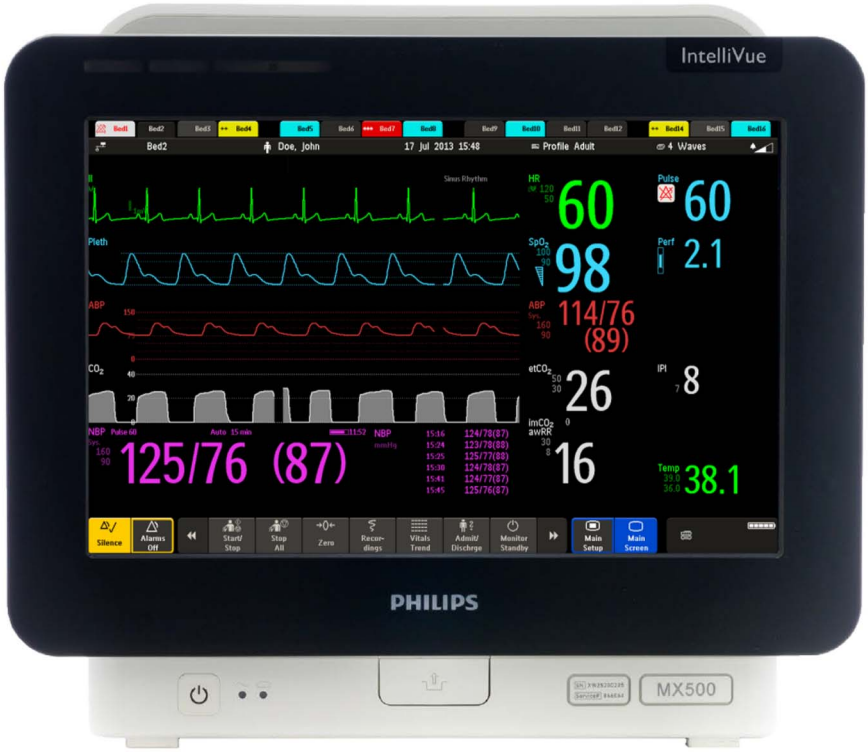



Service Guide

# IntelliVue Patient Monitor

## MX400/MX450/MX500/MX550

**Release K.1**

**Patient Monitoring**

PHILIPS

# Table of Contents

1

# Introduction

This Service Guide contains technical details for the IntelliVue MX400/450/500/550 Patient Monitor, the measurement modules, the Multi-Measurement Module (MMS), the IntelliVue X2, and the Measurement Server 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 that engineers who repair them are better able to understand how they work.

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

## Who Should Use This Guide

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

## 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:

| Name | Abbreviation |
|---|---|
| IntelliVue MX400/450/500/550 Patient Monitor | the monitor |
| Multi-Measurement Module | MMS |
| Measurement Link | MSL |
| Medical Information Bus | MIB |
| IntelliVue G1/G5 Gas Analyzers | G1/G5, the gas analyzer |

# 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.



Philips Medizin Systeme Böblingen GmbH

Hewlett-Packard Str. 2

71034 Böblingen, Germany

The information contained in this document is subject to change without notice.

Philips makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties or merchantability and fitness for a particular purpose.

Philips shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

# Passwords

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

**CAUTION**

Your hospital/organization is responsible that the passwords listed below are revealed to authorized personnel only.

Monitoring Mode: No password required

Configuration Mode: 71034

Demo Mode: 14432

Service Mode: 1345

Consult the configuration guide before making any changes to the monitor configuration.

# 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

**WARNING**

**Grounding**: To avoid the risk of electric shock, the monitor must be grounded during operation. 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, IEC 60601-1-1, UL 60601-1. 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.

## Use Environment

**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. Use of the devices in such an environment 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 .

**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).

# Alarms

**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

**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 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.

**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.

# Maintenance, Repair and Care

**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, make sure 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

2

# Theory of Operation

## Integrated Monitor Theory of Operation

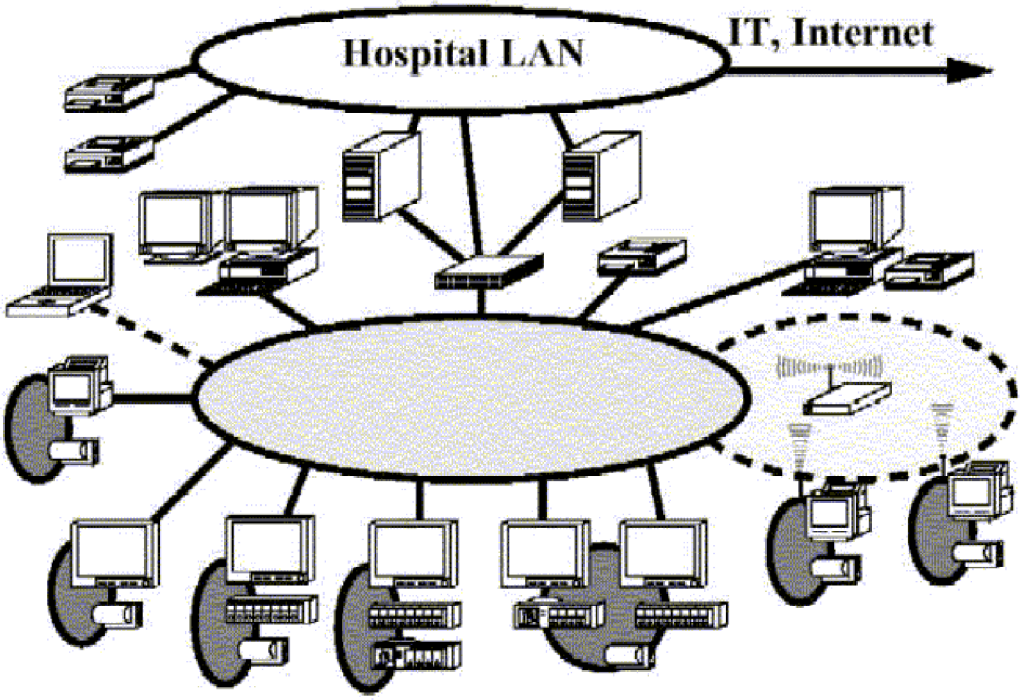
The IntelliVue MX400/450/500/550 Patient Monitor:

- 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 measurement module can be connected to additional building blocks to form a monitoring system with a large number of measurements and 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:




*System Boundaries*

| | |
|---|---|
|  | Measurement connections<br>Built-in measurement block |
|  | Philips Clinical Network (wired LAN)<br>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)<br>like Philips Clinical Network (wired) LAN, however due to current wireless technologies available it has reduced bandwidth, longer latencies, reduced functionality |
|  | Hospital LAN, Internet<br>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:

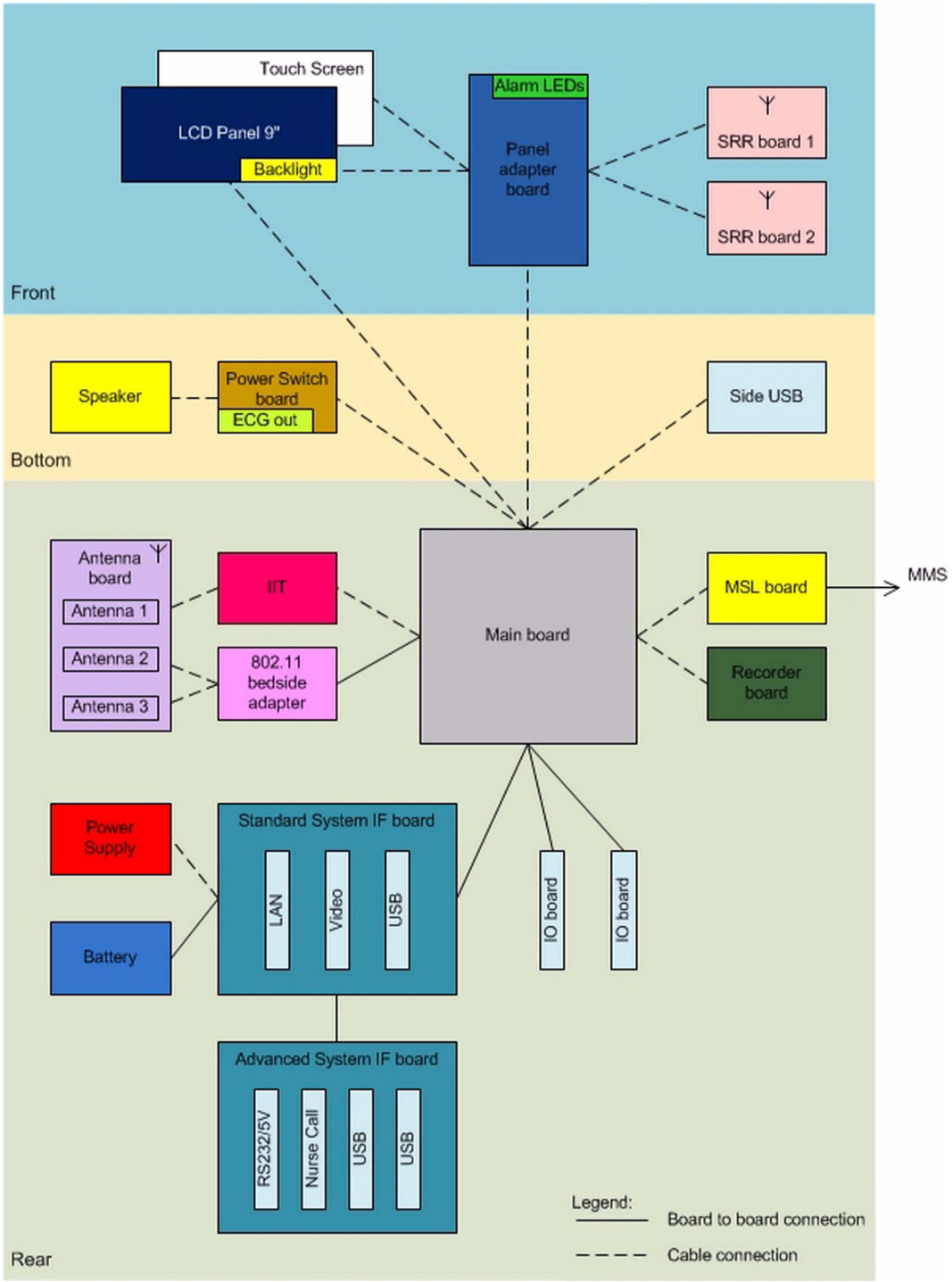
## IntelliVue MX400/450/500/550

The IntelliVue MX400/450/500/550 Monitor:

