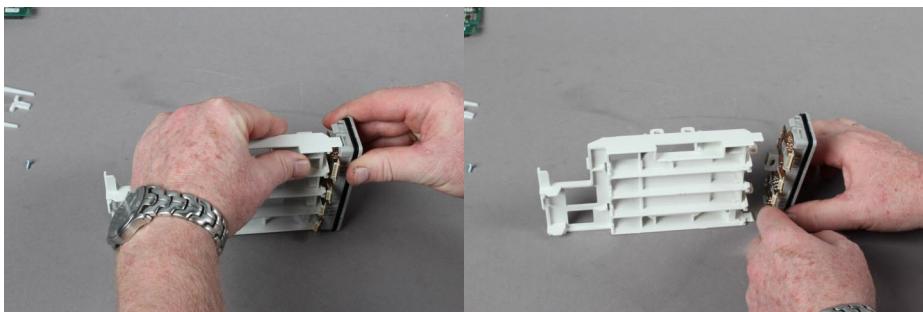
When replacing the power board, the monitor must have the (hardware) serial number and product options reloaded. Support Tool Mark2 is required to perform this task. For details, see [and the Support Tool Instructions for Use](#).

### Removing the Connector Block

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 303.
- 2 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 304.
- 3 Remove the Chassis Sled as described in “[Removing the Chassis Sled](#)” on page 307.
- 4 Remove all Measurement Boards as described in “[Removing the Measurement Boards](#)” on page 309.
- 5 If Microstream CO<sub>2</sub> is installed, Use the mCO<sub>2</sub> Luer Remover to release the Microstream CO<sub>2</sub> connector from the housing and remove the exhaust tubing from the connector block.



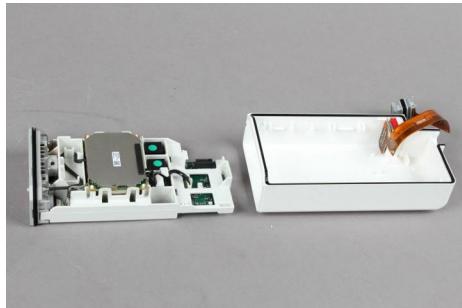
- 6 Carefully pull off the connector block.



- 7 **Reassemble** the extension by performing the above steps in reverse order. For reassembly of the Microstream connector and exhaust tubing, see “[Removing the Microstream CO<sub>2</sub> Measurement Unit](#)” on page 313.

## Removing the Microstream CO2 Measurement Unit

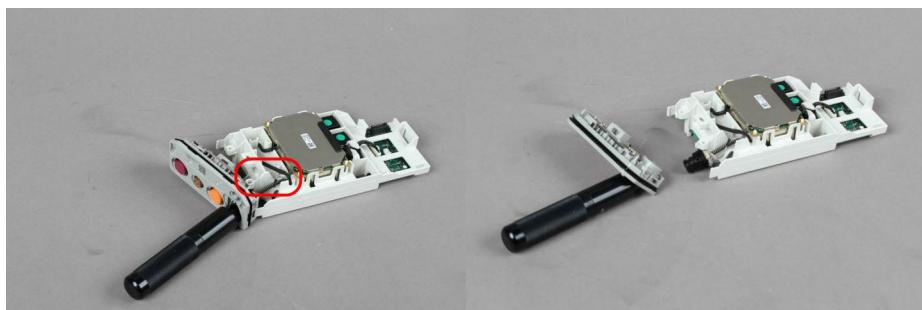
- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 303.
- 2 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 304.
- 3 Remove the Chassis Sled as described in “[Removing the Chassis Sled](#)” on page 307.



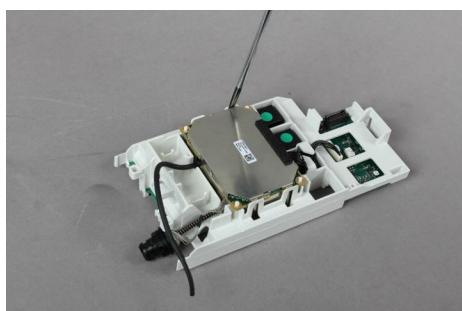
- 4 Use the Luer Remover to release the Microstream CO2 connector from the housing.



- 5 Remove the tubing from the connector block and then pull off the connector block.



- 6 Release the Microstream CO2 measurement unit by pushing out the latches.

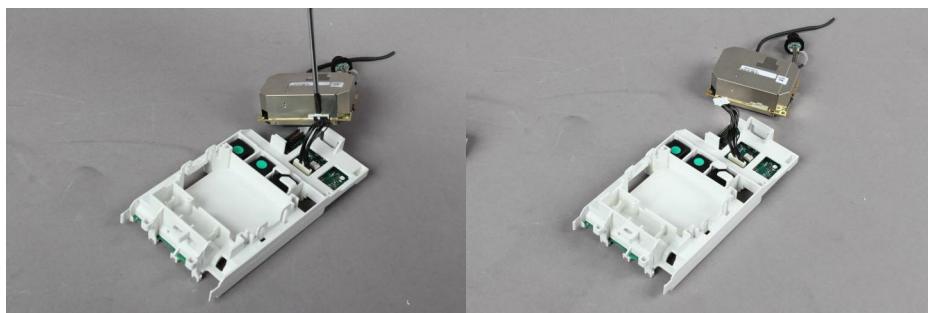


## 5 Repair and Disassembly

- 7 Lift out the Microstream CO<sub>2</sub> measurement unit.

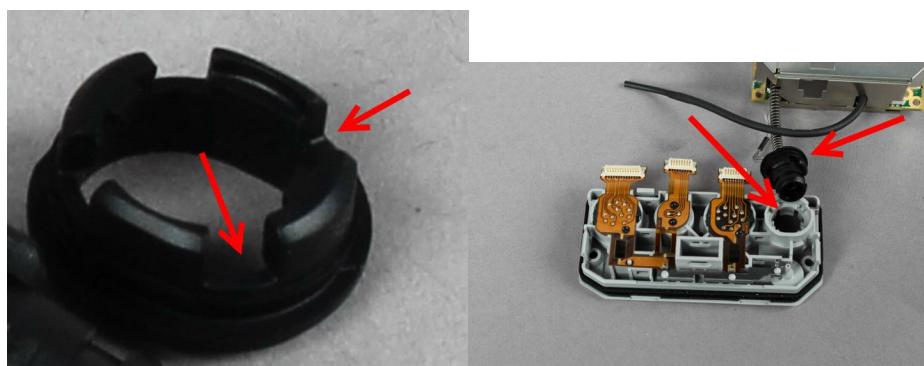


- 8 Remove the connector to the power board.

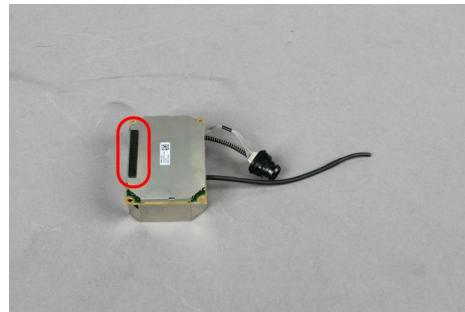


- 9 **Reassemble** the extension by performing the above steps in reverse order while noting the following considerations:

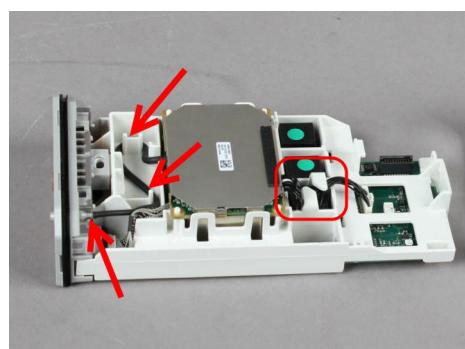
- The Luer connector of the Microstream unit is inserted into a crown-like gasket. Keep this gasket for the reassembly procedure as it is not shipped with the exchange Microstream measurement unit. When reassembling the Luer connector with the gasket, ensure the cut-outs of the gasket fit correctly into the connector block



- The Microstream measurement unit requires the placement of an adhesive foam pad on one side. This is not included with the exchange part. Before reassembling the unit, place the adhesive pad on the exchange unit, using either the foam pad from the defective part or a new one, which is set up as a support part.



- Ensure:
  - the cable from the Microstream unit to the Power Board and the exhaust tube are correctly inserted into the fixation latches.
  - the cable is not pinched or kinked.
  - the exhaust tube is tightly connected to the outlet of the connector block and is not twisted or kinked.



## Measurement Extensions - (Previous Generation - M3012A, M3014A, M3015A/B)

This section describes the exchange procedures for:

- The Top Cover with new release mechanism
- The Dual Link Bar incl. the MSL Board Assembly.

for all Measurement Extension (MSE) types (M3012A, M3014A, M3015A/B).



### Exchange Procedures

#### NOTE

Follow the disassembly and reassembly steps closely.

#### Tools Required:

A thin-bladed screwdriver and a thick-bladed screwdriver, ESD mat and wrist strap

---

#### WARNING

- Do not open the MSE while it is connected to a monitor.
  - Parts inside the instrument may be contaminated with bacteria. Protect yourself from possible infection by wearing examination gloves during this procedure.
- 

#### NOTE

Once you have reassembled the MSE, perform a performance check on it. See the "Testing and Maintenance" chapter of this service guide.

## Removing the Front Bezel

- 1 Position the thin-bladed screwdriver in the small slot provided for this purpose. The front bezel (Bezel) then clicks away from the Extension. Remove the front bezel



### NOTE

There may be a slight resistance when you remove the front bezel.



### Removing the Housing Pin

- 1 Position the MSE on the dual link bar with the measurement connector hardware facing upwards and the arm of the dual link bar away from you. There are four long housing pins threaded into the MSE in each of the four corners under the cover. Locate the heads of the two long housing pins on the top housing and only remove these.
- 2 Use the thin-bladed screwdriver to lift the pins gently out far enough so they can be removed manually.



- 3 Remove the two pins and set them aside for refitting.

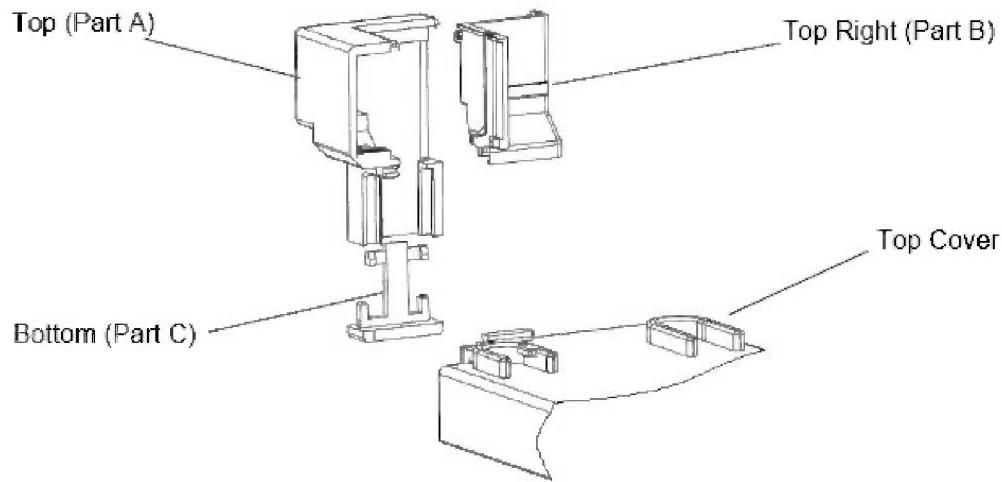


#### NOTE

Without these long housing pins the MSE will not function properly.

## Removing the Dual Link Bar

The Dual Link Bar consists of three parts as shown below. Follow the specific steps carefully to remove the Link Bar.



---

### CAUTION

Do not try to remove the link bar with force as this can damage the MSL Board Assembly

---

- 1 Position the MSE with the measurement connector hardware facing towards you.
- 2 Hold the link bar as shown below. While pressing gently on part B, insert a thick-bladed screwdriver between the MSL connector and part A. Twist the screwdriver to the left and at the same time slide part B to the right, so it is released at the top.



## 5 Repair and Disassembly

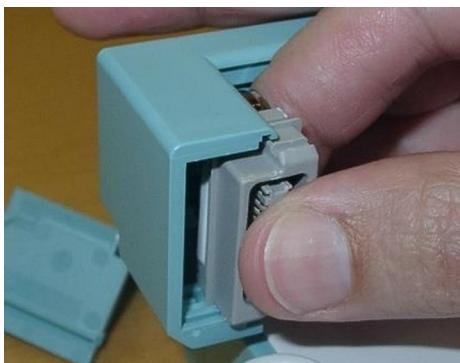
- 3 Repeat Step 2 at the bottom.



- 4 Slide part B to the right. If part B fails to move to the side, repeat steps 2 and 3.



- 5 Now the MSL Flex connector can be moved to the right.



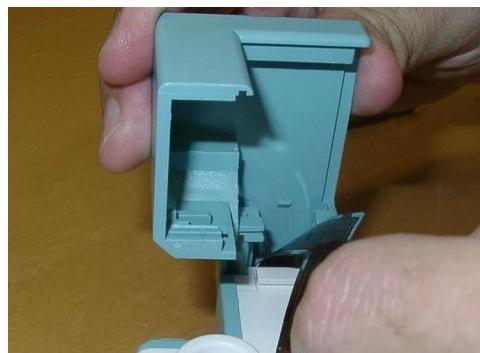
**NOTE**

Ensure the movement of the screwdriver does not pinch the MSL Board Assembly.

- 6 Insert the thin-bladed screwdriver behind the release mechanism of part C. Carefully twist the screwdriver, then press gently so that part C drops down.



- 7 Lift part A upwards. It is fixed in a dovetail. Be careful with the MSL flex.

**Removing the Top Cover**

Begin by gently pulling away the top cover from the MSE. The top cover is press-latched at the link bar end. Remove it slowly, without hitting or touching the inside of the MSE.

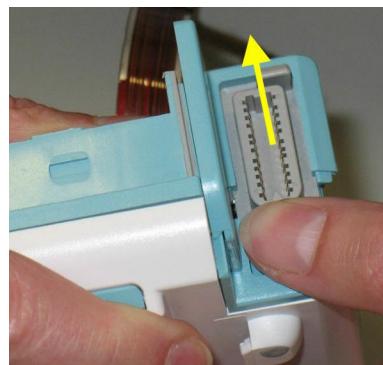


### Replacing the Flex Cable Assembly

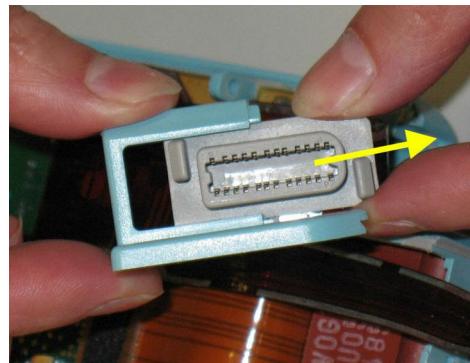
- 1 Hold the Extension firmly and push upwards against the connector. Then slide the connector (with the connector holder) out of the dovetail connection.

#### NOTE

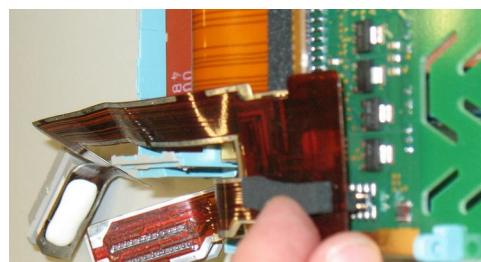
You will probably need to apply some more force until the holder slides out of its mechanical lock.



- 2 Slide the connector out of its holder.

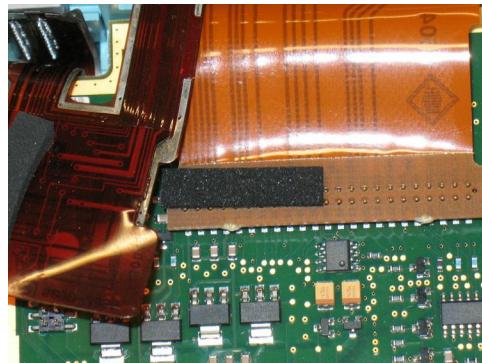


- 3 Remove the flex cable connector on the MSE board. Be careful not to bend any pins on the female part of the MSE connector.

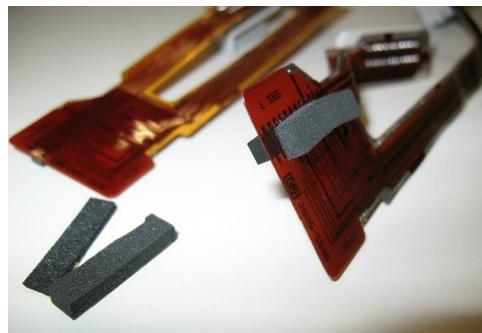


**NOTE**

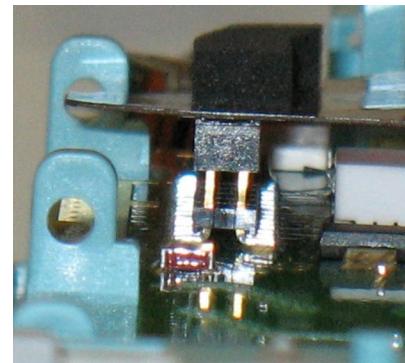
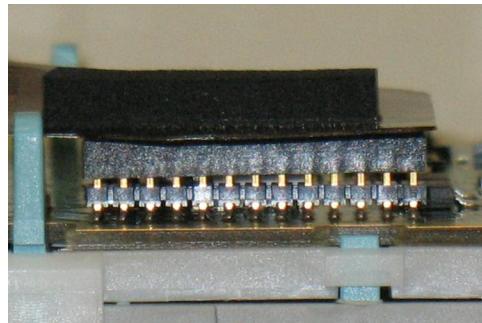
Some units may have a foam pad on the connector of the inner flex cable of the MSEs (as shown below) and some units may not. This has no impact on the functionality of these units.



- 4 Stick the correct foam pad on the rear side of the inner connector. Use the thick pad for : M3012A, M3014A, M3016A. Use the thin pad for: M3015A/B. You can also check the old flex cable for the correct pad.



- 5 Insert the flex cable connector into the female receptacle on the MSE board. **Check from the side and the front that the connector is inserted correctly (there is no mechanical guidance)** and that no pins are bent, otherwise you may damage the MSE when powering it on.



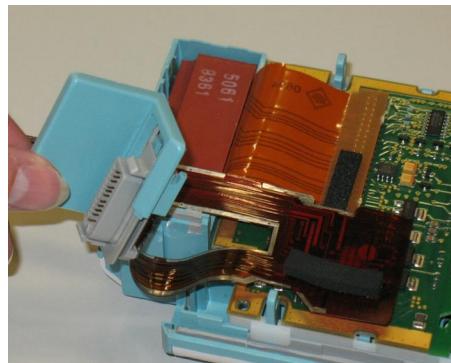
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### WARNING

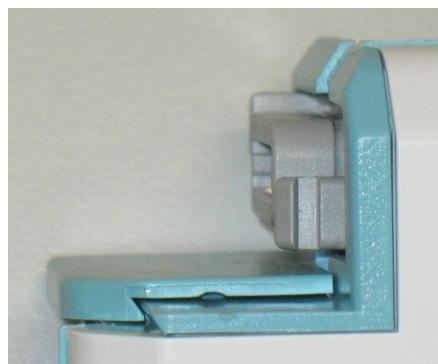
A misplaced connector might damage the MSE or the monitor.

---

- 6 Slide the connector into the holder as shown below. Arrange the flex cable in the space beside and underneath the board (be careful not to bend the cable) while positioning the holder for insertion.



- 7 Insert the holder with the connector into the dovetail connection and slide it down until you hear a click.

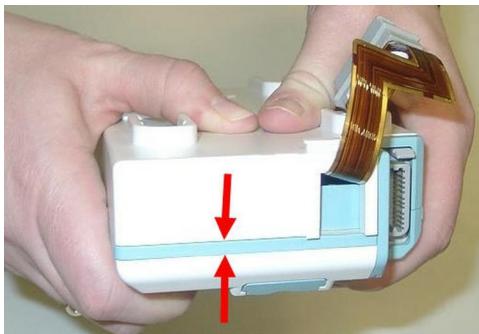


## Refitting the Top Cover

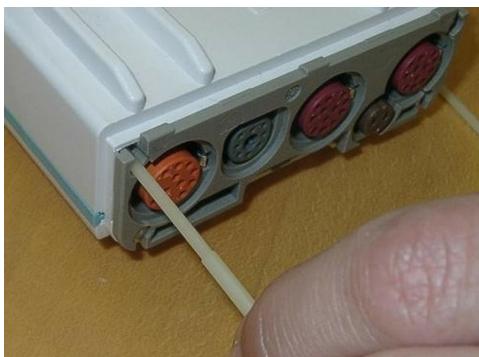
### NOTE

Be careful with the MSL Board Assembly. Ensure it does not get stuck between the covers.

- 1 Position top cover, then press the bottom cover back into place until a click is heard.
- 2 The cover has a rubber seal. Press the covers firmly together and ensure there is no gap between the top and bottom cover.



- 3 Holding the bottom cover firmly in place, slide the two long housing pins completely back into the MSE.



### Assembling the dual Link Bar

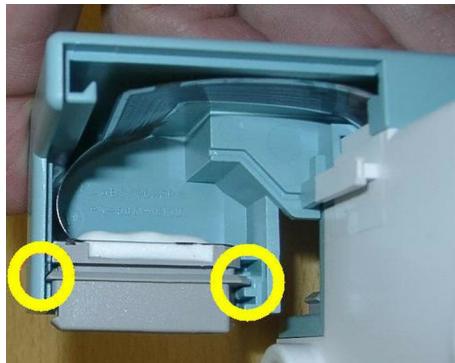
#### CAUTION

Do not try to assemble any part of the link bar with force as this can damage the MSL Board Assembly.

- 1 Position part A into the dovetail and slide it down.



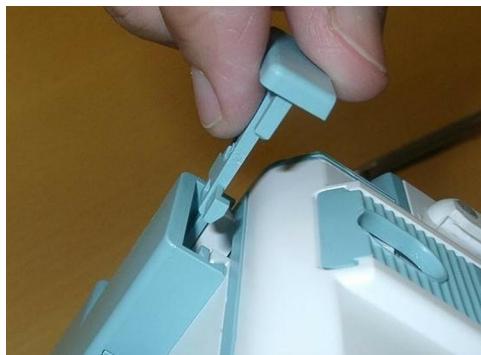
- 2 Ensure the MSL Flex connector is positioned in the correct slot (See indicated slots below). Then push it gently into part A.



- 3 Making sure the MSL Board Assembly lies flat in part A of the assembly, place part B into the dovetail and close the open link bar.



- 4 Turn the MSE around and insert part C into the bottom part of the link bar. When you hear a click, part C is correctly inserted.



### Refitting the Front Bezel

To refit the front bezel, press it back into place over the measurement connector hardware until you hear a click.



### Final Inspection

Perform a final inspection to ensure that:

- The link bar is positioned correctly
- There are no gaps between the link bar parts
- There is no gap between the top and bottom cover



### Testing

To ensure that the MSE is functioning correctly, you must perform a performance check on it. See the "Testing and Maintenance" chapter of this service guide.

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#### **WARNING**

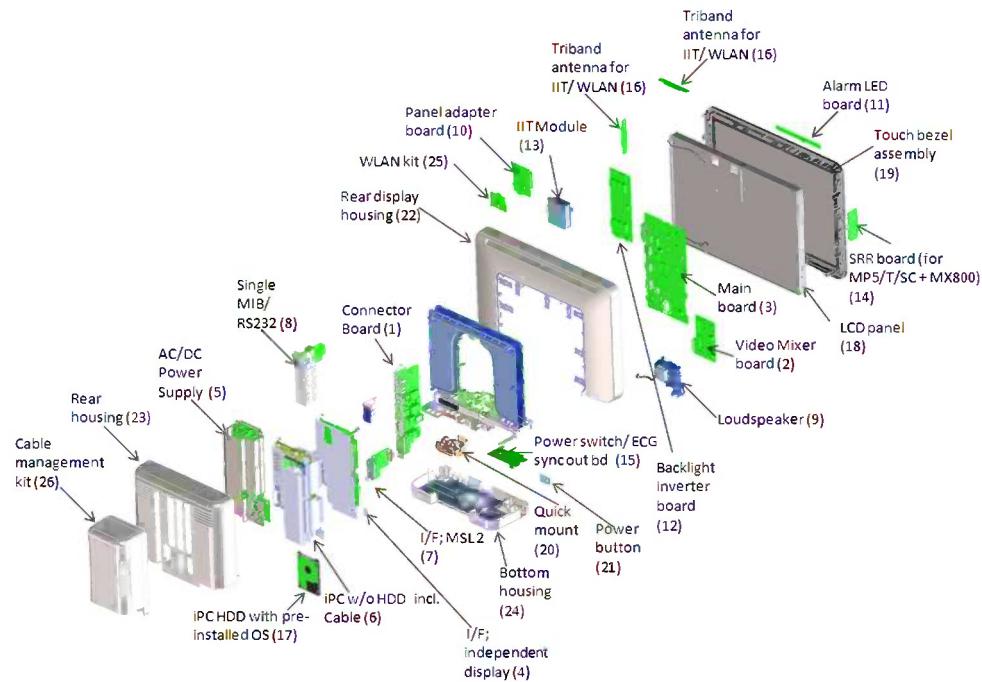
When you disassemble/assemble a Measurement Extension, an applied part leakage current test must be performed before it is used again for monitoring.

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# Parts

This section lists the replacement and exchange parts for the Philips IntelliVue Patient Monitoring System and its components. Note, however, that not all parts are required for all monitor/active display models.

## MX800 Parts



## Exchange Parts

Part number	Description	No in diagram
453564204481	IV2-STAT I/F; Connector Board	1
453564204431	IV2-STAT Main board	3
453564204461	IV2-STAT I/F; independent display	4
453564172631	IV2-STAT ASSY-PWR AC/DC Power Supply	5
453564204591	IV2-STAT iPC w/o HDD incl. Cable ver 1*	6
453564518051	IV2-STAT iPC w/o disk ver2*	

\* As shown in the table below, Version 1 (#PC0) has one iPC DVI connector on the rear of the monitor, while Version 2 (#PC1) has two iPC display ports:

Version		iPC Connector on Rear of Monitor	
1 (#PC0)	2 (#PC1)	DVI Connector	Display Port
			

## Replacement Parts

Part number	Description	No in diagram
453564204351	IV2-STAT I/F; MSL 2	7
453564204361	IV2-STAT I/F; Single MIB/ RS232	8
453564260811	IV2-STAT I/F; Flexible Nurse Call	8
453564541151	IV2-RAB ASSY I/F; Remote Alarm MX600-800	8
453564204381	IV2-STAT MECHASY Loudspeaker	9
453564441601	IV2-STAT Panel adapter bd ver2 MX800	10
453564204391	IV2-STAT PCA Panel adapter bd MX800 ver 1	10
453564204411	IV2-STAT Alarm LED board	11
453564441591	IV2-STAT display ver1 replacement kit	
453564204421	IV2-STAT DSPL Backlight inverter bdMX800	12
453564473921	IV IIT Module 2.4 GHz	13
453564505921	IV IIT Module 1.4 GHz	13
453564258611	IV SRR brd ver2 (for MP5/T/SC+MX6/7/800)	14
453564204471	IV2-STAT Power switch/ ECG sync out bd	15
453564211691	IV2-STAT Triband antenna for IIT/ WLAN	16
453564207391	IV2-STAT iPC RAM DDR3 2 GB ver 1 <sup>1</sup>	n/a
453564207371	IV2-STAT iPC SSD with pre-installed OS ver 1 <sup>1</sup>	n/a
453564562571	IV2-STAT iPC SSD with pre-installed OS ver2 <sup>1</sup>	
453564562581	IV2-STAT iPC RAM DDR3 4GB ver2 <sup>1</sup>	
453563464231	BAT 3V Lithium CR2032	n/a
453564204581	IV2-STAT DSPL Backlights (2x) MX800	n/a
453564441611	IV2-STAT DSPL DSPL LCD panel ver2	18
453564204611	IV2-STAT DSPL LCD panel ver 1	18
453564204621	IV2-STAT Touch bezel assembly 19"	19
453564204641	IV2-STAT MECHASY Quick mount	20
453564204651	IV2-STAT KBD Power button	21
453564204671	IV2-STAT MECHASY Rear dspl housing MX800	22
453564204691	IV2-STAT MECHASY Rear housing	23
453564204701	IV2-STAT MECHASY Bottom housing	24
453564204491	IV2-STAT WLAN Assy ver1 <sup>2</sup>	25
453564505901	IV2-STAT WLAN Assy ver2 <sup>2</sup>	25
453564204631	IV2-STAT CBL Main bd to Indepen. dspl	n/a
453564204511	IV2-STAT iPC cable kit	n/a
453564204521	IV2-STAT cable management kit	26
453564204541	IV2-STAT Small parts kit	n/a
453564204501	IV2-STAT Basic cable kit MX800	n/a

## 6 Parts

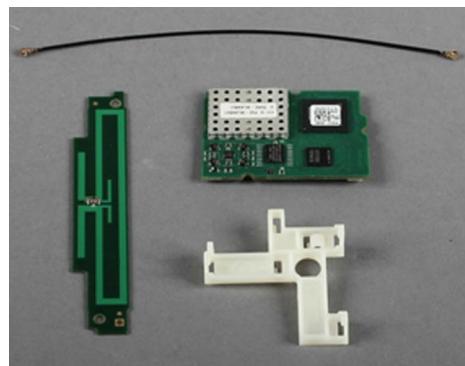
Part number	Description	No in diagram
453564239731	IV2 MECHASY Table Mount Kit	n/a
453564204401	IV2-STAT PCA Video mixer board	2

<sup>1</sup> As shown in the table below, Version 1 (#PC0) has one iPC DVI connector on the rear of the monitor, while Version 2 (#PC1) has two iPC display ports:

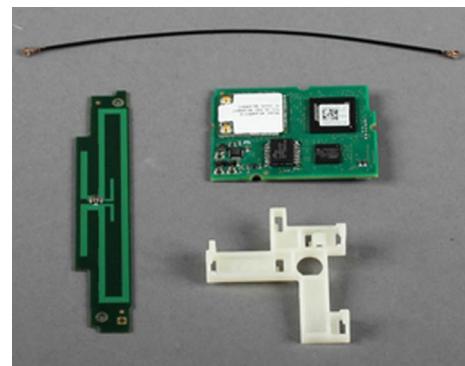
Version		iPC Connector on Rear of Monitor	
1 (#PC0)	2 (#PC1)	DVI Connector	Display Port
			

<sup>2</sup> The WLAN assembly version 2 (ver2) should be ordered to replace either a defective version 1 (ver1) or version 2 board. Brazil is the only country that still needs to order the version 1 board. As soon as Brazil receives clearance for the WLAN version 2 board the version 1 will be made obsolete. Ensure the correct label provided with the support part is applied when replacing version 1 with version 2.

#### WLAN Kit Contents:



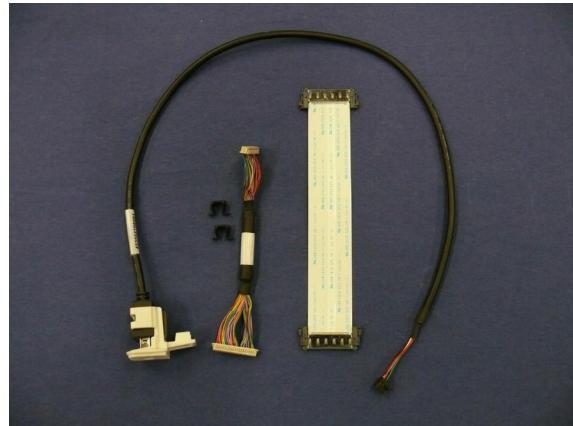
453564204491 WLAN Assy Version 1



453564505901 WLAN Assy Version 2

Item	Quantity
PCA MMS+ WLAN Radio Board	1
IV2-STAT PLAST HOLDER WLAN	1
IV2-STAT PCA Antenna triband	1
CBL ASSY AMC RIGHT ANGL PLG JMPER 14MM	1

#### iPC Cable Kit (453564204511) Contents:



Item	Quantity
IV2-STAT CBL MB-Mixer	1
CBL Ay IV2-STAT SAM-Mixer	1
IV2-STAT MECHASY Assy Holder USB	1
Cable clip	2

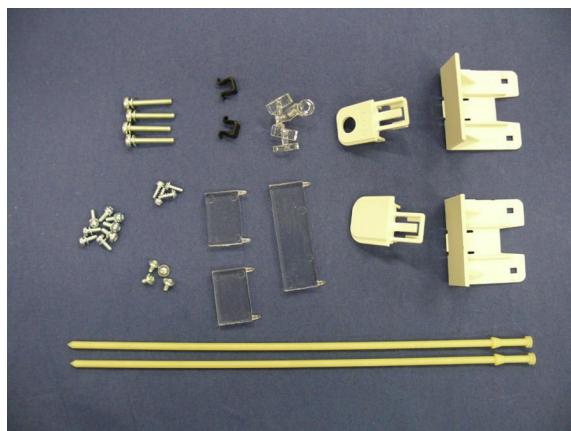
## 6 Parts

Cable Management Kit (453564204521) Contents:



Item	Quantity
SCRW TPG M3.0 X 1.34 8MM-LG WSHR-HD	4
IV2-STAT PLAST Cablehouse	1
IV2-STAT PLAST Cablehouse Lid	1

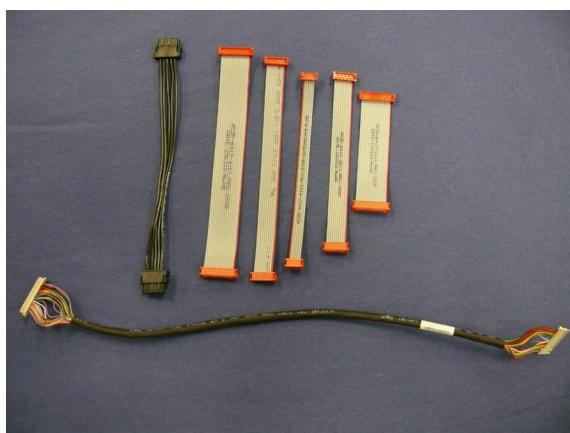
## Small Parts Kit (453564204541) Contents:



Item	Quantity
IV2-STAT PLAST Lightguide P/S	1
IV2-STAT PLAST IO-Slot Cover Blank	2
IV2-STAT PLAST Cover USB Side	1
IV2-STAT PLAST Sync Side Plate	1
IV2-STAT PLAST LIGHTPIPE LARGE	1
IV2-STAT PLAST LIGHTPIPE SMALL	2
IV2-STAT PLAST PIN 265MM	2
Cable clip	2
K30x8	4
M3x5	4
M3x8	8
M4x25	4

## 6 Parts

### Basic Cable Kit (453564204501) Contents:



Item	Quantity
IV2-STAT CBL MB-ALARM	1
IV2-STAT CBL MB-IIT	1
IV2-STAT CBL MB-SRR	1
IV2-STAT CBL MB-AC/DC	1
IV2-STAT CBL MB-Power Switch	1
IV2-STAT CBL PA-Backlight	1
IV2-STAT CBL MB-19" Display	1

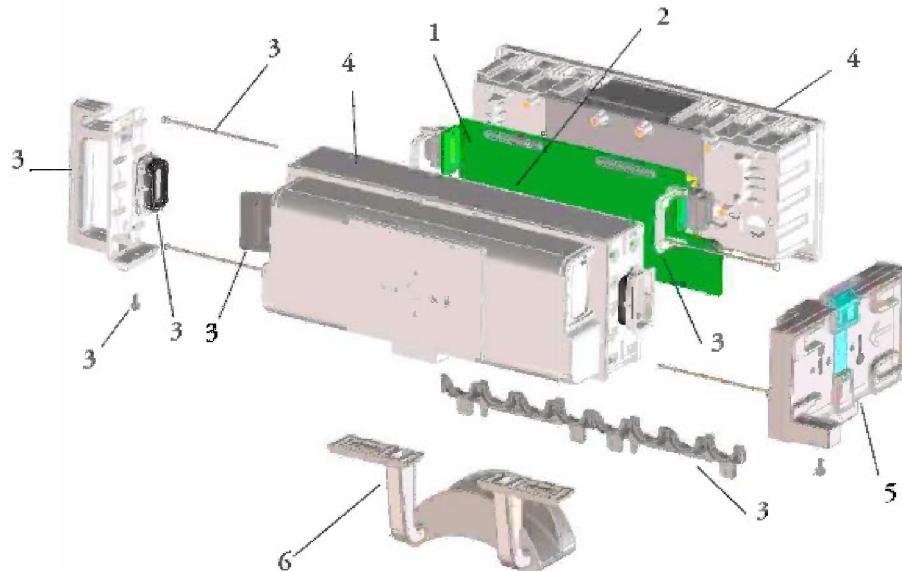
## Remote Control Parts

Part number	12NC	Description
453564212481	453564212481	IV2-RC Remote Control
453564212401	453564212401	IV2-RC PLAST Holder for Remote Control
453564212411	453564212411	IV2-RC CBL USB cable for Remote Control
453564262641	453564262641	IV2-RC CBL Tethering cable

## Remote Alarm Device Parts

Part No.	Description
453564546741	IV2-RAB Remote Alarm Device w/o SRR

## 8-Slot Module Rack (FMS-8) Parts



*Module Rack (FMS-8) Parts*

### Exchange and Replacement Parts

Part Number	12NC	Description	No. in Diagram
M4041-68401	453563459411	IV-FMS Mother board assembly	1
M8055-68401	453563459441	IV CPU board assembly	2
M8048-64002	453563456901	IV-FMS Small Parts kit	3
M8048-64001	453563456891	IV-FMS Housing kit	4 (See Note 1)
M4041-60005	453563477961	IV-FMS Mounting Plate Assy	5
M4041-42303	453563494101	IV-FMS PLAST Cable Management	6
M4041-22302	451261011861	IV-FMS BRKT Mounting Plate Adapter Clamp	
M8040-60100	451261030081	IV SWITCH Universal Clamp	

**Note 1:** If your installed Module Rack has a metal housing sheet installed, you must also install the connector holders which ship with the housing kit. If your installed Module Rack has a plastic sheet installed, you can either use the connector holders installed in the Module Rack or the connector holders which ship with the housing kit.