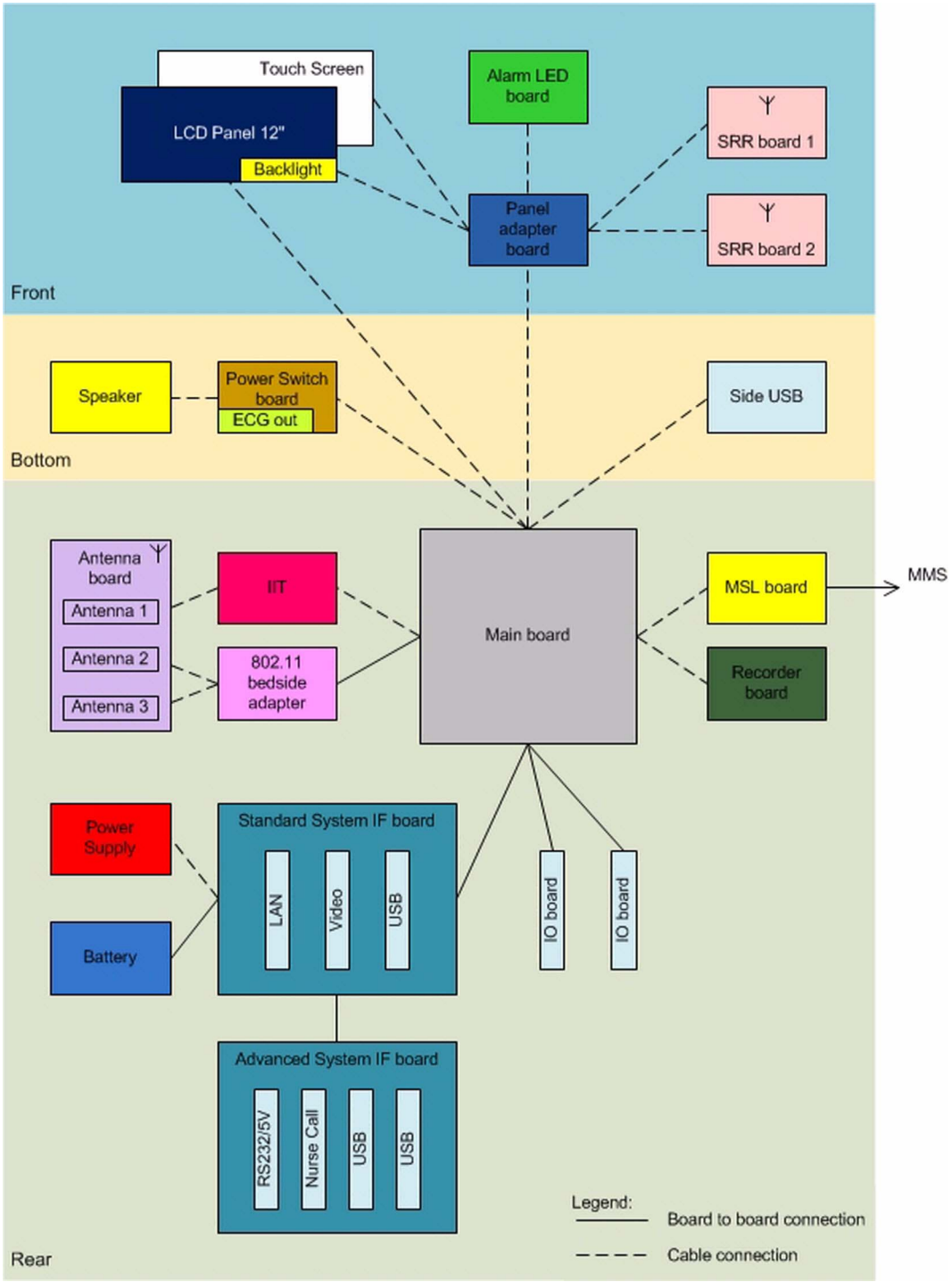
- integrates the display and processing unit into a single package
- uses a 9" TFT WVGA Color display (MX400)
- uses a 12" TFT WXGA Color display (MX450/500)
- uses a 15" TFT WXGA Color Display (MX550)
- uses the touch screen as primary input device; a remote control and computer devices such as mice, trackball, and keyboard can be added optionally.
- has an optional built-in recorder (MX400/450 only)
- has an integrated 3-slot rack (MX500/550 only)

**NOTE**

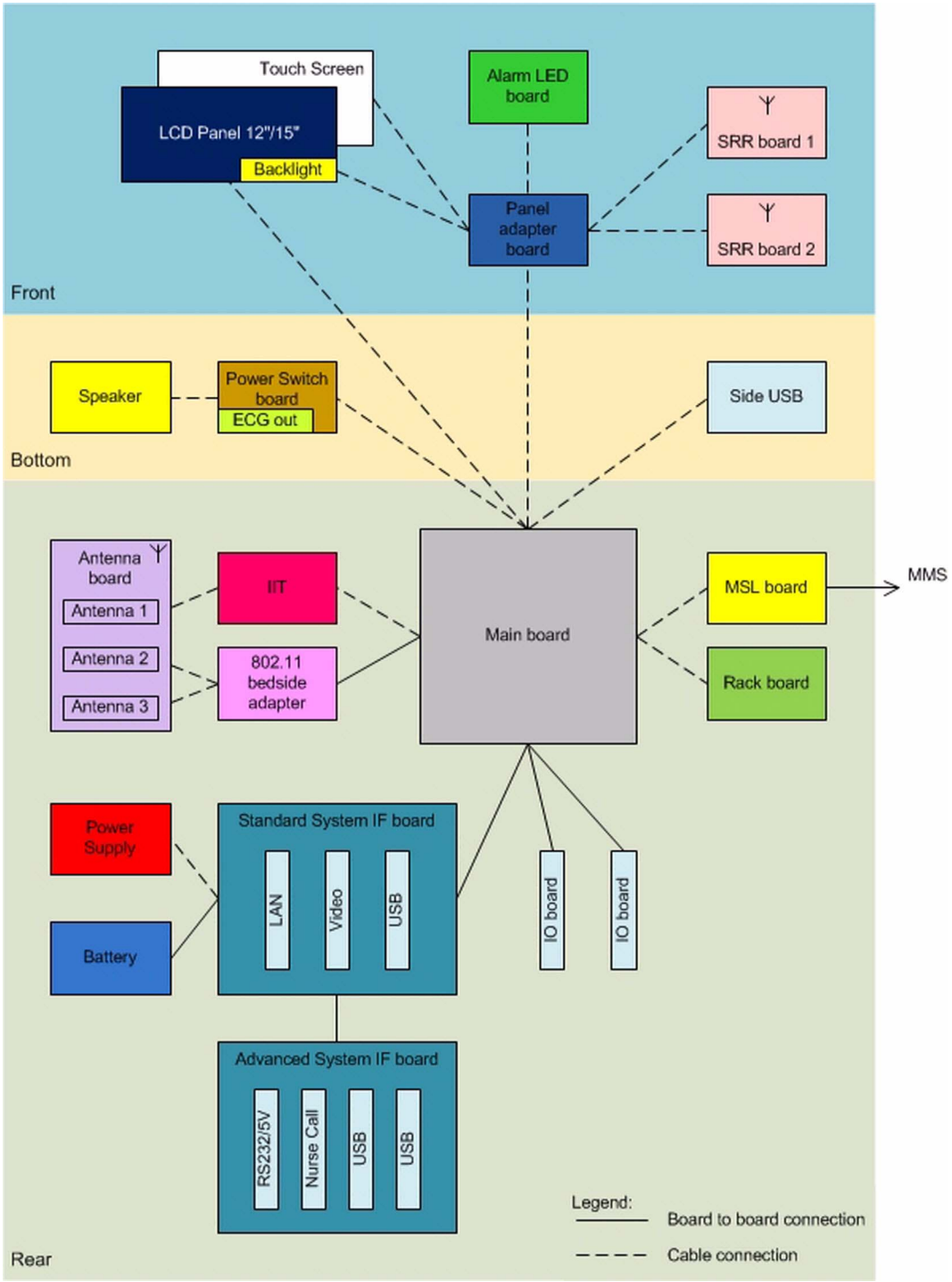
The 802.11 Bedside Adapter (WLAN) and IIT are mutually exclusive.




*MX400 Hardware Building Blocks*

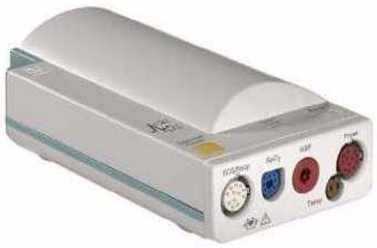



*MX450 Hardware Building Blocks*



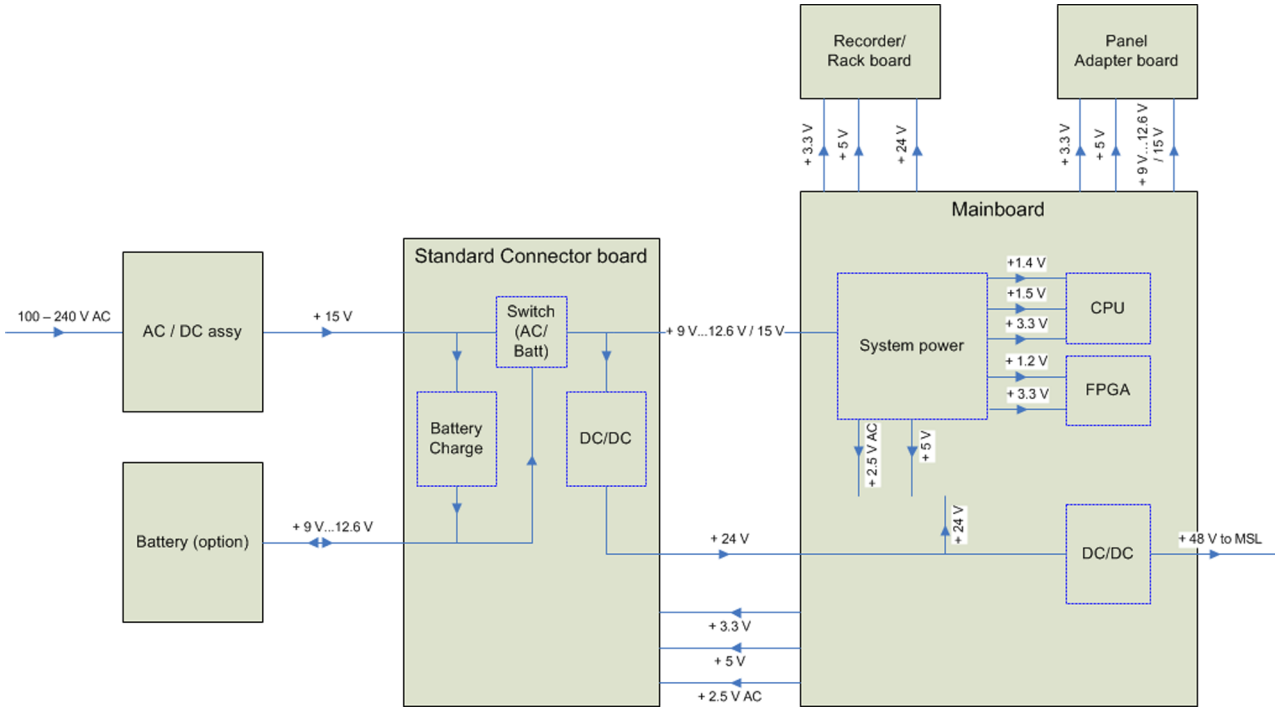

*MX500/MX550 Hardware Building Blocks*

## Compatible Devices

| | |
|---|---|
| **M3001A Multi-Measurement Module (MMS)** |  |
| **M3002A IntelliVue X2** |  |
| **M3012A MMS Extension** |  |
| **M3014A MMS Extension** |  |

| | |
|---|---|
| M3015A/B MMS Extension |  |
| 865244 Remote Control |  |

## Power Supply




The AC/DC converter transforms the AC power coming from the plug into 15V/ 70W DC source and isolates the monitoring system from the AC power mains. The 15V is distributed via power bus either directly or over additional converters to all components of the system:

The battery charger is supplied with 15V and switches between AC/DC supply and battery depending on whether AC power cord is plugged or unplugged.

The 48V DC power needed for the MSL is created by an isolating DC/DC converter.

The LED backlight converter located on the panel adapter board is supplied with 9V - 12.6V / 15V.

The isolated interfaces are supplied with 2.5V AC. The main board is supplied with 5V, 3.3V, 1.5V, 1.4V and 1.2V.

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

## Main Board

The main board contains the CPU which includes the graphic processing unit and USB controller. The main memory, a system FPGA, a system controller including watchdogs and various power supplies are located on this board. Additionally, this board contains the MSL interface, the recorder interface, the ECG Out hardware and various other interfaces.

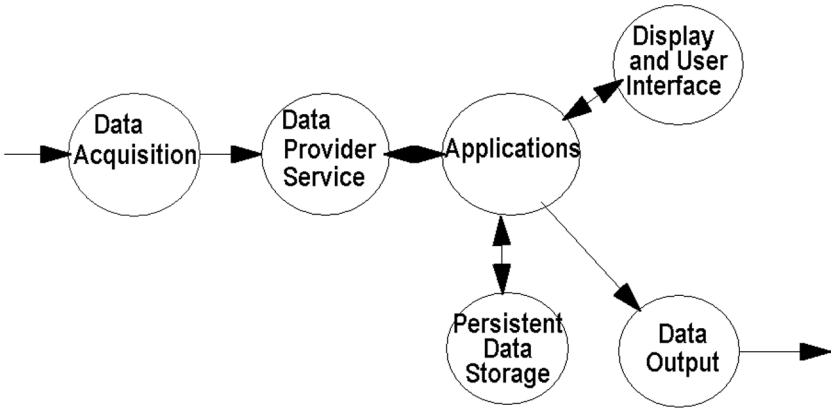
System information is stored in serial EEPROMs to support the automatic configuration of the operating system at boot time.

## I/O Boards

A dual MIB/RS232 board, a Flexible Nurse Call Relay board or an IntelliBridge 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:

- Measurement Servers

  The Measurement Servers 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 measurement servers 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 temorarily 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.

User input is acquired from a variety of input devices, for example the touchscreen or other standard input devices (keyboard, mouse) which may be attached to USB ports. 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, alarm lamps, speaker, 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.

## Internal LAN (Measurement Link)

The monitor and multi-measurement modules 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 measurement server to a display unit)

- Control data representing user interactions (typically from the display unit to a measurement server)
- 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 measurement servers 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 measurement server to the monitor (for example measurement signal data) and the data flow from the monitor to a measurement server (for example to feed data to a recorder module).

## 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.

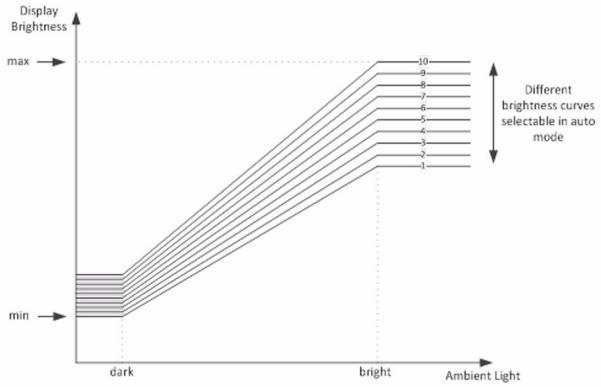
The Philips Clinical Network protocols function very similarly to the protocols used on the internal LAN.

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.

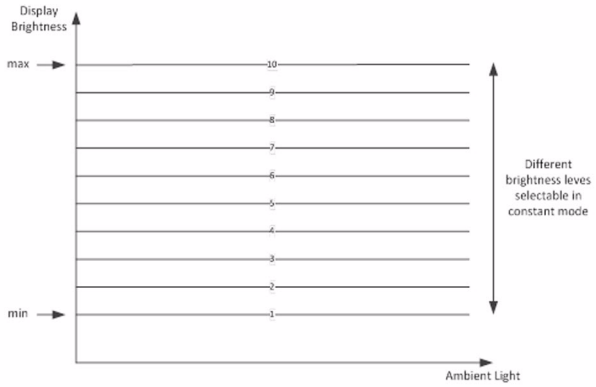
## Ambient Light Sensor




The monitor adjusts its display brightness depending on the ambient light level. Therefore an Ambient Light Sensor is integrated in the front bezel of the display.

Although there is an automatic brightness adjustment, it is still possible for the user to change the brightness. As shown in the figure above, the user can select between different brightness level curves.

If a constant brightness is desired, it is possible to deactivate the automatic brightness control via the Config mode of the monitor. Without automatic brightness control, the user can select between different constant brightness levels as shown below.




## Microstream CO2

CO2 sample rate: 20 samples/second

**Calculation of end tidial CO2 (etCO2)**

The M3015A/B MMS Extensions use Microstream® non–dispersive infrared (NDIR) spectroscopy to continuously measure the amount of CO2 during every breath, the amount of CO2 present at the end of exhalation (etCO2), the amount of CO2 present during inhalation (imCO2), and the respiratory rate. The displayed etCO2 is the maximum etCO2 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 CO2 and N2 gases was used to simulate respiration rates covering the specified range. The resulting end tidal CO2 values were compared to the expected value. Differences between actual and expected end tidal CO2 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 CO2 values beyond those limits.

## How does the Support Tool Work with the Monitor

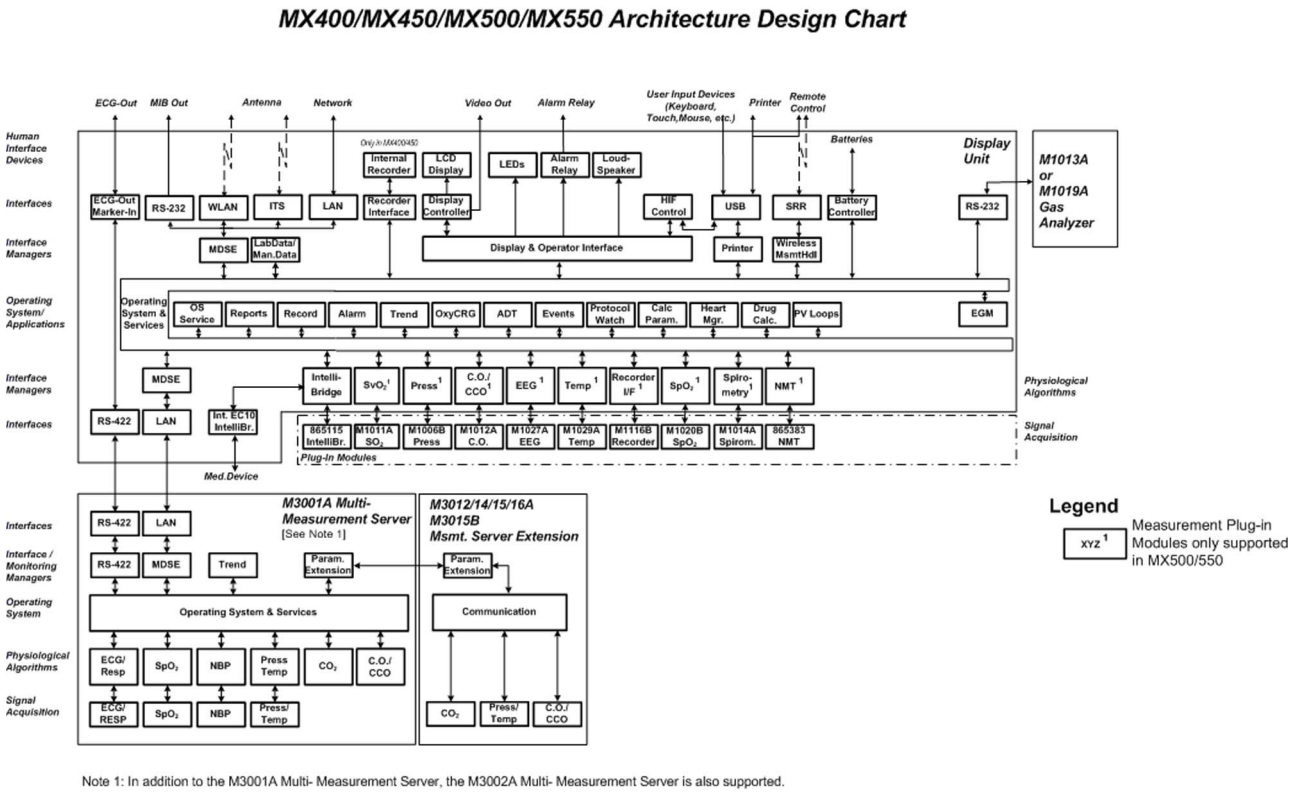
The Support Tool Mark2 is a Windows application typically installed on the laptop of a customer engineer or a biomedical engineer working in the customer's own service department.

The purpose of the Support Tool Mark2 is to upgrade, configure and diagnose all monitoring components (modules, measurement servers, and monitors) in the system over the network.

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 Mark2.

## Monitor Software Block Diagram




Note 1: In addition to the M3001A Multi- Measurement Server, the M3002A Multi- Measurement Server is also supported.

## Block Diagram Legend

| Functional Block | Description |
|---|---|
| **Services** | |
| 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. |

| Functional Block | Description |
|---|---|
| System Services | The System Services provide generic common system services. In particular:<br>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 Measurement Servers and IntelliVue Patient Monitoring System software modules. User configuration data is stored in a non-volatile read/write storage device |
| **Applications** | |
| Reports | The Reports Service retrieves current and stored physiological data and status data to format reports for printing paper documentation. The following reports are supported:<br>• Vital Signs Report<br>• Graphical Trend Report<br>• Event Review Report<br>• Event Episode Report<br>• ECG Report (12 Lead/Multi-Lead)<br>• Cardiac Output Report<br>• Calculations Report (Hemodynamic/Oxygenation/ Ventilation)<br>• Calculations Review Report<br>• Wedge Report<br>• Test Report<br>• Other reports (e.g. Loops, Review Applications, Drug report)<br>The Reports service generates report data which can be printed on a local or a central printer. |
| 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 can also send data to a recorder. |

| Functional Block | Description |
|---|---|
| Alarm | The Alarm Service contains logic that prioritizes alarm conditions that are generated either by the Measurement Servers 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 Multi-Measurement Module. The ADT service controls the deletion of old patient data, the upload of trend data from the M3001A 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. |

| 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., SpO2 and invasive pres-sures). 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. |
| EGM | EGM (extensible Gas Module) interface aneasthesia gas measurement devices. The EGM Module interfaces the M1013A or M1019A Gas Analyzer devices. The EGM 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. |
| **Interface Managers** | |
| 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 Measurement Servers 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 | The Printer Interface Manager provides a high level interface to a printer. It provides means to:<br>• establish a connection to the printer<br>• transfer data to the printer<br>• get status of the printer<br>• close connection to the printer<br>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. |
| Display & Operator Interface | The Display and Operator Interface Manager performs the following tasks:<br>• 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<br>• Screen presentation of operating controls (control windows)<br>• 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 or Measurement Servers<br>• Sound generation (issues audible alarm signals and generates audible information signals, for example QRS and SpO2 tones, operator audible feedback) |
| LabData/Manual Data | 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. |
| Wireless Measurement Manager (WMM) | 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 |
| **Interfaces** | |
| LAN | The LAN interface implements the physical layer of IEEE 802.3, electrical isolation, and ESD protection. Electronically separated interfaces are used for communication to the Measurement Servers and to the network. |
| WLAN | 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. |

| Functional Block | Description |
|---|---|
| Display Controller | The display controller is integrated into the CPU. The video RAM is shared with the main memory. The display controller 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 display controller generates the video synchronization signals and the pixel stream for the internal and external display. |
| 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 MP5, MX400/450/500/550. |
| 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 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 SRR interface allows operation of the monitor with an IntelliVue Remote Control. |
| USB Interface | The USB interface allows connection of USB devices (Mouse, Keyboard, Barcode Scanner, Printer) to the monitor. |
| Remote Control | The remote control allows remote operation of the monitor via a USB cable or SRR connection. |

3

# 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 Module (MMS), the MMS Extensions and the parameter 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 make sure 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, IEC 60601-1-1 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 portable 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 Portable 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.

# Recommended Frequency

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

**Table 1 Suggested Testing Timetable**

| Tests | | Frequency |
|---|---|---|
| **Preventive Maintenance*** | NBP Performance | Once every two years, or more often if specified by local laws. |
| | Microstream $CO_2$ Calibration | **Once a year** or after **4000 hours** of continuous use and following any instrument repairs or the replacement of any instrument parts. |
| **Other Regular Tests** | Visual Inspection | Before each use. |
| | Power On Test | |
| **Performance Assurance Tests** | ECG/Resp Performance | Once every two years, or if you suspect the measurement is incorrect, except Mainstream $CO_2$ Accuracy Check, Sidestream $CO_2$ Accuracy Check and Flow Check - required once a year. |
| | ECG Out Performance | |
| | $SpO_2$ Performance | |
| | NBP Performance | |
| | Invasive Pressure Performance | |
| | Temperature Accuracy | |
| | M3014A Capnography Extension Performance Tests | |
| | Microstream $CO_2$ Performance Test | |
| | Spirometry Accuracy Test | |
| | C.O. Performance | |
| | NMT Performance | |
| | IntelliBridge Performance Test | |
| | Nurse Call Relay Performance | |
| | MSL Assurance Test | |
| | Power Loss Alarm Buzzer Performance Test | |
| | Recorder M1116C Performance Test | |
| | Mounting Integrity Test | |

| 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 |

*M3015A with the old hardware Rev. A (i.e. Serial No. DE020xxxxx) also require the $CO_2$ pump/$CO_2$ scrubber replacement procedure. This is required every three years or after 15000 operating hours.

**NOTE**

The EEG parameter does not require performance testing. See "EEG, SvO2 (SO2) and tcGas Performance Tests" on page 83 for details.