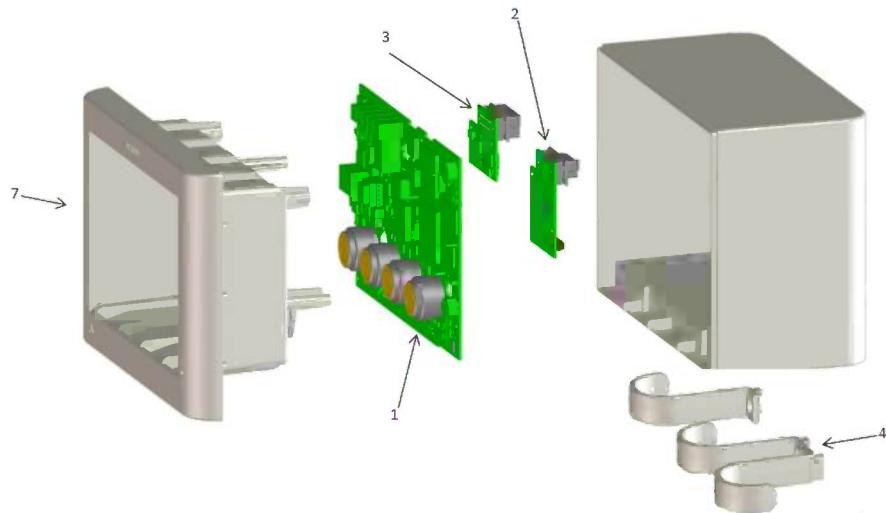
## 6 Parts



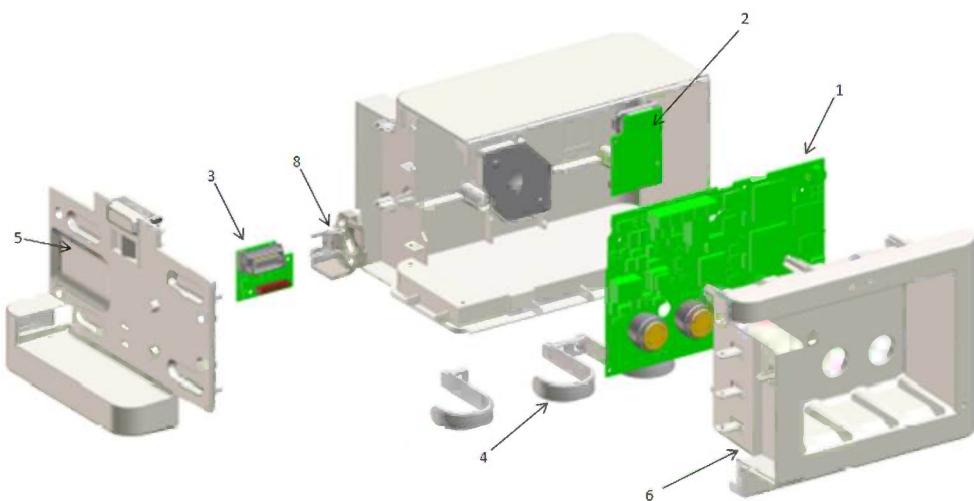
M8048-64002 Small Parts Kit Contents

Description	Quantity	Comments
Torx M3 x 6 mm screws	8	used for securing main board to Module Rack housing
Torx M3 x 20 mm screws	8	used to connect the CPU board w/ spacers to the main board
Torx M4 x 8 mm screws	4	used to secure the handle or the Multi-Measurement Module Mount to the Module Rack housing
Torx M4 x 12 mm screws	4	used to secure the universal clamp to the Module Rack housing
Connector Holder (FE)	2	
Connector Holder (SRL)	2	
Lightpipe	1	
Cover Connector SRL	2	
Cover Side	1	
Pin	4	
Cover Seal Connector	2	
Handle Assembly	1	

## 4-Slot Module Rack (FMS-4) Parts



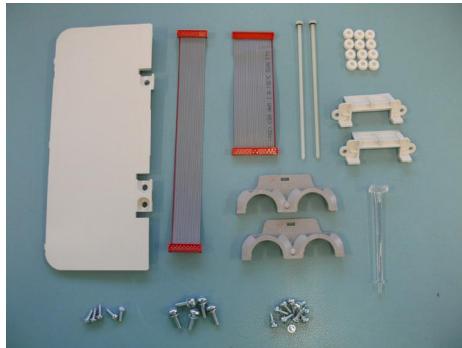
4-Slot Module Rack (FMS-4) without Multi-Measurement Module Mount



4-Slot Module Rack (FMS-4) with Multi-Measurement Module Mount

## Exchange and Replacement Parts

Part Number	12NC	Description	No in diagram
<b>Exchange Parts</b>			
453564261731	453564261731	IV2-FMS4 Main board	1
<b>Replacement Parts</b>			
453564262101	453564262101	IV2-FMS4 MSL up board	2
453564262111	453564262111	IV2-FMS4 MSL down board	3
453564262121	453564262121	IV2-FMS4 Cable management hooks	4
453564262131	453564262131	IV2-FMS4 MMS mount	5
453564262141	453564262141	IV2-FMS4 Assy Front MMS Option	6
453564262151	453564262151	IV2-FMS4 MECHASY Front w/O MMS Option	7
453564262161	453564262161	IV2-FMS4 MECHASY Rear w/o MMS Option	
453564262171	453564262171	IV2-FMS4 MECHASY Rear MMS Option	
453564262181	453564262181	IV2-FMS4 Side MSL Holder	8
453564262191	453564262191	IV2-FMS4 Small Parts Kit	n/a

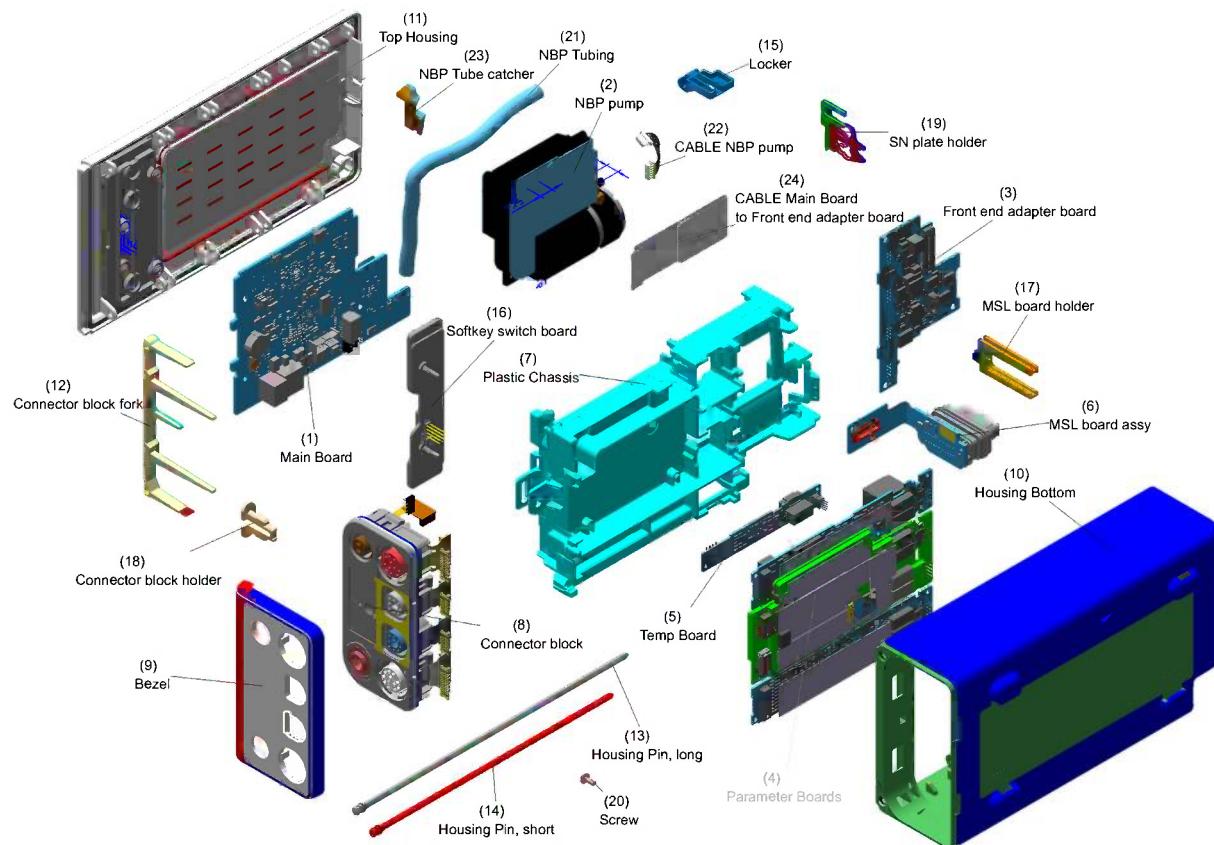


453564262191 Small Parts Kit Contents

Description	Quantity
Light Guide	1
Pin	2
M4 x 12 mm screws (T20)	5
K30 x 8 mm screws (T10)	5
M3 x 8 mm screws (T10)	10
Connector Holder	2
MSL Holder	2
Cable MSL Up	1
Cable MSL Down	1

Description	Quantity
IV2-FMS4 RUBBER Screw Cover	12
IV2-FMS4 PLAST Cover Bottom	1

## Multi-Measurement Module (MMX) Exchange and Replacement Parts



### Exchange Parts

New Support Part Number	Exchange Part Number	Description	Number in Diagram
453564786351	453564786371	MX_MMX Main Board	1

### Replacement Parts

Replacement Part Number	Description	Number in Diagram
453564673781	MX_100/X3 NBP Pump Assembly	2
453564673681	MX_100/X3 Front End Adapter board	3

## 6 Parts

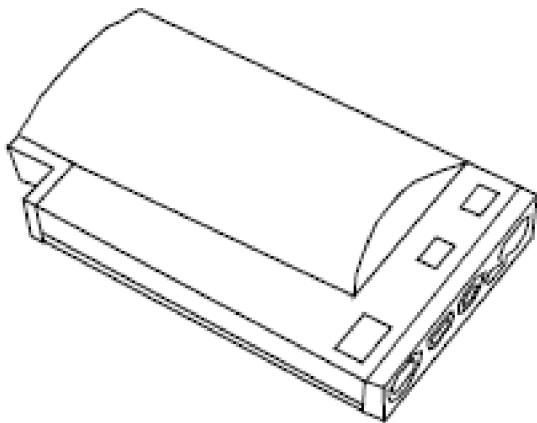
Replacement Part Number	Description	Number in Diagram
453564673691	MX_100/X3 ECG Measurement Board	4
453564673701	MX_100/X3 Pressure Board	4
453564673731	MX_100/X3 FAST SpO2 Board	4
453564685561	MX_EXT RCO2 CO2 Board	4
453564673741	MX_100/X3 OxiMax SpO2 Board	n/a
453564673751	MX_100/X3 OxiMax SpO2 Adapter	n/a
453564673761	MX_100/X3 Rainbow SpO2 Board	n/a
453564673771	MX_100/X3 Rainbow SpO2 Adapter	n/a
453564673711	MX_100/X3 Temperature Board	5
453564786091	MX_MMX MSL Board Assembly	6
453564786641	MX_MMX Plastic Chassis (FAST SpO2)	7
453564786651	MX_MMX Plastic Chassis (OxiMax/Rnbow)	7
453564673611	MX_100/X3 ConnectorBlock FAST	8
453564673621	MX_100/X3 ConnectorBlock OxiMax	8
453564673631	MX_100/X3 ConnectorBlock Rainbow	8
453564673641	MX_100/X3 ConnectorBlock FAST, P, T	8
453564673651	MX_100/X3 ConnectorBlock OxiMax, P, T	8
453564673661	MX_100/X3 ConnectorBlock Rainbow, P, T	8
453564673671	MX_100/X3 ConnectorBlock FAST,CO2, P, T	8
453564705411	MX_100/X3 ConnectorBlock 2xFAST,P,T	8
453564786121	MX_MMX Bezel FAST SYM (3ea)	9 (requires 25)
453564786131	MX_MMX Bezel FAST TXT (3ea)	9 (requires 25)
453564786141	MX_MMX Bezel 2xFAST,P,T SYM (3ea)	9 (requires 25)
453564786151	MX_MMX Bezel 2xFAST,P,T TXT (3ea)	9 (requires 25)
453564786161	MX_MMX Bezel FAST,CO2,P,T SYM (3ea)	9 (requires 25)
453564786171	MX_MMX Bezel FAST,CO2,P,T TXT (3ea)	9 (requires 25)
453564786181	MX_MMX Bezel FAST,P,T SYM (3ea)	9 (requires 25)
453564786191	MX_MMX Bezel FAST,P,T TXT (3ea)	9 (requires 25)
453564786201	MX_MMX Bezel Rainbow SYM (3ea)	9 (requires 25)
453564786211	MX_MMX Bezel Rainbow TXT (3ea)	9 (requires 25)
453564786221	MX_MMX Bezel Rainbow,P,T SYM (3ea)	9 (requires 25)
453564786231	MX_MMX Bezel Rainbow,P,T TXT (3ea)	9 (requires 25)
453564786241	MX_MMX Bezel OxiMax SYM (3ea)	9 (requires 25)
453564786251	MX_MMX Bezel OxiMax TXT (3ea)	9 (requires 25)
453564786261	MX_MMX Bezel OxiMax,P,T SYM (3ea)	9 (requires 25)
453564786271	MX_MMX Bezel OxiMax,P,T TXT (3ea)	9 (requires 25)
453564786281	MX_MMX Housing Bottom	10 (requires 25)
453564786291	MX_MMX Housing Top w/o P/T Eng. TXT	11

Replacement Part Number	Description	Number in Diagram
453564786991	MX_MMX Housing Top w P/T Eng. TXT	11
453564787001	MX_MMX Housing Top w/o P/T SYM	11
453564787011	MX_MMX Housing Top w P/T SYM	11
453564786311	MX_MMX Connector Block Fork (3ea)	12
453564770381	MX_EXT Housing Pin, Long (3ea)	13
453564786301	MX_MMX Housing Pin, Short (3ea)	14
453564786321	MX_MMX Locker	15
453564786331	MX_MMX Soft Key Switchboard	16
453564765791	MX_100/X3 MSL Board Holder (3ea)	17
453564765821	MX_100/X3 Connector Block Holder (3ea)	18
453564765861	MX_100/X3 SN Plate Holder (3ea)	19
453564765831	MX_100/X3 SCREW PT 25x6mm (T8) (5ea)	20
453564765741	MX_100/X3 NBP Tubing (3ea)	21
453564765751	MX_100/X3 CABLE NBP Pump	22
453564765761	MX_100/X3 NBP Tube Catcher (3ea)	23
453564786661	MX_MMX CABLE Mainb-FrontEndAdapter	24
453564768891	MX_100/X3 Label Sheet (3ea)	25 (not shown)*
453564787091	IV2 CONN NBP Inlet X3/MX100/MMX (5ea)	n/a
453564765781	MX_100/X3 OxiMax SpO2 Board Holder (3ea)	n/a

\* 25 (not shown) relates to the MMX\_100/X3 Label Sheet, which is required for all numbers '9' and '10'.

## Multi-Measurement Module Parts

The primary support strategy for the Multi-Measurement Module M3001A is a unit exchange with the additional option of assembly level repair, whereas for the SW license controlled M3001AL (Masimo rainbow SET #A05 only) it is assembly level repair. In order to determine which exchange parts must be ordered check the product number, serial number and the option string of the Multi-Measurement Module as described below.



*M3001A/AL Multi-Measurement Module*

### **M3001AL:**

The M3001AL product number was introduced to reflect the software licensed controlled product (SLCP) version of the M3001A.

The M3001A itself has not been converted to SLCP.

Only the M3001AL includes Masimo rainbow SET technology. Optional parameter cost options are available for this technology which are licensed controlled. The primary support strategy for the M3001AL is assembly level repair only (whole unit replacement parts are not available). Except for the Masimo rainbow SET parts, all other replacement part of the M3001A can be used for the M3001AL.

## Multi-Measurement Module Part Number Overview and Identification

Identify the correct Multi-Measurement Module part number by checking the serial number prefix and the option string on the label on the rear of the Multi-Measurement Module housing or the frame housing. The following picture shows the label of an M3001A. Use the table below to determine the hardware revision and the required exchange part.



Option	M3001A/AL Option Description
#A01	Philips FAST SpO <sub>2</sub>
#A02	Nellcor OxiMax SpO <sub>2</sub> compatible (obsolete)
#A03	Masimo SET SpO <sub>2</sub>
#A04	Nellcor OxiMax SpO <sub>2</sub>
#A05	Masimo rainbow SET SpO <sub>2</sub> (M3001AL)
(#C00)	Standard
#C06	Add Pressure/Temp
#C12	Add 12 Lead ECG (older revisions only - see table below)
(#C18)	(Add Pressure/Temp and 12 Lead ECG) <b>old</b>

With Rel. G.0 option #C18 is split into #C06#C12. Multi-Measurement Module software option #A02 is obsolete and replaced by #A04. Hardware revisions A/B are out of support. If an Multi-Measurement Module with HW Rev. A/B becomes defective, or if the customer prefers to proactively keep the Multi-Measurement Modules in full support., the following options are available:

- Order a replacement from hardware A/B to hardware C via the service channel (Upgrade Multi-Measurement Module).
- Order a new Multi-Measurement Module via the sales channel.

### NOTE

In order to follow the RoHS guidelines, identify and order the appropriate part. Non RoHS = Not RoHS compliant. For the M3001AL there is no whole unit replacement.

HW Revision	Possible Multi-Measurement Module Software Revision	Serial Number Prefix	SW of monitor the Multi-Measurement Module is connected to	Option String	Exchange Multi-Measurement Module (for 12NC information, see tables in the following sections)
HW C (Non RoHS)	D.0 to J.0	DE610 DE 632 DE717 DE907	>=A.2	A01, A01C06, A01C18, A01C06C12	M3001-68x05
				A03, A03C06, A03C18, A01C06C12	M3001-68x07
				A04, A04C06, A04C06C12	M3001-68x06
HW C (RoHS compliant)	> J.0	DE345 DE468 DE522	> = A.2	A01, A01C06, A01C18, A01C06C12	M3001-68x15
				A03, A03C06, A03C18, A01C06C12	M3001-68x17
				A04, A04C06, A04C06C12	M3001-68x06

For further compatibility information, see the Software Compatibility Matrix in the Troubleshooting section.

## Multi-Measurement Module Firmware

To perform a FW upgrade, the Multi-Measurement Module must have SW Revision C.0 or higher and be connected to an IntelliVue patient monitor.

### SpO<sub>2</sub>

Option	SpO <sub>2</sub> FW Rev	Comment
#A01	A.01.48	
	A.04.16	
	A.04.17	Currently shipped FW
#A03	Masimo SET FW	Not upgradeable by Philips
#A04	Nellcor OxiMax FW	Philips upgradeable
#A05	Masimo rainbow SET FW	

**ECG**

ECG FW Rev	Comment
D.01.70	Upgradeable - see <i>Internal Field Notifications</i>
D.01.76	
D.01.77	
D.01.78	
D.01.89	
D.02.02	
D.02.05	(requires Multi-Measurement Module SW Revision F.0) (for ECG HW Rev. D.01)
E.01.16	
E.01.22	Currently shipped FW (for ECG HW Rev. E.01)

## Multi-Measurement Module Whole Unit Exchange Part Numbers

### NOTE

The Multi-Measurement Module always ships with the latest Software Revision. In order to ensure compatibility with the respective monitor, the Multi-Measurement Module may need to be up- or downgraded.

Part Number	12NC	Description
<b>Non RoHS, HW Rev: C; SN Prefix: DE610/DE632/DE717/DE907</b>		
<b>Option: A01</b>		
M3001-68105	451261013041	MS_X1 5ld w/o P/T-Eng - HW C nRoHS
M3001-68205	451261013061	MS_X1 5ld w P/T - Eng - HW C nRoHS
M3001-68305	453564146221	MS_X1 12ld wo P/T-Eng - HW C nRoHS
M3001-68405	451261013081	MS_X1 12ld w P/T -Eng - HW C nRoHS
M3001-68505	451261013101	MS_X1 5ld w/o P/T-Sym - HW C nRoHS
M3001-68605	451261013121	MS_X1 5ld w P/T -Sym - HW C nRoHS
M3001-68705	453564146241	MS_X1 12ld w/o P/T-Sym- HW C nRoHS
M3001-68805	451261013141	MS_X1 12ld w P/T - Sym - HW C nRoHS
<b>Option: A04</b>		
M3001-68106	451261013161	MS_X1 5ld w/o P/T-Eng - Nellcor
M3001-68206	451261013181	MS_X1 5ld w P/T -Eng - Nellcor
M3001-68306	453564146171	MS_X1 12ld wo P/T -Eng- Nellcor
M3001-68406	451261013201	MS_X1 12ld w P/T -Eng - Nellcor
M3001-68506	451261013221	MS_X1 5ld w/o P/T-Sym - Nellcor
M3001-68606	451261013241	MS_X1 5ld w P/T -Sym - Nellcor
M3001-68706	453564146181	MS_X1 12ld wo P/T -Sym- Nellcor
M3001-68806	451261013261	MS_X1 12ld w P/T -Sym - Nellcor
<b>Option: A03</b>		
M3001-68107	451261013281	MS_X1 5ld w/o P/T-Eng-Masimo-HWC nRoHS
M3001-68207	451261013301	MS_X1 5ld w P/T-Eng-Masimo-HWC nRoHS
M3001-68307	453564146301	MS_X1 12ld wo P/T-Eng - Masimo HWC nRoHS
M3001-68407	451261013321	MS_X1 12ld w P/T -Eng-Masimo-HWC nRoHS
M3001-68507	451261013341	MS_X1 5ld w/o P/T-Sym-Masimo-HWC nRoHS
M3001-68607	451261013361	MS_X1 5ld w P/T -Sym-Masimo-HWC nRoHS
M3001-68707	453564146321	MS_X1 12ld w/o P/T-Sym- Masimo-HWC nRoHS
M3001-68807	451261013381	MS_X1 12ld w P/T - Sym-Masimo-HWC nRoHS
<b>RoHS Compliant, HW Rev: C; SN Prefix DE345</b>		
<b>Option: A01</b>		
M3001-68115	453564453341	MS_X1 5ld w/o P/T-Eng - HW C
M3001-68215	453564453361	MS_X1 5ld w P/T - Eng - HW C

Part Number	12NC	Description
M3001-68315	453564453381	MS_X1 12ld wo P/T-Eng - HW C
M3001-68415	453564453401	MS_X1 12ld w P/T -Eng - HW C
M3001-68515	453564453431	MS_X1 5ld w/o P/T-Sym - HW C
M3001-68615	453564453481	MS_X1 5ld w P/T -Sym - HW C
M3001-68715	453564453501	MS_X1 12ld w/o P/T-Sym- HW C
M3001-68815	453564453521	MS_X1 12ld w P/T - Sym - HW C
<b>Option: A04</b>		
M3001-68106	451261013161	MS_X1 5ld w/o P/T-Eng - Nellcor
M3001-68206	451261013181	MS_X1 5ld w P/T -Eng - Nellcor
M3001-68306	453564146171	MS_X1 12ld wo P/T -Eng- Nellcor
M3001-68406	451261013201	MS_X1 12ld w P/T -Eng - Nellcor
M3001-68506	451261013221	MS_X1 5ld w/o P/T-Sym - Nellcor
M3001-68606	451261013241	MS_X1 5ld w P/T -Sym - Nellcor
M3001-68706	453564146181	MS_X1 12ld wo P/T -Sym- Nellcor
M3001-68806	451261013261	MS_X1 12ld w P/T -Sym - Nellcor
<b>Option: A03</b>		
M3001-68117	453564453351	MS_X1 5ld w/o P/T-Eng-Masimo-HWC
M3001-68217	453564453371	MS_X1 5ld w P/T-Eng-Masimo-HWC
M3001-68317	453564453391	MS_X1 12ld wo P/T-Eng - Masimo HW C
M3001-68417	453564453411	MS_X1 12ld w P/T -Eng-Masimo-HWC
M3001-68517	453564453441	MS_X1 5ld w/o P/T-Sym-Masimo-HWC
M3001-68617	453564453491	MS_X1 5ld w P/T -Sym-Masimo-HWC
M3001-68717	453564453511	MS_X1 12ld w/o P/T-Sym- Masimo-HWC
M3001-68817	453564453531	MS_X1 12ld w P/T - Sym-Masimo-HWC
<b>Upgrade Multi-Measurement Module (HW A/B to HW C)</b>		
M3001-60109	453564380641	MS_X1 5ld wo P/T Eng HWA/B > HWC New
M3001-60209	453564380651	MS_X1 5ld w P/T Eng HWA/B > HWC New
M3001-60309	453564380661	MS_X1 12ld wo P/T Eng HWA/B > HWC New
M3001-60409	453564380671	MS_X1 12ld w P/T Eng HWA/B > HWC New
M3001-60509	453564380681	MS_X1 5ld wo P/T Sym HWA/B > HWC New
M3001-60609	453564380691	MS_X1 5ld w P/T Sym HWA/B > HWC New
M3001-60709	453564380701	MS_X1 12ld wo P/T Sym HWA/B > HWC New
M3001-60809	453564380711	MS_X1 12ld w P/T Sym HWA/B > HWC New

**NOTE**

nRoHS=nonRoHS

**Multi-Measurement Module Exchange Parts - PCAs**

The M3001A and M3001AL share the same parts with a few exceptions in the measurement PCAs which are outlined in the table

Part number	12NC	Description
<b>Non RoHS HW Rev: C; SN Prefix: DE610/DE632/DE717/DE907</b>		
M3001-68557	451261020751	MS_X1 PCA ECG-5ld/Fast SpO2 nRoHS
453564186021	453564186021	MS_X1 PCA ECG-5ld/Fast SpO2/w PT nRoHS
M3001-68553	451261020771	MS_X1 PCA ECG-5ld/Masimo SpO2 nRoHS
453564186051	453564186051	MS_X1 PCA ECG-5ld/Masimo SpO2/w PT nRoHS
M3001-68555	451261020791	MS_X1 PCA ECG-5ld/Nellcor SpO2 nRoHS
453564186081	453564186081	MS_X1 PCA ECG-5ld/NellcorSpO2/w PT nRoHS
M3001-68425	453564177921	MS_X1 Main board for HW C nRoHS
<b>RoHS compliant Hw Rev: C; SN Prefix DE345</b>		
M3001-68769	453564458371	MS_X1 PCA ECG-5ld/rainbow SpO2
453564506591	453564506591	MS_X1 PCA ECG-5ld/rainbow SpO2/w PT
M3001-68725	453564453421	MS_X1 Main board for HW C
<b>RoHS compliant (Version 2) HW Rev: C; SN Prefix DE522 DE 468</b>		
453564493451	453564493451	MS_X1 PCA ECG-5ld/Fast SpO2 ver2
453564493461	453564493461	MS_X1 PCA ECG-5ld/Masimo SpO2 ver2
453564493471	453564493471	MS_X1 PCA ECG-5ld/Nellcor SpO2 ver2
453564514941	453564514941	MS_X1 PCA ECG-5ld/Fast SpO2/w PT ver2
453564514951	453564514951	MS_X1 PCA ECG-5ld/Masimo SpO2/w PT ver2
453564514961	453564514961	MS_X1 PCA ECG-5ld/Nellcor SpO2/w PT ver2
M3001-68725	453564453421	MS_X1 Main board for HW C
<b>Masimo rainbow PCAs (M3001AL only)</b>		
M3001-68769	453564458371	MS_X1 PCA ECG-5ld/rainbow SpO2
453564506591	453564506591	MS_X1 PCA ECG-5ld/rainbow SpO2/w PT

## Multi-Measurement Module Replacement Parts

Part number	12NC	Description
M3000-66541	453564107971	MS_X1 PCA DC/DC Board for HW A/B
453564474391	453564474391	MS_X1 MSL Flex Assembly
5041-8114	453563100081	MS_X1 Housing Pin
M3001-64500	451261020561	MS_X1 NBP Assembly for X1/X2/MP2
453564423471	453564423471	MS_X2 CONN NiBP Inlet X1/X2/MP2/MP5(5ea)
453564270591	453564270591	MS_X1 Housing Bottom MMS HW A/B
453564187321	453564187321	MS_X1 Housing Bottom MMS HW C & MSE
M3081-61601	453563402721	CBL MSL 1m

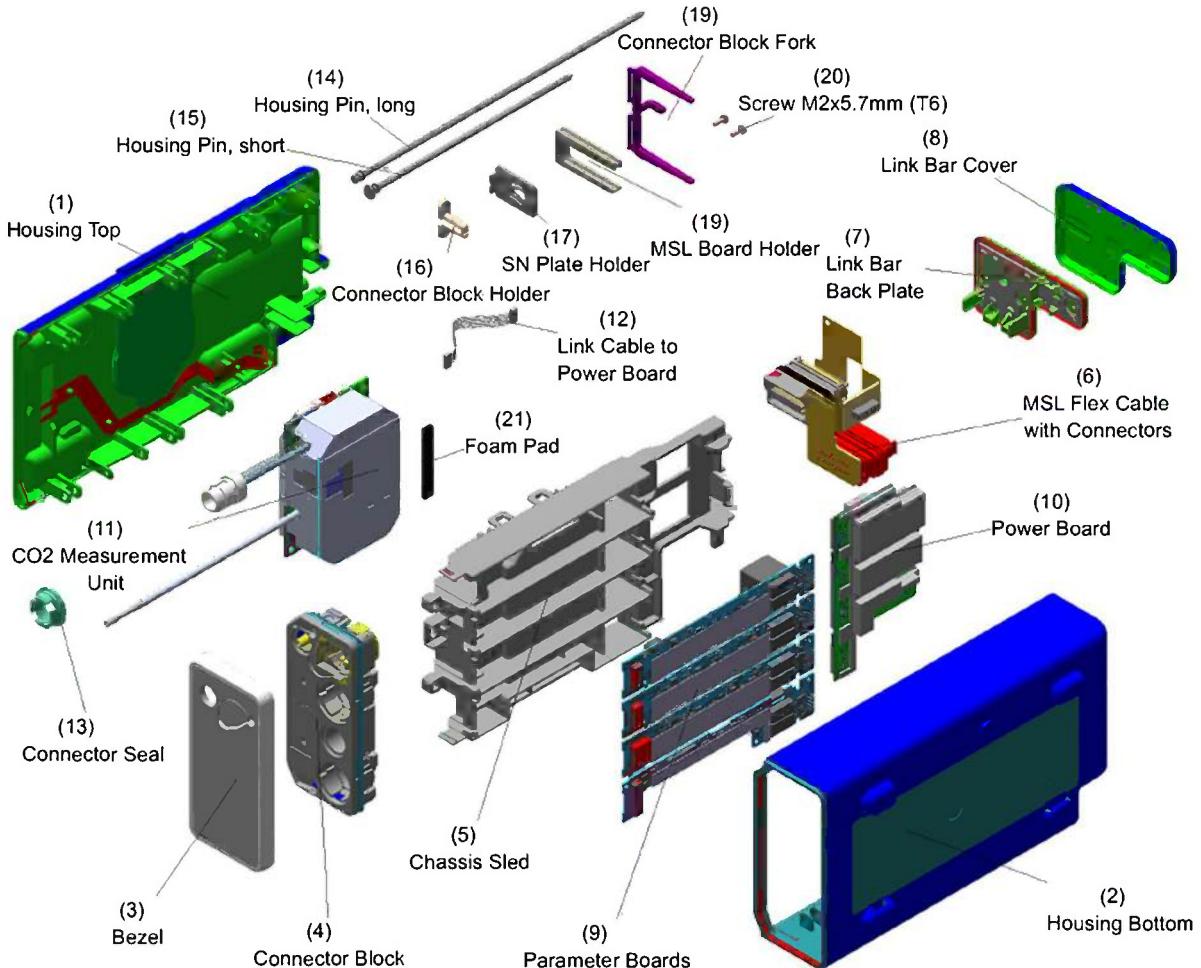
## Multi-Measurement Module Part Numbers - Top Covers

Part number	12NC	Description
M3001-68010	451261016401	MS_X1 Top Cover 5ld w/o P/T Text FAST
M3001-68011	451261016411	MS_X1 Top Cover 5ld w P/T Text FAST
M3001-68012	451261016421	MS_X1 Top Cover 12ld w/o P/T Text FAST
M3001-68013	451261016431	MS_X1 Top Cover 12ld w P/T Text FAST
M3001-68014	451261016441	MS_X1 Top Cover 5ld w/o P/T Sym FAST
M3001-68015	451261016451	MS_X1 Top Cover 5ld w P/T Sym FAST
M3001-68016	451261016461	MS_X1 Top Cover 12ld w/o P/T Sym FAST
M3001-68017	451261016471	MS_X1 Top Cover 12ld w P/T Sym FAST
M3001-68018	451261016481	MS_X1 Top Cover 5ld w/o P/T Text NELLCOR
M3001-68019	451261016491	MS_X1 Top Cover 5ld w P/T Text NELLCOR
M3001-68020	451261016501	MS_X1 Top Cover 12ld w P/T Text NELLCOR
M3001-68021	451261016511	MS_X1 Top Cover 5ld w/o P/T Sym NELLCOR
M3001-68022	451261016521	MS_X1 Top Cover 5ld w P/T Sym NELLCOR
M3001-68023	451261016531	MS_X1 Top Cover 12ld w P/T Sym NELLCOR
M3001-68030	453564147051	MS_X1 TopCover 12ld w/o P/T Text NELLCOR
M3001-68031	453564147061	MS_X1 Top Cover 12ld w/o P/T Sym NELLCOR
M3001-68024	451261016541	MS_X1 Top Cover 5ld w/o P/T Text MASIMO
M3001-68025	451261016551	MS_X1 Top Cover 5ld w P/T Text MASIMO
M3001-68026	451261016561	MS_X1 Top Cover 12ld w P/T Text MASIMO
M3001-68027	451261016571	MS_X1 Top Cover 5ld w/o P/T Sym MASIMO
M3001-68028	451261016581	MS_X1 Top Cover 5ld w P/T Sym MASIMO
M3001-68029	451261016591	MS_X1 Top Cover 12ld w P/T Sym MASIMO
M3001-68032	453564147071	MS_X1 Top Cover 12ld w/o P/T Text MASIMO
M3001-68033	453564147081	MS_X1 Top Cover 12ld w/o P/T Sym MASIMO
453564506611	453564506611	MS_X1 Top Cover w/o P/T Text (incl. Masimo rainbow SET label (M3001AL))
453564506621	453564506621	MS_X1 Top Cover with P/T Text (incl. Masimo rainbow SET label (M3001AL))
453564506631	453564506631	MS_X1 Top Cover w/o P/T Sym (incl. Masimo rainbow SET label (M3001AL))
453564506641	453564506641	MS_X1 Top Cover with P/T Sym (incl. Masimo rainbow SET label (M3001AL))

## Multi-Measurement Module Part Numbers - Front Bezels

Part number	12NC	Description	Options
451261024391	451261024391	MS_X1 Bezel w/o P/T Eng. Text	#A01, #A03
451261024401	451261024401	MS_X1 Bezel w P/T Eng. Text	#A01 #A03
451261024411	451261024411	MS_X1 Bezel w/o P/T Symbols	#A01 #A03
451261024421	451261024421	MS_X1 Bezel w P/T Symbols	#A01 #A03
451261024431	451261024431	MS_X1 Bezel Nellcor w/o P/T Eng. Text	#A02 #A04
451261024441	451261024441	MS_X1 Bezel Nellcor w P/T Eng. Text	#A02 #A04
451261024451	451261024451	MS_X1 Bezel Nellcor w/o P/T Symbols	#A02 #A04
451261024461	451261024461	MS_X1 Bezel Nellcor w P/T Symbols	#A02 #A04
453564506551	453564506551	MS_X1 Bezel rainbow w/o P/T Eng. Text	#A05
453564506561	453564506561	MS_X1 Bezel rainbow w P/T Eng. Text	#A05
453564506571	453564506571	MS_X1 Bezel rainbow w/o P/T Symbols	#A05
453564506581	453564506581	MS_X1 Bezel rainbow w P/T Symbols	#A05

## Current Generation Measurement Extension Parts (867039, 867040, 867041)



### Exchange Parts

Part Number	Description	Number in Diagram
453564685711	MX_EXT MCO2 CO2 Measurement Unit	11

## Replacement Parts

Part Number	Description	Number in Diagram
453564685391	MX_EXT Housing Top	1
453564685381	MX_EXT Housing Bottom	2
453564685501	MX_EXT HMS Bezel P, T, C.O Eng.Text (3ea)	3
453564685511	MX_EXT HMS Bezel P, T, C.O Symbols (3ea)	3
453564685521	MX_EXT HMS Bezel P, T, C.O/CCO Eng. Text (3ea)	3
453564685531	MX_EXT HMS Bezel P, T, C.O/CCO Symbols (3ea)	3
453564685541	MX_EXT HMS Bezel P, T Eng. Text (3ea)	3
453564685551	MX_EXT HMS Bezel P, T Symbols (3ea)	3
453564685601	MX_EXT RCO2 Bezel CO2 Eng. Text/Symb (3ea)	3
453564685621	MX_EXT RCO2 Bezel P, T, CO2 Eng. Text (3ea)	3
453564685631	MX_EXT RCO2 Bezel P, T, CO2 Symbols (3ea)	3
453564685641	MX_EXT RCO2 Bezel P,T,C.O,CO2 Eng. Text (3ea)	3
453564685651	MX_EXT RCO2 Bezel P,T,C.O,CO2 Symbols (3ea)	3
453564685691	MX_EXT RCO2BezelP,T,C.O/CCO,CO2 Eng (3ea)	3
453564685701	MX_EXT RCO2BezelP,T,C.O/CCO,CO2Symb (3ea)	3
453564685751	MX_EXT MCO2 Bezel CO2 Eng. Text/Symbol (3ea)	3
453564685761	MX_EXT MCO2 Bezel P,T,CO2 Eng. Text (3ea)	3
453564685771	MX_EXT MCO2 Bezel P,T,CO2 Symbols (3ea)	3
453564685781	MX_EXT MCO2 Bezel P,T,C.O, CO2 Eng. Text (3ea)	3
453564685791	MX_EXT MCO2 Bezel P,T,C.O,CO2 Symbols (3ea)	3
453564685801	MX_EXT MCO2 Bezel P,T,C.O/CCO,CO2 Eng. (3ea)	3
453564685811	MX_EXT MCO2 Bezel P,T,C.O/CCO,CO2 Symb. (3ea)	3
453564685481	MX_EXT HMS Conn Block P, T, C.O/ CCO	4
453564685491	MX_EXT HMS Conn Block P, T	4
453564685571	MX_EXT RCO2 Conn Block CO2 only	4
453564685581	MX_EXT RCO2 Conn Block P, T , CO2	4
453564685591	MX_EXT RCO2 C- Block P, T, C.O/CCO, CO2	4
453564685721	MX_EXT MCO2 Conn Block CO2 only	4
453564685731	MX_EXT MCO2 Conn Block P, T, CO2	4
453564685741	MX_EXT MCO2 Conn Block P,T,C.O/CCO,CO2	4
453564685401	MX_EXT Chassis Sled	5
453564685441	MX_EXT MSL Board Assembly	6
453564685411	MX_EXT Link Bar Back Plate	7
453564685421	MX_EXT Link Bar Cover	8
453564685461	MX_EXT C.O Board	9
453564769121	MX_EXT COO Board	9
453564685471	MX_EXT Temp Board	9

## 6 Parts

Part Number	Description	Number in Diagram
453564685561	MX_EXT RCO2 CO2 Board	9
453564673701	MX_100/X3 Pressure Board	9
453564685451	MX_EXT Power Board	10
453564686571	MX_EXT MCO2 Link Cable to Power Board	12
453564770651	MX_EXT MCO2 Connector Seal (3ea)	13
453564770381	MX_EXT Housing Pin, Long (3ea)	14
453564770391	MX_EXT Housing Pin, Short (3ea)	15
453564770361	MX_EXT Connector Block Holder (3ea)	16
453564770371	MX_EXT SN Plate Holder (3ea)	17
453564770351	MX_EXT MSL Board Holder (3ea)	18
453564770341	MX_EXT Connector Block Fork (3ea)	19
453564765841	MX_100/X3 SCREW M2x5.7mm (T6) (5ea)	20
453564686561	MX_EXT MCO2 Foam Pad (3ea)	21
453564770411	MX_EXT Locking Pins (4ea)	(Not Shown)
453564770421	MX_EXT Cover Plugs (4ea)	(Not Shown)
453564838611	MX_EXT Release Button (3ea)	(Not Shown)

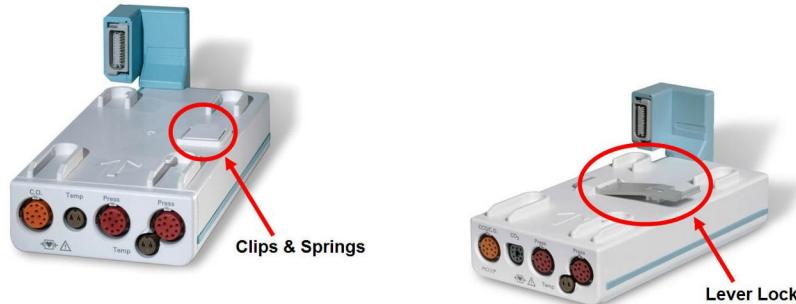
## Previous Generation Measurement Extension Parts (M3012A, M3014A, M3015A/B)

Exchange Measurement Extensions are shipped with English front bezels only. If you require a bezel in another language (compare the part numbers of your language to the English ones to check this) the front bezel has to be ordered additionally. Attach the appropriate bezel before putting the Measurement Extension into operation.

The part numbers in the following parts table below, are used to order parts from your Philips representative.