# When to Perform Tests

This table tells you 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 and any attached MMS/X2 and parameter modules.**

**Table 2 When to perform tests**

| Service Event<br>(When performing... | Tests Required<br>...Complete these tests) |
|---|---|
| **Installation** | |
| **Installation** 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 |
| **Installation** of a monitor with **no** display connected to the video output | Perform Visual Inspection and Power On Test |
| **Installation** of a monitor with a medical display specified by Philips | Perform Visual Inspection and Power On Test |
| **Installation** of a monitor with an off-the-shelf display (non-compliant with IEC 60601-1) | Perform Visual Inspection, Power On and System Test (per each affected video port) |
| **Installation** of a monitor with IntelliVue G1/ G5, connected to separate mains sockets. | Perform Visual Inspection and Power On Tests |
| **Installation** 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 |
| **Installation** of a monitor with recorder module M1116C | Perform Visual Inspection, Power On and Recorder Performance Test |

| Service Event<br>(When performing... | Tests Required<br>...Complete these tests) |
|---|---|
| **Installation** of a monitor with IT equipment e.g. printer, PC connected via a functional connection USB. | Perform Visual Inspection, Power On and System Tests |
| **Installation** of monitor with IntelliVue 802.11 Bedside Adapter | Perform Visual Inspection, Power On and IntelliVue 802.11 Bedside Adapter Communication Test |
| **Installation** of a monitor with IntelliVue Instrument Telemetry | Perform Visual Inspection, Power On and IIT Communication Test |
| **Installation** of monitor with Short Range Radio (SRR) | Perform Visual Inspection, Power On and SRR Communication Test. |
| **Installation** of networked monitor (LAN) | Perform Visual Inspection and Power On Test |
| **Preventive Maintenance** | |
| Preventive Maintenance* | Perform preventive maintenance tests and procedures:<br>NBP calibration<br>Microstream $CO_2$ calibration |
| **Other Regular Tests and Tasks** | |
| Visual Inspection | Perform Visual Inspection |
| Power On Test | Perform Power On test |
| **Repairs** | |
| **Repairs** where the monitor, parameter modules, MMS or X2 have been damaged by impact, liquid ingression, fire, short circuit or electrical surge. | Perform Visual Inspection, Power On, all Safety Tests and Full Performance Assurance Tests |
| **Repairs** where the power supply, the mains socket or an interface board of the monitor 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 |
| **Repairs** of IntelliVue 802.11 Bedside Adapter | Perform Visual Inspection, Power On and IntelliVue 802.11 Bedside Adapter Communication Test |
| **Repairs** of IntelliVue Instrument Telemetry (IIT) Module | Perform Visual Inspection, Power On and IIT Communication Test |
| **Repairs** of Short Range Radio (SRR) Interface | Perform Visual Inspection, Power On and SRR Communication Test |
| **Repairs** of the parameter modules, MMS or X2 (all service events where the parameter modules MMS or X2 have been opened) | Perform Visual Inspection, Power On, all Safety Tests and Basic Performance Assurance Test.<br>If a certain parameter seems suspicious, perform Full Performance Assurance Test for this parameter. |
| **Repairs** where the NBP pump of the MMS or X2 has been replaced | Perform Visual Inspection, Power On, all Safety Tests, Basic Performance Assurance Test and NBP Performance Test and Calibration |

| Service Event<br>(When performing... | Tests Required<br>...Complete these tests) |
|---|---|
| **Repairs** where the parameter module, MMS or X2 has been replaced. | Perform Visual Inspection, Power On and Basic Performance Assurance |
| **Repairs** where the recorder module M1116C has been replaced or repaired. | Perform Visual Inspection, Power On and Recorder Performance Test |
| **Repairs** of the IntelliVue G1/G5 | Perform Basic Performance Assurance Test. For further testing requirements, see IntelliVue G1/G5 Service Guide |
| **Repairs** where the printer connected to the monitor 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** | |
| Software **Upgrades** | Perform Visual Inspection, Power On Test and Basic Performance Assurance Test unless otherwise specified in the Upgrade Installation Notes shipped with the upgrade. |
| Hardware **Upgrades** | Perform Visual Inspection, Power On Test and Basic Performance Assurance Test unless otherwise specified in the Upgrade Installation Notes shipped with the upgrade. |
| Hardware **Upgrades** 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 **Upgrades** where IntelliVue Instrument Telemetry (IIT) is installed | Perform Visual Inspection, Power On Test, Basic Performance Assurance Test and IIT Communication Test |
| Hardware **Upgrades** where Short Range Radio (SRR) is installed | Perform Visual Inspection, Power On Test, Basic Performance Assurance Test and SRR Communication Test |
| Installation of Interfaces or Hardware **Upgrades** where the power supply of the monitor or interface boards of the monitor need to be removed. | Perform Visual Inspection, Power On Test, Basic Performance Tests and all Safety Tests |

| Service Event<br>(When performing... | Tests Required<br>...Complete these tests) |
|---|---|
| **Combining or Exchanging System Components** (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 |

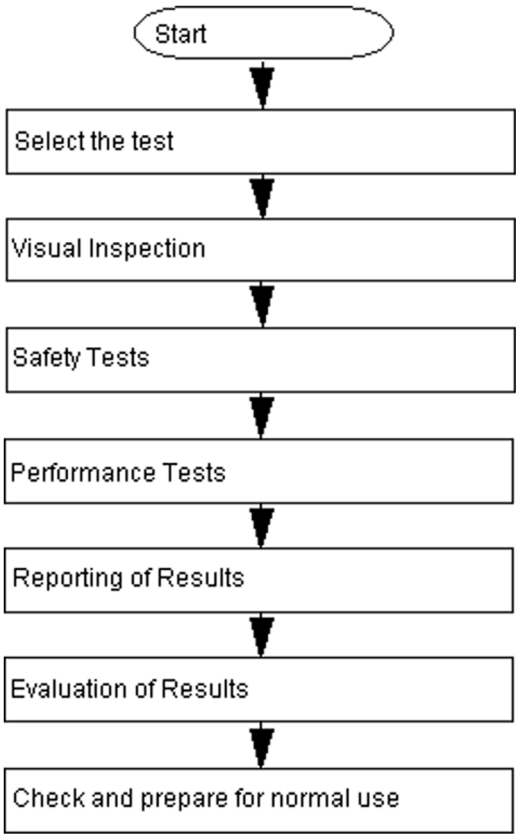
*M3015A with the old hardware Rev. A (i.e. Serial No. DE020xxxxx) also require the pump and scrubber replacement procedures.

**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 recommended sequence of testing:



NOTE

If any single test fails, testing must be discontinued immediately and the device under test must be 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. Refer to the instructions that accompany the relevant mounting solution.

## After Each Service, Maintenance or Repair Event

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, MMS, MMS Extensions, X2, and parameter modules, gas analyzers and IntelliBridge devices.

2 Make sure that 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. We recommend that 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 51.

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

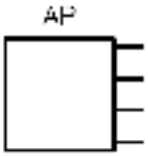
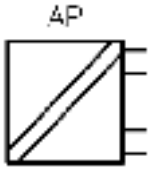
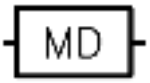
- These tests are well established procedures of detecting abnormalities that, if undetected, could result in danger to either the patient or the operator.
- Disconnect the device under test from the patient before performing safety tests.
- Disconnect the device under test from mains before performing safety tests. If this is not possible, ensure that 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. Please refer to Annex C of IEC/EN 62353 for exact requirements for the measurement equipment and for measurement circuits for protective earth resistance and leakage currents. Refer to 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 that there are no open electrical conductive parts during the performance of these tests. Avoid that users, patients or other individuals come into contact with touch voltage.
- For Europe and Asia/Pacific, the monitor complies with:
  IEC 60601-1:1988 + A1:1991 + A2:1995(Ed.2); EN60601-1:1990 + A1:1993 + A2:1995(Ed.2); IEC 60601-1-1:2001; EN 60601-1-1:2001; IEC 60601-1-2:2001+A1:2004; EN 60601-1-2:2001+A1:2006.
  For USA, the monitor complies with:
  UL60601-1:2003
  For Canada, CAN/CSA C22.2#601.1-M90+S1+A2
- Local regulations supersede the testing requirements listed in this chapter.
- If a non-medical electrical device is connected to a medical electrical device, the resulting medical electrical system must comply IEC 60601-1-1:2000/ EN 60601-1-1:2001 or IEC 60601-1:2005/ EN 60601-1:2006+A1:2012 (Ed.3) Section 16 "ME Systems"
- 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, UL60601-1 (US), IEC/EN 62353, and IEC/EN 60601-1-1. The safety tester should print results as detailed in this chapter, together with other data.

Please refer to 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 |
|   | F-type applied part |   | Measuring device |
|   | Resistance measuring device |  | Connection to accessible conductive parts |
| ..... | Optional connection | | |

**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.

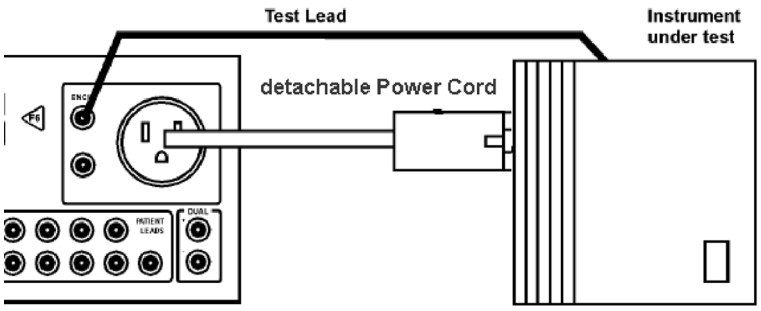
## Hints for Correct Performance of Safety Tests

- 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 act like protective earth connections. These may lead to incorrect measurements and need to be considered during testing. If necessary, unplug these connections.
- During measurements, the device under test shall be isolated from earth (e.g. test on an insulated work bench), except the protective earth conductor in the power supply cord.
- Position all cables and cords in such a manner that they do not influence the safety tests.
- Measurement of insulation resistance is not required.
- 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.

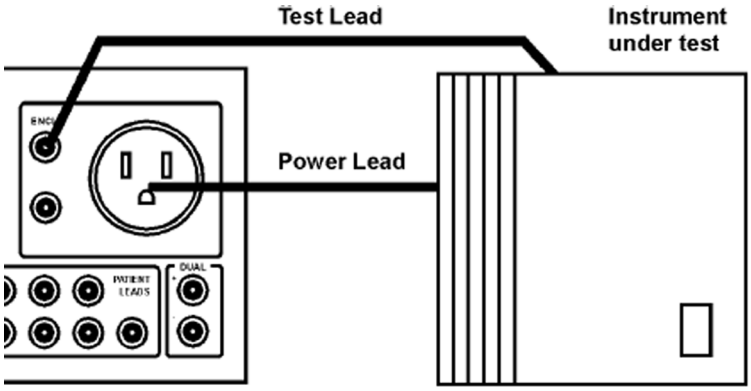
Connect the detachable power cord of the device under test to the safety analyzer's test mains port. Connect the enclosure test lead of the safety analyzer to the enclosure of the device under test, e.g. to the equipotential connector or unearthed conductive accessible parts where applicable during Equipment 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 need to 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. Refer to 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**

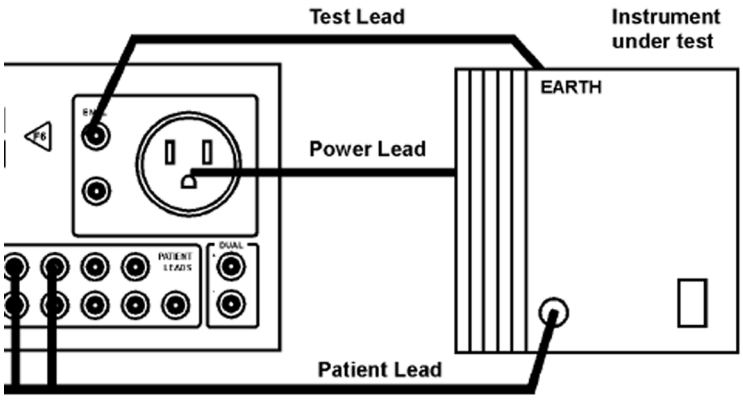
The test lead needs to go to parts that require protective earthing. This may be a single connection or several tested after each other




Equipment Leakage Current Test - Setup Example

**NOTE**

The test lead needs to 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).

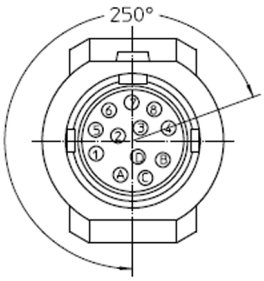
## Safety Test Adapter Cable - Schematics

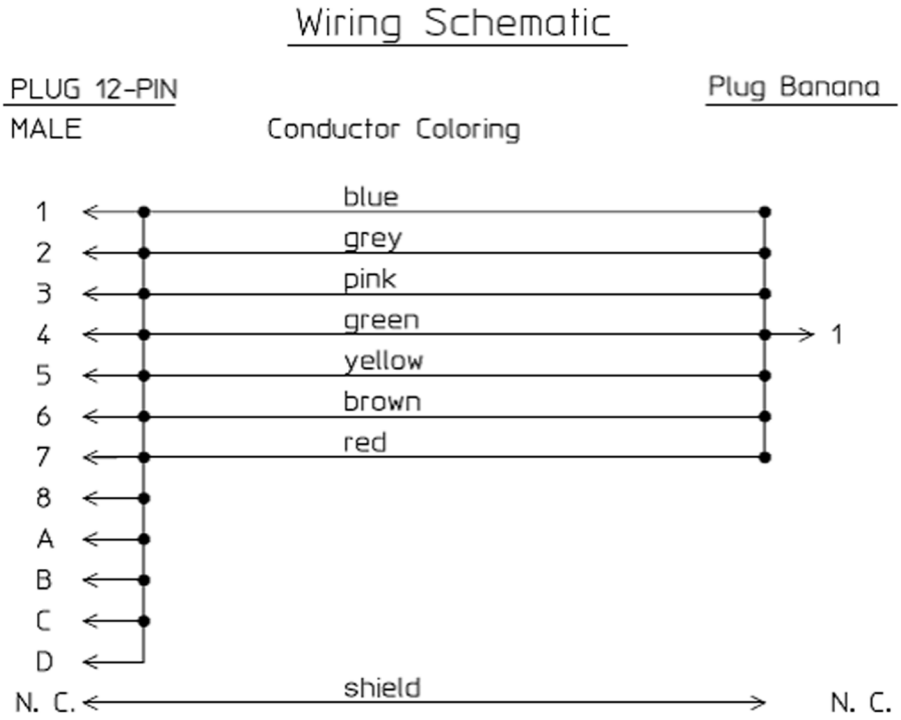
The following graphics provide schematics of safety test (patient lead) adapter cables which can be used for electrical safety testing. These schematics can also be used as a guideline for making your own safety test adapter cables. Alternatively, other methods to make safety test adapter cables can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

**NOTE**

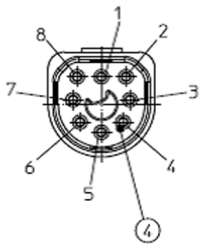
You may not need all of the cables displayed below for electrical safety testing of your respective monitor.

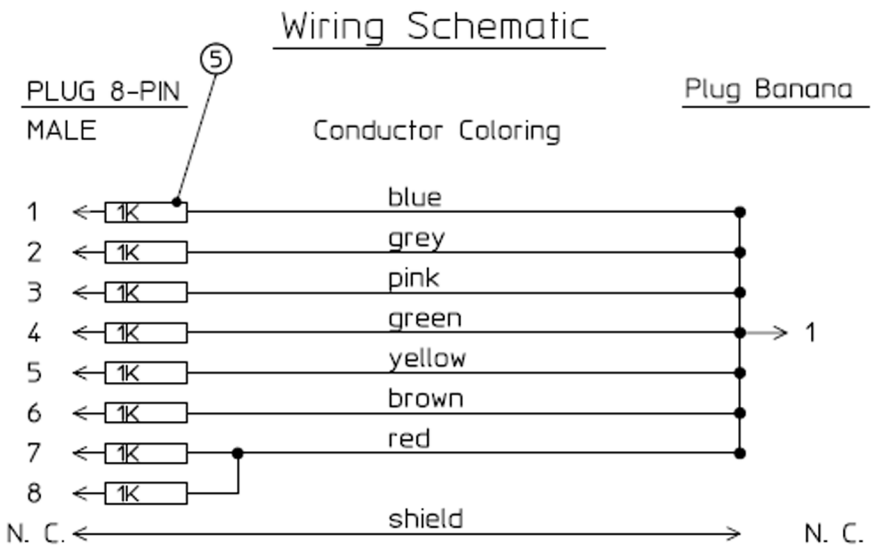
## ECG



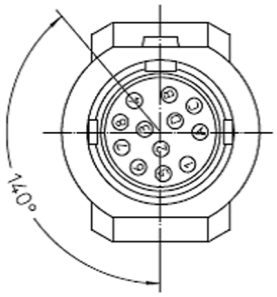



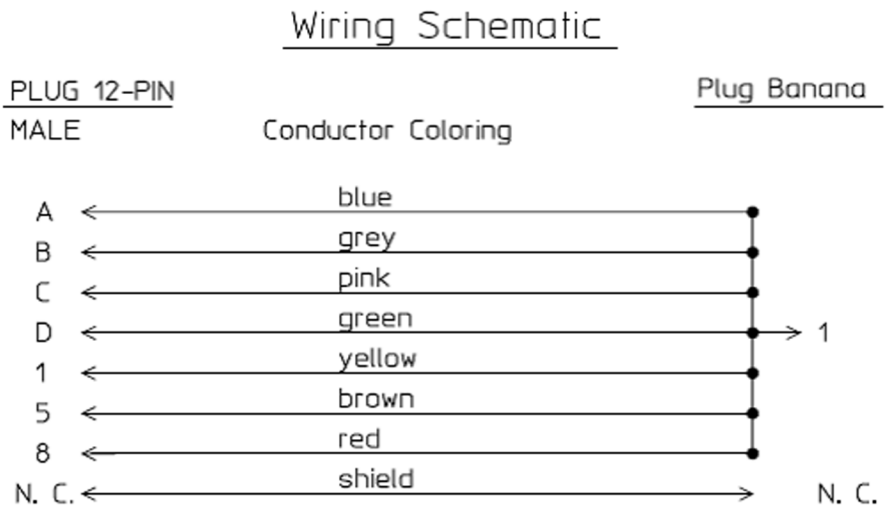

## SpO2 (MP2/X2, MP5, M3001A & M1020B #A01, #A02, #A03, #A04)



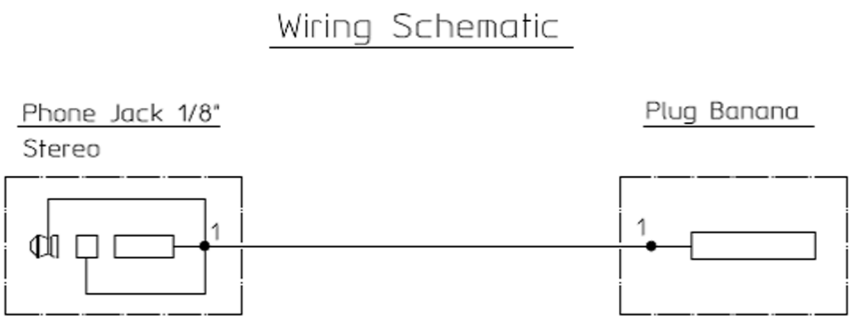



## Invasive Pressure

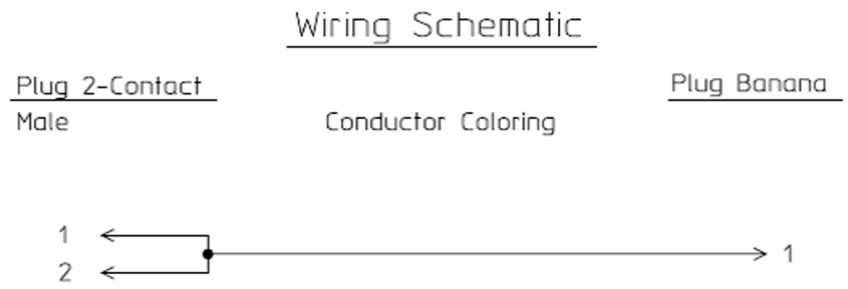


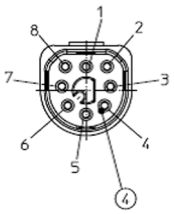

## Invasive Pressure (M1006B #C01)

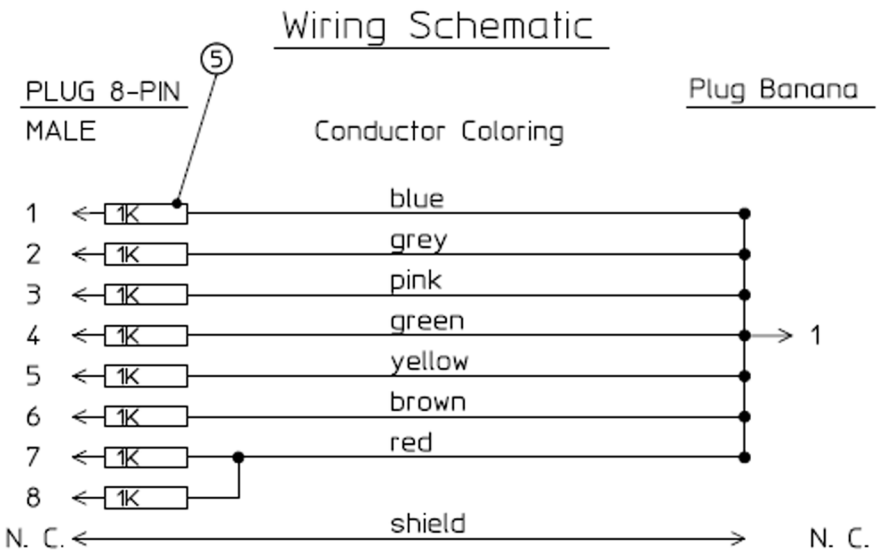



## Temperature

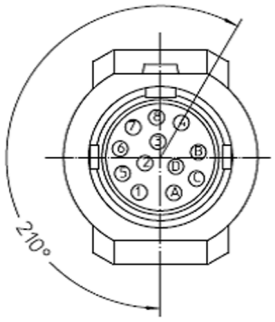



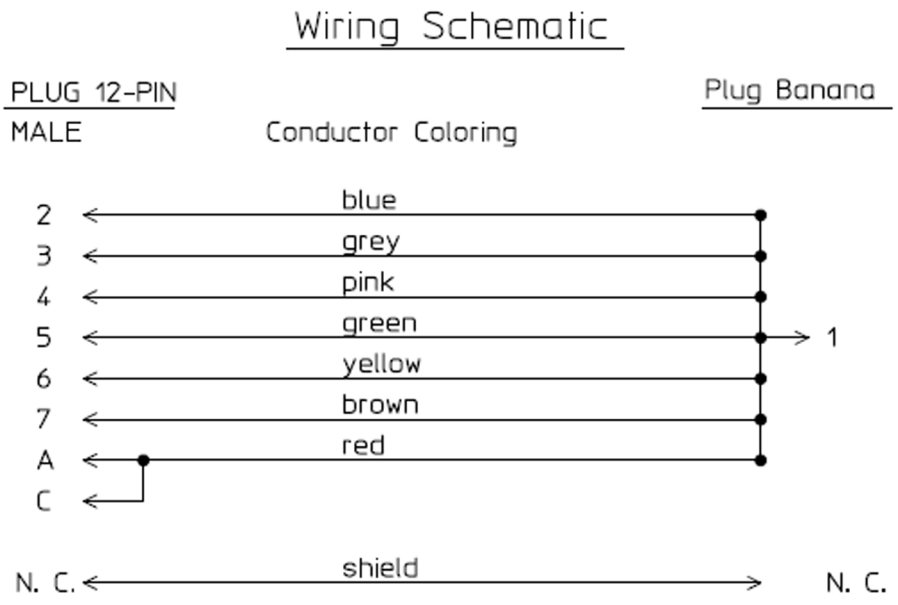
## CO2 (MP5, M3014A)