### Measurement Extension General Support Parts

Part Number	12NC	Description	Comments
M3014-64200	451261012731	MS_RCO2 Measurement Ext Clips+Springs, 10ea	Old top housing
M3012-64600	451261012721	MS_HMS Measurement Ext. Lever Locks (5ea)	Grey lever release mechanism
M3012-64620	451261016601	MS_HMS MSE Top Cover Assy	
M3012-64621	451261016611	MS_HMS MSE Link Bar Assy	Without Flex, must be ordered separately
453564088851	453564088851	MS_MCO2 Flex Cable/Connector Assy	
5041-8114	453563100081	MS_X1 Housing Pin	



## Measurement Extension Front Bezels and Accessories

Part number	12NC	Description
<b>M3012A BEZELS</b>		
451261024471	451261024471	MS_HMS Bezel P, T, P/T Eng. Text
451261024481	451261024481	MS_HMS Bezel P, T, P/T Symbols
451261024491	451261024491	MS_HMS Bezel C.O.,P, T, P/T Eng. Text
451261024501	451261024501	MS_HMS Bezel C.O.,P, T, P/T Symbols
451261024511	451261024511	MS_HMS Bezel CCO,C.O.,P,T,P/T Eng Text
451261024521	451261024521	MS_HMS Bezel CCO, C.O.,P,T,P/T Sym
<b>M3012A Misc</b>		
14454A	453563057651	I.V POLE MOUNT
<b>M3014A Bezels</b>		
451261024531	451261024531	MS_RCO2 Bezel CO2 only Eng. Text/Sym
451261024541	451261024541	MS_RCO2 Bezel C.O., CO2,P,P/T Eng. Text
451261024551	451261024551	MS_RCO2 Bezel C.O., CO2, P, P/T Symbols
451261024561	451261024561	MS_RCO2 Bezel CO2, P, P/T Eng. Text
451261024571	451261024571	MS_RCO2 Bezel CO2, P, P/T Symbols
451261024581	451261024581	MS_RCO2 Bezel C.O., CCO,CO2,P,P/T Text
451261024591	451261024591	MS_RCO2 Bezel C.O.,CCO, CO2, P, P/T Sym
<b>Capnography Sensors RoHS with SN Prefix US401</b>		
M2741-68100	453564453731	MS_MCO2 Sidestream Sensor
M2501-68100	453564453721	MS_MCO2 Mainstream Sensor
<b>Capnography Sensors Non RoHS with SN Prefix other than US401</b>		
M2741-68000	451261011291	SNSR M2741A Sidestream Sensor
M2501-68000	451261006391	MS_MCO2 M2501A MainstreamSensor
<b>Spare Parts</b>		
M2741-60000	451261011731	Mounting Bracket Replacement
<b>M3015A Bezel</b>		
451261024601	451261024601	MS_SCO2 Bezel CO2 w P/T Eng. Text
451261024611	451261024611	MS_SCO2 Bezel CO2 w P/T Symbols
451261024621	451261024621	MS_SCO2 Bezel CO2 w/o P/T Eng. Text
451261024631	451261024631	MS_SCO2 Bezel CO2 w/o P/T Symbols
<b>Spare Parts</b>		
453564312801	453564312801	MS_SCO2 Housing Bottom HW Rev A,B
453564312871	453564312871	MS_SCO2 Top Cover Assy HW Rev C
<b>M3015B Bezel</b>		

Part number	12NC	Description
453564270051	453564270051	MS_SCO2 Bezel Symbols M3015B CO2. P, P, T
453564270061	453564270061	MS_SCO2 Bezel Text M3015B CO2. P, P, T
<b>Spare Parts</b>		
453564312871	453564312871	MS_SCO2 Top Cover Assy HW Rev C

## Exchange Parts List

Exchange parts are parts that have been returned to Philips and reconditioned for further use. Parts offered as exchange parts are in excellent service order according to rigorous Philips standards but offer you a considerable price advantage.

A front bezel with symbols instead of English text is provided with each exchange Measurement Extension.

Part number	12NC	Description
<b>M3012A Non-RoHS SN Prefix &lt;&gt;DE452 &amp; DOM &lt;2014-07</b>		
<b>M3012A</b>	<b>862111</b>	<b>Hemodynamic Measurement Extension</b>
M3012-6801A	451261000201	MS_HMS OEM EXCH.UNIT ENGLISH (#C00) nRoHS
M3012-6831A	451261000341	MS_HMS OEM EXCH.UNIT ENGLISH (#C05) nRoHS
M3012-6861A	451261000491	MS_HMS OEM EXCH.UNIT ENGLISH (#C10) nRoHS
<b>M3012A RoHS SN Prefix =DE452 &amp; DOM &gt;2014-07</b>		
<b>M3012A</b>	<b>862111</b>	<b>Hemodynamic Measurement Extension</b>
M3012-6901A	453564453601	MS_HMS OEM UNIT ENGLISH (#C00)
M3012-6931A	453564453611	MS_HMS OEM UNIT ENGLISH (#C05)
M3012-6961A	453564453621	MS_HMS OEM UNIT ENGLISH (#C10)
<b>M3014A Non-RoHS SN Prefix &lt;&gt;DE454 &amp; DOM &lt;2014-07</b>		
<b>M3014A</b>	<b>862187</b>	<b>Capnography Extension</b>
M3014-6801A	451261009281	MS_RCO2 OEM EXCH.UNIT ENGLISH (#C00) nRoHS
M3014-6831A	451261009311	MS_RCO2 OEM EXCH.UNIT ENGLISH (#C05) nRoHS
M3014-6861A	451261009601	MS_RCO2 OEM EXCH.UNIT ENGLISH (#C10) nRoHS
M3014-6891A	451261009461	MS_RCO2 OEM EXCH.UNIT ENGLISH (#C07) nRoHS
<b>M3014A RoHS SN Prefix =DE454 &amp; DOM &gt;=2014-07</b>		
<b>M3014A</b>	<b>862187</b>	<b>Capnography Extension</b>
M3014-6901A	453564453631	MS_RCO2 OEM UNIT ENGLISH (#C00)
M3014-6931A	453564453641	MS_RCO2 OEM UNIT ENGLISH (#C05)
M3014-6961A	453564453651	MS_RCO2 OEM UNIT ENGLISH (#C10)
M3014-6991A	453564453661	MS_RCO2 OEM UNIT ENGLISH (#C07)
<b>M3015A Non-RoHS SN Prefix &lt;&gt;DE455 &amp; DOM &lt;2014-07</b>		
<b>M3015A</b>	<b>862393</b>	<b>Microstream CO2 Extension</b>
M3015-6802A	451261005311	MS_SCO2 M3015A Unit with P/T (HW Rev. B)

## 6 Parts

Part number	12NC	Description
M3015-6832A	451261005331	MS_SCO2 M3015A Unit wo P/T (HW Rev. B)
453564293881	453564293881	MS_SCO2 OEM Exch. Unit with P/T (HW Rev. C) nRoHS
453564293891	453564293891	MS_SCO2 Exch. Unit without P/T (HW Rev. C) nRoHS
<b>M3015A RoHS SN Prefix =DE455 &amp; DOM &gt;=2014-07</b>		
<b>M3015A</b>	<b>862393</b>	<b>Microstream CO2 Extension</b>
453564435491	453564435491	MS_SCO2 M3015A with P/T (HW C)
453564435511	453564435511	MS_SCO2 M3015A without P/T (HW C)
<b>M3015B Non-RoHS SN Prefix &lt;&gt;DE456 &amp; DOM &lt;2014-07</b>		
<b>M3015B</b>	<b>865377</b>	<b>Microstream CO2 Extension</b>
453564270041	453564270041	MS_SCO2 M3015B with CO2,P, P and T
453564685711	453564685711	MX_EXT MCO2 CO2 Measurement Unit
<b>M3015B RoHS SN Prefix =DE455 &amp; DOM &gt;=2014-07</b>		
<b>M3015B</b>	<b>865377</b>	<b>Microstream CO2 Extension</b>
453564435461	453564435461	MS_SCO2 M3015B with CO2,P,P, and T
453564685711	453564685711	MX_EXT MCO2 CO2 Measurement Unit

## IntelliVue X2 Part Numbers

See the IntelliVue X2 Service Guide for IntelliVue X2 part numbers.

## IntelliVue X3 Part Numbers

See the IntelliVue X3 Service Guide for IntelliVue X3 part numbers.

## Plug-in Modules Part Numbers

For inspection procedures; preventive maintenance procedures; cleaning procedures; maintenance, and good practices used to maintain the instrument in good working order, see *Testing and Maintenance*.

Part Number	12NC	Description
M1001-45011	453563490691	M_ECG PLAST SNAP LOCK SINGLE
5040-4247	453563099401	PLAST Snap Lock (CV color)
453564546661	453564546661	PLAST Rear Housing Single Module CE mark

## M1006B Invasive Blood Pressure Module

Part number	12NC	Description
<b>Exchange Parts</b>		
<b>Non RoHS DOM (Date Of Manufacture) &lt; 2014-03 OR No DOM is present</b>		
<b>Modules</b>		
M1006-69601	453563463061	M_PRS IBP Module ENG, nRoHS
M1006-69602	453564463261	M_PRS IBP Module Symbol Multilang, nRoHS
<b>RoHS compliant DOM ≥ 2014-03</b>		
<b>Modules</b>		
M1006-69701	453564453101	M_PRS IBP Module ENG
M1006-69702	453564463301	M_PRS IBP Module Symbol Multilang
<b>Modules with analog out</b>		
M1006-69751	453564453131	M_PRS IBP Module ENG, w. Analog-out
M1006-69752	453564463321	M_PRS IBP Mod C01 Symbol Multilang
<b>Replacement Parts</b>		
<b>Front Housings</b>		
M1006-60201	453563462101	M_PRS Frt Housg IBP, ENG
M1006-60202	453564463341	M_PRS Frt Housg IBP, Symbol Multilang
<b>Front Housings with analog out</b>		
M1006-60251	453563462091	M_PRS Frt Housg IBP C01, ENG
M1006-60252	453564463351	M_PRS Frt Housg IBP C01,Symbol Multilang
<b>Bezel</b>		
M1006-42202	453563463211	M_PRS PLAST Bezel Press-Square
<b>Cables</b>		
M1006-61689	453563225911	M_PRS CBL ADPTR M1006B#C01 1/4" phone JK

## 6 Parts

### M1011A Intravascular Oxygen Saturation Module

Part number	12NC	Description
453564120301	453564120301	M_SO2 Module Exchange, ENG
453564120311	453564120311	M_SO2 Module Exchange, SYMBOLS
453564105801	453564105801	M_SO2 Front Housing Assy SO2 ENGLISH
453564105811	453564105811	M_SO2 Front Housing Assy SO2 SYMBOL
M1011-42201	453564120341	M_SO2 Bezel
989803151591	989803151591	SO2 Optical Module
453564097201	453564097201	M_SO2 OEM Exchange SO2 Optical Module

### M1012A Cardiac Output Parameter Module

Part number	12NC	Description
<b>Non ROHS, DOM (Date Of Manufacture) &lt; 2014-05 OR No DOM is present</b>		
<b>Modules</b>		
M1012-69601	453563458801	M_CO Module C.O., ENG nRoHS
M1012-69604	453564463371	M_CO Module C.O., Symbol Multilang nRoHS
<b>Modules with PICCO</b>		
M1012-69651	453563463011	M_CO Module C10 PiCCO, ENG nRoHS
M1012-69654	453564463391	M_CO Module PiCCO Symbol Multilang nRoHS
<b>RoHS Compliant, DOM ≥ 2014-05</b>		
<b>Modules</b>		
M1012-69701	453564453161	M_CO Module C.O., ENG
M1012-69704	453564463411	M_CO Module C.O., Symbol Multilang
<b>Modules with PICCO</b>		
M1012-69751	453564453191	M_CO Module C10 PiCCO, ENG
M1012-69754	453564463431	M_CO Module PiCCO, Symbol Multilang
<b>Replacement Parts</b>		
<b>Front Housings</b>		
M1012-60201	453563462021	M_CO Frt Housg CO, ENG
M1012-60204	453564463451	M_CO Frt Housg CO, Symbol Multilang
<b>Front Housings with PICCO</b>		
M1012-60251	453563462031	M_CO Frt Housg C10 PiCCO, ENG
M1012-60254	453564463461	M_CO Frt Housg C10 PiCCO Symbol Multilang

Part number	12NC	Description
<b>Bezel</b>		
M1012-42201	453563463241	M_CO PLAST Bezel CO Module

## M1014A Spirometry Module

Part number	12NC	Description
M1014-69601	451261014451	M_SPR Module Spiro, Eng
M1014-69602	451261014461	M_SPR Module Spiro, Symbol
<b>Front housing</b>		
M1014-60201	451261014491	M_SPR Frt Housg Assy Spiro, ENG
M1014-60202	451261014501	M_SPR Frt Housg Assy Spiro, SYMBOL
<b>Bezel</b>		
M1014-42201	451261014511	M_SPR PLAST Bezel Spiro
<b>Misc</b>		
M1014-64100	451261014521	M_SPR TUBING Leak Test Kit Spiro

## 6 Parts

### M1020B / 867191 / 867192 Pulse Oximetry Module

Part number	12NC	Description
<b>Philips FAST Module</b>		
M1020-69651	451261000061	M_SpO2 M1020B Philips/FAST
M1020-60251	451261000081	M_SpO2 Frt Housg Assy M1020B PhilipsFAST
M1020-66514	453564119121	M_SpO2 PCA PS2+
M1020-42211	453564458841	Bezel SpO2 Module
<b>OxiMax Compatible Module</b>		
M1020-69652	451261000101	M_SpO2 M1020B NELLCOR Oxi
M1020-60252	451261000121	M_SpO2 Frt Housg Assy M1020B NELLCOR
<b>Masimo rainbow SET Module</b>		
N/a	453564734111	M_SpO2 OEM Masimo rainbow SET
N/a	453564744611	M_SpO2 Frt Housg Assy Masimo rainbow SET
<b>Masimo SET Module</b>		
M1020-69653	451261000131	M_SpO2 OEM M1020B Masimo
N/a	453564744601	M_SpO2 Frt Housg Assy Masimo SET
<b>Nellcor OxiMax Module</b>		
453564307951	453564307951	M_SpO2 M1020B-Nellcor

### M1027A EEG Module

Part Number	12NC	Description
M1027-69601	453563459151	M_EEG M1027A Exch, all Lang ex Jap&Gre
M1027-69610	453563459161	M_EEG M1027A EEG Exch, JAP
M1027-69615	453563460481	M_EEG M1027A EEG Exch, Greek
M1027-60201	453563461471	M_EEG Frt Housg Assy EEG, ENG
M1027-60210	453563462131	M_EEG Frt Housg Assy EEG, JAP
M1027-60215	453563462141	M_EEG Frt Housg Assy EEG, GRK
M1027-42201	453563463611	M_EEG PLAST Plast Bezel

## M1027B EEG Module

Part Number	12NC	Description
453564350211	453564350211	M_EEG Module EEG/aEEG, Intl
453564465541	453564465541	M_EEG Module EEG/aEEG, Eng
<b>Front housing</b>		
453564350561	453564350561	M_EEG Frt Housg Assy EEG/aEEG, Intl
453564465521	453564465521	M_EEG Frt Housg Assy EEG/aEEG, Eng

## M1029A Temperature Module

Part number	12NC	Description
<b>Modules</b>		
M1029-69701	453564453281	M_TMP Temp Module ENG
M1029-69702	453564463511	M_TMP Temp Module Symbol Multilang
<b>Replacement Parts</b>		
<b>Front Housings</b>		
M1029-60201	453563461451	M_TMP Frt Housg Temp, ENG
M1029-60202	453564463471	M_TMP Frt Housg Temp, Symbol Multilang
<b>Bezel</b>		
M1029-42201	453563463631	M_TMP PLAST Temp Module Bezel

**M1034B BIS Modules**

Part Number	12NC	Description
<b>BIS Power Link, Non RoHS, SN &lt; BX76675</b>		
M1034-68521	451261003621	M_BIS BISx Power Link nRoHS
<b>BIS Power Link, RoHS, SN &gt; BX76675</b>		
M1034-68621	453564453711	M_BIS BISx Power Link
<b>M1034B</b>	<b>866421</b>	<b>BIS Module</b>
453564471611	453564471611	M_BIS Module BIS, Intl
453564471641	453564471641	M_BIS Module BIS, Eng
<b>Front Housing M1034B</b>		
453564471631	453564471631	M_BIS Frt Housg Assy BIS, Intl
453564471661	453564471661	M_BIS Frt Housg Assy BIS, Eng
<b>M1034B Bilateral Parts</b>		
453564561901	453564561901	M_BIS OEM BIS LoC 4-CH Device PWR Link
453564561911	453564561911	M_BIS CBL BIS LoC 4-CH PIC
453564561921	453564561921	M_BIS CBL BIS LoC 4-CH Bulkhead CONN
<b>Misc</b>		
M1034-61630	453563233721	M_BIS CBL Patient Interface Cable
M1034-61660	451261005261	M_BIS CBL BISx Host Cable
M1034-47600	451261005271	M_BIS CBL BISx Bulkhead Connector
M1034-60104	453563490591	M_BIS MECHASY BIS MODULE RACK MOUNT
M1034-61650	453563233731	M_BIS BIS Sensor Simulator
M1034-42201	453563463661	M_BIS PLAST PLAST Bezel

## BIS Solution Components



- 1 BIS Module
- 2 BIS Device
- 3 Patient Interface Cable
- 4 BIS Sensor

## M1116C Recorder Module

These parts are exclusively for M1116C

Part number	12 NC	Description
453564452831	453564452831	M_REC Recorder Module Text
453564452841	453564452841	M_REC Recorder Module Symbol
<b>Support Parts</b>		
453564456821	453564456821	M_REC MECHASY Roller
453564456791	453564456791	M_REC PLAST Snap Lock kit (2ea)

## 865115 IntelliBridge EC10 Module

Part number	12NC	Description
453564116661	453564116661	IB-EC10 Module RS232/LAN
453564116931	453564116931	IB-EC10 Frt Housg Assy Module RS232/LAN
M1031-42201	453564116891	IB-EC10 Bezel RJ45

## 6 Parts

### 865383 NMT Module

Part number	12NC	Description
453564279141	453564279141	M_NMT Module NMT, Eng
453564279161	453564279161	M_NMT Module NMT, Intl
453564257851	453564257851	M_NMT PLAST Bezel
453564279181	453564279181	M_NMT Frt Housg Assy NMT, Eng
453564279191	453564279191	M_NMT Frt Housg Assy NMT, Intl
989803174581	989803174581	CBL NMT Patient Cable*
453564464081	453564464081	M_NMT CBL IntelliVue NMT Patient Cable

\* Not orderable via SPS. Must be ordered through Supplies.

### 866173 G7m Gas Analyzer

The repair strategy for the G7m gas analyzer module is unit exchange. There are no orderable spare parts.

#### Exchange Service Parts:

Part Number	12NC	Description
453564477391	453564477411	M_G7m Gas Module Text
453564477401	453564477421	M_G7m Gas Module Symbol
453564507181	453564507181	M_G7m Fan Filter Kit

## Tympanic Thermometer Part Numbers

Part Number	Description	Image
989803180831	Genius 2 tympanic temperature probe (commercial)	
453564507601	Probe, Tympanic Temperature, OEM	
4535 634 84591	MIB cable 1,5 m	
4535 634 84601	MIB cable 3,0 m	

## External Display Part Numbers

Part number	12NC	Description
865299	865299	19 in. TFT Touch (S)XGA Display
453564623811*	453564623811*	IV DSPL 19" Med Grade w Touch ver2 (ELO1929M)
453564179151	453564179151	IV DSPL 19" Medical Grade w Touch (ELO1828L)
M8031-64001	451261001931	IV ASSY Pwr Supply Holder 15"/19" displ (only for ELO1828L)
453564116741	453564116741	ASSY-PWR - E539821 Power Brick - 12V (only for ELO 1828L)

\*Currently, the new 19" display (ver2) does not have regulatory clearance in all countries. For this reason, some countries will continue to receive the old 19" display until regulatory clearance is available for the new 19" display (ver2). All countries that do have regulatory clearance for the new 19" display (ver2) will receive that display. Regulatory clearance is reflected in the ordering system.

## Test and Service Tools

**Table 3 UTP LAN Crossover**

Part number	12NC	Description
M3199-60101	453563337371	PIC CBL NI 3FT CROSSOVER UTP
M3199-60102	453563337381	NI CBL UTP Crossover 12ft

**Table 4 Grounding**

Part number	12NC	Description
8120-4808	453563199211	CMS CBL EXT GND ASSY (gnd lug con)
8120-2961	453563198651	CMS CBL EXT GND ASSY(Crocodile clip)

**Table 5 Test Cables**

Part number	12NC	Description
451261026081	451261026081	CBL Safety Test ECG
451261026141	451261026141	CBL Safety Test IBP
451261026071	451261026071	CBL Safety Test M1006A/B #C01 Phone Jack
451261026041	451261026041	CBL Safety Test SpO2 (MMS/M1020B)
453564427181	453564427181	IV CBL Safety Test SpO2 Rainbow
451261026171	451261026171	CBL Safety Test C.O.
451261026091	451261026091	CBL Safety Test EEG
451261026131	451261026131	CBL Safety Test Temp
451261026031	451261026031	CBL Safety Test CO2 (M3014A)
453564127781	453564127781	CBL Safety Test IntelliBridge
451261026191	451261026191	CBL Safety Test Defi paddles
453564127771	453564127771	CBL Cable AY. ScvO2
453564331451	453564331451	CBL NMT Safety Test
M1012-61601	453563227731	M_CO CONN Test Adapter Cardiac Output
453564421601	453564421601	IM CBL IRTemp test cable

**Table 6 Capnography - Resironics Mainstream**

Part number	12NC	Description
M2506A		GAS Verification Gas
M2505A		GAS CYLINDER REGULATOR

**Table 7 Capnography - Resironics Sidestream**

<b>Part number</b>	<b>12NC</b>	<b>Description</b>
M2267A	989803106081	Calibration Regulator
13907A	989803100361	Calibration Tube Assembly
M2506A		GAS Verification Gas
M2776A		Straight Sample Line

**Table 8 Capnography - Microstream Orion**

<b>Part number</b>	<b>12NC</b>	<b>Description</b>
453564117411	453564117411	mCO <sub>2</sub> Luer remover
M1013-64002	451261014851	M_G1 IV G1/G5 Leakage Test Kit
453564178121	453564178121	M_AGM Flowmeter TSI
15210-64010	989803100841	GAS Cal 1 cylinders for TCPC02, 6/bx.
15210-64020	989803100851	GAS Cal 2 Cylinders for TCPC02, 6/bx.
M2267A	989803106081	Calibration Regulator
M3015-47301	989803143081	MS_SCO2 LBSPLY Calibration Line
13907A	989803100361	Calibration Tube Assembly



# Installation Instructions

The information contained in this chapter should enable the MX800 to be installed ready for use (the preparation and planning should be adhered to as specified in the *Site Preparation* section). Configuration of the system is explained in the Configuration Guide.

## Installation Checklist

Use this checklist to document your installation, and file this installation record

Step	Task	Check Box when Task Done
1	Perform initial inspection of delivery, unpack and check the shipment. If a G7m Gas Analyzer module is present and has been exposed to low temperatures, allow the module to warm up for four hours before plugging it in	<input type="checkbox"/>
2	Mount the monitor as appropriate for your installation	<input type="checkbox"/>
3	Connect the monitor to AC mains using the supplied power cord	<input type="checkbox"/>
4	Perform Visual, Power On and Functional test blocks	<input type="checkbox"/>
5	Perform Safety Tests, if required by local laws and regulations	<input type="checkbox"/>
6	Load paper into the recorder, if present	<input type="checkbox"/>
7	Connect gas inlet accessories (water trap, sample line, airway adapter) and gas outlet accessories to G7m Gas Analyzer module, if present	<input type="checkbox"/>
8	Check/set the time and date	<input type="checkbox"/>
9	Ensure the country-specific default settings are appropriate	<input type="checkbox"/>
10	Configure monitor for G7m Gas Analyzer Module usage (including altitude/barometric setting), if present	<input type="checkbox"/>
11	Perform System Test as necessary	<input type="checkbox"/>

## Unpacking the Equipment

Your equipment will arrive in a carton similar to the ones pictured below. All components of the monitoring system are consolidated into a single packing crate. The user documentation is provided in a separate package. The contents of the monitoring system crate depend on the options you have purchased. In addition to the monitor it can contain the following:

- Multi-Measurement Module and user manuals
- Module Rack
- Parameter modules
- Measurement Extensions and accessories



*Accessory Packaging (Remove upper box to reveal monitor)*



*Monitor Packaging*

In the unlikely event of a defect on arrival, please keep the packing materials until you have completed the initial inspection.

## Initial Inspection

### Mechanical Inspection

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

### Electrical Inspection

The instrument has undergone extensive testing prior to shipment. Safety testing at installation is not required (except in situations where devices are interconnected forming a system, see “[Connecting Non-Medical Devices](#)” on page 469 in the *Site Preparation* chapter of this manual). An extensive self check may be performed. This recommendation does not supersede local requirements.

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

## Claims for Damage and Repackaging

### Claims for Damage

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

### Rerepackaging for Shipment or Storage

If the instrument is to be shipped to a Philips Sales/Support Office, securely attach:

- A label showing the name and address of the owner
- The instrument model and serial numbers
- The repair required (or symptoms of the fault)

If available and reusable, the original Philips packaging should be used to provide adequate protection during transit. If the original Philips packaging is not available or reusable contact the Philips Sales/Support Office who will provide information on Philips recommended packaging materials and methods.

# Installing the MX800 Monitor

### NOTE

There are different mounting options available for the monitor. This section covers the general concepts of safe mount installations and specific steps for the mounting options sold by Philips. Instructions which ship with a mounting solution should always take precedence over the instructions described in this chapter.

You MUST follow the instructions that ship with the mounting solution, regardless of manufacturer.

## Mounting Instructions

### Assembling Mounts

- The table mount ships with the monitor. Every type of compatible mounting solution is delivered with a complete set of mounting hardware and instructions. See the documentation delivered with the mounting hardware for instructions on assembling mounts. Compatible table mounts are:
  - M8000-64100 (table mount with gray tops and marked with date code 10/31 or higher), or
  - 453564239731 (completely made of stainless steel).

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### WARNING

- It is the customer's responsibility to have the attachment of the mounting hardware to the ceiling, wall, or mounting rail and the construction of the ceiling, wall, or mounting rail evaluated for structural integrity and compliance with all local, state and any other required codes by a registered, professional, structural and/or mechanical engineer.
- Ensure that this commitment has been met before assembling mounts.
- Incorrect mounting and use of inappropriate mounting material may lead to injury. It is the customer's responsibility to ensure that the mounting procedures have been performed correctly and the appropriate mounting devices have been used.
- Perform the Mounting Integrity Test:
  - whenever you have removed and reassembled a quick mount
  - if one or more of the quick mount screws are loose
  - if the monitor mounting is unstable

See “[Mounting Integrity Test](#)” on page 127 for details.

---

Mount the monitor using either the Philips Quick Mount or Fix Mount solution or another approved mounting solution. The mounting shall be done in a manner that no patient, operator or other person can be harmed by a monitor removed intentionally or released accidentally from the mount. When using the Quick Mount, be aware of the danger of accidental activation of the Quick Mount release button when lifting or moving items located under the monitor, such as pole mounts, etc. If in doubt, use the Philips Fix Mount solution to avoid such situations.

The Fix Mount should be used for those installations where the Quick Mount might not be appropriate. The Fix Mount is already integrated into the monitor bottom housing.

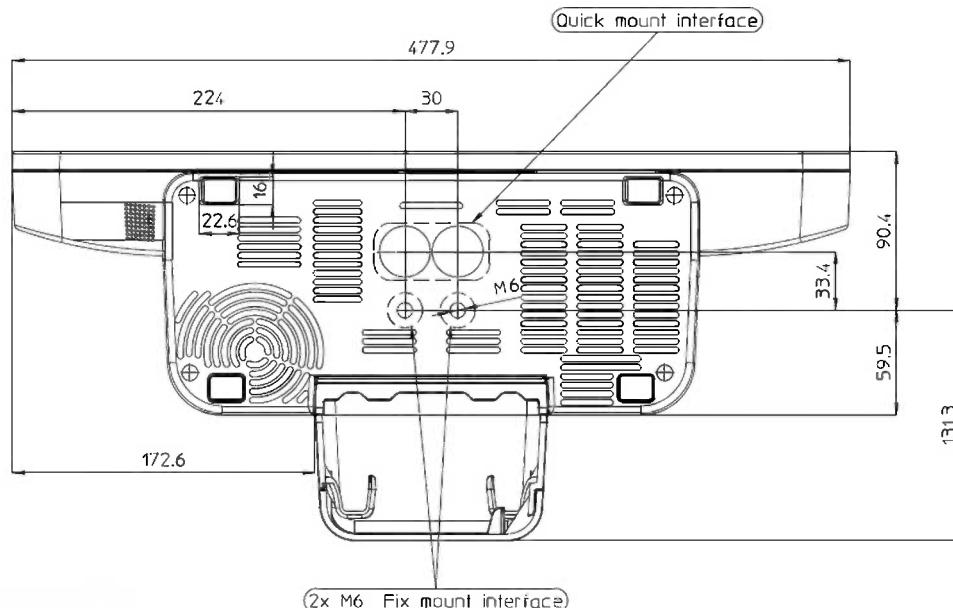
The Quick Mount and Fix Mount solutions are both shipped as standard.

## General Specifications for the Mounting Hardware Interface

### Fixed Mounting

Fixed mounting typically means a screw-fixed installation of a device to a mounting hardware. Torque specification depends on the max. extraction force (see below) and has to be defined and verified by the mounting supplier. It is recommended to use screws with locking coating.

Specifications	Quantity	Unit	Comment
Number of mounting holes	2	EA	
Diameter of through-holes	n/a	mm	
Thread type and diameter	M6	—	
Min. thread depth	6	mm	
Max. thread depth	7	mm	
Max. extraction force per thread insert	1600	N	result of pull-out test divided by a safety factor of 2



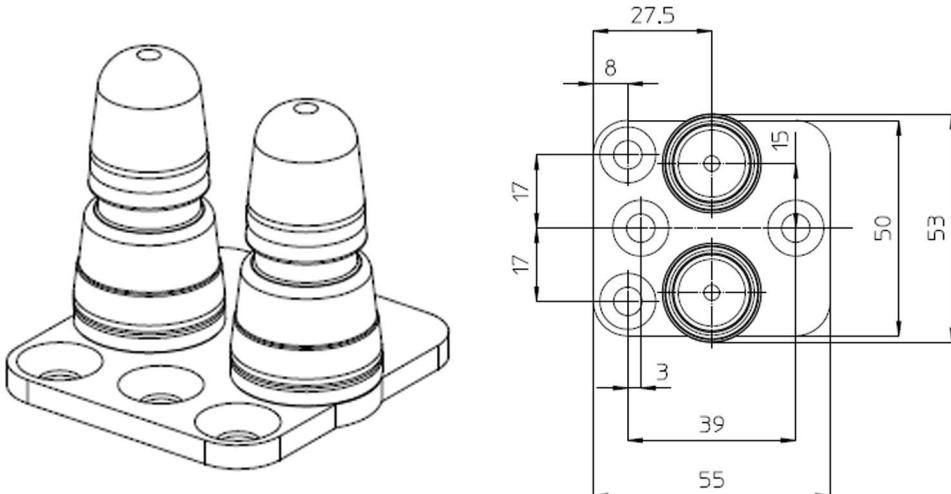
MX800 Mounting Interface

### Quick-Release Mounting

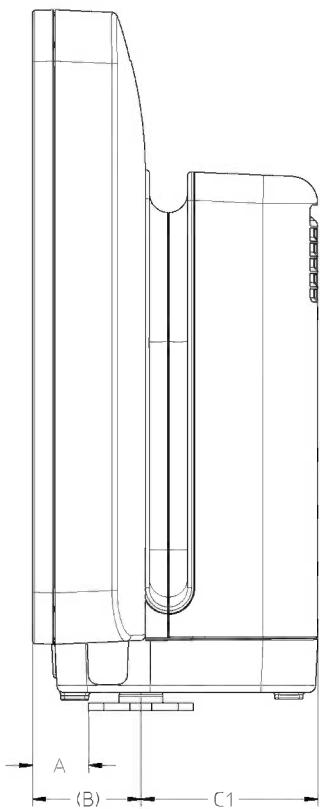
Quick-Release mounting means a flexible installation to mounting hardware using the Philips Quick Mount without any tools. The Philips Table Mount is essential for this mounting solution.

Mounting hardware for use with the Philips Quick Mount, must contain the Philips Table Mount as a counterpart. Similar looking cone plates by other manufacturers are not supported and must not be used.

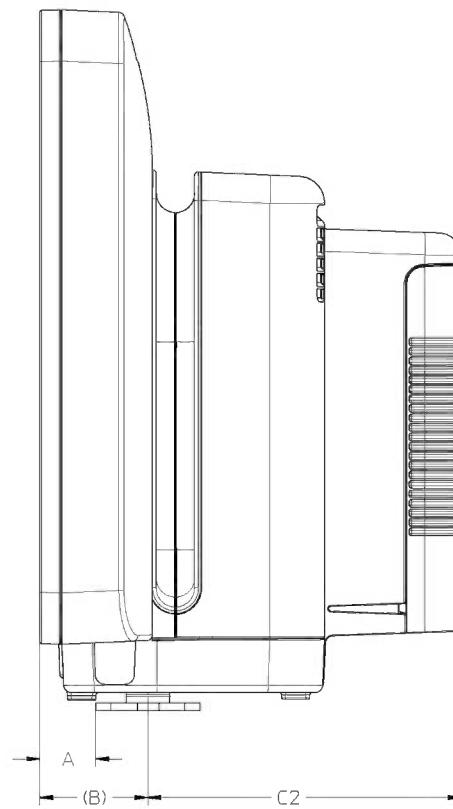
For instructions on how to mount the monitor using the quick release Table Mount, see the Assembly Instructions delivered with the mounting kit M8000-64100 or 453564239731.



*Table Mount*



865240



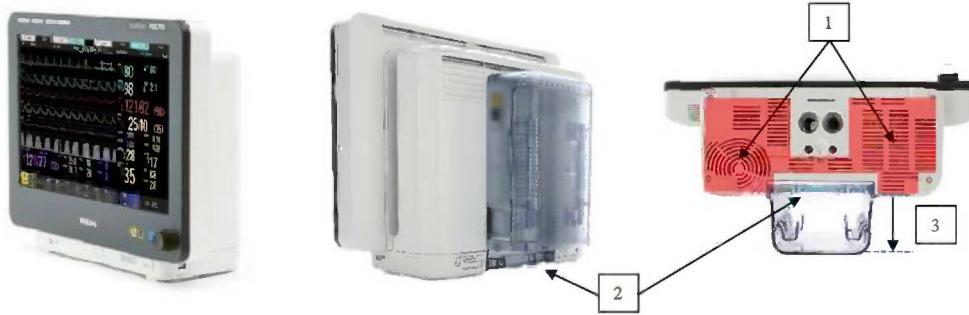
865240 with Cable Management

	A	(B)	C1	C2
MX800	29.5mm	57mm	93.1mm	164.7mm

### Restricted Areas

Mounting hardware must not restrict the typical use of the device. Therefore, the environmental and space requirements of the device must always be observed: e.g. vents area, swing range of movable components, cable slots and cable management, slots for Philips plug-in modules, bed mount area, Quick Mount openings, height restrictions.

- 1 To ensure adequate air circulation, it is not allowed to cover more than 20% of the vents.
- 2 Do not restrict access to connectors.
- 3 Consider the protruding case of the cable management.

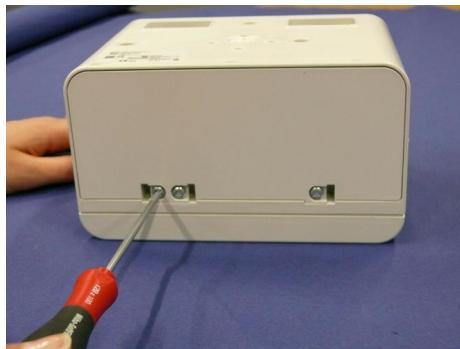


### NOTE

If the interface for fixed mounting is intended for a fixed stationary installation using an additional adapter plate, use of the Quick Mount is no longer allowed. Due to the geometry of the plate, there is a danger that the Quick Mount lock will not function properly. In this case, the use of the Quick Mount must be prevented and the Quick Mount openings on the bottom of the device must be covered by this additional adapter plate

## Installing the 4-Slot Module Rack Cable Management Hooks (without Multi-Measurement Module Mount)

- 1 Remove the three (T20) screws from the bottom of the Module Rack.



- 2 Remove the bottom cover.



- 3 Insert the cable management hooks in the desired position



- 4 Reinsert the bottom cover at the back first and then flip it down.



## 7 Installation Instructions

- 5 Reinsert and tighten the three screws on the bottom cover.

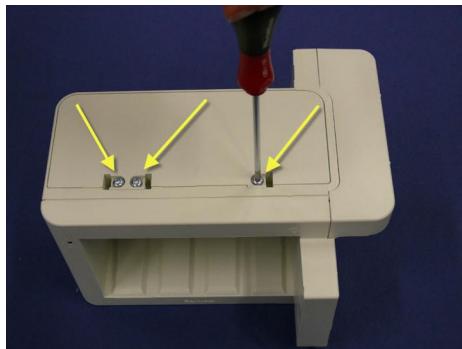


- 6 You can install up to three cable management hooks.



## Installing the 4-Slot Module Rack Cable Management Hooks (with Multi-Measurement Module Mount)

- 1 Remove the three (T20) screws from the bottom cover of the Module Rack.



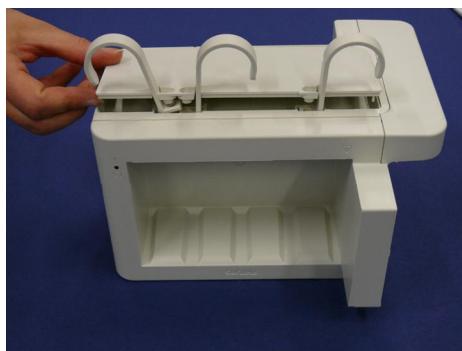
- 2 Remove the bottom cover.



- 3 Install the cable management hooks in the desired position.



- 4 Reinsert the bottom cover at the back first and then flip it down.



## 7 Installation Instructions

- 5 Reinsert and tighten the three screws in the bottom cover.



- 6 You can install as many cable management hooks as you wish.



## Installing the Wired Remote Control

### NOTE

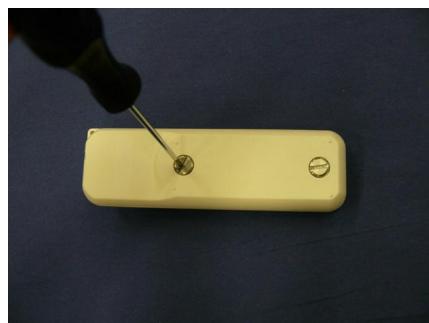
Connection of a remote control requires SW Rev H.0 or higher

The remote control comes with a cradle and USB cable.



To install the remote control:

- 1 Remove the two screws on the back of the remote control.



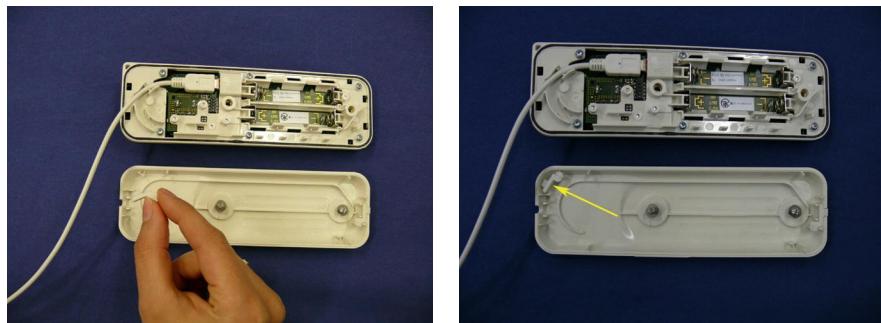
- 2 There are two ways to install the USB cable - at the top of the remote control or at the bottom. If you want to install the cable at the bottom of the remote control, proceed to step 3. To install the cable at the top of the remote control:

- a. Plug the USB cable and lead it through the remote control housing as shown below.

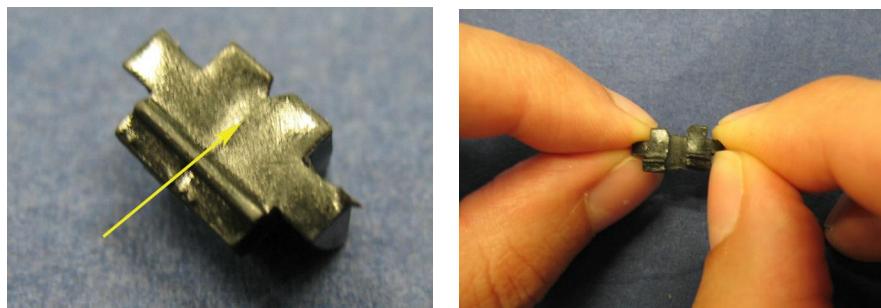


## 7 Installation Instructions

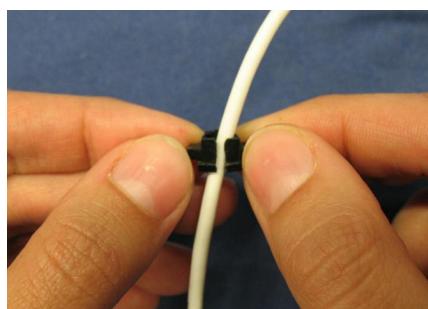
- b. Remove the plastic cover from the top of the remote control rear housing and reinsert it in the corner of the housing as shown below.



- c. Break open the rubber seal for the USB cable at the perforation as shown below.



- d. Insert the USB cable into the rubber seal.



- e. Insert the rubber seal into the cable slot of the remote control housing.



### NOTE

Be sure to always insert the rubber seal when installing the remote control, as it prevents liquid from running into the remote control.

- f. Put the housing of the remote control back together and reinsert the screws.



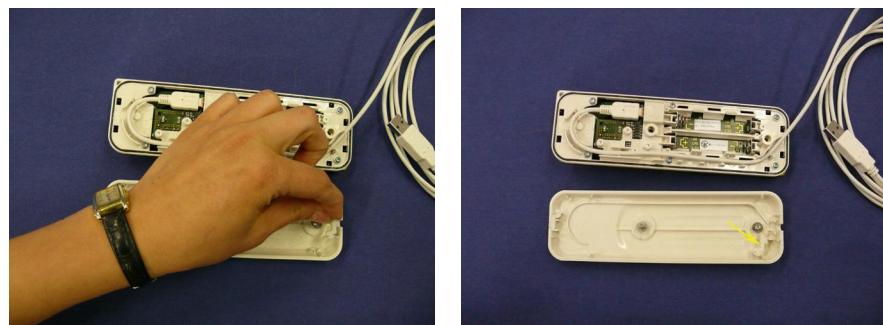
- g. Perform a functional test to ensure the remote control is functioning correctly.

**3** To install the cable at the bottom of the remote control:

- a. Plug the USB cable and lead it through the remote control housing as shown below.



- b. Remove the plastic cover from the bottom of the remote control rear housing and reinsert it in the corner of the housing as shown below.

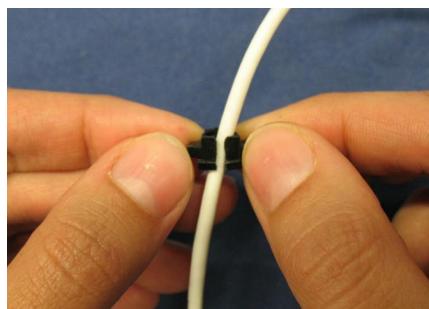


- c. Break open the rubber seal for the USB cable at the perforation as shown below.

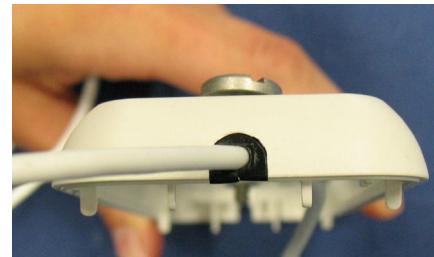


## 7 Installation Instructions

- d. Insert the USB cable into the rubber seal.



- e. Insert the rubber seal into the cable slot of the remote control housing.



### NOTE

Be sure to always insert the rubber seal when installing the remote control, as it prevents liquid from running into the remote control.

- f. Put the housing of the remote control back together and reinsert the screws.



- g. Perform a functional test to ensure the remote control is functioning correctly.

## Mounting the Wired Remote Control

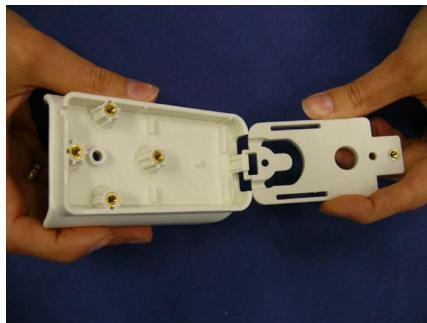
The Remote Control can either be mounted to a wall or with the Universal Mounting Clamp.

To mount the remote control to a wall:

- 1 Remove the screw from the remote control holder.



- 2 Separate the back plate from the remote control holder.



- 3 Insert the USB cable into the holder on the back plate at the desired length.

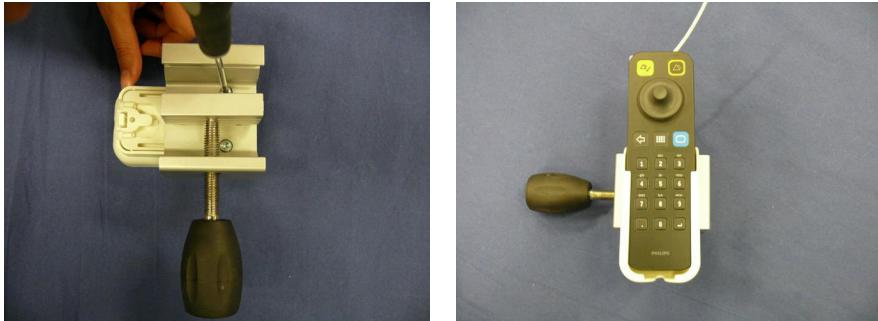


- 4 Screw the holder back plate to a wall and then reattach the holder to the back plate.

## 7 Installation Instructions

To mount the remote control using the Universal Mounting Clamp:

- 1 Ensure the back plate is attached to the cradle
- 2 Screw the Universal Mounting Clamp to the back of the cradle in the desired direction.



- 3 Insert the USB cable into the holder on the back plate at the desired length.

## Installing the Wireless Remote Control

### NOTE

Monitors with a serial number prefix <DE125 require a hardware upgrade to ensure compatibility with the wireless remote control. Order the appropriate hardware upgrade.

In order to use the wireless remote control with the monitor, the remote control must be assigned to the monitor first. To assign a remote control to the monitor:

- 1 Go into Service Mode or Configuration Mode.
- 2 Press the back key for more than two seconds. This initiates the remote control discovery procedure.



The **Add Cableless** key appears instead of the measurement selection key.

- 3 Select the **Add Cableless** key to open the **Add Cableless** window. The Remote Control is shown in the window with a symbol and its label.



- 4 Select the remote control in the window. The monitor displays the assignment prompt message: **cl RC added <clRC serial number>** in the Status Line of the monitor.

### NOTE

- While the remote control discovery procedure is active, the functionality of the remote control is disabled.
- If there is already a remote control assigned to the monitor, this remote control must be unassigned before a new remote control is assigned.

### To remove a remote control:

- 1 Select **Main Setup-> Hardware -> cl Remote Control**
- 2 Select **Remove RemCtrl**
- 3 Select **Confirm** to unassign the remote control

---

**CAUTION**

When using a remote control without a cable, it is important that the user knows which remote control is assigned to which monitor. Use the tethering cable delivered with the remote control to attach it to a bed rail or IV pole, or label the remote control with the bed or monitor ID.

---

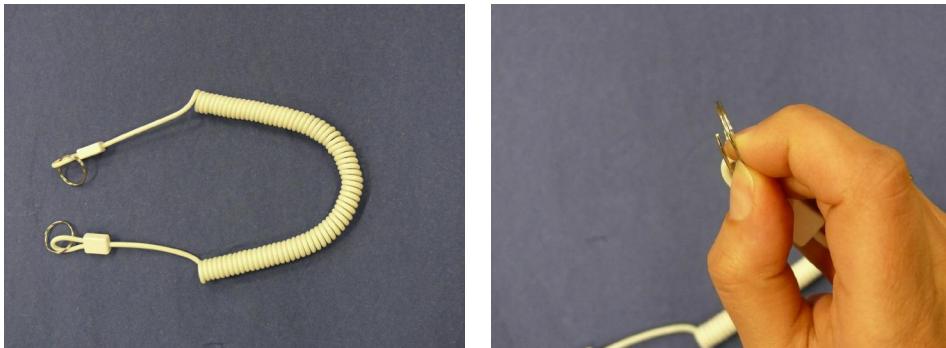
### Wireless Remote Control Assignment Rules

- Only one remote control can be assigned to a monitor at a time. To assign another remote control, unassign the remote control currently assigned.
- Switching from wireless remote control to USB connected remote control operation with the same remote control will lose the assignment to the monitor. Switching back to wireless remote control operation means the remote control must be reassigned.
- If you assign a wireless remote control to a second monitor without unassigning it from the first monitor and then come back to the monitor it was originally assigned to, press the back key on the remote control to start discovery mode. Once the remote control has been recognized by the monitor you can reassign it immediately. It does not have to be removed first.
- An assignment can only be initiated from the remote control itself.
- An unassignment can only be initiated from the monitor.
- If you exchange the battery of a remote control the assignment to a monitor is kept. You do not need to reassign the remote control

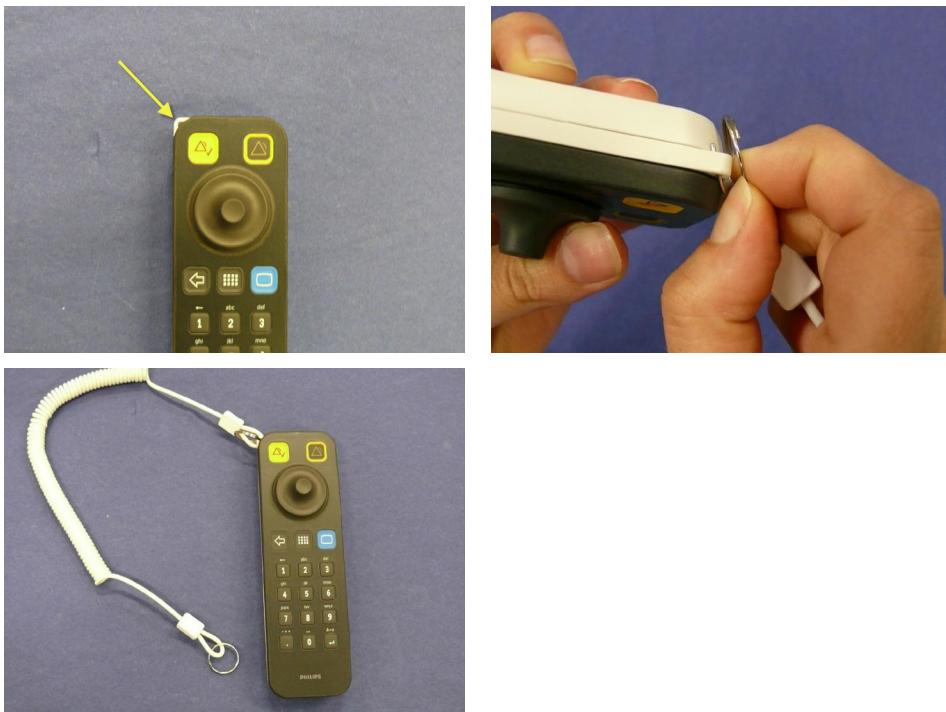
## Installing the Tethering Cable

To attach the tethering cable to a remote control:

- 1 Pull apart the ring on one end of the tethering cable.



- 2 Insert the end of the metal ring spiral into the hole at the top left corner of the remote control.

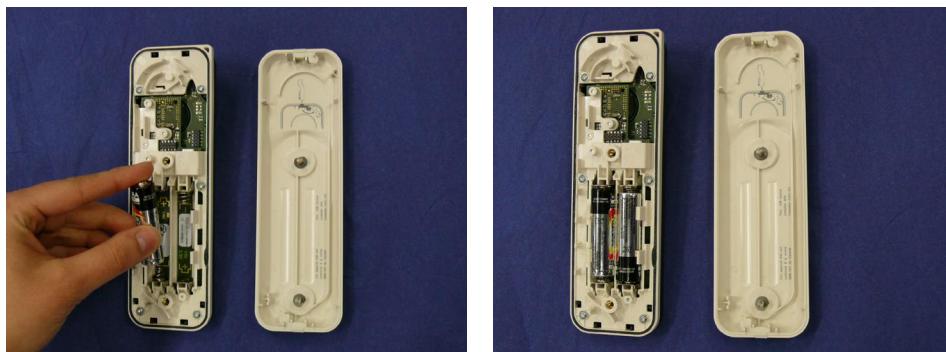


### Exchanging the Remote Control Battery

- 1 Loosen the two screws on the back of the remote control and open the remote control.



- 2 Remove the old batteries and insert the new batteries as shown below.



- 3 Close the remote control and tighten the screws on the back cover.
- 4 Perform a functional test to ensure the remote control is functioning correctly.

#### NOTE

Use only non-rechargeable batteries with the remote control. Never attempt to charge non-rechargeable batteries.

To avoid leaking batteries, replace empty batteries immediately and do not use batteries after their expiration date. When a battery needs replacement, always change both batteries.

When the remote control is not used for a longer period of time, remove the batteries.

## Installing the Remote Alarm Device

- 1 Remove the screw from the connector cover on the bottom of the Remote Alarm Device.



- 2 Slide the connector cover forward to release it and then lift it up.



- 3 Insert the cable into the connector and ensure it clicks into its correct position.



- 4 Close the cover, slide it back into its position, and reinsert the screw.



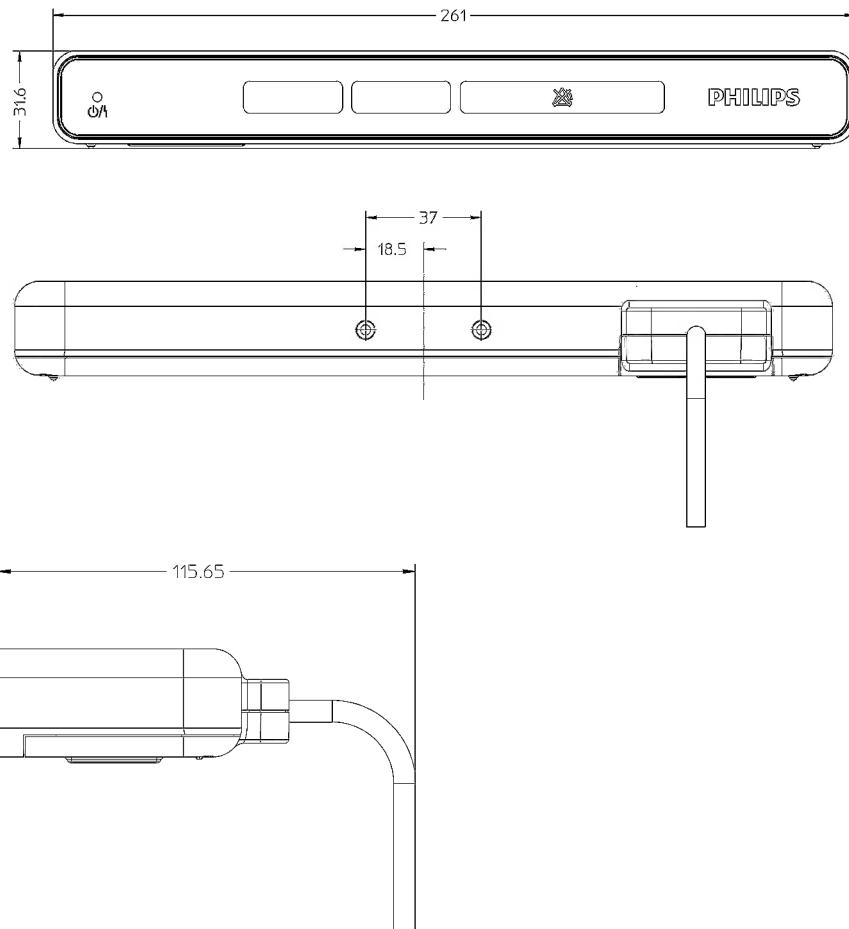
- 5 Connect the other end of the cable to the remote device interface of your patient monitor.

### Mounting the Remote Alarm Device

You can use the Universal Mounting Clamp (M8040-60100/451261030081) or another mounting device of your choice to mount the Remote Alarm Device.

#### **WARNING**

- It is the customer's responsibility to have the attachment of the mounting hardware to the ceiling, wall, or mounting rail and the construction of the ceiling, wall, or mounting rail evaluated for structural integrity and compliance with all local, state and any other required codes by a registered, professional, structural and/or mechanical engineer.
- Ensure that this commitment has been met before assembling mounts.
- Incorrect mounting and use of inappropriate mounting material may lead to injury. It is the customer's responsibility to ensure that the mounting procedures have been performed correctly and the appropriate mounting devices have been used.



## Setting Up Multiple Speakers

Depending on your use model, you may want to configure your monitor to allow muting of alarms at either the remote alarm device **or** at the monitor itself. To do this you must first configure the audio settings in service mode.

### NOTE

Alarms can never be muted at the monitor **and** the remote alarm device at the same time.

- 1 Select **Main Setup -> Hardware -> Multiple Speaker** to enter the Multiple Speaker window.



- 2 The primary speaker is always configured to **Audio 1** and cannot be changed.
- 3 Select **Audio 1** or **Audio 2** for Secondary Speaker. If you select **Audio 1**, the Remote Alarm Device and the Monitor will both behave in the same way, i.e. alarms will **NOT** be mutable. If you set Secondary Speaker to **Audio 2** you can configure the secondary speaker (either the Remote Alarm Device **OR** the monitor) to be mutable. This setting is made in Configuration Mode. See your Configuration Guide for details.

## Installing the HS1-R Barcode Scanner

This section describes how to install and test the HS1-R (2D) Barcode Scanner. It does not apply to the HS1 Barcode Scanner without RFID functionality. The HS1-R Barcode Scanner is easily identifiable by the RFID symbol.



### Supported Barcode Symbologies

The 2D barcode scanner can read the following barcode symbologies:

- Composite Code
- Code 128
- Code 39
- Codabar
- Interleaved 2 of 5
- Code 11
- Code 93
- Matrix 2 of 5
- MSI Plessey
- Straight 2 of 5 (IATA)
- EAN (Default Setting: OFF)
- PDF 417
- UPC (Default Setting: OFF)
- Aztec
- Data Matrix
- Maxicode
- QR Code
- Micro PDF
- RSS-14
- GS1 Formatting

## Installation Instructions

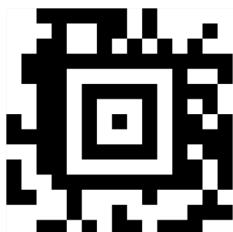
Plug the barcode scanner into the USB connector of your IntelliVue patient monitor. See “[Connection of USB Devices](#)” on page 421 for details. You can use the barcode scanner as provided on delivery, or use the JADAK Programming Service to have it configured to your requirements.

### Using the Barcode Scanner with Default Settings

The Barcode Scanner is preconfigured by the manufacturer with the following default settings:

- **RFID Mode:** RFID-Off
- **Beeper Mode:** Beeper Off
- **Vibration Mode:** Vibrates on positive Reading
- **Keyboard Country:** Keyboard Country US
- **Barcode Symbolologies:** Enable all one and two dimensional codes except for retail symbologies (UPC and EAN)
- **Barcode Formatting:** No additional formatting of barcode like prefix, suffix, carriage return or separators

To reset the barcode scanner to these default settings, scan the following barcode:

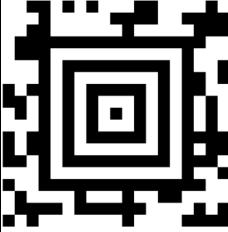


In addition, you can change the settings for RFID, Serial Number Mapping, Beeper Volume and Vibration using the barcodes below.

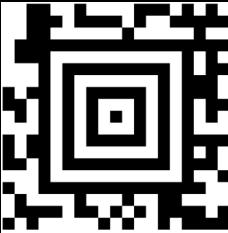
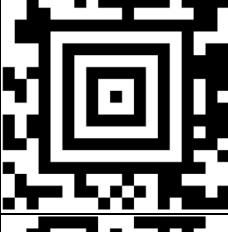
The RFID Reader (only applicable for HS1-R) can work in two different modes:

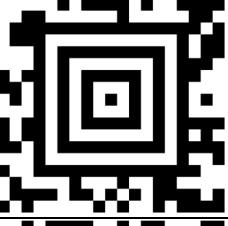
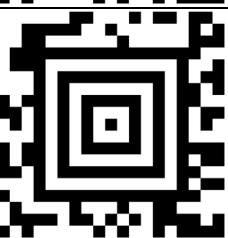
- In compatibility mode, the RFID reader can be used to read the serial number of any supported (ISO14443A/B or ISO15693 compliant) RFID tag. Depending on the Serial Number Mapping setting, the serial number of the tag will be used as one of the following items:
  - OperatorID
  - LocationID
  - MRN
  - Transaction ID
  - FirstName
  - MiddleName
  - LastName
- In standard mode (requires SW Rev. L.0 or higher), the reader additionally supports the IntelliVue ProxiTag (e.g. for assignment of CL pods).

### RFID MODE

	RFID Off
	RFID Compatibility Mode On
	RFID Standard Mode On

### Serial Number Mapping

	No Mapping
	MRN/Lifetime ID
	Transaction ID

	First Name
	Middle Name
	Last Name
	Location ID
	Operator ID

## 7 Installation Instructions

### Beeper Volume

Note that when Beeper Volume is on (High/Medium/Low) the Beeper will only beep on a good reading or during power-up.

	Beeper Off
	Beeper Volume Low
	Beeper Volume Medium
	Beeper Volume High

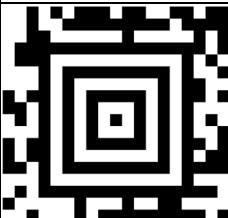
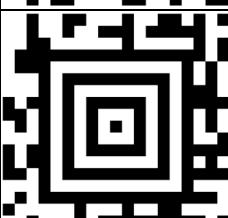
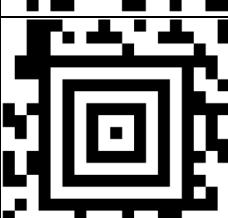
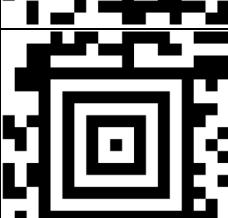
### Vibration

Note that when Vibration is on it will only vibrate on a good reading.

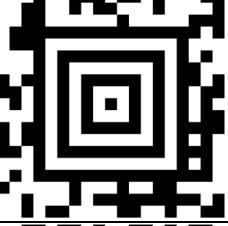
	Vibration Off
	Vibration On

**Keyboard Country**

Scan the appropriate country code below to program the keyboard for your country. For support of special or country-specific characters (e.g. @|\$#{}[]='`<>~äöü), ensure the monitor and the barcode scanner both have the same keyboard country setting.

	English - US
	English - UK
	German - Germany
	French - France
	French - Belgium
	Swedish - Sweden

## 7 Installation Instructions

	Norwegian - Norway
	Danish - Denmark
	Dutch - Netherlands
	Portuguese - Portugal
	Italian - Italy
	Spanish - Spain

## **Using the Programming Service**

The barcode scanner manufacturer JADAK provides a programming service to:

- Simplify the configuration
- Automatically detect the content of the barcode, for example:
  - Operator Id from nurse badge
  - Lifetime or encounter id from patient wristband
  - Location from bed label, and to
- Support 2D barcodes with multiple contents

This service is offered free of charge for customers who purchase bar code scanners through Philips Healthcare.

Should you require JADAK to program the barcode scanner for you, download the Programming Service Request Form (453564567201) from InCenter. and complete it according to its instructions. JADAK will send you a programming barcode containing your requested settings.

### Testing the Barcode Scanner

Use the following procedure to test the 2D barcode scanner. This test checks the scanner's ability to accurately read data and input that information into the monitor.

To perform the barcode scanner test:

- 1 Print the following sample barcodes:

Symbology	Barcode	Expected Output
QR Code		abcd-12345
Aztec		abcd-12345
Code 39	 *987654*	987654
Reduced Space Symbology (RSS)	 (01)00000009876545	0100000009876545

**NOTE**

\*The 01 is displayed as 01 without the parentheses

- 1 Open the Quick Admit menu of your monitor.
- 2 Scan a barcode. The information written below the barcode should appear in the first recommended patient admission field (defined by the ADT Quick Admit configuration). If the barcode information does not appear, see the *Troubleshooting* section.
- 3 Press the Main Screen smartkey to close the menu.
- 4 Repeat steps 2 to 4 for each of the remaining barcodes.

**Cleaning the Barcode Scanner**

- 1 Disconnect the scanner from the monitor.
- 2 Dampen a soft cloth with water (or a mild detergent-water solution). Wring any excess moisture from the cloth.
- 3 Wipe the surfaces of the scanner. If a detergent solution is used, rinse the scanner with a soft cloth dampened with water only.

Reading performance may degrade if the barcode scanner's window is not clean. If the window is visibly dirty, or if the scanner is not operating well:

- 1 Dampen a soft cloth or lens tissue with water (or a mild detergent-water solution). Wring any excess moisture from the cloth.
- 2 Clean the window. If a detergent solution is used, rinse the window with a soft cloth dampened with water only.

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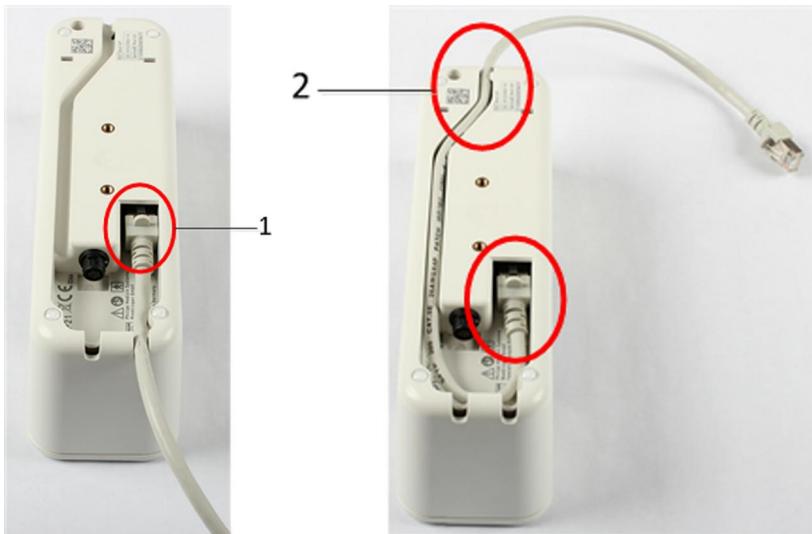
**CAUTION**

Do not submerge the barcode scanner in water. Do not use abrasive wipes or tissues on the scanner's window, as they may scratch the window. Never use solvents (for example acetone, benzene, ether, or phenol-based agents) on the housing or window. Solvents may damage the finish or the window.

---

### Installing the Tympanic Thermometer

- 1 Insert the communication cable into the connector (1) until it clicks into place. Then route the communication cable through one of the channels (2) in the base station.



- 2 Attach the mounting plate or mounting clamp to the base station. See “Mounting the Tympanic Thermometer Base Station” on page 410 for details.
- 3 Insert the thermometer cable into the base station by aligning the white arrows on the cable connector and the base station.



- 4 Route the cable through the strain relief in the base station.



- 5 Insert the probe covers into the base station. Up to two units of 16 probe covers each can be stored within the base station.

- 6 Insert the thermometer into the base station until it clicks into place.



- 7 Insert the other end of the communication cable into the MIB/RS232 port of the monitor.
- 8 Configure the MIB/R232 port at the monitor to iTemp.  
Switch to the Service Mode.  
Select the **Main Setup** SmartKey to open the **Main Setup** window and select **Hardware** from the menu.  
In the **Setup Hardware** window select **Interfaces**.  
In the **Setup Interfaces** window select **iTemp** for the MIB/R232 port.

#### NOTE

When disconnecting the thermometer cable from the base station, DO NOT twist the connector. Pull on the ring of the connector to disconnect the cable.

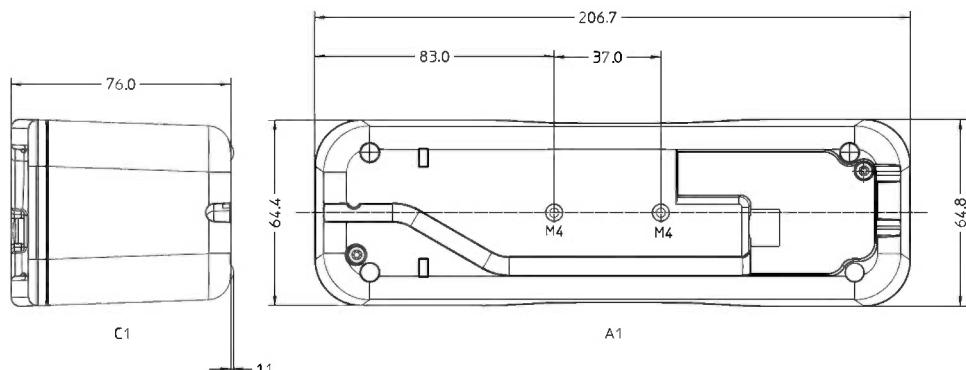
### Mounting the Tympanic Thermometer Base Station

The Tympanic Thermometer can be mounted either to the wall using a mounting plate or to a pole or rail mount using the Universal Mounting Clamp.

The picture below shows as an example, how the mounting clamp is attached to the Tympanic Thermometer Base Station.



**Mounting Interface:**



## Tympanic Thermometer Biotech Mode

### NOTE

To access biotech mode, the tympanic thermometer must be switched off and with no probe cover on the probe.

The biotech function is used to select the operational mode of the thermometer and to verify the installed software version. All operational mode settings in biotech mode are stored in nonvolatile memory and retained through system power cycles, such as changing batteries. All factory calibration parameters are also stored in nonvolatile memory.

The factory default settings are shown below:

Temperature mode	°C (unlocked)
Site mode	Ear
Site text	On

The biotech mode is accessed by pressing and holding the timer and °C/F buttons for four seconds. All LCD segments will light for one second, the thermometer will issue a single beep, and the display will show scrolling dashes. Pressing the timer button cycles through the biotech modes. When options are available within a mode, the °C/F button cycles through the options.



Pressing the timer button after the site text display will return the user to the installed software version. To exit biotech mode, two options are available: (1) press and hold the °C/F and timer buttons for one second, or (2) the device will automatically exit biotech mode after about 30 seconds of inactivity. Any changes are saved.

The biotech mode sequence is shown below:

### Software version

Displays the installed software version of device. Where “00” is the current software version.



### Temperature mode

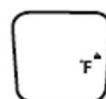
°C (unlocked)



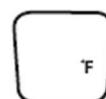
Locked °C



Locked °F

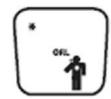


°F (unlocked)



### Site mode

Oral



Core



Rectal



Ear



### Site text

Pressing the °C/F button when in this mode turns the body site text labels on or off. The labels will remain on when an “X” appears inside the box icon, and the text will remain off when the box is empty.



### Installing the G7m Gas Analyzer Module

#### **WARNING**

**Explosion Hazard:** Do not use in the presence of flammable anesthetics or gases. Use of the device in such an environment may present an explosion hazard.

Do not place the device into operation if oxygen leakage is suspected in the vicinity. Stop all oxygen supplies and contact service personnel.

If using a flow regulator, do not use lubricants on the flow regulator.

**Risk of Fire:** Do not introduce drugs or other substances based on flammable solvents, such as alcohol, into the device and do not use explosive anesthetic agents such as ether or cyclopropane or spray them into the device. If highly flammable substances are used for disinfection, adequate ventilation is required.

**Environmental Specifications:** The performance specifications for the gas analyzers, measurements and accessories apply only for use within the temperature, humidity and altitude ranges specified.

**Liquid Ingress:** If you spill liquid on the equipment or accessories, or they are accidentally immersed in liquid, contact your service personnel or Philips service engineer. Do not operate the equipment before it has been tested and approved for further use.

#### **CAUTION**

If the gas analyzer has been stored at temperatures below freezing, it needs a minimum of 4 hours at room temperature to warm up before any connections are made to it.

The environment where the gas analyzer is used should be free from vibration, dust, corrosive or explosive gases, and extremes of temperature and humidity.

The gas analyzer operates within specification at ambient temperatures between 10°C and 40°C, approximately 2.5 minutes after plugging it in. Ambient temperatures that exceed these limits could affect the accuracy of this instrument and cause damage to the components and circuits.

Avoid any restriction or blockage of air flow as this could cause overheating of the gas analyzer and result in injuries.

Use the following procedure to install the gas analyzer module:

- 1 Insert the IntelliVue G7m Gas Analyzer module into the Module Rack or integrated module slot of the patient monitor (not compatible with the internal slots of MP60/MP70).
- 2 Ensure a water trap is attached to the gas analyzer

**CAUTION**

Never run the gas analyzer without the water trap attached. Sucked in dust or cleaning agents may distort measurement results, or irreparably damage the instrument.

- 3 Switch on the IntelliVue patient monitor as described in the monitors Instructions for Use. A warm up period of typically 2.5 minutes takes place, during this time the INOP <Gas Analyzer> **Warmup** is displayed on the monitor.
- 4 Observe the indications given by the patient monitor.
- 5 After 30 minutes the zero calibration starts automatically. For information about the calibration process and status, see *Zero Calibration* in the *Instructions for Use*. Wait until the G7m has been successfully calibrated. In this case the G7m is ready to use and the formerly displayed INOP <Gas Analyzer> **Zero Running** disappears from the patient monitor's screen. In the case where a zero calibration fails, one or two further zero calibration attempts may be performed automatically. If all the zero calibration attempts fail, the INOP: <Gas Analyzer> **Zero Failed** is displayed. In this case, see *Patient Alarms and INOPs*.

**Gas Analyzer Module Orientation**

The gas analyzer module operates in two mounting orientations – Horizontal and Vertical.

Dependent on the module orientation the water trap must be rotated into the vertical position. If the water trap is not in the correct (vertical) position the gas analyzer will not start and an INOP **Align Watertrap** is displayed. After the water trap has been placed in the correct position the INOP is cleared and the gas analyzer can start.

Deviations of  $\pm 15^\circ$  from the optimum position are allowed and tolerated.

**Returning the Gas Sample**

You will need the following equipment to return the gas sample to the anesthesia circuit:

Equipment	Part Number	Comments
Gas Exhaust Return Line	M1655B	Tubing includes two parts: Tube A = 300 cm long Tube B = 30 cm long
Gas Exhaust Return Filter	M1656B	Single patient use only
Gas Exhaust Tubing	M1015-40001	Multi-Patient use

### Setting Up the Gas Return

- 1 Fit the shorter tube tightly to the female side of the filter. Shorten the tube if it is worn or does not fit tightly onto the filter.

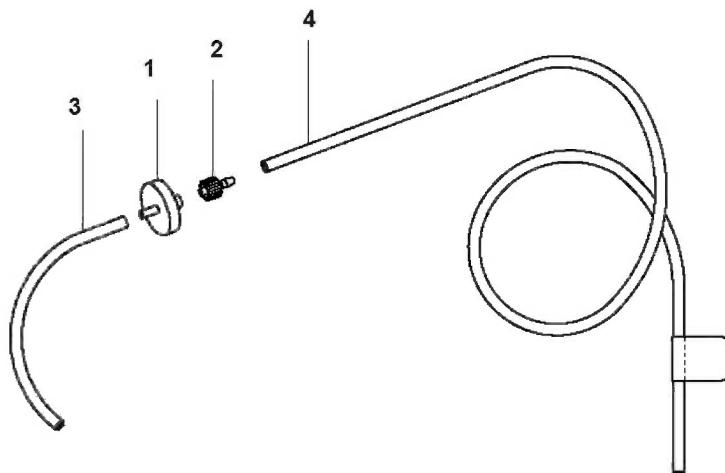
#### NOTE

When using the M1656B Gas Exhaust Return Filter with an old M1655A Gas Exhaust Return Line, you must cut off the connector of the shorter tube first before connecting to the filter.

- 2 Fit the female connector (2) of the longer tube to the male side of the filter.
- 3 Fit the open end (4) of the longer tube to the Anesthetic Gas Exhaust outlet.
- 4 Fit the open end (3) of the shorter tube to the ventilation circuit.

#### NOTE

Ensure the sample gas is routed through the CO<sub>2</sub> absorber before going back to the patient.



#### Legend

- |   |   |
|---|---|
| 1 | M1656B Gas Exhaust Return Filter                            |
| 2 | Female connector  |
| 3 | Shorter tube connecting to the ventilation circuit          |
| 4 | Longer tube connecting to the Anesthetic Gas Exhaust Outlet |

## Removing the Gas Sample

To remove the gas sample from the anesthesia circuit, a scavenging system must be connected to the gas analyzer's Anesthetic Gas Exhaust. If you intend to use a scavenging system with the gas analyzer, one of the following parts must also be connected to protect it against malfunction:

- 1 A ventilator reservoir where the suction pressure does not exceed 70 mbar or
- 2 A scavenging interface, properly set and maintained (see the scavenging interface manufacturer's instructions).

### NOTE

If you are not returning the gas sample into the patient's breathing circuit, install the M1655B Exhaust Return Tubing without the M1656B Exhaust Return Filter, shorter tube and the luer lock fitting. See the *Instructions for Use* provided with the tubing and filter for further details.

## Setup and Configuration Procedures

This section describes final setting up and configuration procedures that must be completed after the gas analyzer is connected to the monitor and before the gas analyzer is used for monitoring.

### Altitude Configuration

The altitude setting for the monitor is important as it is used as a reference to check the gas analyzer ambient pressure measurement.

### Connect Sample Input Tubing

Connect the sample input tubing to the water trap. For details, see the Patient Monitor Instructions for Use.

### Connecting the Monitor to AC Mains

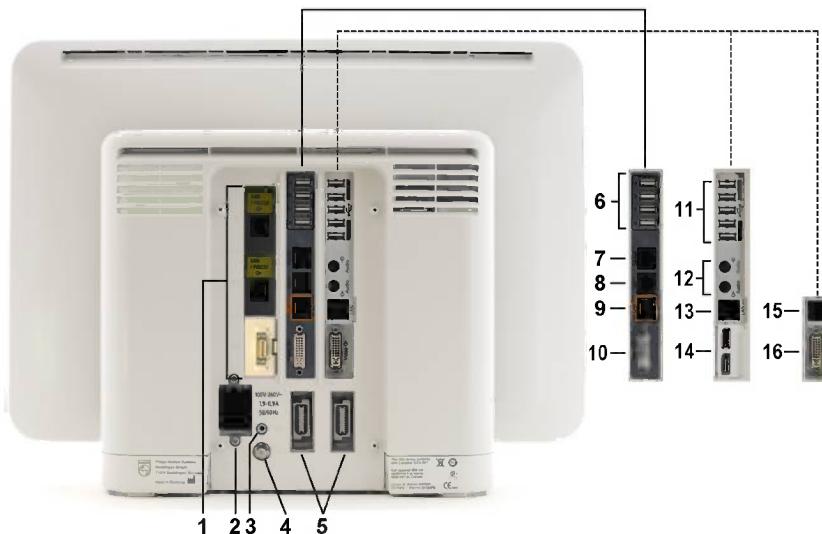
The monitor has a wide-range power supply that allows you to operate the monitor from an AC (alternating current) power source of 100 V to 240 V ( $\pm 10\%$ ) and 50/60 Hz ( $\pm 5\%$ ).

#### **WARNING**

- Always use the supplied power cord with the earthed mains plug to connect the monitor to an earthed AC mains socket. Never adapt the mains plug from the power supply to fit an unearthing AC mains socket.
- Do not use AC mains extension cords or multiple socket-outlets. If a multiple socket-outlet without an approved isolation transformer is used, the interruption of its protective earthing may result in enclosure leakage currents equal to the sum of the individual earth leakage currents, so exceeding allowable limits.
- Do not connect any devices that are not supported as part of a system.
- Any non-medical device placed and operated in the patient's vicinity must be powered via an approved isolation transformer that ensures mechanical fixing of the power cords and covering of any unused power outlets.
- The On/Standby switch does not disconnect the monitor from the AC power source. To disconnect, unplug the power cable.
- Always ensure that the monitor is positioned so that the AC power plug is easily accessible, to allow disconnection of the monitor from the AC power source.

## Connections

The following figure shows the cable and interface board connections:



No.	Description
1	Serial/MIB (RS232) connectors, type RJ45, Flexible Nurse Call, or Remote Device Interface (not shown)
2	AC power input
3	Protective earth screw hole
4	Equipotential ground connector
5	Main measurement links (MSL)
6	USB rear connectors (for remote control, keyboard, pointing devices, printer)
7	Serial RS232 connector
8	Nurse Call
9	Wired network connector
10	Video out connector (digital/analog)
The following connectors are only present with the iPC	
11	USB rear connectors (for keyboard, pointing devices, printer)
12	Audio in/out
13	Local Area Network
14	Two independent Video out connectors (DisplayPort) (iPC Version 2*) or Video out connector (digital/analog) (iPC Version 1*, not shown)
The following connectors are only present with the Independent Display Interface	
15	Serial RS232 connector for touch
16	Video out connector (digital/analog)

\* Version 1 (#PC0) has one iPC DVI connector on the rear of the monitor, while Version 2 (#PC1) has two iPC display ports. See [“Exchange Parts” on page 330](#) for full details.

## 7 Installation Instructions

### NOTE

- For installation of software on the iPC, see the documentation provided with the software you want to install.
- If an iPC is installed, the video interface of the connector board is disabled.



1 ECG Sync Output/Analog ECG output connector



1 USB side connector (only present with the iPC)

## Video Interface on the Connector Board

### NOTE

- The DVI video interface on the connector board has slave display capability only. For a second independent display, the Independent Display Interface is required. Slave displays must have the same resolution as the MX800's built-in display. If you connect a slave display with a different resolution, you may see distortion or black bars on the edge of your screen.
- The slave display capability is not supported if an iPC is installed. Use one of the iPC's independent graphic outputs instead.

The video timing of the DVI video interface differs slightly from the VESA standard. Compatible displays are:

- Fimi P240LT
- Fimi P240L

## Audio Interface (for iPC only)

The audio interface does not provide an electrical separation. When connecting an audio device which uses an additional power supply e.g. an active speaker, a separation device according to IEC/EN 60601-1 edition 3 clause 16 is required. After installation, a system test is required to ensure that the resulting equipment leakage current does not exceed the limits of IEC/EN 60601-1 edition 3 clause 16. For detailed information see the *Testing and Maintenance* chapter.