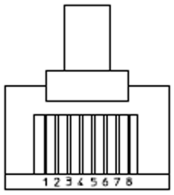



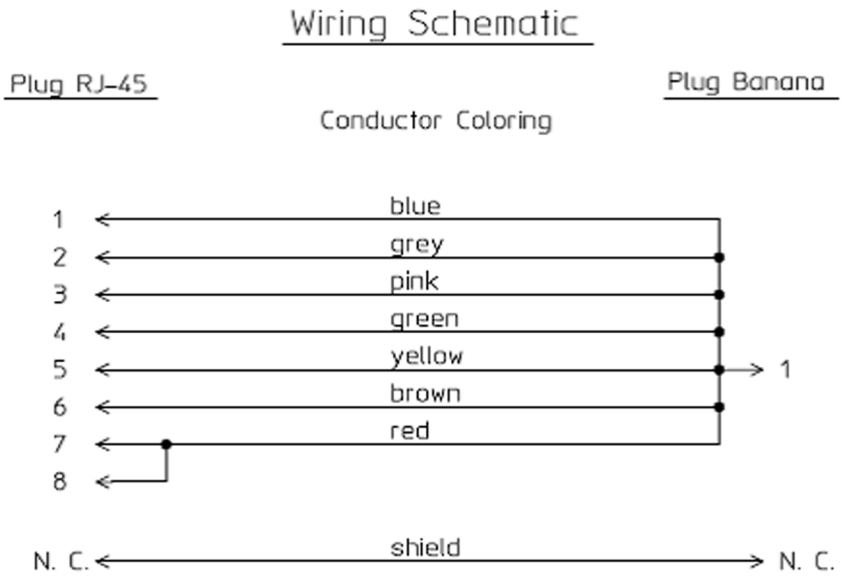

## Cardiac Output



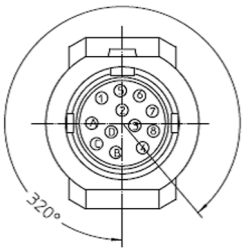



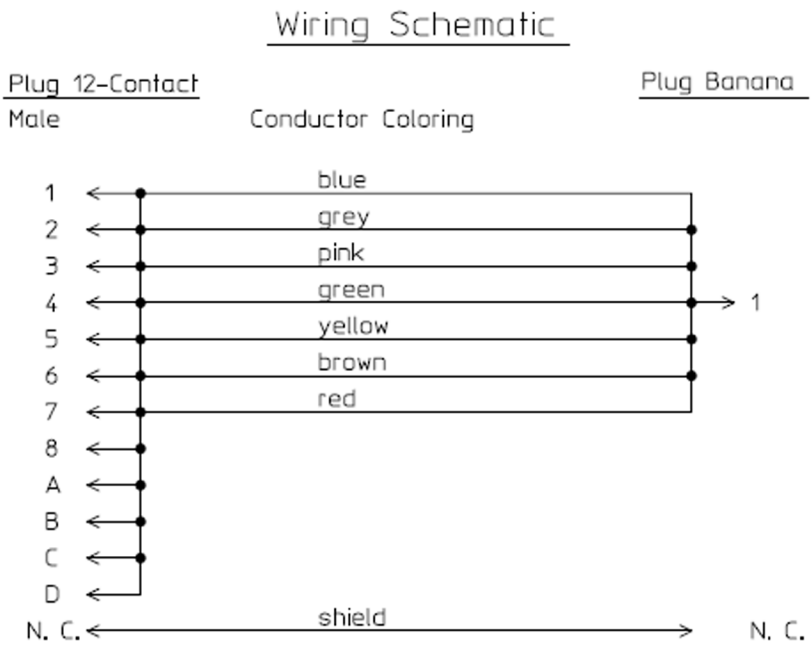
## IntelliBridge



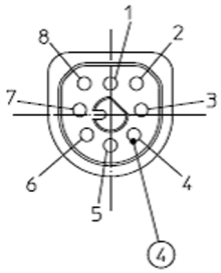



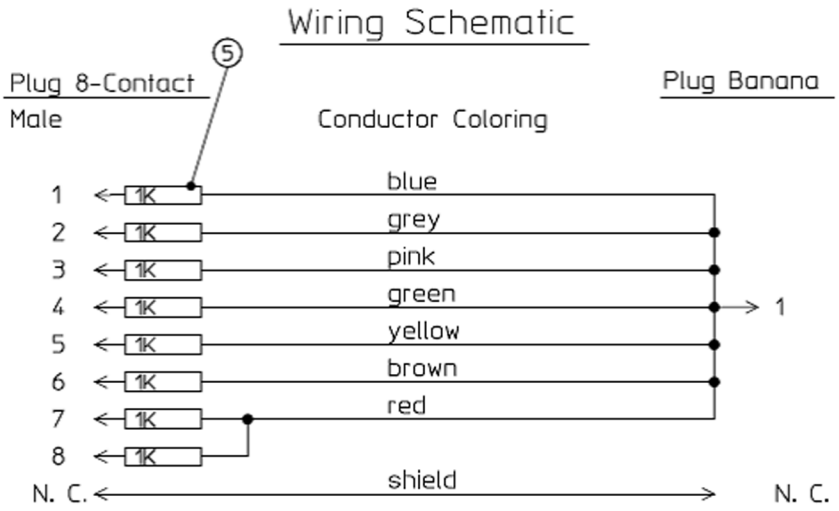

## EEG



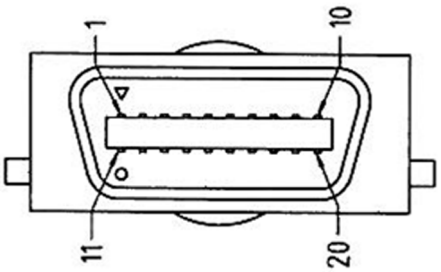



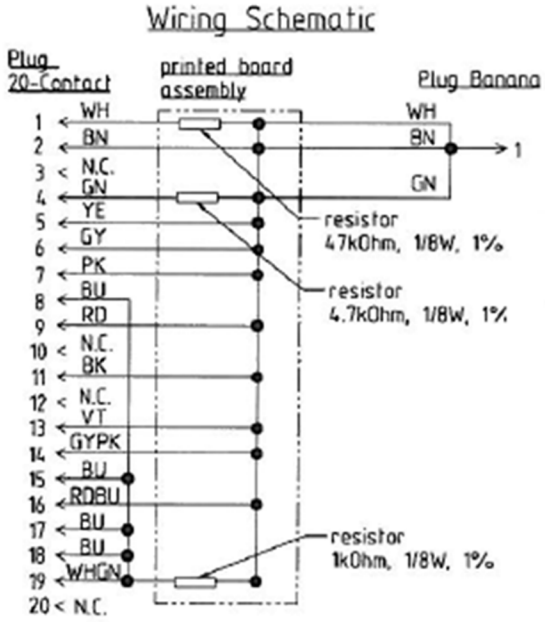
## ScVO2 (M1011A)




## TcG10

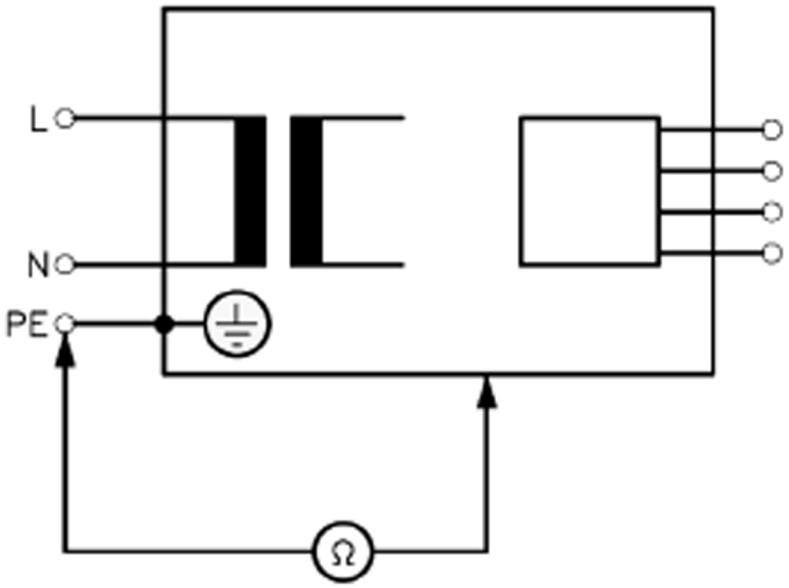


# Electrical Safety Testing

## 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).

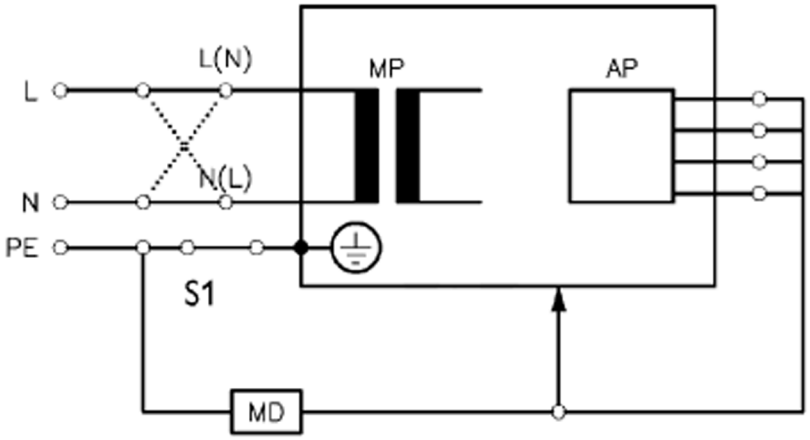
| Test | Expected test results |
|---|---|
| Protective Earth Resistance Test (with mains cable) | X1 <= 300mOhms |

**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 |

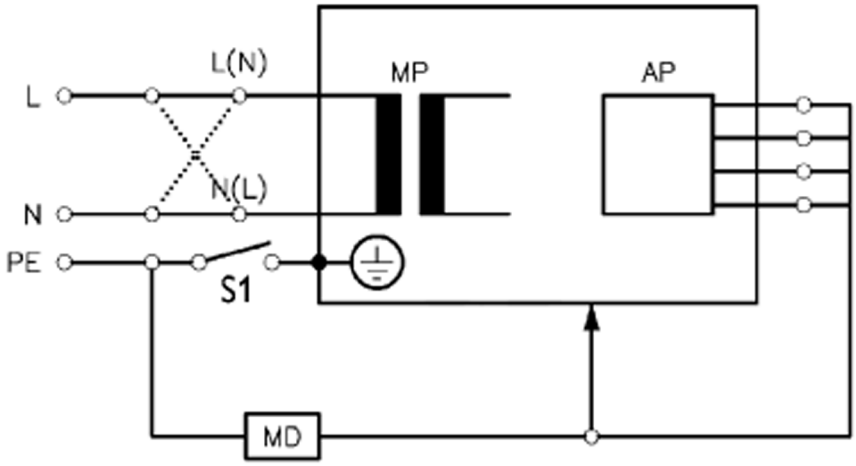
**NOTE**

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 <= 300µA |

**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 when the safety tester is connected to the invasive blood pressure and temperature connectors at the same time during the applied leakage current measurement.

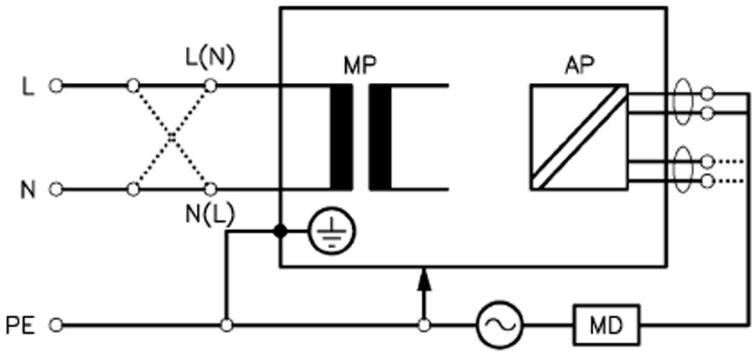
The connectors for the invasive blood pressure and temperature are independently functioning connectors.



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, refer to 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.

### Reference: Allowable Values for IEC 60601-1:1998 and UL 60601-1 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 (IEC 60601-1 and UL60601-1): 100 µA (N.C.)

Enclosure leakage current:(IEC 60601-1): 500 µA (S.F.C)

Enclosure leakage current (UL 60601-1): 300 µA (S.F.C)

Patient leakage current: (IEC 60601-1 and UL60601-1): 100 µA (N.C.) for BF

Patient leakage current: (IEC 60601-1 and UL60601-1): 500 µA (S.F.C.) for BF

Patient leakage current: (IEC 60601-1 and UL60601-1): 10 µA (N.C.) for CF

Patient leakage current: (IEC 60601-1 and UL60601-1): 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

It is not recommended to perform measurements of the insulation resistance. Refer to IEC 62353 for details about methods of the insulation resistance measurement.