## Connection of Devices via the RS232 Connector on the Connector Board

The following devices can be connected to the RS232 connector on the connector board:

- IntelliVue G1 Anesthetic Gas Module
- IntelliVue G5 Anesthetic Gas Module
- M1026B Anesthetic Gas Module
- Barcode Scanner
- Touchscreen

### NOTE

The RS232 connector on the connector board has no data export capability

### Connection of Devices via the MIB/RS232 I/O Board

The configuration of a specific MIB/RS232 port can be viewed in config mode and altered in service mode. This is required, for example, when a slave display with touchscreen is installed. To alter the configuration of an MIB/RS232 port select **Main Setup** then **Hardware** then **Interfaces**. You can configure **GM**, **Touch 1** and **Touch 2** to the MIB/RS232 port.

**Data Out** can be configured up to two times (on two or more MIB/RS232 boards), but cannot be assigned. The:

- First MIB/RS232 port configured to **Data Out** (i.e. the first one to receive a request) provides wave AND numeric export.
- Second MIB/RS232 port configured to **Data Out** exports ONLY numerics.

#### NOTE

Be aware that if you change a port assignment this assignment is not reset upon boot up. If the MIB/RS232 board is removed and replaced with a different type of board the settings are deleted. If the MIB/RS232 board is then refitted, you must reconfigure the MIB/RS232 port. The configuration of MIB/RS232 is not cloned between monitors. **GM** can only be configured **once** to an MIB/RS232 port.

## Connection of USB Devices

The USB ports on the connector board support the following USB devices:

- printer (restrictions apply. See “[Compatible Printers](#)” on page 425 for details.)
- keyboard
- barcode scanner
- computer mouse or trackball
- remote control

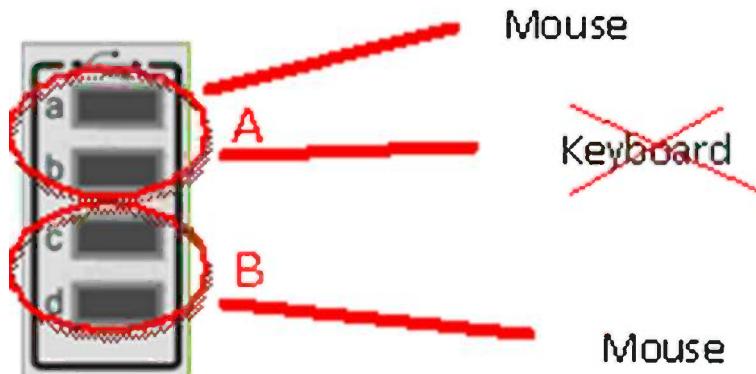
### NOTE

- Connect only the above mentioned devices to the USB Interface. Other devices are not supported.
- Connection of a remote control requires SW Rev H.0 or higher
- A remote control is treated as a keyboard. Either a remote control or a keyboard can be connected to one group.

### CAUTION

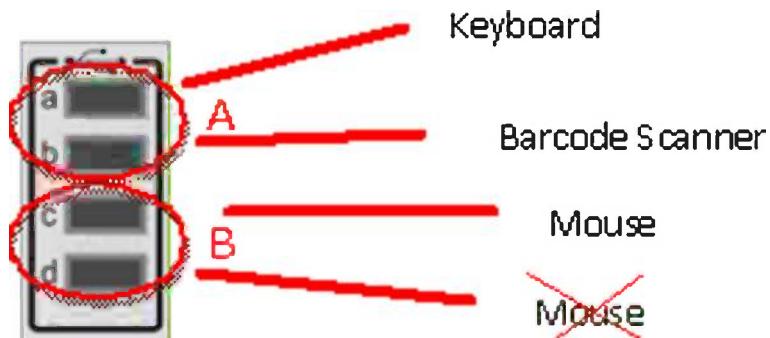
- Non-medical grade IT equipment used in a medical environment could be adversely impacted by other devices (for example because of electromagnetic susceptibility).
- After connecting peripherals to the monitor, make sure that the system complies with all relevant local regulations.
- Do NOT connect a remote control to a USB connector on the iPC (including the side USB Connector) as it will not function properly. To ensure you have connected the remote control to the connector board and not the iPC, press the SmartKeys button on the remote control. The SmartKeys window should appear. If it does not, check the USB connection of the remote control.

As the patient monitor software only supports two input devices, only two input devices can be connected to the USB ports on the connector board. For this purpose, the USB ports are divided into two groups, "A" and "B". Only one input device per group is allowed. In the graphic below, a mouse is connected to a port in each group. Therefore the keyboard is not recognized.



## 7 Installation Instructions

It is, however, possible to connect a mouse, a keyboard and a barcode scanner. In this case, the keyboard and barcode scanner are treated as one input device and must be connected to two ports of the same group.



### NOTE

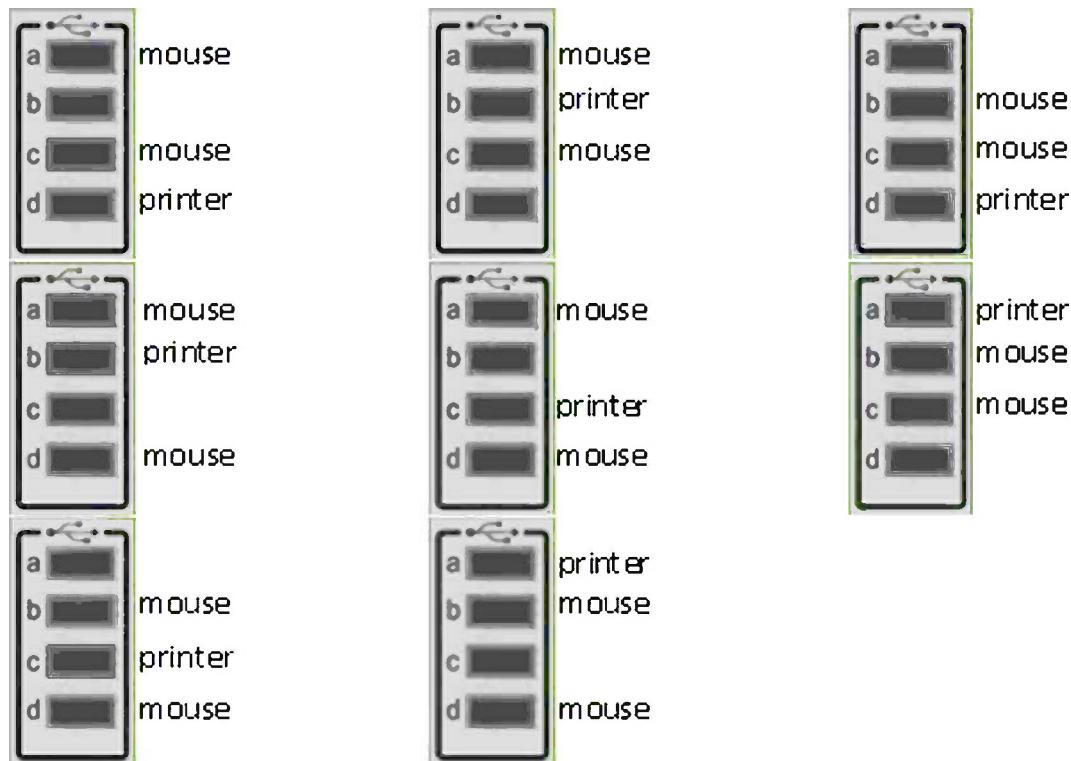
Other USB devices, e.g. USB sticks, iPods etc. are not supported by the USB IF board. **Do not** use USB adapters to connect PS/2 or other devices to the USB board.

## Possible USB Device Combinations at the Connector Board

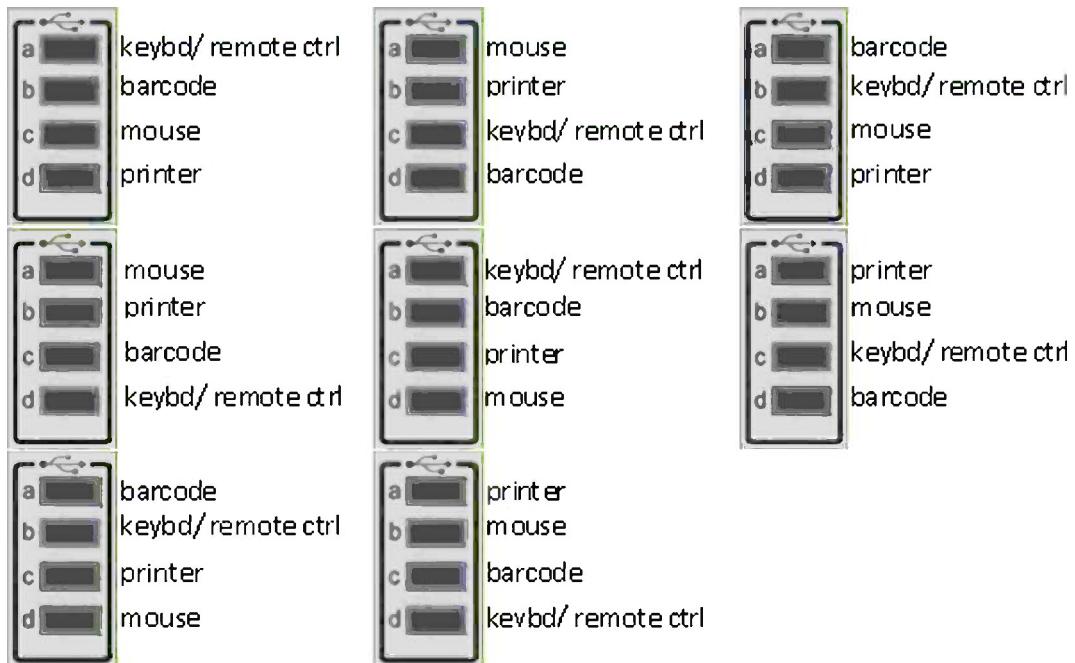
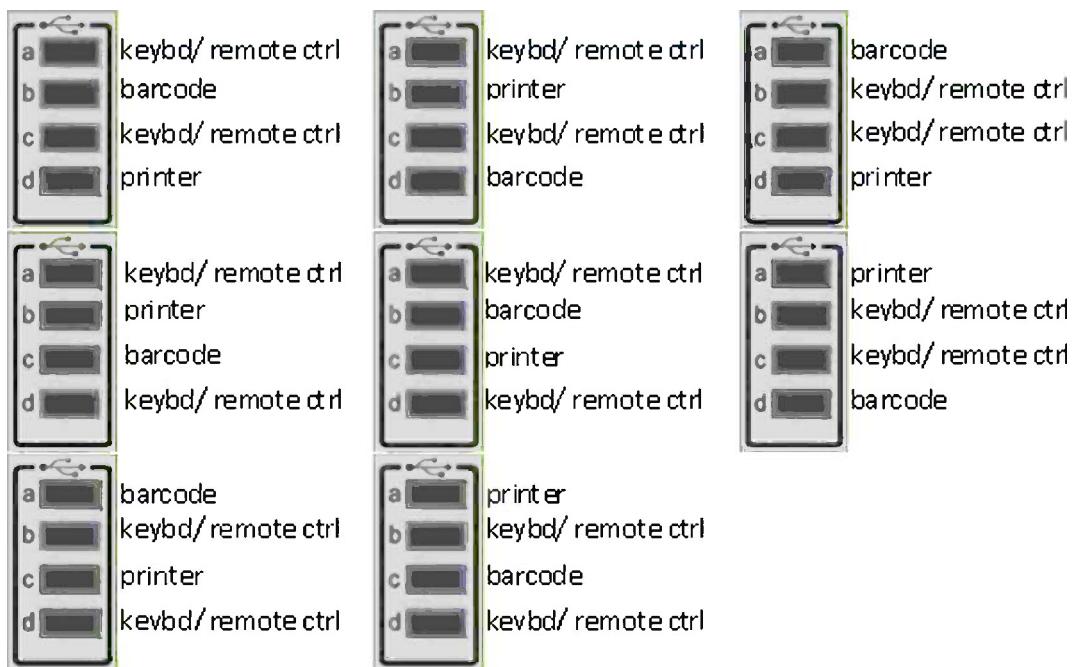
The following three groups of USB device combinations are supported:

- mouse/mouse combination
- keyboard/mouse combination
- keyboard/keyboard combination.

The figures below show the possible device combinations for each of the three groups.



Possible Mouse/Mouse combinations

*Possible Mouse/ Keyboard combinations**Possible Keyboard/ Keyboard combinations***NOTE**

Every time a new device is connected to the USB ports, all connected USB devices are stopped and the ports are scanned. Depending on whether the combination is allowed or not, the devices will function again after the scan.

Combined input devices such as a keyboard with an integrated trackball are also supported. However, no additional mouse can be connected in this case. Multiple combined devices are also not allowed.

### CAUTION

The USB ports do not provide an electrical separation. Either the USB device has to provide the required separation according to IEC60601-1 or a separation device has to be used. For the calculation of the Working Voltage of the required separation a voltage of 100 V inside the IntelliVue Patient Monitors has to be taken into account. The resulting Medical Electrical System, i.e. the combination of the USB device and the IntelliVue Patient Monitor, has to comply with and has to be tested according to IEC 60601-1 3rd edition including but not limited to clause 16. For detailed information see the *Testing and Maintenance* chapter.

## Possible USB Device Combinations at the iPC

The iPC is treated as a regular PC device. There are no specific rules for the connection of USB devices. For more information about connecting peripherals to the iPC, see “[Peripherals](#)” on page 498.

You can connect input devices to the rear connectors of the iPC or to the front USB connector and use them for the iPC. Input devices connected to the iPC can also be shared with the patient monitor. Sharing input devices and touchscreen input requires a specific software application; see the *IntelliVue XDS Application Instructions for Use* for details.

If the iPC is switched off when input devices are shared, any input devices connected to it will not be available for use with the monitor.

### CAUTION

The USB ports do not provide an electrical separation. Either the USB device has to provide the required separation according to IEC60601-1 or a separation device has to be used. For the calculation of the Working Voltage of the required separation a voltage of 100 V inside the IntelliVue Patient Monitors has to be taken into account. The resulting Medical Electrical System, i.e. the combination of the USB device and the IntelliVue Patient Monitor, has to comply with and has to be tested according to IEC 60601-1 3rd edition including but not limited to clause 16. For detailed information see the *Testing and Maintenance* chapter.

## Configuring the USB Interface for Use with a Programmable Barcode Scanner

- |   |   |
|---|---|
| <b>Requires SW<br/>Rev. H.0 or<br/>Higher</b> | If you want to use a programmable barcode scanner, the USB Interface group you want to connect the barcode scanner to must be configured to Barcode.<br><br><ol style="list-style-type: none"><li>1 Go into Service Mode.</li><li>2 Select <b>Hardware -&gt; Interfaces-&gt;USB</b></li><li>3 Select the <b>Change Setting</b> key</li><li>4 Change the setting to <b>Barcode</b> and select the <b>Done</b> key.</li></ol> |
|---|---|

### NOTE

A programmable barcode scanner must be pre-configured to provide the codes in the correct form to the monitor. Refer to the Installation Note 'Installing and Testing the 4600g Barcode Scanner' on the IntelliVue Documentation DVD for details.

## Compatible Printers

Printers connected to the USB port of the monitor require native PCL5 capability or higher.

The following printers have native PCL5 capability or higher and work when plugged into the USB port on IntelliVue Patient Monitors:

- HP LaserJet Pro 400 M401
- HP LaserJet Pro 400 M451dn (color)
- HP LaserJet Enterprise P3015dn
- HP LaserJet P2050 Series models (P2055d, P2055dn and P2055x)

If your selected printer has a comparable specification to the printers listed above, it is very likely the printer will work with the IntelliVue Patient Monitor when connected to the USB port of the monitor.

### NOTE

- Some printers ship with the "HP Smart Install" feature enabled. In these cases, the printer will not be identified by the monitor and the "HP Smart Install" feature must be disabled. For further details on how to disable the "HP Smart Install" feature, see the documentation which ships with the printer. After disabling the "HP Smart Install" feature, the printer must be power cycled in order to make the printer work with the monitor.
- In rare cases, a specific native PCL5 or higher printer may not be supported. This is typically caused by different printer firmware implementations of the printer manufacturers. Philips recommends testing the functionality of any printer before installation.
- Printing a report on both sides of a page is not supported.

## Installing Remote Devices

This section provides instructions for Philips products. Installation instructions for devices not sold by Philips must be provided by the device manufacturer.

## Hardware Settings

- This section lists settings grouped in the Hardware Settings Block which are available in Service Mode. These settings are set once per monitor and are the same in every profile. Any changes made to the hardware settings configuration are automatically stored, there is no need to save them in an extra step. Hardware settings must be entered for each monitor individually, they are stored in the monitor, and they are not cloned. To enter the hardware settings menu, select **Main Setup -> Hardware**.
- Keyboard - this setting enables you to select the language of the keyboard connected via USB. See the USB Keyboard/Mouse sections in this chapter for details.
- Setup Video - this setting allows you to set the correct display resolution for the external displays and to choose between the basic (black background) or classic (photo of nurse and child in the background) standby/boot screen.

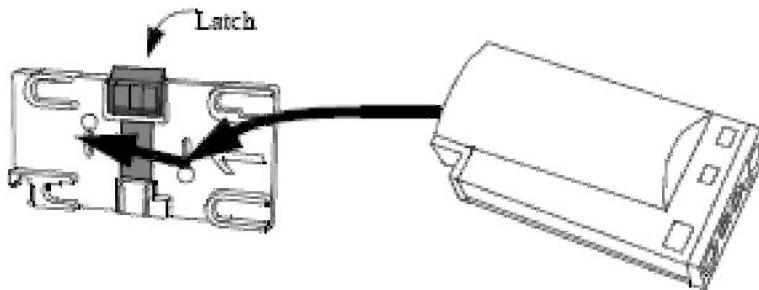


- MIB/RS232 - see "[Connection of Devices via the MIB/RS232 I/O Board](#)" on page 420 for details.

### Module Rack and/or Multi-Measurement Module

#### Attaching the Multi-Measurement Module to a Mount

- 1 Ensure the Multi-Measurement Module is oriented correctly relative to the mount (see the picture below).
- 2 Place the Multi-Measurement Module on the back mount. If it is not tight against the mount, slip it in the direction of the measurement connectors until it is.
- 3 Slip the Multi-Measurement Module forward until it clicks into place.



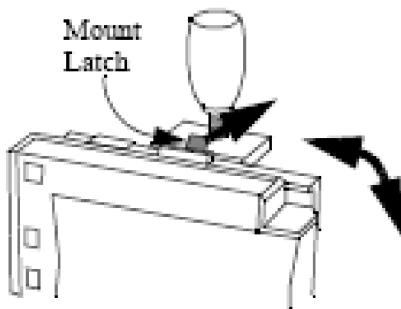
#### Detaching the Multi-Measurement Module from a Mount

- 1 Press and hold the latch (in the middle at the top of the mount) away from the Multi-Measurement Module.
- 2 Slide the Multi-Measurement Module off the mount in the direction of the measurement connectors.

#### Positioning the Multi-Measurement Module on a Clamp Mount

If you have your Multi-Measurement Module on the clamp mount, you can have it in one of four positions. You can reposition it as follows:

- 1 Press and hold the mount latch toward the clamp screw.



Rotate the Multi-Measurement Module and mount until you get it to the position you want.

- 2 Release the mount latch, and ensure it is clicked into one of the four slots on the back of the mount.

**Mounting the Multi-Measurement Module Mount to the Module Rack (M8048A)**

- 1 Connect the Multi-Measurement Module Mount to the Module Rack and snap it into place.



- 2 Insert and tighten the screw at the bottom of the Module Rack.

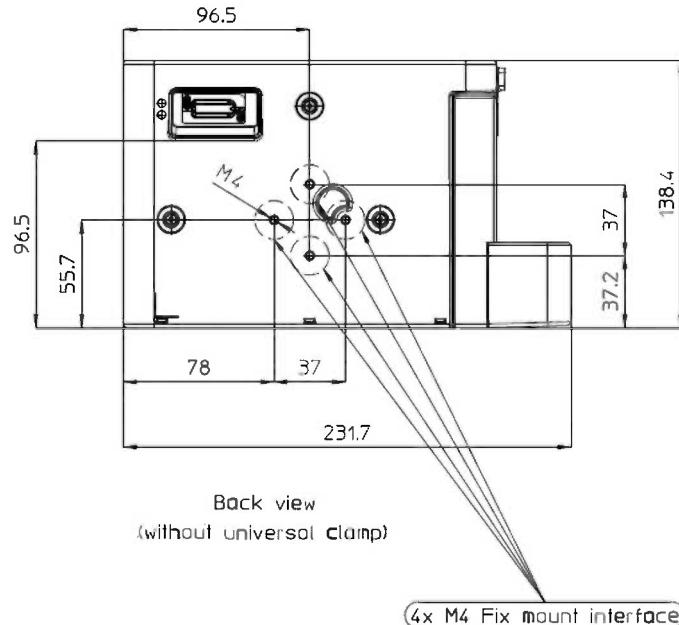


### Mounting the Module Rack

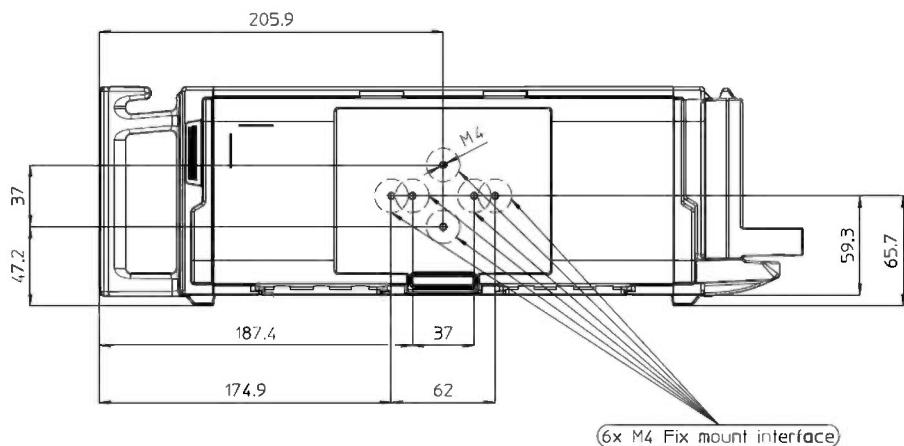
A universal clamp for vertical rail or pole solutions ships with each Module Rack.



**Module Rack-4 Mounting Interface without Universal Clamp:**



**Module Rack-8 Mounting Interface without Universal Clamp:**



### Connections

The cable specifications and part numbers for through wall solutions of the M8048A FMS-8, 865243 FMS-4 and M3001A/AL are described in the *Site Preparation* section of this manual.

## MSL Cable Termination

The following installation procedure describes how to install the wall installation cable kit when the patient monitor and the Multi-Measurement Module are not located at the same site. The kit consists of two connector boxes and a cable (15m or 25m).

For this procedure you need the insertion tool (M3086-43801) and a small screwdriver.

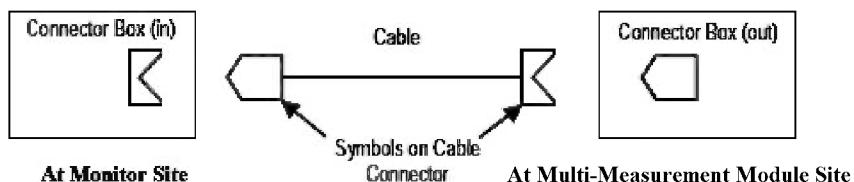
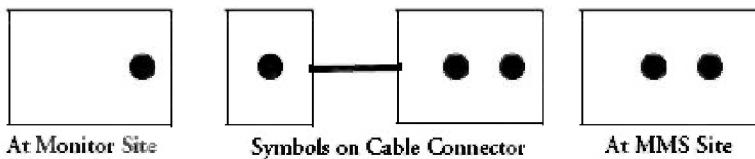
- 1 Draw the MSL cable through the wall from the site of the monitor to the site of the Multi-Measurement Module.

Each MSL face plate kit contains two connector boxes; one in-going and one out-going. (The US version contains an additional rectangular wall-mounting plate).

### NOTE

The installation procedure is the same for both connector boxes. This means you must perform steps 3 to 8 of this procedure twice.

The connectors on each box are different, so you must ensure that the correct box is placed at the correct location. The dots on the plastic angled cover indicates at which site you should install the box:



If there are no dots on the cover, symbols are used:

Symbol:  $\square$  is connector box (in) and must be placed at the monitor site.

Symbol:  $\triangle$  is connector box (out) and must be placed at the Multi-Measurement Module site.

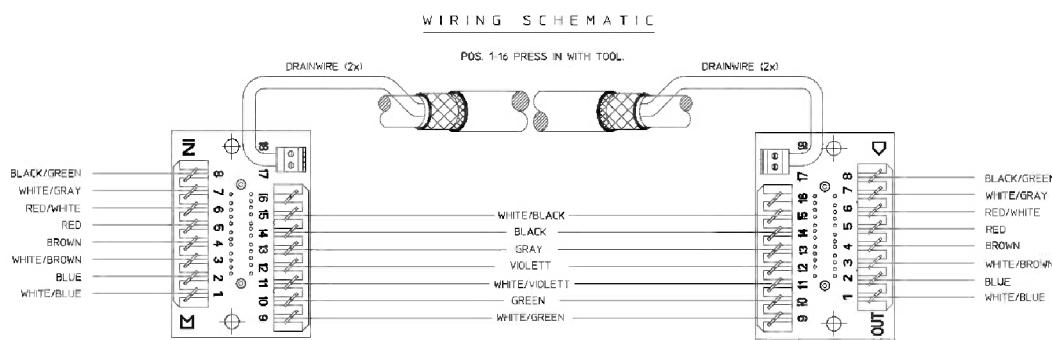
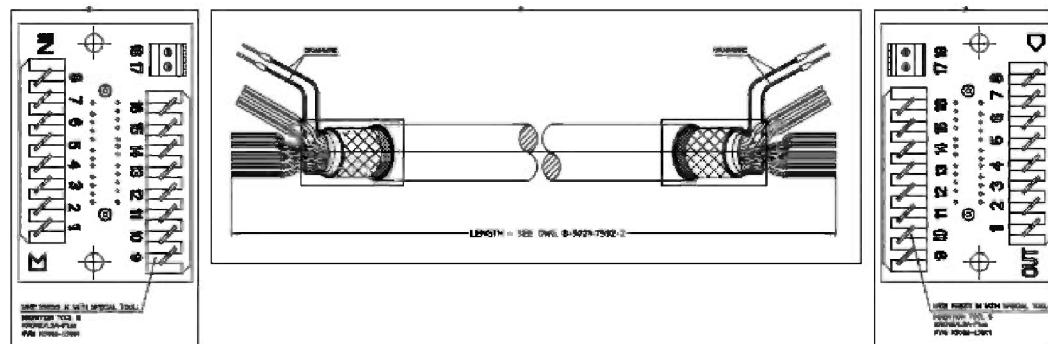
The correct connector cable (M3081-61601, M3081-61602 or M3081-61603) has the opposite symbol:

- 2 Detach the PCB assembly (in/out) from the metallic mounting flange.
- 3 Use the Insertion Tool (M3086-43801) to position each wire on the PCB according the wiring schematic below, where each color corresponds to a number.

## 7 Installation Instructions

### NOTE

The Insertion Tool should be set to cutting mode on.



*Wiring Schematic*

- 4 Use a small screwdriver to connect the two drain wires to the PCB.
- 5 Slide the PCB back on to the metallic mounting flange.
- 6 Use screws to fasten the mounting flange to the wall.

### NOTE

US version only: Fasten the rectangular wall-mounting plate to the wall. Attach the mounting flange to the wall-mounting plate.

- 7 Mount the plastic cover. The plastic cover consists of two pieces:

- Frame
- Angled cover

Put the frame over the mounting insert and the PCB. Place the angled cover on top and fasten with two screws.

- 8 Connect the monitor and the Multi-Measurement Module to the wall installation.
- 9 Perform the following tests as described in the Test and Maintenance section of this manual:
  - Power-on test blocks
  - Safety test blocks
  - ECG Sync Performance Test

## Clinical Network (Wired and Wireless)

Creating a network solution to support patient monitoring system data is a significant undertaking. The network must be designed to support real-time transmission of patient waveforms, data, and alarms on an uninterrupted and continuous basis.

Philips can deploy a patient monitoring system in one of two ways:

- 1 Some customers prefer to purchase a patient monitoring system that includes a Philips-provided network switching infrastructure. These systems are known as a Philips-Supplied Clinical Network (PSCN).
- 2 Other customers prefer to run their patient monitoring system on the hospital's existing network infrastructure. These types of systems are known as a Customer-Supplied Clinical Network (CSCN).

See the appropriate PSCN/CSCN documentation when connecting bedside devices to an IntelliVue Information Center via PSCN or CSCN infrastructure.

For creating network solutions that connect to systems other than an IntelliVue Information Center, see the documentation of the respective systems.

---

### **WARNING**

In order to maintain the galvanic isolation of the IntelliVue monitor, it is essential that UTP (Unshielded Twisted Pair) LAN cables is used to connect the IntelliVue monitor to other devices.

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### IntelliVue Instrument Telemetry (IIT)

Frequency Coordination (USA only):

Frequency coordination is a registration and coordination process for wireless medical telemetry devices used in the U.S.A. which operate in the FCC-allocated Wireless Medical Telemetry Service (WMTS) bands (608-614 MHz, 1395-1400 MHz, 1427-1432 MHz). The 865240 #J45 operates in both of the 1395-1400 and 1427-1432 MHz bands.

Under U.S. Federal Communications Commission (FCC) rules, authorized healthcare providers must register their WMTS devices with an authorized Frequency Coordinator designated by the FCC. The American Society for Healthcare Engineering (ASHE) is the current designated Frequency Coordinator.

Registration/Coordination is a two-step process.

**Step 1: Registration:** Register the healthcare facility on-line, from the ASHE website). Click on the link for Wireless Medical Telemetry Service and come to the registration page. Fill out the details, and pay the associated fee as per the instructions provided. You will receive confirmation of this registration. Confirmation must be received before proceeding to the next step.

**Step 2: Frequency Coordination:** Along with confirmation of registration, you will receive access information necessary to perform this second step, frequency coordination. This step involves logging the equipment and frequencies used into the FCC's database, so as to identify any existing potential interference and to help prevent potential future interference. Coordination is accomplished via the ASHE website. Click on the links for Wireless Medical Telemetry Service and then Frequency Coordination. The coordination process must be repeated twice: once for the 1395-1400 MHz band, and then again for the 1427-1432 MHz band. Both of these are used concurrently by the Philips product. There is a separate fee for each coordination request, which varies, depending on the number of transmitting devices used and the band(s) of operation. Coordination is executed by a company named Comsearch, on behalf of ASHE.

The following information is required in order to complete the frequency coordination forms:

- The county.
- Latitude and longitude that represents the center of the area where the transmitting devices will be deployed. Comsearch can help provide this information; [www.comsearch.com](http://www.comsearch.com) provides contact information.
- The name/s of the Clinical Unit/s using the devices (e.g. ICU4, CCU-West, ER1, Step-Down North, etc.)
- The radius of deployment, expressed in meters. Imagine drawing a circle around the center of the clinical unit, that encloses/encompasses the unit. What is its radius?
- The number of the highest floor on which a transmitting device will operate.
- How many transmitting devices will be used, i.e. the total number of IntelliVue Instrument Telemetry adapter devices combined.
- The Effective Radiating Power: 6.3 mW.
- The Equipment Manufacturer: Philips Medical Systems.
- The Model numbers: 865240 #J45 IntelliVue Instrument Telemetry adapter used with 865240 (MX800)
- The Frequency Range to be used: Two separate coordinations are required: For the first one, click on the range of 1395.0 through 1400.0 MHz. For the second one, click on all the frequency ranges listed in the range of 1427.0 through 1432.0 MHz.

When both Registration and Frequency Coordination have been successfully completed, the IntelliVue Instrument Telemetry System can be activated. Note that this process is the responsibility of the customer, as the final "operator" of the transmitting equipment.

### Philips IntelliVue Information Center

See the installation instructions and Instructions for Use of the IntelliVue Information Center Rev. System J or higher.

## Short Range Radio

Installation of the Short Range Radio interface should be performed by Philips service personnel.

Before installing an SRR infrastructure it might be necessary to perform a site survey to determine available channels. This should be performed by Philips telemetry installation experts.

## Configuring SRR Channels

Hardware Setting: **Main Setup -> Hardware -> SRR Channel**

SRR channel settings only apply for monitors that have a short range radio interface installed. They must be set to match the hospital's wireless infrastructure. SRR channel settings are hardware settings and will typically be set by service personnel at installation.

See your configuration guide for details.

### SRR Channel Settings Configuration Implications

**Channel:** Use this setting to configure the SRR channel the monitor should use. SRR provides a total of 16 channels in the ISM (2.4 GHz) band. The channels are labeled 11 to 26. Up to two SRR connections can be established per channel. The ISM band is not exclusively reserved for SRR applications. It is also used by, for example, Wireless LAN (WLAN) and the IntelliVue Telemetry network. For this reason, depending on the hospital's existing wireless infrastructure, a number of SRR channels might already be occupied by other wireless applications.

To achieve the best SRR performance possible, follow these Philips recommendations:

- Usage of WLAN together with SRR may cause interferences. Each WLAN network uses at least four of the 16 SRR channels. If the use of WLAN cannot be avoided, limit the number of channels used for the WLAN infrastructure to a minimum.
- Usage of Bluetooth devices together with SRR may cause interferences. Bluetooth devices automatically change channels regardless of whether a channel is already used by another component of the wireless infrastructure and therefore interfere with SRR connections.
- Usage of cordless phones using the ISM band in the vicinity of SRR devices may cause interferences.
- Usage of wireless PC keyboards or mice using the ISM band in the vicinity of SRR devices may cause interferences.

### To assign SRR channels to all monitors in a unit that should be used with SRR connections,

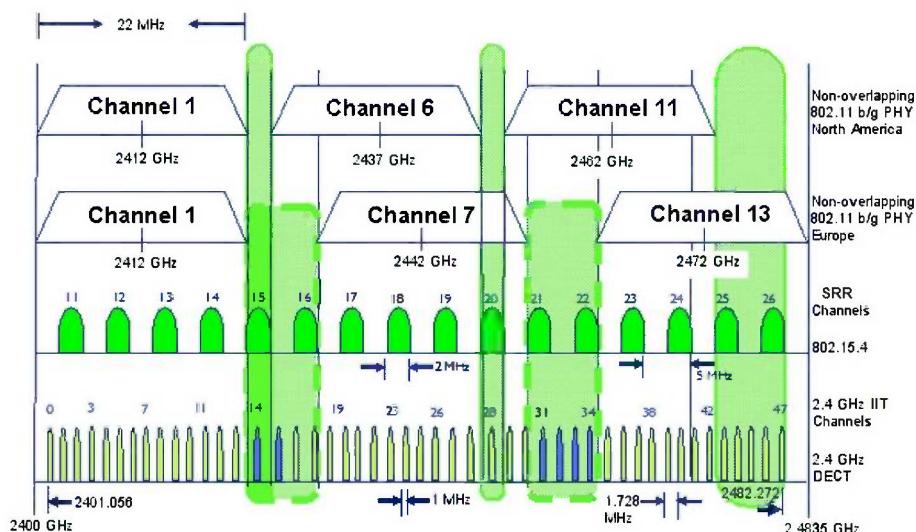
- 1 Identify unused SRR channels. This can be done by using commercially available tools, such as AirMagnet.
- 2 Obtain a floor plan of the unit and identify where the monitors with SRR interface are located.
- 3 Determine SRR groups. An SRR group may contain a maximum of two monitors which share the same SRR channel. Monitors belonging to an SRR group should be located close to each other.
- 4 For each SRR group, assign the same SRR channel to all monitors belonging to a group.

## 7 Installation Instructions

### SRR Channel Restrictions with WLAN, IIT, and DECT Phones

The following table and graphic show the restrictions of WLAN, IIT, or DECT phone usage together with SRR.

US WLAN (802.11)	1				6				11							
Europe WLAN (802.11)	1				7				13							
IIT 2.4 GHz (Smart Hopping Channels)	0 - 13			14	15 - 30				29 - 47							
SRR (802.15.4)	11 2405 MHz	12 2410 MHz	13 2415 MHz	14	15	16	17	18	19	20	21	22	23	24	25	26 2480 MHz



For a successful SRR deployment, the SRR channels must be located in RF spectra where they are least likely to be interfered with. Choosing appropriate channels after reviewing the Spectrum Analyzer data is critical. In hospitals, 802.11 systems are most the likely source of interference with SRR channels. The figures above show the relationship between 802.11 devices, IIT devices, and DECT phones. For example, if the site uses European 802.11 channel 1 for WLAN and has no IIT devices or DECT phones in the SRR channels 15 or 16, these channels can be used for SRR. Philips telemetry experts will identify available SRR channels by performing a site survey.

When using the Philips IntelliVue 802.11 Bedside Adapter, Philips recommends using the 5 GHz band to free the 2.4 GHz band for SRR usage.

#### NOTE

Short range radio signals are low power signals and therefore have a relatively short range. You can use this fact if the number of unused channels is low, and you run out of channels. Provided the distance between two SRR groups is large enough, i.e. none of the short range radio signals transmitted by the one group can interfere with signals of the other group, you may attempt to assign the same SRR channel to both groups. Take into consideration that portable components (such as Telemetry transceiver, MP5/MP5T or an X2) belonging to one group may be temporarily used within the range of another group.

The range of SRR signals cannot be clearly defined as it depends on external factors such as the components and structure of walls, ceilings, etc.

### Electromagnetic Interference (SRR)

Commercially available Short Range Radio 802.15.4 transceivers operate at very low RF power levels to transmit data and require high sensitivity receivers to achieve a good link budget. Due to technological limitations the selectivity of the receiver is limited. Consequently, the SRR link is susceptible to other strong RF transmitters not only in the operating frequency band and 5% around it, but also to non-transient RF disturbances stronger than 1V/m at frequencies close to the operating frequency band (2.0 to 2.3 GHz)

## ECG Out Functionality

### Connections

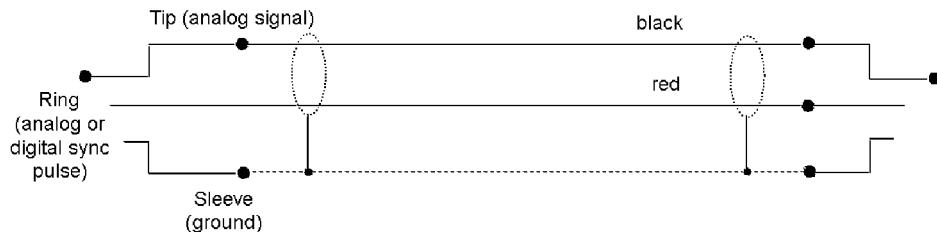


*ECG Out Connector*

The cables 8120-1022 and M1181-61625 have both ends terminated. The photograph above shows the monitor side connection.

If using a non-terminated cable:

- 1 Strip 5 mm (3/16") insulation from leads and twist conductor strands tightly.
- 2 Solder leads to the connector as shown in the following diagram.



### WARNING

According to AAMI specifications the peak of the synchronized defibrillator discharge should be delivered within 60 ms of the peak of the R wave. The signal at the ECG output on the IntelliVue patient monitors is delayed by a maximum of 30 ms. Your biomedical engineer should verify that your ECG/Defibrillator combination does not exceed the recommended maximum delay of 60 ms.

### Configuration Tasks

You must configure these settings during installation in configuration mode.

- Line Frequency
- Printer
- Altitude
- Equipment Label (for wireless networked monitors, or when the Information center is in flexible monitoring mode).
- ECG cable colors
- Height and Weight units
- Setup Network
- Setup WLAN
- Setup IIT

### Checking Country-Specific Default Settings

Some settings are made in the factory to match the typical requirements in a specific country. Line frequency, units for weight and height, and ECG cable colors (AAMI or IEC) have been set to appropriate values. If you suspect that these settings may not match your institution's requirements, check the settings and change them if necessary as described in the *Configuration Guide*.

#### **WARNING**

Before starting monitoring, check whether the configuration meets your requirements, especially patient category, alarm limits and paced setting.

To enter configuration mode:

- 1 In the **Main Setup** menu, select **Operating Modes**.
- 2 Select **Config** and enter the passcode.

The passcode for configuration mode is given in the monitor's Service Guide.

The monitor displays **Config** at the right hand side of the status line and in the center of the Screen while you are in configuration mode.

Before you leave configuration mode, always store any changes you made. You must store changes made to each Settings Block and to each Profile, individually. As it may be difficult to remember whether the settings you changed belong to a Monitor Settings block or a Measurement Settings block, Philips recommends you store each block before you leave configuration mode.

To leave configuration mode:

- In the **Main Setup** menu, select **Operating Modes** and then select **Monitoring**.

### Setting Altitude, Line Frequency, ECG Cable Colors and Height & Weight Units

You require a local barometric pressure rating from a reliable source (such as airport, regional weather station, or hospital weather station) that is located at the same altitude as the institution.

- 1 From the **Main Setup** menu, select **Global Setting**. Select **Altitude** and enter the altitude.
- 2 From the **Main Setup** menu, select **Global Setting**. Select **Line Frequency** and choose the Line Frequency.
- 3 From the **Main Setup** menu, select **Global Setting**. Select **ECG Cable Color** and choose the Cable Color.
- 4 From the **Main Setup** menu, select **Global Setting**. Select **Height Unit** and choose the Height unit.
- 5 From the **Main Setup** menu, select **Global Setting**. Select **Weight Unit** and choose the Weight unit.

## Configuring the Equipment Label

If the Information Center is in fixed monitoring mode, it controls the equipment label. You do not need to follow this procedure.

However, if you are on a wireless network, or your Information Center is configured for flexible monitoring mode, you must set the equipment label. This associates the monitor with a central monitoring sector. An identical monitor label must also be configured in the Information Center.

- 1 Select **Main Setup -> Bed Information** to call up the **Bed Information** menu.
- 2 Select **Equipment Label** to call up the onscreen keyboard.
- 3 Enter the system identifier. This needs to be set up in either the monitor or the Information Center. If the Information Center is in flexible monitoring mode, the monitor must be setup to match the Information Center's monitor label.

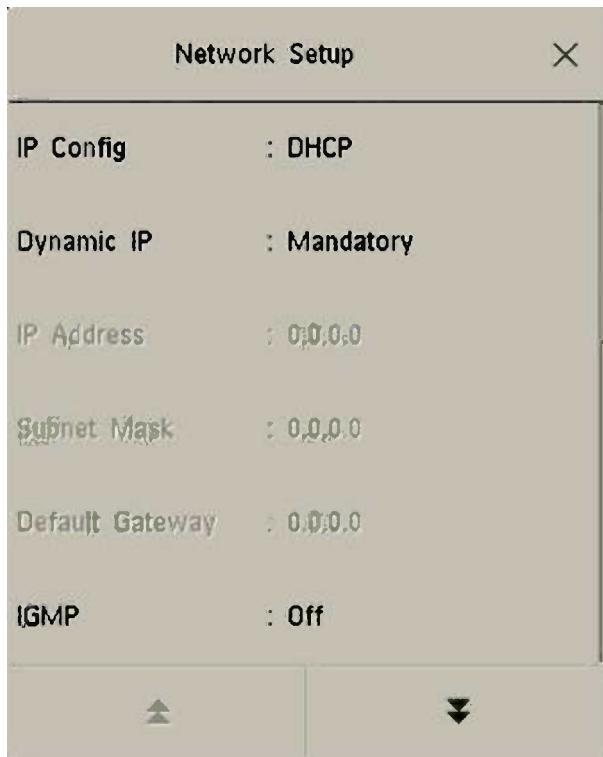
## Configuring the Printer

- 1 From the **Main Setup** menu select **Reports**.
- 2 Select **Printer Settings** and configure **Local** to enabled if the printer is connected directly to the monitor. See the *Configuration Guide* for further details.

### Setup Network

#### Network Setup Window

Main Setup -> Network -> Setup Network



#### NOTE

- LLDP added with SW Rev. J.1
- Directory Mode, Directory Addr added with SW Rev. H.0
- CI Mode, CI Address, CI TTL and IGMP added with SW Rev. G.0

**IP Config** Allows you to change the mode to acquire the IP address. Choices are **BOOTP**, **DHCP**, **DHCP restricted** and **Manual**. In **DHCP restricted** mode, any true BOOTP responses are ignored.

**Dynamic IP** Can be either **Mandatory** (default) or **Optional**. If **Mandatory** is set, the bedside will issue an INOP if an IPv4 address could not be acquired.

**IP Address** If IP Config is set to Manual, the IP address should be a valid IP address, e.g. not 0.0.0.0. The configured value is ignored when IP Config is not set to Manual.

**Subnet Mask** The Subnet Mask must be provided for manual IP addresses. The Subnet Mask must consist of a single consecutive series of "1" bits; e.g. 255.255.248.0. The configured value is ignored when IP Config is not set to Manual.

**Default Gateway** The IP address of the Default Gateway can be optionally configured. The configured value must be within the range of the Subnet Mask. The configured value is ignored when IP config is not set to Manual.

**IGMP** Enables or disables IGMP support (**On/Off**)

**CI Mode** The mode in which CI messages (Connect Indication messages) are sent (**Broadcast**, **Multicast**, **Manual**)

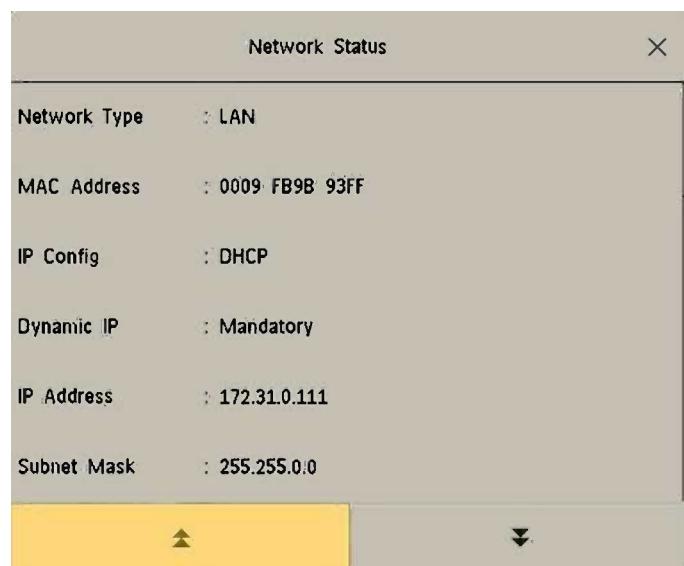
- CI Address** Multicast address for Device Connect Indication (only used if **CI Mode** is set to **Manual**). If **CI Mode** is set to **Broadcast**, the CI address is implicitly the subnet broadcast address. If **CI Mode** is set to **Multicast**, the CI address is implicitly 224.0.23.63
- CI TTL** Sets the TTL (Time to Live) of the CI message. Defaults to **1**.
- QoS State** QoS (Quality of Service) can be switched **On** or **Off**.
- QoS Level** The QoS Level (DSCP CoS value) can be entered between **0** and **7**
- Directory Mode** The mode in which Directory Service requests are received (**Broadcast**, **Multicast**).
- Directory Addr** Multicast address for Directory Service requests (if **Directory Mode** is set to **Multicast**).
- LLDP** LLDP (Link Layer Discovery Protocol) enables information exchange with other devices. Can be switched **On** or **Off**.
- Store** The entered values are verified when the **Store** softkey is pressed. A valid configuration is immediately activated and the window closed. If any field is invalid (e.g. invalid subnet mask or gateway not in subnet), an error popup window is shown and the configuration is not applied.

## 7 Installation Instructions

### Network Status Window

The network status window provides network status information which can be used for troubleshooting purposes.

**Main Setup => Network => Network Status**



**Network Type** Displays the current active network type (**LAN, IIT, WLAN**)

**MAC Address** MAC Address of LAN adapter

**MAC IIT** MAC Address of IntelliVue Instrument Telemetry adapter (only when IIT is enabled)

**RF Access Code** IntelliVue Instrument Telemetry specific partitioning of the radio domain (only when IIT is enabled)

**LLDP System Name** Advertised System Name of the link partner. This is normally a switch or router.

**LLDP Chassis ID** Advertised Chassis ID of the link partner. Chassis ID is an administratively assigned name that identifies the particular chassis.

**LLDP Port ID** Advertised Port ID of the link partner. Port ID is a string that identifies the port component of the link partner.

**LLDP Port Status** Shows the current ethernet duplex mode and the speed of the link partner.

The **MAC Address**, current IP address configuration (**IP Address, Subnet Mask, Default Gateway, Server IP address and CI mode/ CI Address/ CI TTL**) and **BOOTP/ DHCP Server** is displayed. The IP address configuration can be changed in Service Mode only. Manually entered IP addresses are marked by the suffix "Manual", invalid fields are marked by the suffix "Invalid".

If the Instrument Telemetry interface is available, its **MAC Address** and **RF Access Code** are displayed. In addition, the bedside monitor's IPv6 link local address is shown.

### Network Configuration Check (only for SW ≥ K.2)

If LLDP is configured "on" while a network connection is established, the network is checked for specific LLDP related issues or incompatibilities.

If issues are found during this check, the status message „Check LLDP Configuration" will be shown in the status prompt area of the monitor's resting display.

The status message is shown when one of the following issues is found:

Cause of Failure	Failure Isolation and Remedy
LLDP is configured "on" and a static IP is configured and LLDP answers are received via the network	do not configure a manual IP address when using LLDP
LLDP is configured "on" and the received Chassis ID and Port ID of the link partner changed	Check LLDP settings of switch
LLDP is configured "on" and more than one link partner is sending LLDP answers (e.g. if monitor is connected to hub or non- LLDP/multicast capable switch)	connect monitor to LLDP/multicast capable devices

The prompt will be cleared after a power cycle or after reconnecting the network cable, but will be shown again if the issue persists.

## Setup WLAN

Main Setup => Network => Setup WLAN

Setup Wireless LAN	
Country	1000
IP Address	172.31.10.04
WMM Mode	disabled
Mode	802.11bg
SSID	Philips
Security Mode	WPA2Enterpr.
WEP Key Size	40 bit
WEP Key	*
WEP Key Index	2
WPA Password	*
Authentication	PEAP
Inner Authentication	MSCHAPv2
PEAP Version	Default
PEAP Label	Default
User Name	username
Password	secret
Anonymous Ident.	anonymous
CertificateCheck	Enabled
CA Certificate	Installed

The Setup Wireless LAN Menu allows you to configure the following items:

- Country** Country setting for the WLAN card to adapt to the local frequency and transmit power regulations. The default value 1000 should be left to support adapting to country provided by the AP.

**IP Address** IP Address of the WLAN card. Typically the automatic configuration via the BOOTP/DHCP Server of the central station is used. In this case the field is set to 0.0.0.0. For special requirements, it is possible to switch to a manual/fix IP address configuration.

Manually entered IP addresses are marked by the suffix “Manual”

#### NOTE

- The subnet mask and the gateway address of the WLAN card will be taken from the corresponding fields in the **Bed Information** or **Setup Network** menu.
- Only limited checks of the manual values are possible. Therefore it is mandatory that a manual configuration is only performed by experienced service personnel to prevent problems such as duplicate IP addresses, non matching subnet mask, etc.

**WMM Mode** Changes to WMM (Wireless Multimedia Mode) mode for the WLAN adapter supporting this feature.

**Mode** Defines the WLAN operating mode/IEEE 802.11 Standard. Valid values are either 802.11ah, 802.11bg (not recommended), 802.11g, Auto (not recommended) or None. None indicates that no wireless connection should be established although a wireless adapter is available and operational.

**SSID** Set Identifier: Logical WLAN Network Name.

**Security Mode** **WEP**, **WPA(PSK)** or **WPA2(PSK)**, **WPA-Enterprise** and **WPA2-Enterprise** with either Protected EAP (PEAP) or Tunneled TLS (TTLS) as authentication methods.

**WEP Key Size** 40 bit or 104 bit.

**WEP Key** The number of hex chars for the WEP key depends on the WEP key size chosen. For a 40 bit WEP key size the WEP key must be 10 hex chars long, for a 104 bit key the WEP key must be 26 hex chars long. Will be shown as “\*\*” after the user entered the key.

**WEP Key Index** Defines the transmit WEP Key Index. This entry must match the WEP Key Index configured at the infrastructure device, i.e. on a WLAN Access Point, and ranges from 1 to 4.

**WPA Password** In WPA(PSK) or WPA2(PSK) mode this entry defines the Pre-Shared-Secret or Password with 8 to 63 alpha-numeric characters. Will be shown as “\*\*” after the password is entered.

In WPA-Enterprise or WPA2-Enterprise mode the following read only fields are available. The configuration can only be performed via the IntelliVue Support Tool:

**Authentication** Authentication method can be either Protected EAP (PEAP) or Tunneled TLS (TTLS).

**Inner Authentication** PEAP and TTLS can be used with several different Inner Authentication methods. PEAP with MSCHAPv2 and TTLS with PAP, CHAP, MSCHAP or MSCHAPv2

**PEAP Version** This setting describes the PEAP protocol version to be used while authenticating against the authentication server. Valid values are either Default, Version 0 and Version 1. If set to Default the decision is up to the wireless adapter. Version 0 or 1 forces the wireless adapter to use the protocol version required for a certain authentication server. This setting is intended for experts only.

**PEAP Label** The PEAP label setting defines the string to be used to signal EAP-PEAP encryption to the authentication server. Valid values are Default, EAP or PEAP. Default lets the decision up to wireless adapter. Both EAP and PEAP forces the wireless adapter to use this setting. This setting is intended for experts only.

**Username** The username used in the encrypted tunnel with 1-63 alpha-numeric characters. It is also used as outer identity as long as the Anonymous Identity is not set.

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- Password** The password used in the encrypted tunnel with 8-63 alpha-numeric characters. Will be shown as four stars “\*\*\*\*” after the user entered the password.
- Anonymous Identity** The identity used for the outer PEAP or TTLS authentication, which may be “unprotected”. Thus, the identity should be different to the Username for enhanced security. The Anonymous Identity contains 1-63 characters. It can be set to NotConfigured by clearing it.
- CA Certificate** Indicates that the certificate of the Certification Authority (CA) has been installed on the device. The CA certificate is the root certificate of the server delivered certificate chain. The certificate chain ends with the server certificate, which contains the key material used to build up the encrypted tunnel for PEAP or TTLS. Values are either Installed or NotInstalled. This field is not user configurable. The CA certificate can only be installed with the IntelliVue Support Tool.
- Certificate Check** As long the Certificate Check is set to Enabled, the CA Certificate is used to verify the authenticity of the certificate chain delivered by the authentication server. The verification involves also the system time to check the validity period of every certificate in the chain. This item can only be set to Enabled, if an CA Certificate has been installed. Valid values are Disabled or Enabled.

### WLAN Diagnostic Window

The WLAN Diagnostic window provides WLAN status information which can be used for troubleshooting purposes.

Main Setup => Network => WLAN Diagnostic

WLAN Diagnostic	
Wireless LAN	On
Check WLAN	Security Mode
MAC WLAN	0097 3498 87EC
IP Address WLAN	172.31.11.15
IP Address	172.31.10.03
Server IP	172.31.10.165
Subnet Mask	255.255.0.0
Country	1000 / 1276
WMM Mode	Disabled
Mode	802.11bg
Security Mode	WPA2Enterpr.
Authentication	PEAP
Inner Athentic.	MSCHAPv2
PEAP Version	Default
PEAP Label	Default
User Name	username
Anonymous Ident.	anonymous
CertificateCheck	Enabled
CA Certificate	Installed
SSID	Philips
Rate	54,0 Mb/s
Active Channel	9
RSSI	65 -
Conn. Status	Connected
MAC AP WLAN	00A0 F8CE D231

In the WLAN Diagnostic window, the wireless LAN address information is shown (**MAC address**, **IP addresses** and **Subnet Mask**) as well as the active security settings, WLAN **Mode**, **SSID** as well as **Country** setting, which are all not editable in this window. In addition, the following status information is shown:

- Wireless LAN** State of the wireless adapter. Off indicates inactive or just starting, On indicates operational. Does not take the wireless state into account.
- Check WLAN** Indicates that a configuration issue has been detected. The message text depends on the operating mode.

## 7 Installation Instructions

<b>Country</b>	The configured country code and the dynamically chosen country code based on access point setting.
<b>WMM Mode</b>	The WMM mode being used.
<b>Mode</b>	Defines the WLAN operating mode/IEEE 802.11 Standard. Valid values are either 802.11ah, 802.11bg, 802.11g, Auto (not recommended) or None. None indicates that no wireless connection should be established although a wireless adapter is available and operational.
<b>RSSI</b>	Received Signal Strength Indicator.
<b>Conn. Status</b>	Current wireless LAN connection status ( <b>None, Scanning, Authenticating, Authenticated Shared, Associating, Connected, Link Problem</b> ).
<b>Active Channel</b>	Current radio channel.
<b>Rate</b>	Currently selected transmission rate (adapts dynamically based on wireless signal propagation behavior).
<b>MAC AP WLAN</b>	The MAC address of the access point to which a connection has been established.

### RF Design Requirements for Philips Devices

Philips medical devices require a robust and high capacity WLAN. The WLAN deployed should meet specific RF requirements in all areas of coverage where Philips devices will operate. One of these requirements is the minimum RF signal (RSSI) level of -67 dBm.

Due to different internal calculation the RSSI will be different for WLAN assembly version 1 and 2. To achieve the required minimum signal strength of -67dBm, the RSSI must be as follows:

WLAN Assembly Version 1	WLAN Assembly Version 2
RSSI ≥ 28	RSSI ≥ 22

**Identification of installed WLAN Firmware (Main Setup -> Revision -> WLAN):**

WLAN Assembly Version 1	WLAN Assembly Version 2
>SW Rev 1 A.xx.xx	>SW Rev 1 B.xx.xx
Firmware versions for WLAN assembly version 1 always have the numbering format <b>A.xx.xx</b>	Firmware versions for WLAN assembly version 2 always have the numbering format <b>B.xx.xx</b>

### **WLAN Configuration Check**

Before a wireless connection is established, the configuration is checked for basic issues or incompatibilities. If issues are found during this check, a status message will be shown in the status prompt area of the monitor's resting display. Additionally, the Check WLAN line of the WLAN Diagnostic window will display the status message. In Service Mode, a detailed status message is shown, while a simplified message is shown in all other operating modes.

The table below lists the status messages displayed in service mode, depending on the issue found.

Issue	Status Message
Security Mode	Check WLAN Security Mode
Country Setting	Check WLAN Country Setting
IEEE Wireless Mode	Check WLAN IEEE Mode
WMM Mode	Check WLAN WMM Mode
WEP Encryption	Check WLAN WEP Settings
WPA Encryption	Check WLAN WPA/WPA2 Key
Authentication	Check WLAN Authentication Mode
Inner Authentication	Check WLAN Inner Authentication Mode
PEAP settings	Check WLAN PEAP Properties
Certificate Check	Check WLAN Certificate Check Setting
User Name, Password	Check WLAN EAP Credentials

The simplified message in all other operating modes is "Check WLAN Settings"

### Setup IIT

Main Setup => Network => Setup IIT

IIT Setup	
IIT	Enabled
RF Access Code	1

The Setup IIT Menu allows you to configure the following items:

- Instr. Telemetry** The Instrument Telemetry network interface can be disabled by a Global Setting to suppress network related technical INOPS if the IIT-capable device is operated in a non-IIT environment.
- RF Access Code** Instrument telemetry specific partitioning of the radio domain. Displays “Disabled” instead of RF Access Code if Instrument Telemetry is disabled by Global Setting.

### Instrument Telemetry Diagnostic Window

The Instrument Telemetry Diagnostic window provides IIT status information which can be used for troubleshooting purposes.

Main Setup => Network => IIT Diagnostic

Instrument Telemetry Diagnostic	
MAC IIT	0097 3498 87EC
RF Access Code	2
IP Address	172.31.10.03
Server IP	172.31.10.165
Subnet Mask	255.255.0.0
RSSI	-50
Conn. Status	Active

**Network addresses** To support troubleshooting of the network connection, the following fields are displayed: Instrument Telemetry **MAC Address**, **IP Address**, **BOOTP/ DHCP Server IP address** and **Subnet Mask**.

- RF Access Code** Instrument telemetry specific partitioning of the radio domain. Displays “Disabled” instead of RF Access Code if Instrument Telemetry is disabled by Global Setting.
- RSSI** Received Signal Strength Indicator.

**Conn. Status** Current connection status of the Instrument Telemetry Subsystem.

### IntelliBridge EC10

The IntelliBridge EC10 web based service interface allows you to:

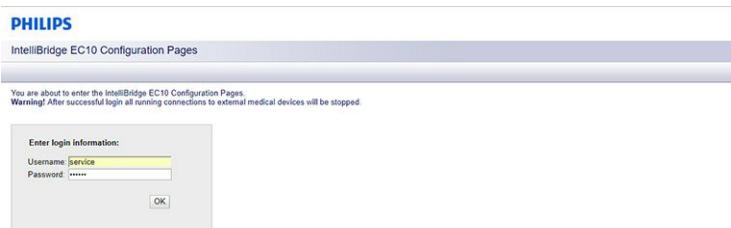
- upgrade the EC10 Firmware
- upload or remove device drivers
- generate and upload clone files
- view system information

### NOTE

If you have no LAN connector on your laptop/PC, a standard USB-to-LAN adapter is satisfactory.

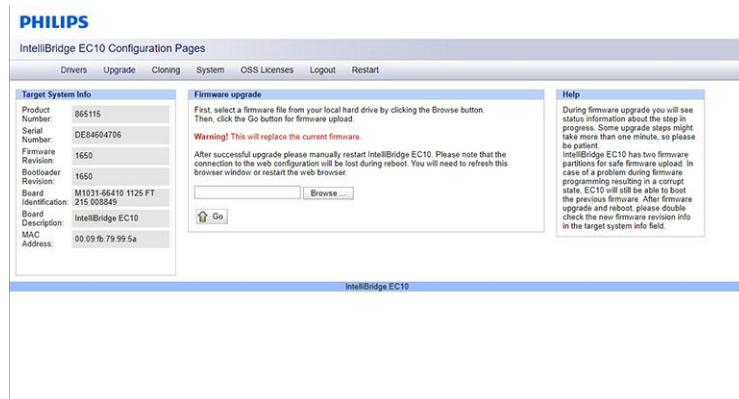
## Accessing the IntelliBridge EC10 Service Interface

- 1 Connect the Service PC to the IntelliBridge EC10 module or IntelliBridge EC10 interface board using a standard LAN cable.
- 2 Ensure the TCP/IP settings of your Local Area Connection Properties on the Service PC are set to "**obtain IP Address automatically**".
- 3 Open your Internet Browser. Internet Explorer 11 is supported. Other versions or browsers may also function.
- 4 Enter **192.168.100.2** in the navigation field of the internet browser.
- 5 The EC10 Configuration screen will open up. Enter the following login information:  
Username: service  
Password: IBEC10



## Firmware Upgrade

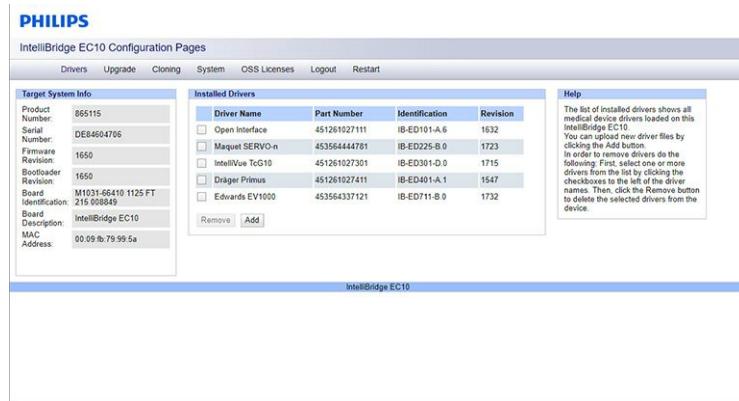
- 1 In the EC10 Configuration Screen select the tab **Upgrade**.
- 2 The Firmware upgrade window will open up.



- 3 Click on the **Browse** button and select the correct FW file.
- 4 Click **Go**.
- 5 After you are finished with the upgrade, make sure to restart the IntelliBridge EC10 device by either clicking on **Restart** (located on the tab bar, if available) or, if you are using an IntelliBridge EC10 module, by unplugging and replugging the module.

### Uploading and Removing Device Drivers

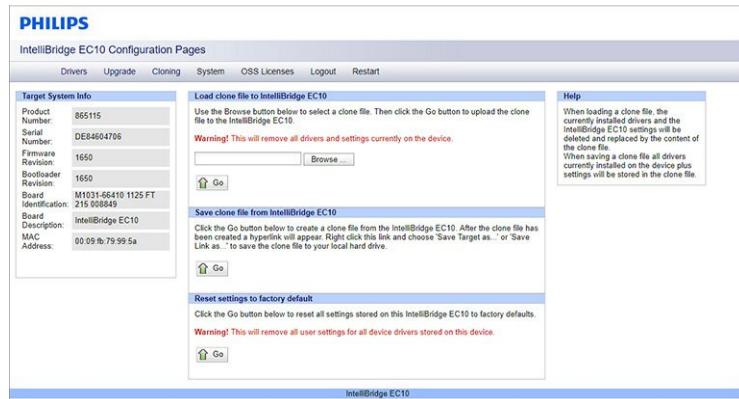
- 1 In the EC10 Configuration Screen, select the **Drivers** Tab.
- 2 A list of the available drivers on the IntelliBridge EC10 will appear.
- 3 To upload a new driver, click the **Add** button, then click the **Browse** button and select the driver file. To remove one or more drivers, select the driver(s) from the list of available drivers and click the **Remove** button.



- 4 When you are finished with the configuration, click **Logout** on the tab bar.

### Generating and Uploading Clone Files

- 1 In the EC10 Configuration Screen, select the **Cloning** tab.
- 2 To generate a clone file, click the **Go** button in the *Save clone file from IntelliBridge EC10* window. A hyperlink will appear. Right click this link and select "**Save Target as...**" to save it to the desired location.
- 3 To upload a clone file click the **Browse** button in the *Load Clone File to IntelliBridge EC10* window and select the clone file. Then click **Go**.



- 4 When you are finished with the configuration, click **Logout** on the tab bar.

## Viewing System Information

- In the EC10 Configuration Screen, select the **System** Tab. This screen allows you to view Log files and other system information.

**Target System Info**

Product Number:	865115
Serial Number:	DE84604706
Firmware Revision:	1650
Bootloader Revision:	1650
Board Identification:	M1031-66410 1125 FT 215 008849
Board Description:	IntelliBridge EC10
MAC Address:	00:09:fb:79:99:5a

**Log files**

Click on the following links to view log files:  
[maxsys.log](#)  
[error.log](#)  
[thttd.log](#)

You can download a [logFile package](#) containing all the above log files from the system. Right click this link and choose "Save Target as..." or Save Link as... to save the file.

**Power On Self Test**

Errors from Power On Self Test: none

**Misc Info**

System Memory:	MemTotal: 29803 kB MemFree: 8520 kB
Bootloader bootcount:	N/A
Bootloader bootselect:	2
Serial Stats:	1.usartATMEL_SERIAL mmio 0xFFFFB0000 irq 6 tx:176135 tx:14774 RTSCTS10TR 3.usartATMEL_SERIAL mmio 0xFFFFB8000 irq 8 tx:259354 rx:1 brk:1 RTSIDTR0SRICD1RI

- When you are finished with the configuration, click **Logout** on the tab bar.

### NOTE

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 For information about how to obtain source code, see last text section below.

List of open source software

- ace, the adaptive communications environment, offered under a license by Douglas C. Schmidt
- busybox: A small executable that replaces many UNIX utilities, licensed under the terms of the GPLv2 only
- dojox: json script toolkit, licensed under the terms of the "New" BSD License
- Emboss: Emboss is a general purpose library for the Java programming language, licensed under the terms of the GPL v2
- expat: XML parser library, licensed under the terms of the MIT license
- flexLexer: licensed under a BSD license
- git: a distributed version control system, licensed under the terms of the GPLv2
- jaula, c++ json parser / generator library, licensed under the terms of the LGPLv2.1
- kepler, web development platform, licensed under a MIT style license
- lcm: a communication protocol for distributed systems, licensed under the terms of the MIT license
- linux kernel: Core of the Linux operating system, licensed under the terms of the GPLv2 with additions
- lirc: Loss Less Configuration utility, licensed under the terms of the GPLv2.1
- lircd: a daemon for receiving remote control signals, licensed under the terms of the GPLv2
- lusexpat: expat wrapper for lua, licensed under a MIT style license
- metalog: system logger, licensed under the terms of the GPLv2 with additional notes
- ncurses: a library of subroutines for writing terminal-independent programs, licensed under the terms of the GPLv2
- openSHELL: SSH connectivity tools, licensed under the terms of the BSD license
- openssl: Secure Sockets Layer toolkit, licensed under the terms of a BSD style license
- openSSL: OpenSSL is a toolkit for the transport layer security (TLS) and related protocols
- The U-Boot: Universal Bootloader, licensed under the terms of the GPLv2 with additions
- thttd: tiny HTTP server, licensed under the ACME Labs Freeware License
- xmisc1: sign/verify/encrypt and decrypt XML documents, licensed under the terms of the MIT license
- zlib: Compression utilities and libraries, licensed under the terms of the zlib (all-permissive) license

**GPLv2:**  
**GNU GENERAL PUBLIC LICENSE**

### Handing Over the Monitor

If you are handing over the monitor to the end-users directly after configuration, ensure it is in Monitoring mode.

Ensure the users have access to the following materials:

- Training Program in the Philips Learning Center ([www.theonlinelearningcenter.com](http://www.theonlinelearningcenter.com)) - for self-training on the monitor before use
- Instructions for Use (delivered with the monitor) - for more detailed questions during use.

---

#### **WARNING**

All users must complete the training program and read the Instructions for Use before working with the monitor.

---

These training materials (in combination with this service guide) can also be used to train service personnel on how to use and service monitor.

See the Testing and Maintenance section of this service guide to determine the respective safety and performance tests to be performed before handing over the monitor to the customer.

### Setting Up Multiple Displays

The MX800 supports a second external main display via the independent display interface. Most screen elements can be displayed on both displays.

The main displays support all input devices. Input devices can be assigned to an operator independent of the display they are connected to. However, we recommend assigning the input devices to the display to which they are physically connected.

The MX800's built-in display has a fixed resolution. You may connect external displays to the MX800 via the independent display interface that have a different resolution than the built-in display. Note that when connecting an external display, you must choose a screen that matches the resolution and aspect ratio of the external display. Choosing a screen with a resolution or aspect ratio that does not match the display results in distortion or black bars at the edge of the screen.

Before setting up multiple displays you must have a clear idea of your intended use model. (For example: Are the displays to be operated by one or two operators? Which display will be operated by which user? Will you be using displays as one wide screen or one tall screen?). See the examples at the end of this section that illustrate possible use models.

#### **NOTE**

An MX800 with an independent display has two MAC addresses and therefore requires the assignment of two IP addresses.

### Installation of Multiple Displays

The MX800 supports two display systems. When positioning the individual displays, note that Display 1 is always the integrated display of the MX800 patient monitor. Ensure you position the displays in the correct sequence from left to right or top to bottom to ensure correct cursor movement across the displays.

The MX800 also supports wide screen and tall screen configurations. In order to combine two displays to one wide screen or tall screen, the two displays must have the same resolution.

For a two display system, make the appropriate video & touch cable connections as described later in this chapter.

Make all cable connections before switching on the monitor.

## Configuring Multiple Displays

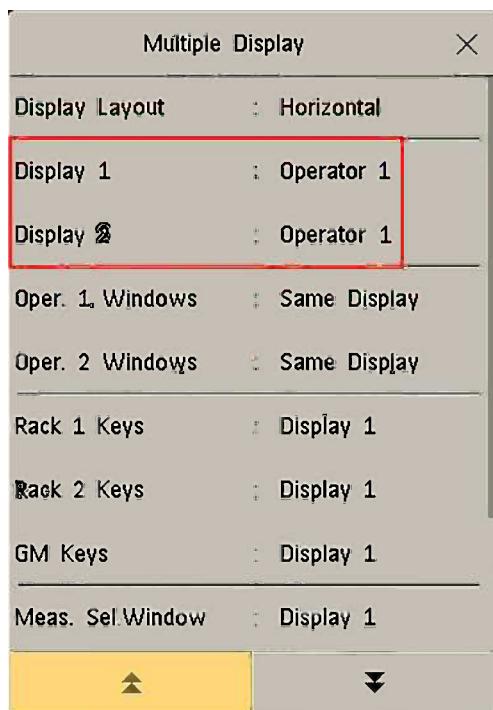
To configure multiple displays correctly you must answer four questions:

### 1. Who will be operating which display?

Up to two operators can operate up to two displays.

To assign displays to operators:

- 1 Go into the Multiple Displays menu by selecting **Main Setup -> Hardware -> Multiple Display**
- 2 Set **Display 1** and **Display 2** to either **Operator 1** or **Operator 2**



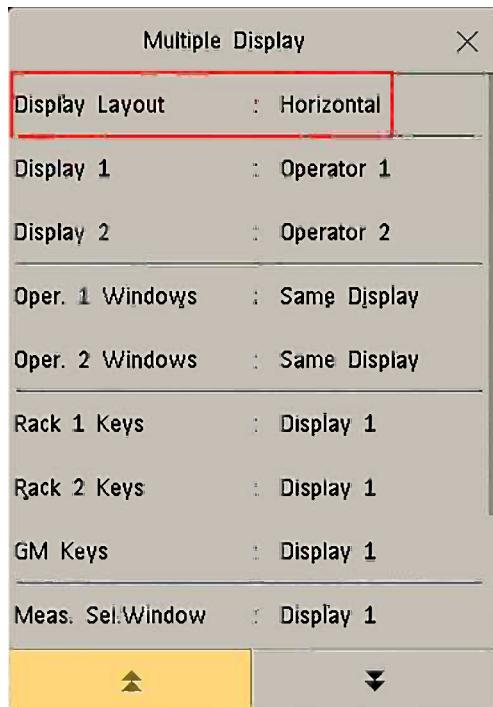
#### NOTE

If you want to use wide screens or tall screens on display 1 and display 2, you must assign these two displays to the same operator.

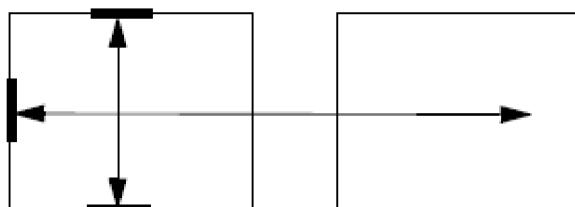
### 2. How are the displays positioned in relation to each other?

In a scenario where two displays are assigned to one operator, determine how they should be positioned in relation to each other (for example next to each other or above each other). Ensure you position the displays in the correct sequence from left to right or top to bottom to ensure correct cursor movement across the displays.

- 1 Go into **Main Setup -> Hardware -> Multiple Display**
- 2 Set the **Display Layout** to **Horizontal** or **Vertical** depending on the location of the individual displays relative to each other.



**Horizontal** - restrains the movement of the remote control/mouse cursor across two screens to the horizontal borders of the display.

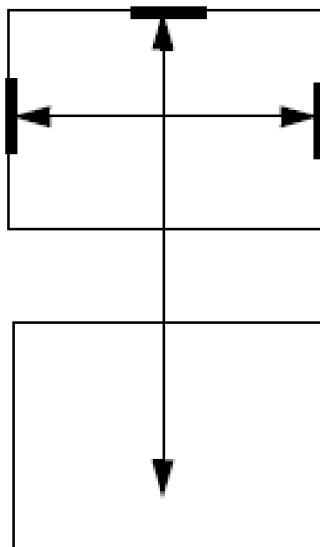


*Remote Control/Mouse Cursor Movement with Display Layout set to "Horizontal"*

If you are using the remote control and the display layout is set to horizontal, you can move from one screen to the next by moving the highlight to the Main Screen key and then turning one click further. The highlighting automatically moves to the jump field at the edge of the screen (shown below). Press the navigation knob of the remote control to confirm and the highlighting will automatically move to the other display.



**Vertical** - restrains the movement of the remote control/mouse cursor across two screens to the vertical borders of the display.



*Remote Control/Mouse Cursor Movement with Display Layout set to "Vertical"*

## 7 Installation Instructions

If you are using the remote control and the display layout is set to vertical, you can move from one screen to the next by moving the highlight to the Main Screen key and then turning one click further. The highlighting automatically moves to the jump field at the edge of the screen (shown below). Press the navigation knob of the remote control to confirm and the highlighting will automatically move to the other display.



### 3. Which Operator (or which display) are the connected input devices assigned to?

To assign the input devices to either an operator or a display, change the individual settings in the **Interfaces** menu:

- 1 Connect all input devices.
- 2 Go into **Main Setup -> Hardware -> Interfaces** and select an input device.
- 3 Use the **Change Settings** pop-up key to assign input devices either to a specific display or to all displays that were assigned to an operator.

Setup Interfaces			
Slot	Interface	Driver	Setting
04a	LAN,USB+RS232+NC	Mouse/Keybd	Display 2
		Keybd/Mouse	Display 1
04b	LAN,USB+RS232+NC	Touch 1	
06a	MainBd 866/100 H	Touch 1	

Legend	
Slot 4a	USB ports of connector board. Input devices must be connected according to USB rules
Slot 4b	Touch connector of Connector Board
Slot 6a	Touch connector of independent display interface

Input devices can be set to either **Operator 1**, **Operator 2**, **Display 1**, **Display 2**, or **Same Display**. **Same Display** means that the input device will function on the display which it is physically connected to.

#### NOTE

A wireless remote control can also be assigned to an operator or display once it is assigned to a monitor. The default setting is **Display 1**. To change this setting go to **Main Setup -> Hardware -> cl RemoteControl** and select the desired setting.

#### 4. On which display should an operator's windows appear

To define where menus and windows for an individual operator appear, go into **Main Setup -> Hardware -> Multiple Display** and set the appropriate settings in the **Multiple Displays** menu.

Multiple Display	
Display Layout	: Horizontal
Display 1	: Operator 1
Display 2	: Operator 1
Oper. 1 Windows	: Same Display
Oper. 2 Windows	: Same Display
Rack 1 Keys	: Display 2
Rack 2 Keys	: Display 2
GM Keys	: Display 2
Meas. Sel.Window	: Display 2
Patient Demogr.	: Display 2
Timer Window	: Display 2
ProtWatch Window	: Display 2
EventSurv.Window	: Display 2

- **Operator 1 Windows:** If operator 1 is operating more than one display, this setting defines on which display the windows of this operator are placed. Choices are Display 1, **Display 2 or Same Display**. Same Display means the window opens on the display where the window has been selected.
- **Operator 2 Windows:** If operator 2 is operating more than one display, this setting defines on which display the windows of this operator are placed. Choices are Display 1, Display 2 or Same Display. Same Display means the window opens on the display where the window has been selected.
- **Rack 1 Keys:** defines on which display a setup menu or application window appears when any of the hard keys on a plug-in module in Module Rack 1 is pressed. If the configured display is not available, the monitor automatically uses Display 1.
- **Rack 2 Keys:** defines on which display a setup menu or application window appears when any of the hard keys on a plug-in module in Module Rack 2 is pressed. If the configured display is not available, the monitor automatically uses Display 1.
- **GM Keys:** defines on which display the gas analyzer setup menu appears when the Setup Key on the gas analyzer is pressed. If the configured display is not available, the monitor automatically uses Display 1.
- **Measurement Sel. Window:** defines on which display the Measurement Selection window pops up if **Meas. Selection** is configured to **Window**, a label conflict occurs, and no other menu/window

is open at the same time. If the configured display is not available, the monitor automatically uses Display 1.

- **Patient Demogr. Window:** defines on which display the Patient Demographics window pops up if a patient identification mismatch occurs and no other menu/window is open at the same time. If the configured display is not available, the monitor automatically uses Display 1.
- **Timer Window:** defines on which display the Timers window pops up when a timer expires, the **Auto Window** setting for that timer is set to **Yes**, and no other menu/window is open at the same time. If the configured display is not available, the monitor automatically uses Display 1.
- **ProtWatch Window:** defines the display on which the Protocol Watch Window pops up if triggered automatically.
- **EventSurv. Window:** defines the display on which the Event Surveillance Window pops up if triggered automatically.

#### NOTE

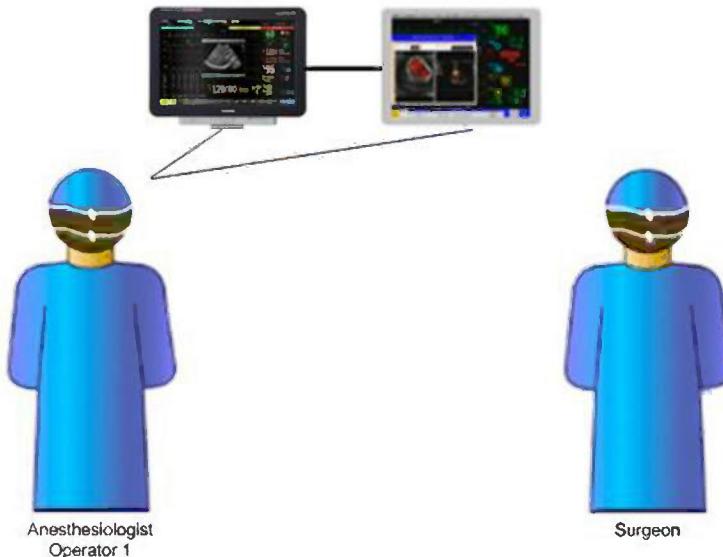
In order to determine which Module Rack is Rack 1 and which is Rack 2, go to the measurement selection window. Rack 1 is always displayed on top.