# System Test

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

## 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 portable socket-outlet.

- Devices forming a medical electrical system must comply either with IEC/EN 60601-1-1 or 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 either with IEC/EN 60601-1-1 or 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

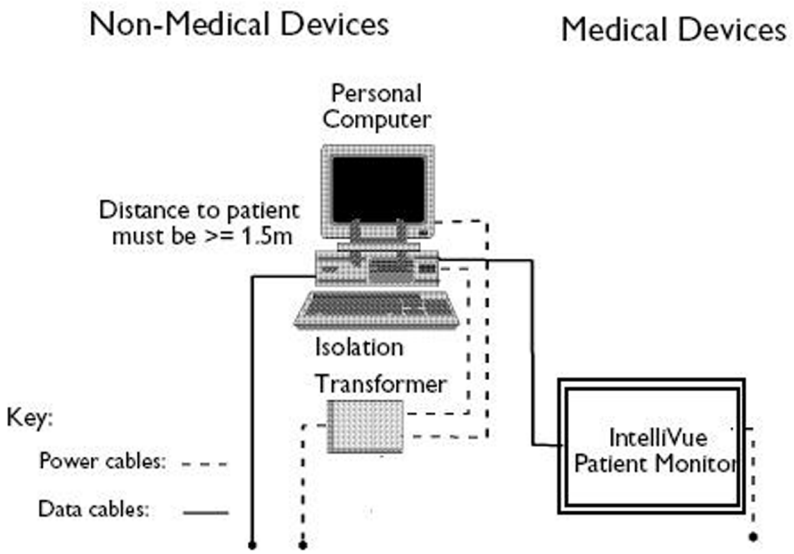
After installation or subsequent modification, a system must comply with the requirements of the system standard IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16. Compliance is checked by inspection, testing or analysis, as specified in the IEC/EN 60601-1-1 or in this book.

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 60601-1-1 or 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 portable socket-outlets. If a multiple portable socket-outlet is used, the resulting system must be compliant with IEC/EN 60601-1-1 or 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/EN 60601-1 or IEC 60601-1 edition 3 clause 16. The whole installation, including devices outside of the patient vicinity, must comply with IEC/EN 60601-1-1 or 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

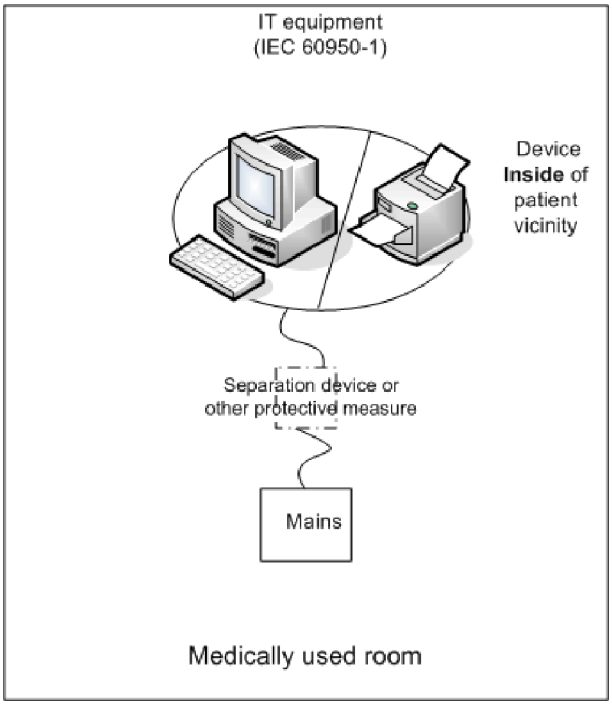
transformer (compliant with IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16) that ensures mechanical fixing of the power cords and covering of any unused power outlets.

## System Installation Requirements

- Ensure that the medical electrical system is installed in a way that the user achieves optimal use.
- Make sure 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 in such a way that the user is able to carry out the necessary cleaning, adjustment, sterilization and disinfection procedures listed in the Instructions for Use.
- Ensure that the medical electrical system is installed in a way that an interruption and restoration of power to any part of the medical electrical system does not result in a safety hazard.
- We recommend using fixed mains socket outlets to power the medical system or parts thereof. Avoid using multiple portable socket-outlets.
- Any multiple portable socket outlets used must be compliant with IEC 60884-1 and IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16.
- Ensure that any part of the system connected to multiple portable socket-outlets is only removable with a tool, i.e. the multiple portable socket-outlet provides a locking mechanism to prevent power cords from being plugged or unplugged unintentionally. Otherwise, the multiple portable 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 that any functional connections between parts of the medical electrical system are isolated by a separation device according to IEC/EN 60601-1-1 or 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 (e.g. 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 when if 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) 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.

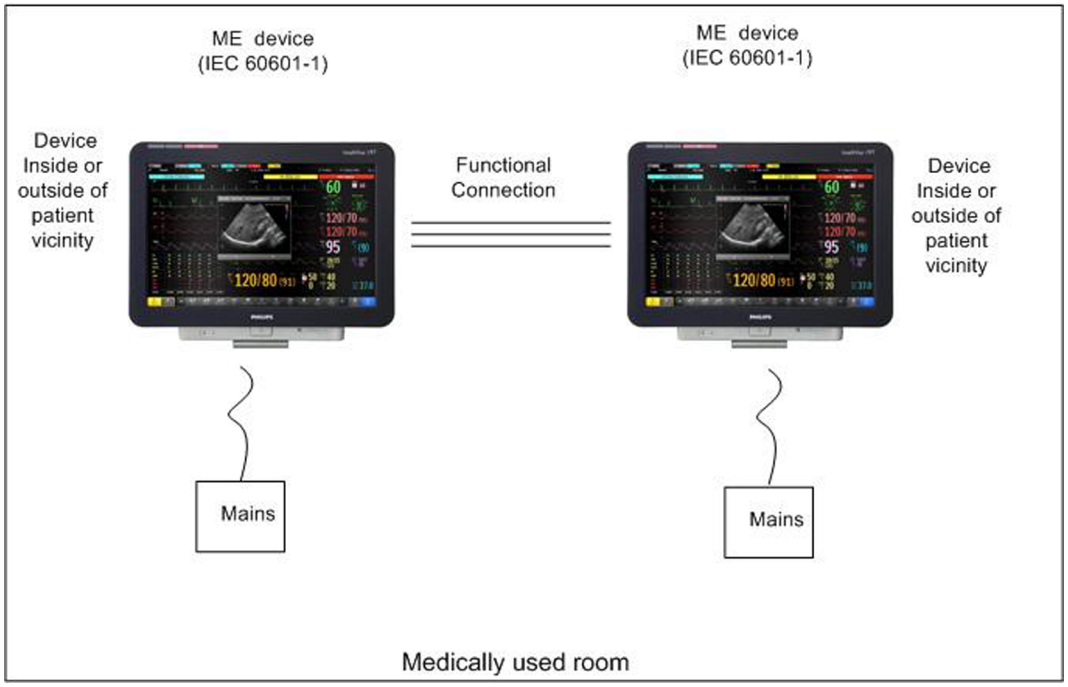


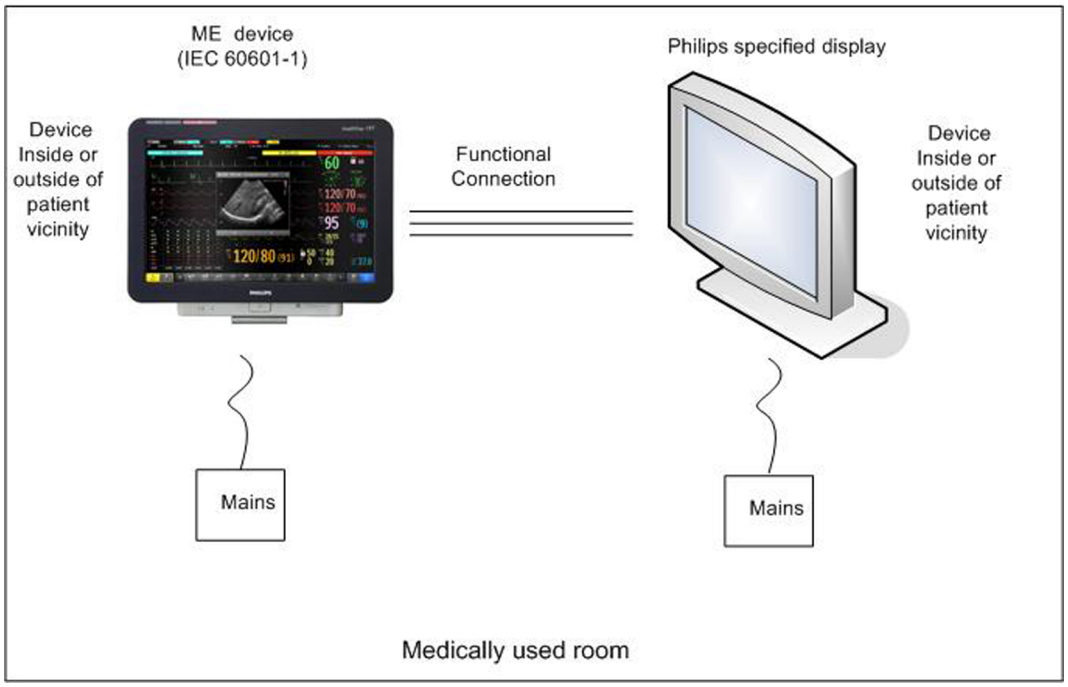

## Case 1: Medical Device Combined with Medical Device

If you combine a medical device with another medical device (incl. Philips specified displays) to form a medical electrical system according to IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.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.

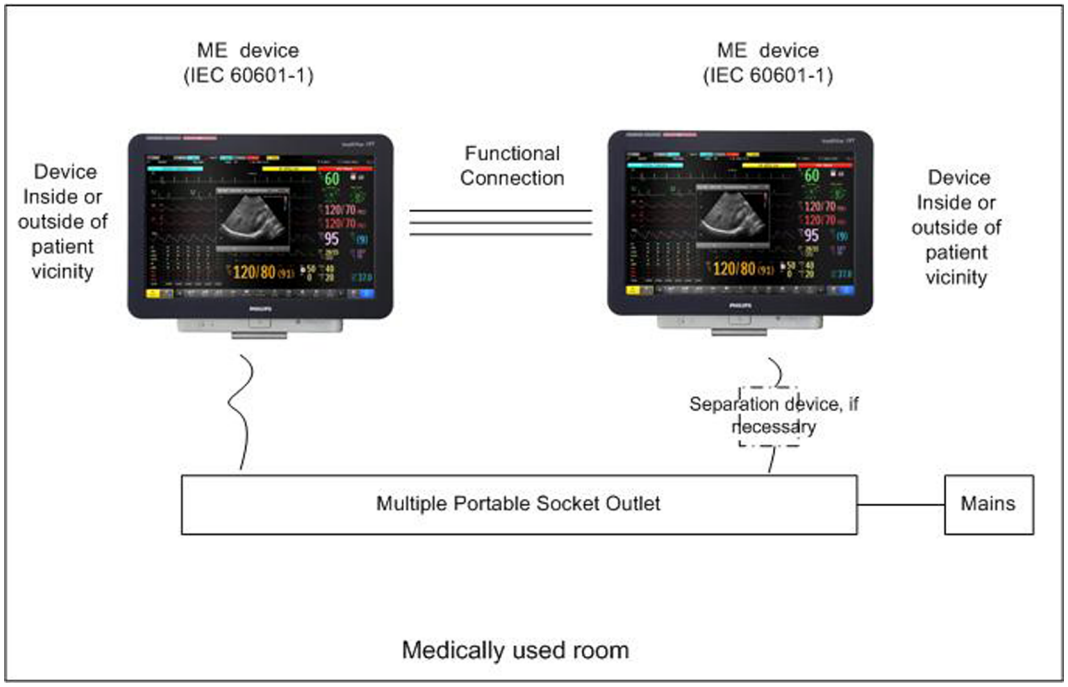
**NOTE**

The pictures below and in the following chapters show the MX800 monitor as an example. All cases apply to the MX400/450/500/550/600/700 monitors as well.