## Examples for Multiple Display Use Models

The following examples illustrate possible use models for multiple display scenarios:

### Use Model 1: Cardio-thoracic OR

- Anesthesiologist (Operator 1 - Display 1 and 2)
  - real-time data, trends, alarming, interaction
- Surgeon (Display 2)
  - real-time data, big waves, no alarming, no interaction

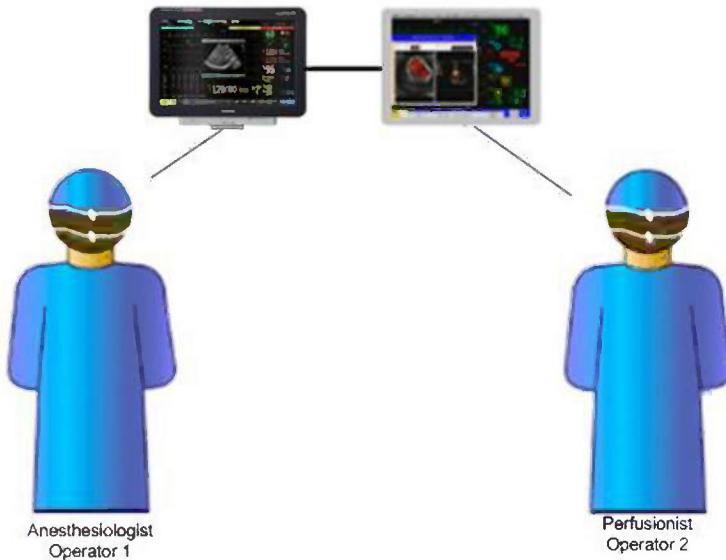


**Recommended Settings for this Use Model:**

<b>Display 1</b>	Operator 1
<b>Display 2</b>	Operator 1
<b>Display Layout</b>	Horizontal
<b>All Input Devices Connected to MX800</b>	Same Display
<b>Operator 1 Windows</b>	Display 1

## Use Model 2: Infection Room, Burn Unit/Bone-marrow transplant

- Outside (Display 1)
  - real-time data, alarming, interaction
  - trends, applications or charting
- Bedside (Display 2)
  - real-time data, alarming, interaction, trending, applications



### NOTE

In this use model, the system can only be switched on from the outside (MX800).

Recommended Settings for this Use Model:	
Display 1	Operator 1
Display 2	Operator 2
Display Layout	Horizontal
All Input Devices Connected to MX800	Operator 1
All Input Devices Connected to Display 2	Operator 2
Operator 1 Windows	Display 1
Operator 2 Windows	Display 2

## 7 Installation Instructions

# Site Preparation

## Introduction

This section describes the procedures you should follow to plan and prepare a site for an IntelliVue monitor installation. It describes:

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

## Site Planning

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

The site planning phases prior to equipment installation are:

- **Location:** Planning the location of the various system components.
- **Environment:** Confirming and correcting, as necessary, the environment of the proposed installation site(s).
- **System Capabilities:** Explaining the possibilities for system expansion.
- **Mounting:** Referencing the mounting hardware information website for the listing of suitable mounting hardware Philips recommends for use with the various system components, and all details on the available mounts and accessories.
- **Cabling:** Identifying the requirements for the cabling, conduiting and faceplates for connecting the various system components.

## Roles & Responsibilities

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

### Site Preparation Responsibilities

#### Local Staff:

- Ensure all safety, environmental and power requirements are met
- Provide power outlets
- Prepare mounts
- Pull cables, install conduit, install wallboxes
- Terminate network cables if a Philips Clinical Network is in use
- It may be necessary to certify the network cable plant, see the *Philips Clinical Network Installation Manual* for details

#### Philips Personnel:

- Provide the customer with the safety, environmental and power requirements
- Assemble mounts
- Prepare monitor remote cabling

### Procedures for Local Staff

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

- Providing Power Outlets

One power outlet for each display and for any peripheral device (for example, a printer or slave display) is required by the system. Provide a power outlet in the vicinity (1 m or 3 ft) of each component that requires power.

---

#### **WARNING**

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

---

- Preparing Mounts

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

- Providing and installing all hardware which is required to install the mounting hardware supplied by Philips as detailed in the installation notes.
- Making sure that all ceilings, walls, and mounting rails that supports mounting hardware are suitable for their proposed load.

---

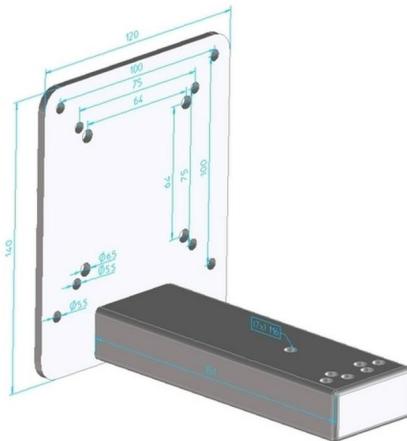
#### **WARNING**

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

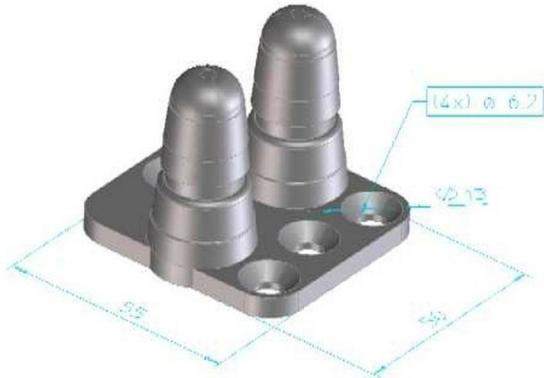
Although considerable effort has been made to ensure the safety of the ceiling mount installation and or mounting guidelines, it is to be understood that the installation itself is beyond the control of Philips Medical Systems. Accordingly, Philips Medical Systems will not be responsible for the failure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

---

The following figures show the dimensions required for the M1180A #C53 wall and the table mounting bracket which ships with the monitor.



*Wall Mounting Bracket Dimensions*



*Table Mounting Bracket Dimensions*

- Providing Conduit

Where a remote installation is required, for example the installation of a remote display, the customer is responsible for the following hardware installations:

- Providing conduit and/or trunking of a sufficient cross-sectional area for the planned cables and possible future expansion (for additional components or systems). See “[Cabling Options and Conduit Size Requirements](#)” on page 470 for cable specifications for remote installations.
- Providing and/or installing suitable wall boxes to accommodate the faceplates.

- Pulling Cables

---

### **WARNING**

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

---

- Installing Wall Boxes

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

## Procedures for Philips Personnel

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

# Monitor MX800 Site Requirements

## Space Requirements

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

Maximum dimensions and weight:

Size (W x H x D)	Weight
478mm x 364mm x 152mm <sup>1</sup> (18.82" x 14.33" x 5.98")	12kg <sup>3</sup> (26.46lb)
478mm x 364mm x 224mm <sup>2</sup> (18.82" x 14.33" x 8.82")	

1: Without cable management

2: With cable management

3: Without options

For detailed specifications, see the *Specifications* chapter.

## Environmental Requirements

The environment where the MX800 monitor will be used should be reasonably free from vibration, dust and corrosive or explosive gases. The ambient operating and storage conditions for the MX800 monitor must be observed. If these conditions are not met, the accuracy of the system will be affected and damage can occur.

For detailed environmental specifications, see the Specifications chapter.

# Electrical and Safety Requirements (Customer or Philips)

## Safety Requirements

If the monitor is to be used in internal examinations on the heart or brain ensure that the monitor is connected to an equipotential grounding system.

### Grounding

The monitor **MUST** be grounded during operation (Class I equipment according to IEC 60601-1). If a three-wire receptacle is not available then the hospital electrician must be consulted to ensure that proper grounding is available on installation. **NEVER** attempt to use a three-wire to two-wire adapter with the monitor.

---

### **WARNING**

Each component must be individually grounded for safety and interference suppression purposes.

---

## Electrical Requirements

### Line Voltage Connection

The MX800 monitor uses < 200 W.

### Line Voltage

The MX800 monitor may be operated on ac line voltage ranges of 100 to 240V (50/60 Hz).

## Remote Device Site Requirements

The system can be installed with one or more combinations of the following remote devices:

- Module Rack or Multi-Measurement Module
- Remote Display
- Remote Control
- Remote Alarm Device

Where more than one site is used for locating equipment (a remote installation), the following sections should be considered for EACH device:

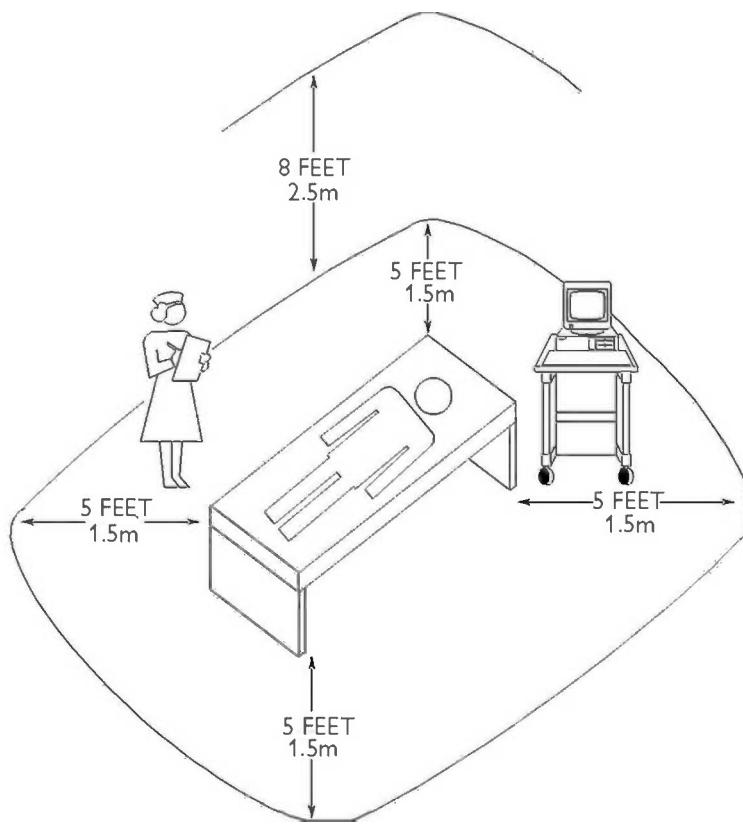
- Space Requirements
- Environmental Requirements
- Mounting
- Electrical and Safety Requirements
- Cabling Options and Conduit Size Requirements

## Connecting Non-Medical Devices

The standard IEC/EN 60601-1+A1 Ed.3 clause 16 applies to any combination of medical and non-medical electrical devices, where at least one is a medical electrical device. Therefore IEC/EN 60601-1+A1 Ed.3 clause 16 must still be met after all devices are connected.

### **WARNING**

Do not use a device in the patient vicinity if it does not comply with or IEC 60601-1 edition 3 clause 16. The whole installation, including devices outside of the patient vicinity, must comply with IEC/EN 60601-1+A1 Ed.3 clause 16. Any non-medical device placed and operated in the patient's vicinity must be powered via a separating transformer (compliant with IEC/EN 60601-1+A1 Ed.3 clause 16) that ensures mechanical fixing of the power cords and covering of any unused power outlets.



*Equipment Location in the Patient Vicinity*

### **NOTE**

The site planning requirements, with the exception of the cabling, must be provided by the device manufacturer, if the remote device is not purchased from Philips.

## 8 Site Preparation

**Multi-Measurement Modules (MMX) 867036, (MMS) M3001A/AL, IntelliVue X2 M3002A, IntelliVue X3 867030, 8-Slot Module Rack (FMS-8) M8048A, 4-Slot Module Rack (FMS-4) 865243 or Remote Control 865244**

For physical and environmental specifications, see the Specifications chapter.

### Cabling Options and Conduit Size Requirements

The following table describes the cabling options for the Module Rack and Multi-Measurement Module.

Table 9 Multi-Measurement Module and Module Rack Cables

Part number	12NC	Description	Conduit sizes	Bend Radius	Connector Size (L x W)
<b>Both Ends are Terminated with MSL Connectors</b>					
M3081-61626	453563474781	CBL MSL 0.75m	72mm <sup>2</sup>	40 mm	40 mm x 17 mm
M3081-61601	453563402721	CBL MSL 1m	72mm <sup>2</sup>	40 mm	40 mm x 17 mm
M3081-61602	453563377851	CBL MSL 2m	72mm <sup>2</sup>	40 mm	40 mm x 17 mm
M3081-61603	453563402731	CBL MSL 4m	72mm <sup>2</sup>	40 mm	40 mm x 17 mm
M3081-61627	453563484501	CBL MSL 10m terminated	72mm <sup>2</sup>	40 mm	40 mm x 17 mm
M3081-61628	453563484511	CBL MSL 15m terminated	72mm <sup>2</sup>	40 mm	40 mm x 17 mm
M3081-61629	453563484521	CBL 25m MSL Install terminated	72mm <sup>2</sup>	40 mm	40 mm x 17 mm
<b>Cable Clamp</b>					
453564277211	453564277211	IV PLAST MSL Cable Clamp Kit			
					
<b>Both Ends are Unterminated, use Faceplates</b>					
M3081-61615	453563484481	CBL MSL Instal.15m unterminated	72mm <sup>2</sup>	40 mm	40 mm x 17 mm
M3081-61625	453563484491	CBL MSL Instal.25m unterminated	72mm <sup>2</sup>	40 mm	40 mm x 17 mm
<b>Faceplates</b>					

Part number	12NC	Description	Conduit sizes	Bend Radius	Connector Size (L x W)
M3081-68707	453563484531	CBL MSLFace Plate pair of boxes NON US 800mm x 800mm x 350mm	72mm <sup>2</sup>	40 mm	40 mm x 17 mm
M3081-68708	453563484541	CBL MSL Face Plate pair of boxes US 800mm x 800mm x 350mm	72mm <sup>2</sup>	40 mm	40 mm x 17 mm
<b>Insertion Tool</b>					
M3086-43801	453563484771	MSL Insertion Tool for unterminated CBL	72mm <sup>2</sup>	40 mm	40 mm x 17 mm

## Mounting

**Table 10 867036 Multi-Measurement Module (MMX), M3001A/AL Multi-Measurement Module (MMS), M3002A IntelliVue X2, 867030 IntelliVue X3 Mounts**

Product Option Number	Part Number 12NC Part No.	Description
M8040A #A01	n/a	Mounting Plate
M8040A #A02	n/a	Mounting Plate with Clamp

**Table 11 M8048A Module Rack Mounts**

Product Option Number	Part Number	12NC Part No.	Description
M8048A #E15	M4041-42303	453563494101	Cable Management
M8048A #E20	M4041-60005	453563477961	Multi-Measurement Module Mount
	M8048-64002	453563456901	Handle (part of small parts kit)
M1180A #C33	M1034-60104	453563490591	BIS Mount
n/a	M4041-22302	451261011861	Mounting Plate Adapter clamp (for wall mounting)

## 8 Site Preparation

### Remote Displays (865299)

#### Space Requirements

Size (W x D x H)	Weight
429.0 mm x 61.0 mm x 359.0 mm (16.89" x 2.40" x 14.13")	6.1 kg (13.45 lb)

#### Environmental Requirements

Temperature	Humidity	Altitude
<b>Operating</b>		
0 to 40°C (32 to 104°F)	30%-70% Relative Humidity (RH) (non-condensing)	Up to 4000m (13123.36 ft.)
<b>Storage and Transport</b>		
-20 to 60°C (-4 to 140°F)	10%-90% Relative Humidity (RH) (non-condensing)	Up to 12000m (39370.08 ft.)

#### Electrical and Safety Requirements

Voltage Ranges	Voltage Selection	Power Consumption
100V to 240V	Wide range input, no voltage selection required	-48W)

#### Cabling Options and Conduit Size Requirements

The following table describes the cabling options for the 865299 19" TFT Medical Grade Touch Display.

**Table 12 Digital Video cables**

Part number	12NC	Description
M8071-61001	453563484551	IV CBL 1.5m Cable Kit
M8071-61002	453563484561	IV CBL 3m Cable Kit
M8071-61003	453563484571	IV CBL 10m Cable Kit.

## Touch Cable

Part Number	12NC	Description	Conduit Sizes	Bend Radius	Connector Size (L x W)
M8081-61010	451261006551	IV CBL Touch, 1.5m	30mm <sup>2</sup>	25 mm	35 x 16 mm
M8081-61011	451261006561	IV CBL Touch, 3.0m	30mm <sup>2</sup>	25 mm	35 x 16 mm
M8081-61012	451261006571	IV CBL Touch, 10m	30mm <sup>2</sup>	25 mm	35 x 16 mm
M8081-61013	451261006581	IV CBL Touch, 15m	30mm <sup>2</sup>	25 mm	35 x 16 mm
M8081-61014	451261006591	IV CBL Touch, 25m	30mm <sup>2</sup>	25 mm	35 x 16 mm

## Remote Alarm Device (866406)

### Space Requirements

Size (W x H x D)	Weight
261mm x 32mm x 82mm (10.3" x 1.2" x 3.2")	0.4kg (0.9lb)

### Environmental Requirements

Temperature	Humidity	Altitude
<b>Operating</b>		
0 to 40°C (32 to 104°F)	15%-95% Relative Humidity (RH) (non-condensing)	-500m to 3000m (-1600 to 10000 ft.)
<b>Storage and Transport</b>		
-20 to 60°C (-4 to 140°F)	5%-90% Relative Humidity (RH) (non-condensing)	-500m to 4600m (-1600 to 15000 ft.)

## 8 Site Preparation

### Cabling Options and Conduit Size Requirements

The following table describes the cabling options for the Remote Alarm Device 866406.

Part number	12NC	Description	Conduit sizes	Bend Radius	Connector Size (L x W)
M8086-61003	453563484641	IV CBL 1.5m Monitor to Remote Device	30 mm <sup>2</sup>	30 mm	27 x 13 mm
M8086-61004	453563484651	IV CBL 3m Monitor to Remote Device	30 mm <sup>2</sup>	30 mm	27 x 13 mm
M8086-61005	453563484661	IV CBL 10m Monitor to Remote Device	30 mm <sup>2</sup>	30 mm	27 x 13 mm
M8086-61006	453563484671	IV CBL 15m Monitor to Remote Device	30 mm <sup>2</sup>	30 mm	27 x 13 mm
M8086-61007	453563484681	IV CBL 25m Monitor to Remote Device	30 mm <sup>2</sup>	30 mm	27 x 13 mm

### Input Devices

Part number	12NC	Description
453564115901	453564115901	KBD KEYBOARD FRENCH Trackball USB
453564115911	453564115911	KBD KEYBOARD ITALIAN Trackball USB
453564115921	453564115921	KBD KEYBOARD GERMAN Trackball USB
453564115931	453564115931	KBD KEYBOARD DANISH Trackball USB
453564115941	453564115941	KBD KEYBOARD SWEDISH Trackball USB
453564115951	453564115951	KBD KEYBOARD ENGLISCH Trackball USB
453564119161	453564119161	KBD KEYBOARD SPANISH Trackball USB
453564115961	453564115961	KBD KEYBOARD FRENCH Standard USB
453564115971	453564115971	KBD KEYBOARD ITALIAN Standard USB
453564115981	453564115981	KBD KEYBOARD GERMAN Standard USB
453564115991	453564115991	KBD KEYBOARD DANISH Standard USB
453564116001	453564116001	KBD KEYBOARD SWEDISCH Standard USB
453564116011	453564116011	KBD KEYBOARD ENGLISH Standard USB
453564119171	453564119171	KBD KEYBOARD SPANISH Standard USB
453564119241	453564119241	KBD Spillcover Trackball US
453564119251	453564119251	KBD Spillcover Trackball EUROPE
453564119261	453564119261	KBD Spillcover Standard US
453564119271	453564119271	KBD Spillcover Standard EUROPE
M4046-60103	451261000651	IV-MP70 PCACY Wired Track Ball USB/PS2
M4046-60106	451261000681	IV-MP70 PCACY WIRED TRACKBALL USB/PS2

## IntelliBridge

### Cabling Options

Part Number	12NC	Description	Conduit Sizes	Max. Bend Angle	Connector Size (L x W)
M8081-61001	453563484591	IV CBL 1.5m LAN/RS232 straight	30 mm <sup>2</sup>	25 mm	15 x 15 mm
M8081-61002	453563484601	IV CBL 3m LAN/RS232 straight	30 mm <sup>2</sup>	25 mm	15 x 15 mm
M8081-61003	453563484611	IV CBL 10m LAN/RS232 straight	30 mm <sup>2</sup>	25 mm	15 x 15 mm

### Local Printer

See printer documentation

## RS232/MIB/LAN Interface

Table 13 MIB Cable and Serial Cable

Part Number	12NC	Description	Conduit Sizes	Max. Bend Angle	Connector Size (L x W)
M8081-61001	453563484591	IV CBL 1.5m LAN/RS232 straight	30 mm <sup>2</sup>	25 mm	15 x 15 mm
M8081-61002	453563484601	IV CBL 3m LAN/RS232 straight	30 mm <sup>2</sup>	25 mm	15 x 15 mm
M8081-61003	453563484611	IV CBL 10m LAN/RS232 straight	30 mm <sup>2</sup>	25 mm	15 x 15 mm
M8081-61004	453563484621	IV CBL 15m LAN/RS232 straight	30 mm <sup>2</sup>	25 mm	15 x 15 mm
M8081-61005	453563484631	IV CBL 25m LAN/RS232 straight	30 mm <sup>2</sup>	25 mm	15 x 15 mm

## Nurse Call Paging Cable

Part Number	12NC	Description	Conduit Sizes	Bend Radius	Connector Size
453564214531	453564214531	CBL Nurse paging cable 3m	0.125 mm <sup>2</sup>	12 mm	9 x 12 mm One end terminated with 6P6C connector. one end without connector.
453564220531	453564220531	CBL Nurse paging cable 10m	0.125 mm <sup>2</sup>	12 mm	9 x 12 mm One end terminated with 6P6C connector. one end without connector.
M8087-61001	453563484741	IV CBL 10m flex nursepaging MDR&open con	40 mm <sup>2</sup>	30 mm	35 x 16 mm One end terminated with straight MDR connector, one end without connector

## ECG Out Interface

Table 14 ECG Out Cable

Part Number	12NC	Description	Conduit Sizes	Bend Radius	Diameter	Comments
8120-1022	453563198151	CBL ECG Out 3m Phone Plug Terminated	40 mm <sup>2</sup>	30 mm	13 mm	3m cable (Both ends are terminated with .25" phone plugs)
M1181-61625	453563255091	CMS CBL ECG OUT CABLE KIT 25m				cable kit consisting of:  25 m raw cable, 2 x 1/4" socket, 1 x 1/4" plug
M1783A	989803105251	Sync Cable 12-Pin 2.5M. (8ft.)				one end is terminated with ECG 12 pin and one end is terminated with phone plug
M5526A	989803129001	24' Sync Cable				one end is terminated with ECG 12 pin and one end is terminated with phone plug

## **8 Site Preparation**

# Gas Analyzers

For details on the M1026A/B Anesthetic Gas Module, the M1013A IntelliVue G1 and the M1019A IntelliVue G5, see the respective Service Guides on your documentation CD.

For details on configuring the RS232/MIB port for the gas analyzers, see *Connection of Devices via the MIB/RS232 Interface (Rev. D.00.xx or higher)* in the *Installation Instructions* chapter.

This section describes Software Uploads for the IntelliVue G7m Gas Analyzer Module.

## G7m Software Uploads

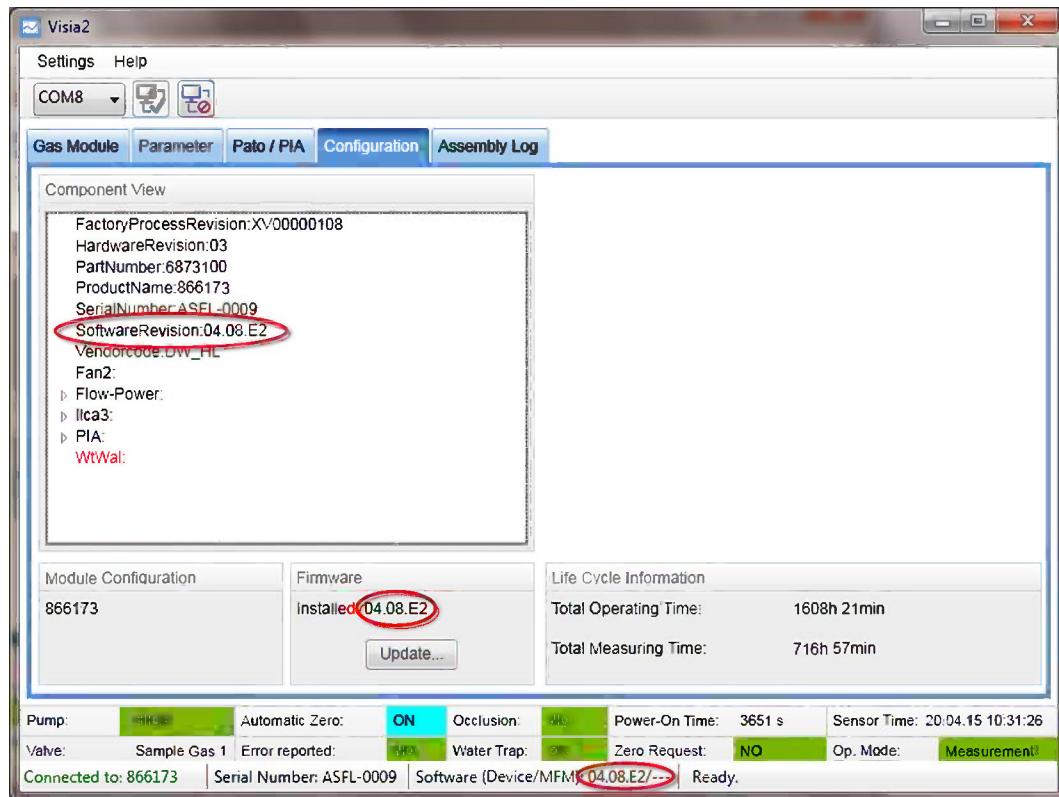
A software update of the IntelliVue G7m requires the most recent software listed in the Service Bulletin (SB) or Field Change Order (FCO). Download it from InCenter and save it to an easily-located folder, for example C:/TEMP.

Use the support tool VISIA2 and connect the G7m. The connection is made automatically when VISIA2 is opened and the cables are plugged into the PC/ Laptop and the G7m; otherwise press the “Connect”  button in the VISIA2 tool.

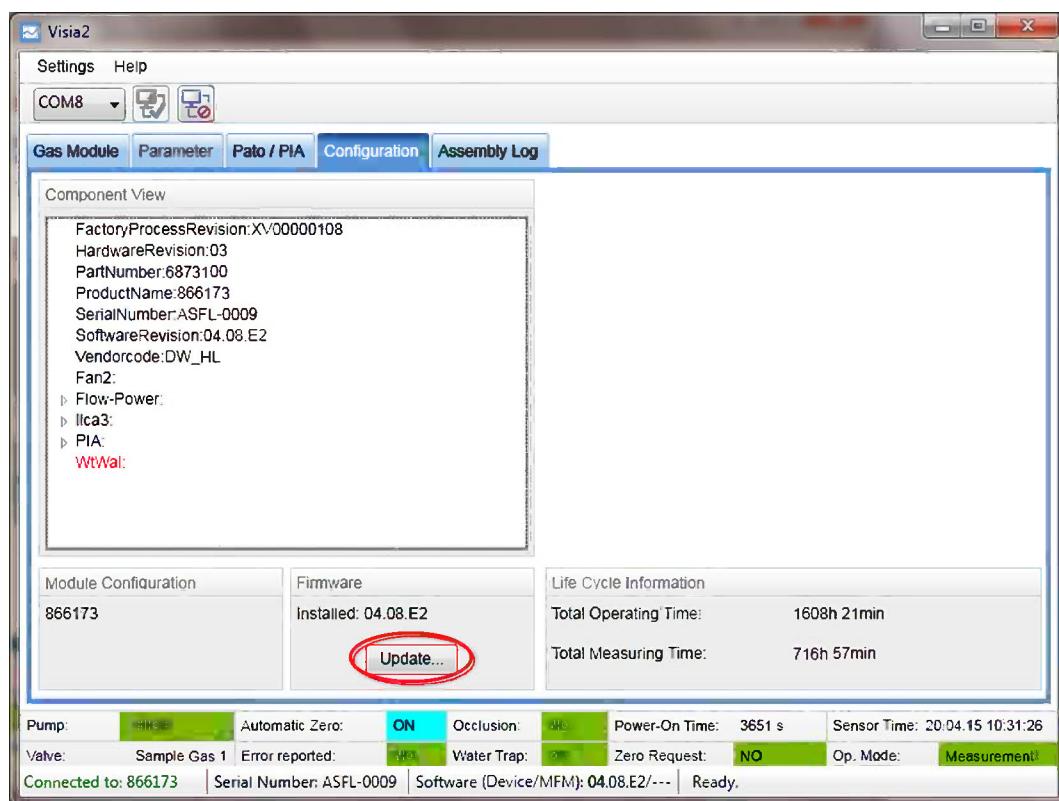
For automatic connection power on the G7m and wait 30 seconds before initializing the VISIA2 tool.

### Uploading the Software

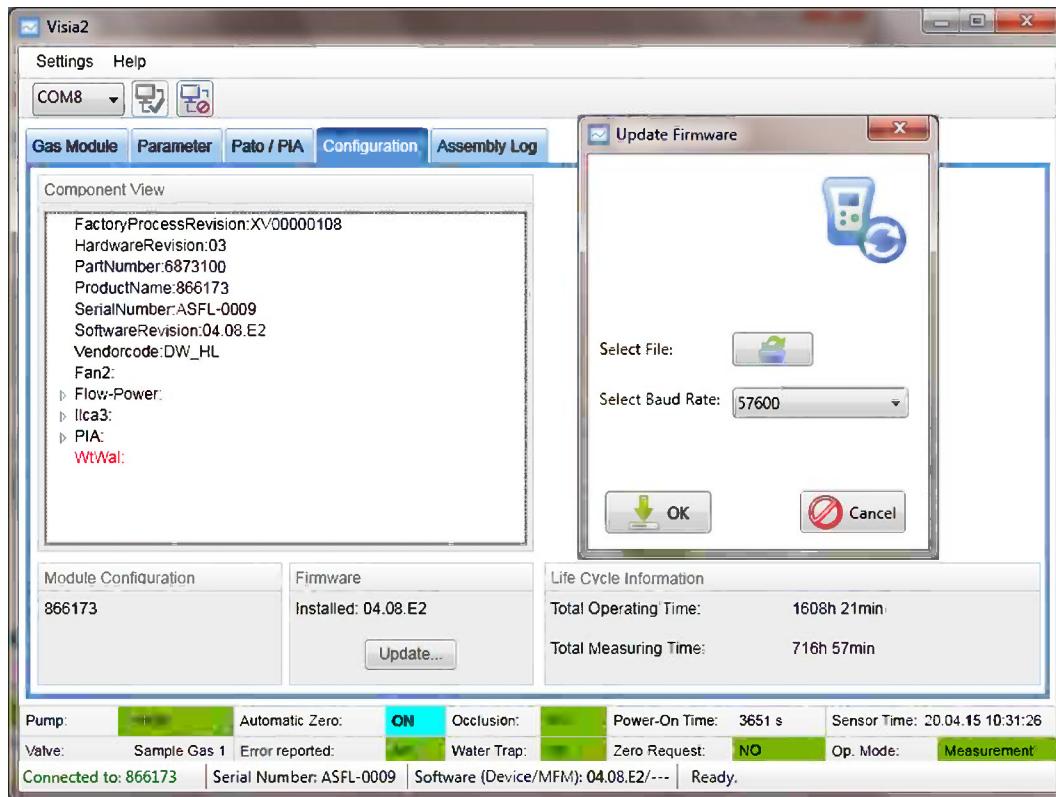
- 1 Check the firmware revision in the Configuration Tab in the VISIA2 tool.



- 2 In the **Firmware** section, click the **Update** button.



- 3 The **Update Firmware** dialog window opens. Click the **Select File** button and select the software file from the folder to which it was downloaded. The Baud rate is automatically set to 57600. Do not change this setting.



- 4 Click the **OK** button and wait for the automatic software load procedure to begin. This may take a few seconds. Do not interrupt this procedure.

### CAUTION

While loading, do not interrupt the Power Supply or unplug the G7m Gas Analyzer module. Do not disconnect the serial line. This may destroy the memory in the module and the module will need to be exchanged and repaired.

- 5 When the download is finished, the programming process will automatically start.  
6 After the programming process, unplug and replug the G7m Gas Analyzer Module.

### Checking the Unit for Functionality

After performing a software update, check the IntelliVue G7m Gas analyzer module for functionality. See the Testing and Maintenance section for details.

# Specifications

This section contains selected specifications for the IntelliVue MX800 Patient Monitors. For a complete and detailed list of specifications, see the *Instructions for Use*.

## Essential Performance Characteristics

This chapter defines the Essential Performance for IntelliVue patient monitors, in combination with Multi-Measurement-Modules, Measurement Extensions, 4-Slot and 8-Slot Module Racks, measurement (plug-in) modules and IntelliVue Cableless measurement devices.

Under normal and single fault conditions either at least the performance / functionality listed in the table below is provided or failure to provide this performance / functionality is readily identifiable by the user (e.g. technical alarm, no waves and/or numeric values, complete failure of the monitor, readily identifiable distorted signals, etc.).

Parameter	Essential Performance
General	No interruption or cessation of current operating mode (e.g. no reboot, display ok). No spontaneous operation of controls (e.g. no activation of touch screen without user interaction).
BIS	Measurement of bispectral index (BIS).
C.O./C.C.O	Measurement of blood temperature within the specified accuracy/ error limits. Alarming on blood temperature limit violations.
ECG	Measurement of heart rate within $\pm 10\%$ or $\pm 5$ bpm, whichever is greater. Alarming on Asystole, or heart rate limit violation within specified delay time. Detection of VFIB and alarming on it. ECG-Out Signal delay $\leq 35$ msec.
EEG	Measurement of spectral edge frequency, mean dominant frequency, peak power frequency, total power, as well as the percentage of power in bands alpha, beta, theta and delta.
Invasive Pressure	Measurement of systolic, diastolic and mean blood pressure within $\pm 4\%$ or $\pm 4$ mmHg, whichever is greater, and pulse rate within $\pm 10\%$ or $\pm 5$ bpm, whichever is greater. Alarming on systolic, diastolic and mean blood pressure and pulse rate limit violations.

Parameter	Essential Performance
NBP	Measurement of systolic, diastolic and mean blood pressure and pulse rate within specified accuracy / error limits.
	Automatic cycling.
	Alarming on systolic, diastolic and mean blood pressure limit violations.
NMT	Measurement of Train-Of-Four, Post-Tetanic-Count, Double Burst and Single-Twitch stimulation responses.
	Alarming on TOF Count limit violation.
Respiration	Measurement of respiration rate within specified accuracy/ error limits.
	Alarming on apnea and on respiration rate limit violation.
Respiratory Gases (CO <sub>2</sub> , O <sub>2</sub> , N <sub>2</sub> O, Anesthetic Agents)	Measurement of respiratory gases within the following measurement accuracy ranges:
	<b>Halogenated agent:</b> ± (0,2 % absolute + 15 % of reading)
	<b>CO<sub>2</sub>:</b> ± (0,43 % absolute + 8 % of reading)
	<b>Nitrous oxide:</b> ± (2,0 % absolute + 8 % of reading)
	<b>O<sub>2</sub>:</b> ± (2,5 % absolute + 2,5 % of reading)
	Measurement of airway respiration rate within specified accuracy/ error limits.
	Alarming on apnea, airway respiration rate and respiratory gas limit violation.
Spirometry	Measurement of spirometry values within specified accuracy/ error limits.
	Alarming on apnea and PEEP, PIP, MV and respiration rate limit violation.
SpO <sub>2</sub>	Measurement of oxygen saturation within 4% <sub>RMS</sub> over the range from 70 to 100% and pulse rate within 10% <sub>RMS</sub> or 5 bpm <sub>RMS</sub> , whichever is greater.
	Alarming on oxygen saturation and pulse rate limit violation.
Intravascular Oxygen Saturation	Measurement of intravascular oxygen saturation within specified accuracy/ error limits.
	Alarming on intravascular oxygen saturation limit violation.

Parameter	Essential Performance
tcpO <sub>2</sub> /tcpCO <sub>2</sub>	Measurement of partial pressure O <sub>2</sub> within $\pm 6$ mmHg over the range from 40 to 100 mmHg and partial pressure CO <sub>2</sub> within $\pm 6$ mmHg over the range from 30 to 60 mmHg.
	Alarming on transcutaneous partial pressure O <sub>2</sub> and CO <sub>2</sub> limit violation.
Temperature	Measurement of temperature within specified accuracy/ error limits.
	Alarming on temperature limit violation.
Predictive Temperature	Measurement of temperature within specified laboratory accuracy/ error limits.
	Alarming on temperature limit violation
Tympanic Temperature	Measurement of temperature within specified laboratory accuracy/ error limits.
	Alarming on temperature limit violation.

The table above also represents the minimum performance when operating under non-transient electromagnetic phenomena according to IEC 60601-1-2:

- Radiated electromagnetic fields
- Conducted disturbances induced by RF fields
- Conducted disturbances induced by magnetic fields
- Voltage dips/ voltage variations

The following table identifies minimum performance for transient electromagnetic phenomena according to IEC 60601-1-2:

- Electrostatic Discharge (ESD)
- Electrical Fast Transients / Bursts
- Surges
- Voltage interruptions
- Electrosurgery (ESU)
- Defibrillation

Parameter	Essential Performance
All	After electrostatic discharge, fast transients/bursts, surges, electro surgery interference and defibrillation the equipment returns to previous operation mode within 30 seconds (tcpO <sub>2</sub> /tcpCO <sub>2</sub> : 60 seconds) without operator intervention and without loss of any stored data.
	After voltage interruptions the equipment returns to previous operating mode without operator intervention and without loss of any stored data.

1 Some standards (e.g. IEC 60601-2-49, IEC 60601-2-27, etc.) may specify additional essential performance or shorter recovery times for defibrillation.

## MDD Classification

According to the Council Directive 93/42/EEC (Medical Devices Directive) the device classification is IIb, according to Rule 10.

## Classification According to IEC 60601-1

Classification (according to IEC 60601-1): Class 1, Type CF, Continuous Operation. The BIS and NMT measurements and the G7m gas analyzer use a Type BF applied part.

## Safety and Regulatory Information

For details about safety and regulatory information, see the Instructions for Use.

## Use Environment

### Hospital Environment

The monitors are suitable for use in all medically used rooms which fulfill the requirements regarding electrical installation according to IEC 60364-7-710 "Requirements for special installations or locations - Medical locations", or corresponding local regulations.

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### WARNING

The monitors are not intended for use in an MRI environment or in an oxygen-enriched environment (for example, hyperbaric chambers).

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## Physical Security and Limited Access to the Monitor

Access to the monitor must be limited to authorized users. It is important that you consider physical security measures to ensure that unauthorized users cannot gain access.

## Disconnecting from Power

The On/Standby switch does not disconnect the monitor from the AC power source. To disconnect, unplug the power cable.

## Symbols

These symbols can appear on the monitor and its associated equipment and packaging.

Symbols			
	Caution, is necessary when operating the device.		Operating instructions should be considered when operating the device.
	Follow instructions for use.		Quick mount release
	Equipotential grounding		Protective earth
	Connector has special protection against electric shocks and is defibrillator proof (Type CF according to IEC 60601-1)		Applied part has special protection against electric shocks (Type BF according to IEC 60601-1) and is defibrillator proof
	Start a measurement		Stop a measurement
	Standby		Module Rack power-on indicator
	Error LED		Alternating current
	Connection direction indicator		Connection direction indicator
	Electrical input indicator (In some cases gas input indicator)		Electrical output indicator (In some cases gas output indicator)
	Gas input indicator		Gas output indicator
	Data input/output symbol		USB interface
	Manufacturer's name and address		Identifies date of manufacture
	Non-ionizing radiation symbol		Always use separate collection for waste electrical and electronic equipment (WEEE)
	Pressure connector		NBP connector
	Cardiac Output connector		SpO <sub>2</sub> connector
	Temperature connector		Monitor supports 12-lead ECG

## 10 Specifications

Symbols			
	Masimo SET technology		Nellcor OxiMax compatible
	Masimo rainbow SET technology		Uses FAST SpO <sub>2</sub> algorithm
	Alarms Switched Off		Acknowledge Alarms
	Alarms On/Off		Main Screen
	SmartKeys		Back key
	Enter the measurement setup menu		Purge flow tubing with air and perform automatic zero calibration
	Zero the invasive pressure transducer		ECG Sync Output/ Analog ECG Output
	Enter the measurement setup menu to start a calibration		Followed by two alphanumeric characters, indicates ingress protection grade
	Indicates location of catalog number		Indicates location of service number
	Mass in kilogram (kg)		Rechargeable battery symbol
	Battery LED		Indication for battery placement in battery compartment
	Label for the setup key, used to enter the measurement setup menu		Indicates location of batch number.
	Indicates the location of the "use by" date.	Rx only	Prescription use only
	Not made with natural rubber latex		Contents of the packaging are not sterile.
	Atmospheric pressure limitations for storage		Humidity limitations for storage
	Temperature limitations for storage		Indicates location of serial number
	NFC Transceiver		

## Physical Specifications

Product	Maximum Weight	W x H x D	Comments
MX800 Monitor	11 kg (26.3 lb)	478 x 364 x 222 mm (18.8 x 14.3 x 8.7 in)	with cable management
M3001A/M3001AL Multi-Measurement Module (MMS)	0.6 kg (1.3 lb)	189 x 98 x 57 mm (7.4 x 3.9 x 2.2 in)	
M3002A Multi-Measurement Module (X2)	1.2 kg (2.6 lb)	189 x 99 x 89 mm (7.4 x 3.9 x 3.5 in)	including battery, without handle or options
		199 x 146 x 89 mm (7.8 x 5.7 x 3.5 in)	including battery, with handle
867030 Multi-Measurement Module (X3)	1.4 kg (3.1 lbs)	249 x 97 x 111 mm (9.8 x 3.8 x 4.4 in)	including battery and options, with handle
		194 x 97 x 85 mm (7.6 x 3.8 x 3.3 in)	including battery and options, without handle
867036 Multi-Measurement Module (MMX)	<1.0 kg (2.2 lbs)	188 x 97 x 58 mm ± 5% (7.4 x 3.8 x 2.3 in)	
867039 Hemodynamic Extension	<0.55 kg (1.2 lbs)	200 x 97 x 90 mm (7.9 x 3.8 x 3.5 in)	
867040 Capnography Extension	<0.55 kg (1.2 lbs)	200 x 97 x 90 mm (7.9 x 3.8 x 3.5 in)	
867041 Microstream Extension	<0.75 kg (1.7 lbs)	200 x 97 x 90 mm (7.9 x 3.8 x 3.5 in)	
M3012A Hemodynamic Extension	0.6 kg (1.4 lbs)	200 x 98 x 89 mm (7.9 x 3.9 x 3.5 in)	
M3014A Capnography Extension	0.6 kg (1.4 lbs)	200 x 98 x 89 mm (7.9 x 3.9 x 3.5 in)	
M3015A/B Microstream Extension	0.6 kg (1.4 lbs)	202 x 98 x 89 mm (8 x 3.9 x 3.5 in)	
M8048A 8-Slot Module Rack (FMS-8)	2.3 kg (5.1 lb)	421 x 132 x 206 mm (16.6 x 5.2 x 8.1 in)	without plug-in modules
865243 4-Slot Module Rack (FMS-4)	1.6 kg (3.5 lb)	204 x 139 x 158 mm (8.0 x 5.5 x 6.2 in)	without Multi-Measurement Module Mount
M1006B Invasive Press Module	0.3 kg (0.7 lb)	36 x 102 x 111 mm (1.4 x 4.0 x 4.4 in)	Specifications are also valid for Opt. C01.
M1029A Temperature Module	0.3 kg (0.7 lb)	36 x 102 x 111 mm (1.4 x 4.0 x 4.4 in)	
M1012A Cardiac Output Module	0.3 kg (0.7 lb)	36 x 102 x 111 mm (1.4 x 4.0 x 4.4 in)	Specifications are also valid for Opt. C10.
M1014A Spirometry Module	0.3 kg (0.7 lb)	36 x 102 x 111 mm (1.4 x 4.0 x 4.4 in)	
M1020B SpO <sub>2</sub> Module	0.3 kg (0.7 lb)	36 x 102 x 111 mm (1.4 x 4.0 x 4.4 in)	
M1011A SO <sub>2</sub> Module	0.3 kg (0.7 lb)	36 x 102 x 111 mm (1.4 x 4.0 x 4.4 in)	
Optical Module	0.2 kg (0.4 lb)	50 x 30 x 120 mm (2.0 x 1.2 x 4.7 in)	including 2.9 m cable
M1027A/B Electroencephalograph Module	0.3 kg (0.7 lb)	36 x 102 x 111 mm (1.4 x 4.0 x 4.4 in)	

## 10 Specifications

Product	Maximum Weight	W x H x D	Comments
M1034B BIS Module	0.3 kg (0.7 lb)	36 x 102 x 111 mm (1.4 x 4.0 x 4.4 in)	without cables
BIS Device	0.5 kg (1.1 lb)	diameter x height: 95.3 x 63.5 mm (3.8 x 2.5 in)	with Patient Interface Cable (1.22 m, 4 ft) and cable to BIS module
865115 IntelliBridge EC10 Module	0.3 kg (0.7 lb)	36 x 102 x 111 mm (1.4 x 4.0 x 4.4 in)	
865114 IntelliBridge EC5 Module	0.03 kg (0.07 lb)	35 x 17 x 57 mm (1.4 x 0.7 x 2.1 in)	with D-Sub 9-pin male or female connector
	0.02 kg (0.04 lb)	21.5 x 17 x 65 mm (0.9 x 0.7 x 2.6 in)	without cable and strain relief
M1116B Thermal Array Recorder Module	0.6 kg (1.3 lb)	73 x 102 x 118 mm (2.9 x 4.0 x 4.6 in)	
M1116C Thermal Array Recorder Module	0.5 kg (1.1 lb)	73 x 102 x 111 mm (2.9 x 4.0 x 4.4 in)	
865244 Remote Control	0.4 kg (0.9 lb)	53 x 40 x 172 mm (2.1 x 1.6 x 6.8 in)	without navigator knob, with holder 59 x 52 x 175 mm (2.3 x 2.0 x 6.9 in)
866406 #A01 Remote Alarm Device	0.4 kg (0.9 lb)	261 x 32 x 82 mm (10.3 x 1.2 x 3.2 in)	
865383 IntelliVue NMT Module	0.3 kg (0.7 lb)	36 x 102 x 111 mm (1.4 x 4.0 x 4.4 in)	without cables
866173 IntelliVue G7m Gas Analyzer Module	1 kg (2.2 lb)	72 x 101 x 157 mm (2.8 x 4.0 x 6.2 in)	

## Environmental Specifications

The monitor may not meet the performance specifications given here if stored or used outside the specified temperature and humidity ranges.

When the monitor and related products have differing environmental specifications, the effective range for the combined products is that range which is common to the specifications for all products.

### MX600/700/800 Monitor

Item	Condition	Range
<b>Temperature Range</b>	Operating	0 to 40°C (32 to 100°F) 0 to 35°C (32 to 95°F) when equipped with the iPC
	Storage	-20 to 60°C (-4 to 140°F)
<b>Humidity Range</b>	Operating	15% to 95% Relative Humidity (RH) (non condensing)
	Storage	5% to 95% Relative Humidity (RH)
<b>Altitude Range</b>	Operating	-500 m to 3000 m (-1600 to 10000 ft)
	Storage	-500 m to 4600 m (-1600 to 15000 ft)
<b>Ingress Protection</b>		Protected against harmful effects of vertically dripping water (rated IPX1 per IEC 60529).

### X2 (M3002A) and External Power Supply (M8023A)

Item	Condition	Range
<b>Temperature Range</b>	Operating	0 to 40°C (32 to 104°F)
	Storage including transportation	-20 to 60°C (-4 to 140°F)
<b>Temperature Range when charging the battery or when equipped with IntelliVue Instrument Telemetry or the IntelliVue 802.11 Bedside Adapter</b>	Operating	0 to 35°C (32 to 95°F)
<b>Humidity Range</b>	Operating	15% to 95% Relative Humidity (RH)
	Storage including transportation	5% to 95% Relative Humidity (RH)
<b>Altitude Range</b>	Operating	-500 m to 3000 m (-1600 to 10000 ft)
	Storage including transportation	-500 m to 4600 m (-1600 to 15000 ft)
<b>Ingress Protection</b>	X2	Protected against harmful effects of vertically dripping water with the device tilted at any angle up to 15° and ingress of foreign objects larger than 2.5 mm (rated IP32 per IEC 60529).
	M8023A	Protected against harmful effects of vertically dripping water and ingress of foreign objects larger than 2.5 mm (rated IP31 per IEC 60529).

## 10 Specifications

### X3 (867030), MMX (867036) and Measurement Extensions (867039, 867040, 867041)

Item	Condition	Range
Temperature Range	Operating	0 to 40°C (32 to 104°F)
	Operating when charging the battery, when equipped with wireless LAN or IntelliVue Instrument Telemetry Wireless network, or when X3 is mounted directly on a host monitor	0 to 35°C (32 to 95°F)
	Storage including transportation	-20 to 60°C (-4 to 140°F)
Humidity Range	Operating	15% to 95% Relative Humidity (RH)
	Storage including transportation	5% to 90% Relative Humidity (RH)
Altitude Range	Operating	-500 m to 3000 m (-1600 ft to 10000 ft)
	Storage including transportation	-500 m to 4600 m (-1600 ft to 15000 ft) <sup>1</sup>
Ingress Protection	867030 IntelliVue X3	IP32 when mounted horizontally
	867036 MMX	IP32 when mounted horizontally
	867039 Hemodynamic Extension	IP32 when mounted horizontally
	867040 Capnography Extension	IP32 when mounted horizontally
	867041 Microstream CO <sub>2</sub> Extension	IP32 when mounted horizontally
<b>Definition of IP codes used:</b>		
IP32	Protected against ingress of water when the water is dripping vertically and the monitor is tilted up to 15°, and ingress of solid foreign objects 2.5 mm in diameter or larger.	

<sup>1</sup> Sufficient for flight altitudes up to 12000 m with pressurized cabins

### Devices for Acquiring Measurements and 8-Slot Module Rack

<b>Multi-Measurement Module M3001A/M3001AL, Measurement Extensions M3012A, M3014A, M3015A/B, Measurement Modules, and 8-Slot Module Rack M8048A</b>		
Item	Condition	Range
Temperature Range	Operating	0 to 45°C (32 to 113°F)
	Non-operating	-40 to 70°C (-40 to 158°F)
Humidity Range	Operating	95% Relative Humidity (RH) max. @ 40°C (104°F). M3015A/B only non-condensing.
	Non-operating	90% Relative Humidity (RH) max. @ 65°C (150°F)
Altitude Range	Operating	-500 m to 4600 m (-1600 to 15000 ft)
	Non-operating	-500 m to 15300 m (-1600 to 50000 ft)

### Ingress Protection for MMS M3001A/M3001AL, 8-Slot Module Rack M8048A, Module M1020B

Ingress Protection	M3001A/M3001AL	Protected against harmful effects of vertically dripping water with the device tilted at any angle up to 15° and ingress of foreign objects larger than 2.5 mm (rated IP32 per IEC 60529).
	M3014A, M3015A/B, M8048A and M1020B	Protected against harmful effects of vertically dripping water (rated IPX1 per IEC 60529).

## G7m Gas Analyzer Module (866173)

Item	Condition	Range
<b>Temperature Range</b>	Operating	10 to 40°C (50 to 104°F)
	Non-operating	-20 to 60°C (-4 to 140°F)
<b>Humidity Range</b>	Operating	5 to 95% RH up to 40°C (104°F) non-condensing
	Non-operating	5 to 95% non condensing
<b>Altitude Range</b>	Operating/non-operating	-500 to 4750 m (-1640 to 15584 ft)
<b>Ingress Protection</b>	Protected against harmful effects of vertically dripping water and ingress of foreign objects larger than 2.5 mm (rated IP31 per IEC 60529).	

## 4-Slot Module Rack (FMS)

4-Slot Module Rack 865243		
Item	Condition	Range
<b>Temperature Range</b>	Operating	0 to 40°C (32 to 100°F)
	Storage	-20 to 60°C (-4 to 140°F)
<b>Humidity Range</b>	Operating	15% to 95% Relative Humidity (RH) (non condensing)
	Storage	5% to 95% Relative Humidity (RH)
<b>Altitude Range</b>	Operating	-500 m to 3000 m (-1600 to 10000 ft)
	Storage	-500 m to 4600 m (-1600 to 15000 ft)
<b>Ingress Protection</b>		Protected against harmful effects of vertically dripping water (rated IPX1 per IEC 60529).

## Thermal Array Recorder Module M1116B/C

Item	Condition	Range
<b>Temperature Range</b>	Operating	+5 to 45°C (41 to 113°F)
	Non-operating	-10 to 70°C (14 to 158°F)
<b>Humidity Range</b>	Operating	95% Relative Humidity (RH) max. @ 40°C (104°F) (non condensing)
	Non-operating	90% Relative Humidity (RH) max. @ 65°C (150°F) (non condensing)
<b>Altitude Range</b>	Operating	up to 3048 m (10000 ft)
	Non-operating	up to 3048 m (10000 ft)

## 10 Specifications

### Remote Control (865244)

Item	Condition	Range
Temperature Range	Operating	0 to 40°C (32 to 104°F)
	Storage	-20 to 60°C (-4 to 140°F)
Humidity Range	Operating	15% to 95% Relative Humidity (RH) (non condensing)
	Storage	5% to 95% Relative Humidity (RH)
Altitude Range	Operating	-500 m to 3000 m (-1600 to 10000 ft)
	Storage	-500 m to 4600 m (-1600 to 15000 ft)

### Remote Alarm Device (866406/453564501281)

Item	Condition	Range
Temperature Range	Operating	0 to 40°C (32 to 104°F)
	Storage	-20 to 60°C (-4 to 140°F)
Humidity Range	Operating	15% to 95% Relative Humidity (RH) (non condensing)
	Storage	5% to 90% Relative Humidity (RH) (non-condensing)
Altitude Range	Operating	-500 m to 3000 m (-1600 to 10000 ft)
	Storage	-500 m to 4600 m (-1600 to 15000 ft)

## Measurement-Related Specifications

### Mainstream and Sidestream CO<sub>2</sub>

CO<sub>2</sub> sample rate: 100 samples/second

#### Calculation of end tidal CO<sub>2</sub> (etCO<sub>2</sub>):

Peak of the expired CO<sub>2</sub> waveform. The displayed etCO<sub>2</sub> is the maximum etCO<sub>2</sub> over the previous peak-picking interval as defined by the Max Hold setting (configuration mode). It can be set to no peak picking (off), 10 seconds and 20 seconds.

#### Test method for respiration rate range:

Respiration Rate accuracy was verified by using a solenoid test setup to deliver a square wave of known CO<sub>2</sub> concentration to the device. 5% and 10% CO<sub>2</sub> concentrations were used and respiration rate was varied over the range of the device.

### Microstream CO<sub>2</sub>

CO<sub>2</sub> sample rate: 20 samples/second

#### Calculation of end tidal CO<sub>2</sub> (etCO<sub>2</sub>):

Microstream® uses non-dispersive infrared (NDIR) spectroscopy to continuously measure the amount of CO<sub>2</sub> during every breath, the amount of CO<sub>2</sub> present at the end of exhalation (etCO<sub>2</sub>), the amount of CO<sub>2</sub> present during inhalation (imCO<sub>2</sub>), and the respiratory rate. The displayed etCO<sub>2</sub> is the maximum etCO<sub>2</sub> over the previous peak-picking interval as defined by the Max Hold setting (configuration mode). It can be set to no peak picking (off), 10 seconds and 20 seconds.

#### Test method for respiration rate range:

A breath simulator system combined with CO<sub>2</sub> and N<sub>2</sub> gases was used to simulate respiration rates covering the specified range. The resulting end tidal CO<sub>2</sub> values were compared to the expected value. Differences between actual and expected end tidal CO<sub>2</sub> values were within the limits of the specified accuracy for the respective respiration rate, i.e. there was no effect of the respiration rate on the end tidal CO<sub>2</sub> values beyond those limits.

### G7m Gas Analyzer

The influence of respiration rate and the inspiratory/expiratory time ratio (I:E) on the accuracy of end tidal gas readings was determined from the measured concentration gradients in a simulated breathing system with rectangular concentration transitions.

The end tidal gas concentration is the value of a specific gas that is measured at the time of the maximum CO<sub>2</sub> concentration in the expiration phase. This time is determined for each breath individually.

The maximum data sample rate that can be displayed on the monitor for gas waves is 1 sample per 32 ms. The actual data sample rate displayed is dependent on the wave speed set at the monitor.



# Appendix - IntelliVue iPC

## Introduction

The IntelliVue iPC is a fan-less, medical grade PC. It is designed for continuous operation in the patient vicinity. It is designed for use with an IntelliVue patient monitor and with the IntelliVue XDS Software.

The iPC is intended for use with standard or a medical grade displays, either provided by Philips (for example, the IntelliVue Information Center display), or another manufacturer. Philips is not responsible for the selection, purchase, installation, repair or disposal, and cannot assure the compatibility of third-party displays.

The iPC supports one or two external displays, with or without touch operation.

### NOTE

This appendix explains the setup, installation, and troubleshooting of the latest iPC version (version 2, #PC1). Depending on your iPC version, some statements and descriptions might not apply.

## Abbreviations

Abbreviations used throughout this guide are:

Name	Abbreviation
Integrated PC	iPC
IntelliVue Clinical Network	ICN

## Connections

The iPC has two LAN interfaces, two video outputs, and six USB interfaces for input devices or printer connection.

The LAN 1 interface is used for a Hospital Network connection (IT LAN), the LAN 2 interface connects to the Medical LAN or IntelliVue Clinical Network (ICN). The LAN 2 interface is connected internally to the monitor via an internal switch and is accessible via the Orange LAN connector on the back of the monitor.

### NOTE

The USB ports are not isolated. When using the iPC in the patient vicinity, device connections must be according to IEC 60601-1-1 or IEC 60601-1 edition 3 clause 16.

### Lithium Battery

The iPC mainboard is equipped with a Lithium battery (CMOS battery). When replacing the battery, follow the applicable instructions in the section “[Repair and Disassembly](#)” on page 183.

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#### **WARNING**

Danger of explosion when replaced with the wrong type of battery. Replace only with the same type or an equivalent type recommended by the manufacturer.

---

**Dispose of used batteries** promptly and in an environmentally-responsible manner. Do not dispose of the battery in normal waste containers. Consult your hospital administrator to find out about local arrangements.

### Peripherals

---

#### **CAUTION**

- After installing additional software or connecting peripherals to the iPC, make sure that the system complies with all relevant local regulations.
  - Non-medical grade IT equipment used in a medical environment could be adversely impacted by other devices (for example because of electromagnetic susceptibility).
- 

### Displays

Peripheral displays must be suitable medical grade displays; they must comply with the specifications listed below.

If you want to use a display with a touch screen capability with the iPC, make sure that the touch screen supports USB connection, and that a driver is available from the manufacturer for the operating system in use.

The 865244 Remote Control used with the MX600, MX700, and MX800 Patient Monitors is not supported for use with the iPC.

#### **Display specifications**

**Resolution:** max. 2560 x 1600 (width x height) at 60 Hz

**Color bit depth:** 32 bits true color (recommended) or lower

**Video connection:** two independent DisplayPort outputs

---

#### **CAUTION**

Displays used in the patient vicinity must be medical grade, or connected to an isolation transformer.

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### Input Devices - Keyboard and Mouse

The iPC supports a USB keyboard and mouse. If possible, select input devices requiring standard Microsoft drivers rather than custom drivers. PS/2 input devices are not supported.

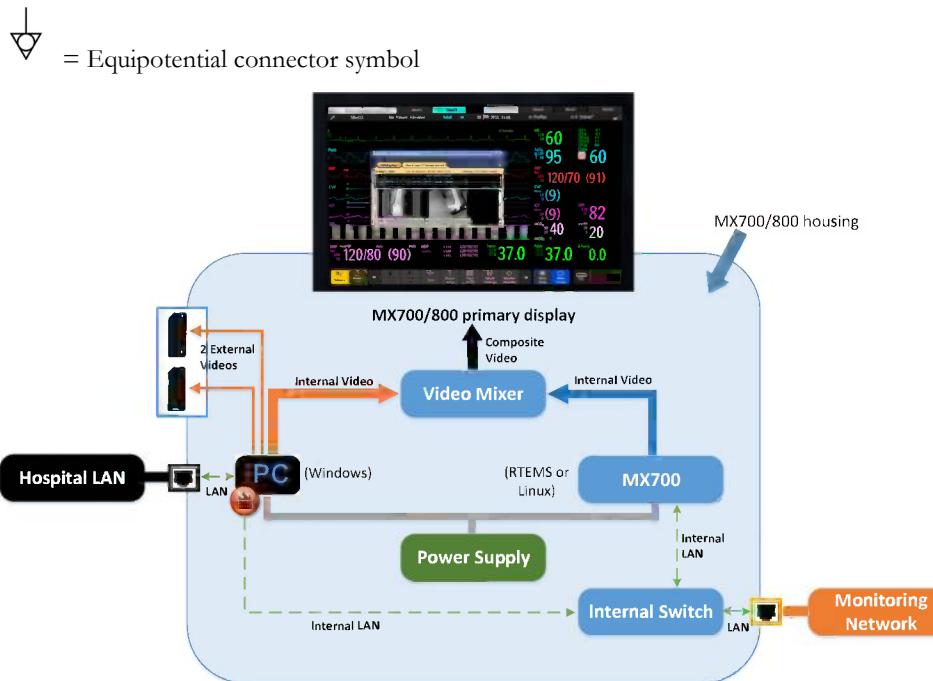
## Connecting the Peripherals

Connect the displays, printer (if required), network cables and the required input devices (mouse, keyboard, and so on) to the connector panel of the iPC.

Connected peripherals and wiring (USB, DisplayPort, and Sound) must be compliant with IEC 60601-1-2 and either IEC 60601-1-1 or IEC 60601-1 edition 3 clause 16. The maximum cable length is limited to 5 m.

Make the connections in the following order:

- 1** Display 1 – video, DisplayPort
  - 2** Display 1 – touch (optional), USB (1 - 5)
  - 3** Display 2 – video (optional), DisplayPort
  - 4** Display 2 – touch (optional), USB (1 - 5)
  - 5** Keyboard (optional) – USB (1 - 5)
  - 6** Mouse (optional) – USB (1 - 5)
  - 7** Printer (optional) – USB (1 - 5)
  - 8** Patient monitor or ICN network – Medical LAN (orange connector)
  - 9** Optional – Hospital IT LAN (black connector)
  - 10** AC mains connector
  - 11** Connect the supplied equipotential cable to the equipotential connector on the monitor and to the equipotential connector in the room.



## NOTE

Medical electrical equipment used in medical rooms must be connected to potential equalization equipment (equipotential cable) to avoid electrical potential differences. Check your local requirements for details.

## Connecting to Networks with Philips Patient Monitors and Central Station

- To ensure the best performance, Philips recommends to install IntelliVue XDS Software on the iPC. For information about the installation, see the *XDS Software Installation and Configuration Guide*.
- Only Philips permitted applications are allowed to communicate on the medical network, for example, IntelliVue XDS Software and IntelliVue Central Station.
- Configure the firewall to control the traffic in the Medical LAN, or configure XDS Software to control the firewall.
- Do not install additional non-IP, network protocol drivers which send data to the network where Philips Patient Monitors and a Central Station are connected.
- You may install the Philips IntelliVue Support Tool and its network drivers on the iPC.
- The Medical LAN network interface card of the iPC is connected internally to a switch. The speed and duplex configuration of this Medical LAN NIC must not change. The internal switch only supports Autonegotiate mode. Any other configuration of the Medical LAN network adapter will create communication problems.

## iPC Operating System Installation

### NOTE

If you are installing your own Windows OS image, see “[Windows OS Installation](#)” on page 503.

### CAUTION

Do not interrupt the installation of the Operating System. Only turn on the PC when you are ready to do the complete installation.

## Overview

Windows 7 Professional is pre-installed on the iPC before delivery. To complete the installation, the following steps are required:

- Select the language of the operating system
 

Only frequently used languages are selectable for automatic installation. Other languages require a manual installation.
- Configure site-specific settings
  - Computer name
  - Monitoring and hospital network settings
  - Install touch driver (optional)
  - Display settings; see “[Making Graphics Properties Settings for the iPC](#)” on page 505
- Install a different OS language (if required), then remove unused languages
- Update with latest Microsoft Security Patches

## Completing the Operating System Installation

- 1 Turn on the iPC.  
The setup process starts.
- 2 Select the language of the operating system, then click **Next**. If your language is not pre-installed, select English. You can manually install other languages in a later step.  
After about five minutes, Windows completes the setup and displays the desktop.
- 3 Configure the settings of your displays as described in “[Making Graphics Properties Settings for the iPC](#)” on page 505.
- 4 If you want the iPC to use a keyboard language other than US English, configure the keyboard layout:
  - a. Go to the Control Panel and click **Change Keyboards and other input methods**.
  - b. In the **Region and Language** settings window, select the **Keyboards and Languages** tab and click **Change Keyboards**.
  - c. Click **Add** to add a new keyboard language.
  - d. Select the required keyboard language from the list and click **OK**.
  - e. Set your keyboard language as the **Default input language**.
  - f. Click **OK** to exit this dialog and return to the **Region and Language** settings window.

**Important:**

You must complete the next steps to change the keyboard layout for the login screen. Otherwise, you may not be able to enter a password at a later point in time.

- g. Click the **Administrative** tab and then click **Copy settings**. If you are prompted for an administrator password or confirmation, type the password or provide confirmation.
- h. Check the **Welcome screen and system accounts** box, then click **OK** twice to exit the windows.

- 5 Perform the following tasks:
  - a. Set up the computer name, but do not reboot until later in the installation.
  - b. If you want to use an external display with touch capability, install the corresponding touch driver according to the manufacturer's instructions.
  - c. Check the date, time, and time zone. Adjust them if necessary.
  - d. Set the IP address for Local Area connection 1 (Medical LAN), if necessary.
  - e. Set the IP address for Local Area connection 2 (Hospital LAN), if necessary. The default is DHCP.

If your language was not pre-installed, manually install the language now as described in step 6.

If you were able to select your language in step 2, proceed now to step 8.

- 6 If required, install a different language:
  - a. Open a command prompt with the **Run as administrator** setting.
  - b. Execute the following command:

```
dism.exe /Online /Add-Package /PackagePath:C:\IntelliVue-XDS\langpacks\<languagecode>\1p.cab
```

Where <languagecode> is the corresponding code for your language. For a list of available language codes, see “[Language Codes](#)” on page 502.

The command will take approximately 10 minutes to execute completely.

- c. To verify that the language pack has been installed, run **1pksetup.exe**. Select **Uninstall** and check that the language is included in the list. Do *not* uninstall.

- d. To activate the OS language, you must restart the iPC. Execute the following command:

```
%windir%\system32\sysprep\sysprep.exe /oobe /reboot
```

The iPC restarts.

- e. After the restart, select your language from the list. This procedure is equivalent to a new Windows installation. You must create a new Admin User (with: **Add new User**) and enter the following settings:

- Regional settings
- Computer name
- Network type
- Time zone

- 7 Open a command prompt with the **Run as administrator** setting and run **lpremove.exe** to remove unused language packs. This task will be executed when the iPC shuts down and will take approximately 20 minutes.
- 8 Restart the iPC.
- 9 If you have manually installed a language and created a new Admin User, remove that user with **User Management** now. For information on the default user accounts, see “[Default Passwords](#)” on page 503.
- 10 Perform the Power-On test:
  - a. Switch on the iPC. This includes connected displays with touch, keyboard, mouse, printer, and LAN connections.
  - b. If the iPC starts up and displays the Windows desktop, the test was successful.

You can now install the IntelliVue XDS Software according to the *XDS Software Installation and Configuration Guide*.

## Language Codes

Language	Code	Language	Code	Language	Code
Arabic (Saudi Arabia)	ar-sa	Greek (Greece)	el-gr	Portuguese (Portugal)	pt-pt
Bulgarian (Bulgaria)	bg-bg	Hebrew (Israel)	he-il	Romanian (Romania)	ro-ro
Chinese (Hong Kong SAR, PRC)	zh-hk	Hungarian (Hungary)	hu-hu	Russian (Russia)	ru-ru
Chinese (PRC)	zh-cn	Korean (Korea)	ko-kr	Serbian (Serbia, Latin)	sr-latin-cs
Chinese (Taiwan)	zh-tw	Latvian (Latvia)	lv-lv	Slovak (Slovakia)	sk-sk
Croatian	hr-hr	Lithuanian (Lithuania)	lt-lt	Slovenian (Slovenia)	sl-si
Czech (Czech Republic)	cs-cz	Norwegian (Norway)	nb-no	Thai (Thailand)	th-th
Estonian (Estonia)	et-ee	Polish (Poland)	pl-pl	Turkish (Turkey)	tr-tr
Finnish (Finland)	fi-fi	Portuguese (Brasil)	pt-br	Ukrainian (Ukraine)	uk-ua

## Default Passwords

When the Philips pre-installed Operating System is used on the iPC, the passwords for the pre-installed user accounts must be changed to ensure appropriate security.

Only provide access to user accounts with administrator privileges to users that require them. The default passwords and settings are shown in the following table.

<b>User Name</b>	ClinicalUser	ServiceUser
<b>Long Name</b>	Clinical User	Service User
<b>Password</b>	BedPC	Supp0rtuzr (0 is zero)
<b>Password expires</b>	Never	Never
<b>Group</b>	Users	Administrators
<b>Comment</b>	For normal operation	For service purposes

For service, configuration, and setup, you must use the ServiceUser account. Because you can execute commands and applications with the **Run as administrator** setting, you do not need to log off every time.

On the iPC you may also need the BIOS password, for example, when installing a different operating system:

BIOS Password	865159
BIOS keys (to be pressed when re-booting the PC)	
Del	Enter BIOS setup
F8	Windows startup options
F10	Confirm TPM operation
F11	Boot selection menu

## Windows OS Installation

Philips does not recommend that you create your own operating system image from scratch. Philips provides OS images for Windows 7, tailor-made for the iPC. Philips recommends that you use the OS images provided as a basis for customizing and then re-imaging instead of starting with a standard Windows Setup.

Using these images as a basis for customization has the following advantages:

- Contains valid Windows license (automatic OS activation on the PC hardware)
- Contains correct drivers
- Contains correct configuration of Windows system settings

### CAUTION

If you have installed **Windows 8.1 or Windows 10** as your operating system on an iPC, you **must** carry out the following steps to ensure that the iPC in the patient monitor operates correctly.

## Correct iPC Shutdown for Windows 8.1 and Windows 10

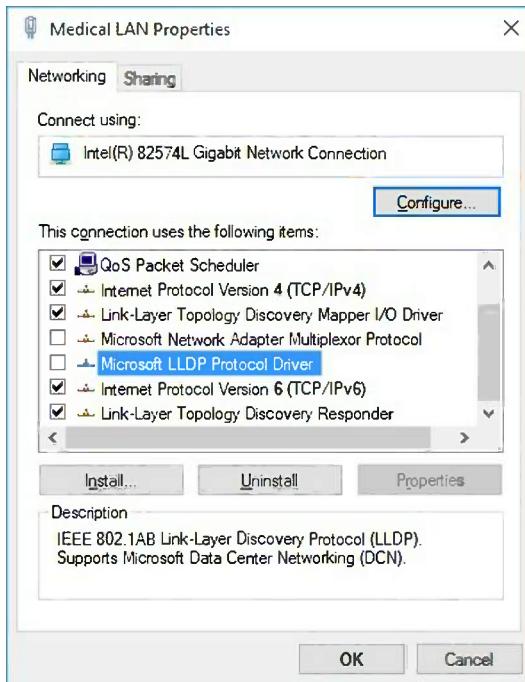
To ensure that the iPC shuts down correctly, do the following:

- 1 In the Windows **Power Options**, select **Choose what the power buttons do**.
- 2 In the section **Power and sleep buttons and lid settings - When I press the power button**, select **Shutdown**.
- 3 In the section **Shutdown settings**, uncheck the **Turn on fast startup (recommended)** and **Sleep** check boxes.
- 4 Click **Save changes**.

## Correct LLDP Configuration for Windows 8.1 and Windows 10

To ensure that the LLDP is correctly configured for the iPC, proceed as follows:

- 1 Open the Windows **Network connections**.
- 2 Right-click the Medical LAN network adapter and select **Properties**.  
The Medical LAN Properties window opens.



- 3 Deselect the "Microsoft LLDP Protocol Driver".
- 4 Click **OK**.

## Partitioning for use with an SSD instead of a Hard Disk

For example, connect the SSD as an additional (non-boot) disk to a Windows 7 or Windows 8.1 system and use 'diskpart' to partition the SSD, using the command:

```
> create partition primary align=1024
```

## Making Graphics Properties Settings for the iPC

You can configure the iPC to use the MX800, MX700, or MX600 patient monitor built-in display, one or two external displays, or a combination of the three. When running on an iPC, the XDS Software automatically adjusts the resolution of the built-in monitor display. To use the iPC built-in display prior to the XDS Software installation, you must set the graphics properties to match the display you use. To change your display settings, right-click the desktop and select **Graphics Properties...** from the context menu to open the Intel Graphics and Media Control Panel.

### General Settings

With the MX800, MX700, and MX600 patient monitors built-in display, set the **Scaling** to **Center Image** and the **Resolution** to **1280 x 768** or a value appropriate to the size of the desktop.



With an external display, enter the corresponding settings for that display in the **General Settings** window. The settings will generally be the same as the ones shown above except for the **Resolution** setting.

### Multiple Displays

In the Multiple Displays window, you can decide to use the **Single Display**, **Extended Desktop**, or **Clone Display** operating mode. Based on your selection, you define which of the connected monitors to use as your Primary, Second, or Third Display.

For example:



**CAUTION**

If the Input Device Service is enabled and an "iPC Desktop" screen is available, the use of the configuration "Clone Display" for multiple displays is **not allowed**. You may only use "Clone Display" when the Input Device Service is disabled.

## Troubleshooting

For additional troubleshooting information, see “[iPC](#)” on page 151.

### Troubleshooting the iPC

Depending on the issue you want to troubleshoot, see the following sections:

- “[Troubleshooting Power-On Test Errors](#)” on page 506
- “[Troubleshooting a Corrupted Operating System](#)” on page 508
- “[Troubleshooting a Defective Hard Disk](#)” on page 510

### Troubleshooting Power-On Test Errors

**Situation:** An error occurs during the Power-On test. The iPC does not power up or the prompt message "PC HW Malfunction" is displayed.

**Solution:** Errors during the Power-On test are signaled by the status LED. Check the status LED to find out what caused the error.

**NOTE**

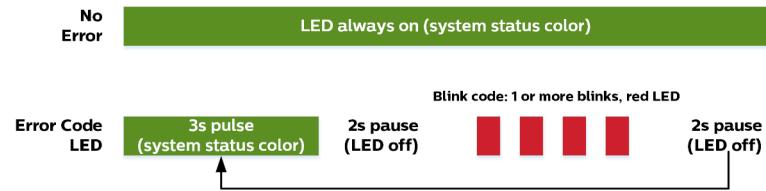
The status LED of the iPC is located behind the monitor rear housing, inside the iPC. To see the light of the LED, look into the ventilation slots on the back of the monitor, or open the rear housing.

### System Status

LED color	Status
Off	The power is off or the embedded controller failed.
Red	The system holds off (for example due to over temperature) or another error causes the issue, signaled by a blink code.
Orange	The system appears to be off and is in the state Sleep, Hibernate, or Soft Off. The power consumption is reduced.
Green	The system is fully functional.

## Blink Codes

Blink codes display system errors. First, the LED displays the system status for three seconds, as described above. Then the LED pauses for two seconds and shows the blink code. After another pause of two seconds, the LED restarts the cycle by displaying the system status.



Number of blinks	Description
1	Voltage error
2	Temperature error
3	Fan error
4	CMOS battery low
5	Abnormal reset <b>Note:</b> The status LED also blinks red five times after being connected to power mains.
6	Input voltage error
7	Embedded controller internal error

## Troubleshooting a Corrupted Operating System

Depending on whether you use the Philips OS image or your own OS image, different solutions apply.

- **Philips OS image:** “Restoring the System Partition to Factory Default” on page 508
- **Non-Philips OS image:** “Reinstalling the OS Image” on page 509

### Restoring the System Partition to Factory Default

**Situation:** You use the Philips OS image. The hard disk is functional but the Windows operating system is corrupted.

**Solution:** You can restore the operating system to the factory default configuration by using the recovery partition.

#### NOTE

Restoring the recovery partition will lose all data and configuration done on your device; only the contents of the “Data” partition remain untouched.

- 1 Restart the iPC.
- 2 When the "Philips" screen appears, press the **F8** key repeatedly to access the Advanced Windows Start-up Options.
- 3 Select **Repair Your Computer**.
- 4 Select the keyboard layout and click **Next**.
- 5 Select a user and password: Use the **Service User** account, because Administrator privileges are required for the following step.
- 6 At **Choose a recovery tool**, select **Command Prompt**.

There will be the following partitions and drive letters:

C: The System Partition (normally C:)

D: The Data Partition (normally D:)

X: The Recovery Partition (normally hidden from Windows, no drive letter)

- 7 To install the recovery image on the hard disk, run the script

**X:\RepairSystem.cmd** for the iPC.

- 8 Confirm erasing of the System Partition on the hard disk by pressing any key. (Or press CTRL-C to cancel.)

- 9 Wait until the disk is initialized. The disk initialization takes about 6 to 10 minutes.

- 10 Press a key to reboot the computer.

The computer will automatically boot the updated System Partition.

- 11 The System Initialization begins. The system initialization takes about 30 minutes.

When the partition is restored, follow the instructions in the section *iPC Operating System Installation*.

## Reinstalling the OS Image

**Situation:** You use your own OS image. The hard disk is functional but the Windows operating system is corrupted.

**Solution:** If you have an image backup, reinstall the image. If you do not have an image backup, restore the system partition to factory default or reload a Philips OS image.

If you have a copy of the image available on the hospital PXE server, do the following:

- 1 Restart the PC.
- 2 Press the **F11** key repeatedly to access the boot menu.
- 3 In the boot menu, select the boot device **Network:IBA GE Slot 0300** (Hospital LAN) and press **Enter**.  
The iPC connects to the hospital PXE server where the images are available.

If you do not have a copy of the image, do the following:

- 1 Restore the system partition to factory default. Follow the steps described in “[Restoring the System Partition to Factory Default](#)” on page 508.  
Note that if the HDD was partitioned and formatted, this may not work.
- 2 If the first step does not work, reload one of the Philips OS images by using the Support Tool. For details, see “[Reloading the OS Image](#)” on page 510.
- 3 Reinstall the operating system by using an original medium (for example CD or USB flash drive).

## Troubleshooting a Defective Hard Disk

Depending on whether you have a replacement hard drive from Philips, different solutions apply.

- **Replacement HDD from Philips:** The HDD already includes a Windows image. Turn on the iPC and complete the installation as described in “[Completing the Operating System Installation](#)” on page 501.
- **Replacement HDD not from Philips:** Follow the instructions in “[Reloading the OS Image](#)” on page 510.

### Reloading the OS Image

**Situation:** Your hard disk is defective. You do not have a replacement hard disk from Philips or the recovery image is not available anymore.

**Solution:** Use the Support Tool to reload the image.

- 1 Decide which operating system you want: Windows XP, Windows Vista, Windows 7, with 32-bit or 64-bit.
- 2 Determine what hardware is used (#PC0 or #PC1).
- 3 Identify which image you need by checking the latest version of the SB86201350.
- 4 Go to InCenter and download the corresponding image.
- 5 Execute the archive to load it into the Support Tool.  
The files are copied to the appropriate location, by default to **C:\Program Files (x86)\Philips\M3086A\Storage\Depot\DeviceFamily.PC\Images**
- 6 Configure the Support Tool with the options **Enable DHCP server** and **Support PC devices** enabled. For details, see the instructions in the section "Configuring the Network Interface Card for MX400-MX550 and X3/MX100 Monitors" in the *Support Tool Mark2 Instructions for Use*.
- 7 Update the iPC software according to the instructions in the section "iPC or XDS Bedside Device Software Update Procedure" in the *Support Tool Mark2 Instructions for Use*. However, contrary to the Support Tool instructions, do the following:
  - When you connect the patient monitor's LAN connector to the service PC, use the black connector (Hospital LAN), not the orange connector (Medical LAN).
  - In the boot device menu, select the boot device **Network:IBA GE Slot 0300**.
  - Before you disconnect the LAN cable and close the Support Tool, observe the update progress on the iPC: after booting, follow the wizard on the iPC to show log files and confirm that you want to continue. Reboot the iPC only after the installation completed successfully and you can click **Reboot**.

Complete the installation of the operating system. For details, see “[Completing the Operating System Installation](#)” on page 501.

## Troubleshooting the XDS Software

A padlock symbol on an iPC screen indicates that the Input Device Service is not running, has failed, or was not enabled. Restart the (Infrastructure Services) Input Device Service.

For more information, see the section "Troubleshooting the XDS Software" in the *IntelliVue XDS Software Installation and Configuration Guide*.



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