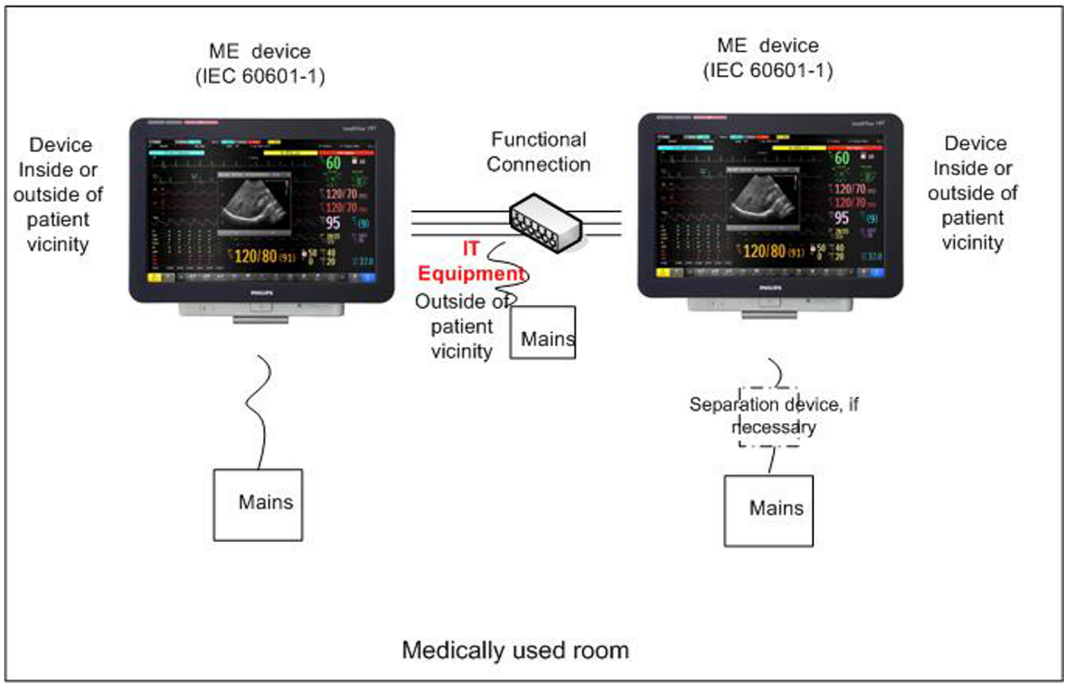




If the combined medical devices are connected to the same multiple portable socket outlet an enclosure leakage current test of the entire device combination on the multiple portable socket outlet is required to ensure that the resulting protective earth leakage current and equipment leakage current does not exceed the limits of IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.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.

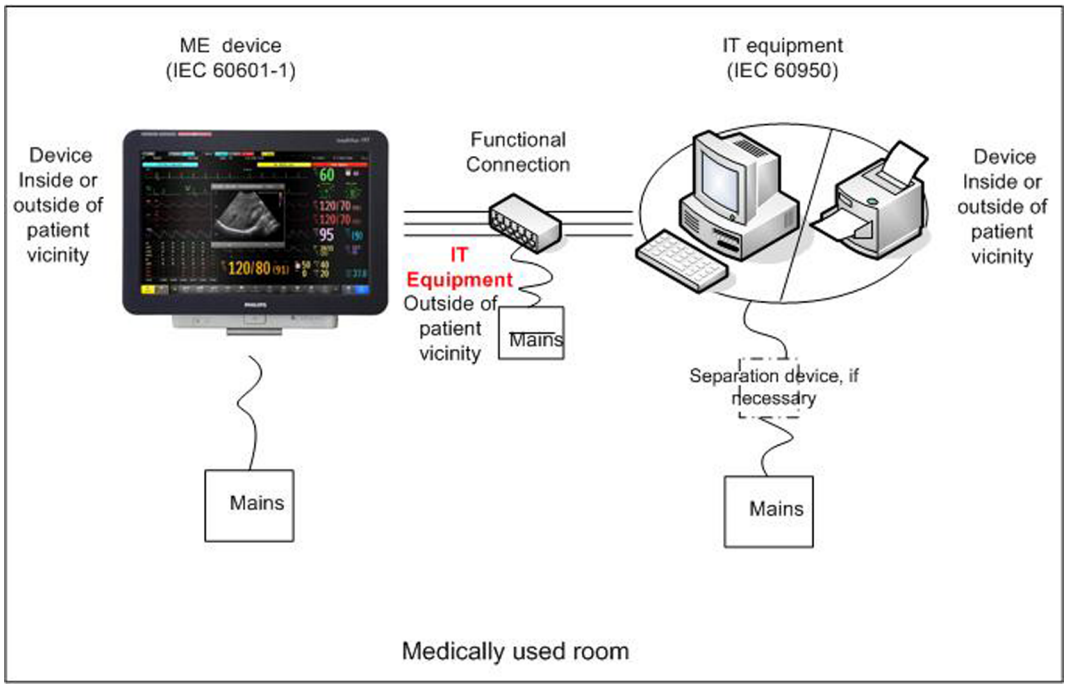


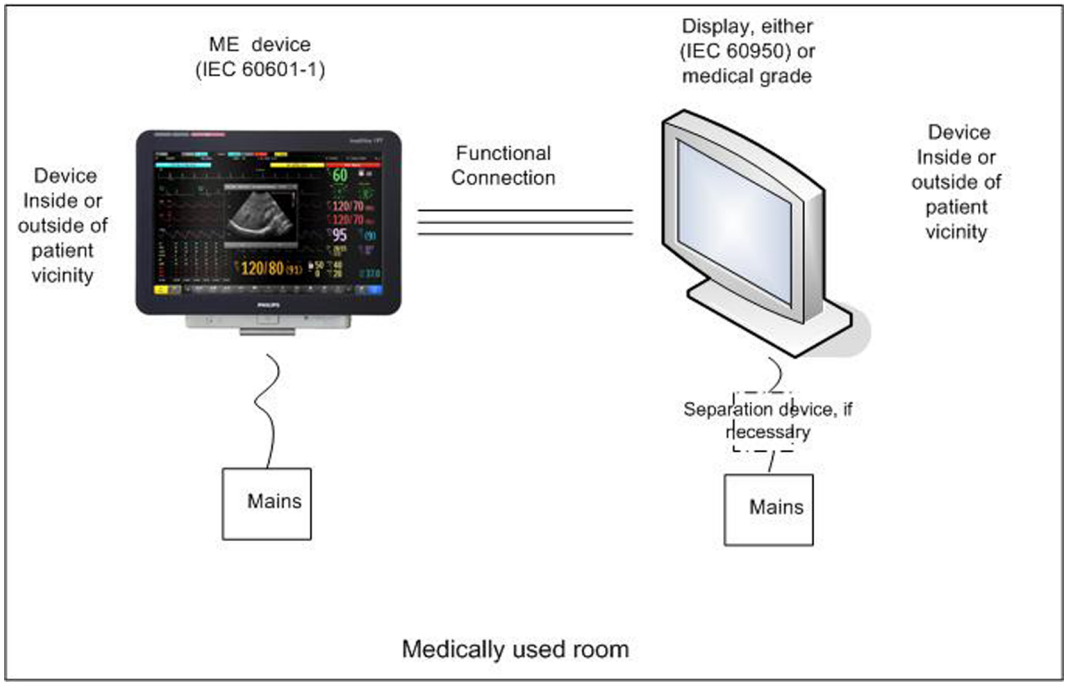

## Case 2: Medical Device Combined with a Non-Medical Device

If you combine a medical device with a non-medical device to form a medical electrical system according to IEC/EN 60601-1-1 or 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 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16.



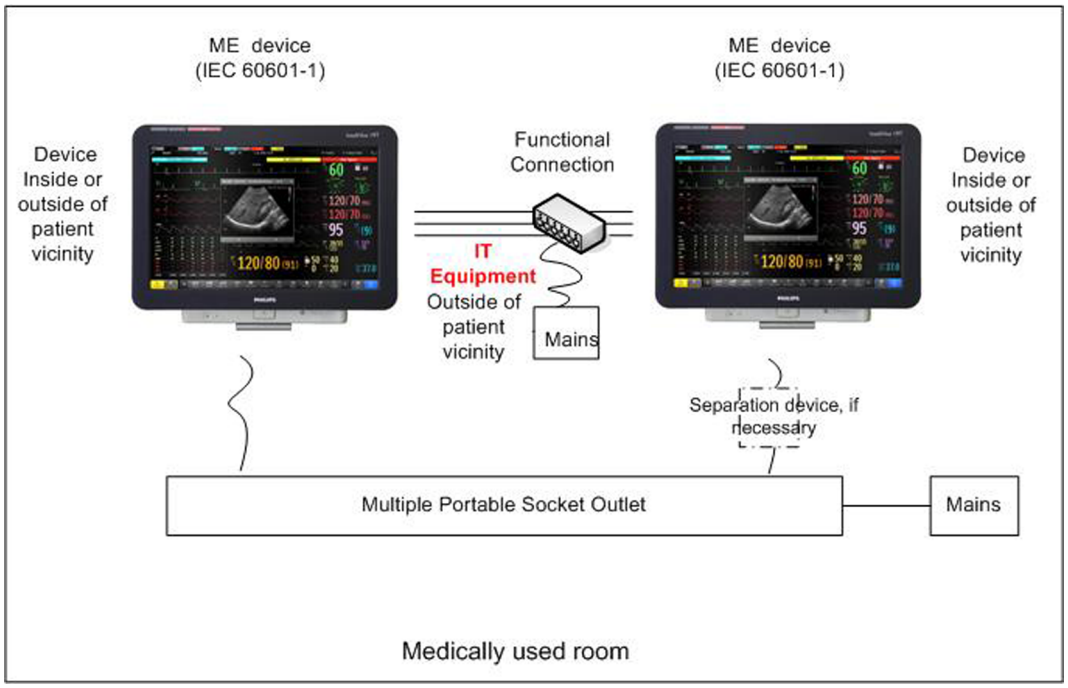
For any IT equipment (IEC60950-1) operated in patient vicinity ensure that the equipment leakage current does not exceed the limits described in IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16. Use a separation device to ensure compliance. After installation of IT equipment in patient vicinity,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



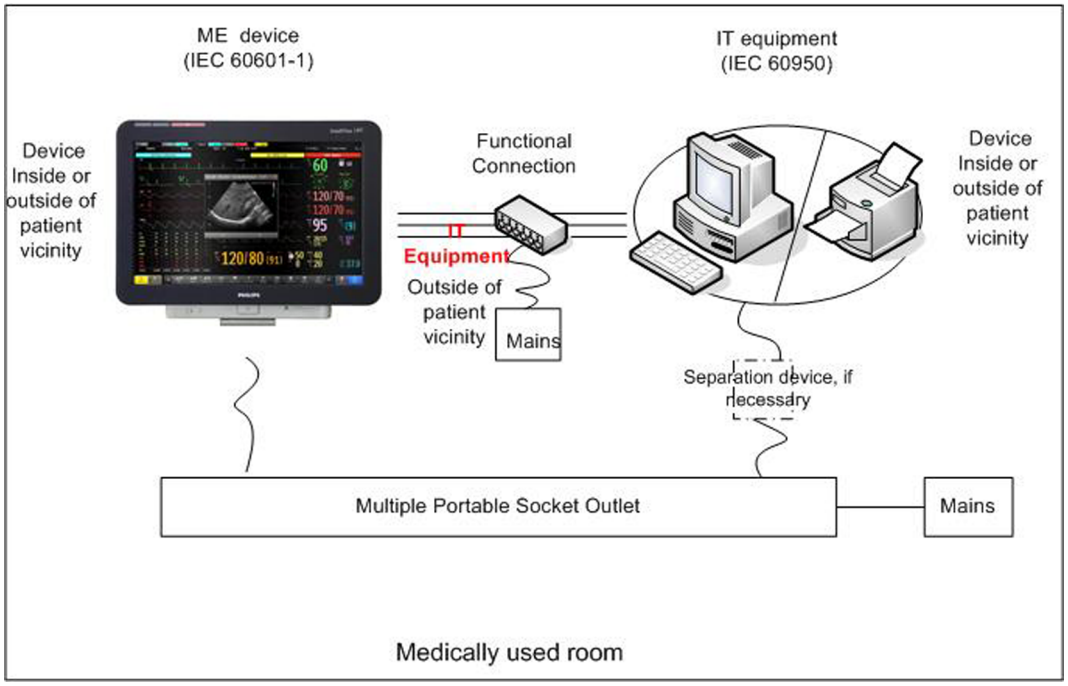




If the combined devices forming the medical electrical system are connected to the same multiple portable socket outlet, ensure that the resulting protective earth leakage current **and** equipment leakage current do not exceed the limits of IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16. The medical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

or IEC/EN 60601-1+A1 Ed.3 clause 16 are exceeded, additional protective measures are required, e.g. a separation device or the connection of each device to separate mains.

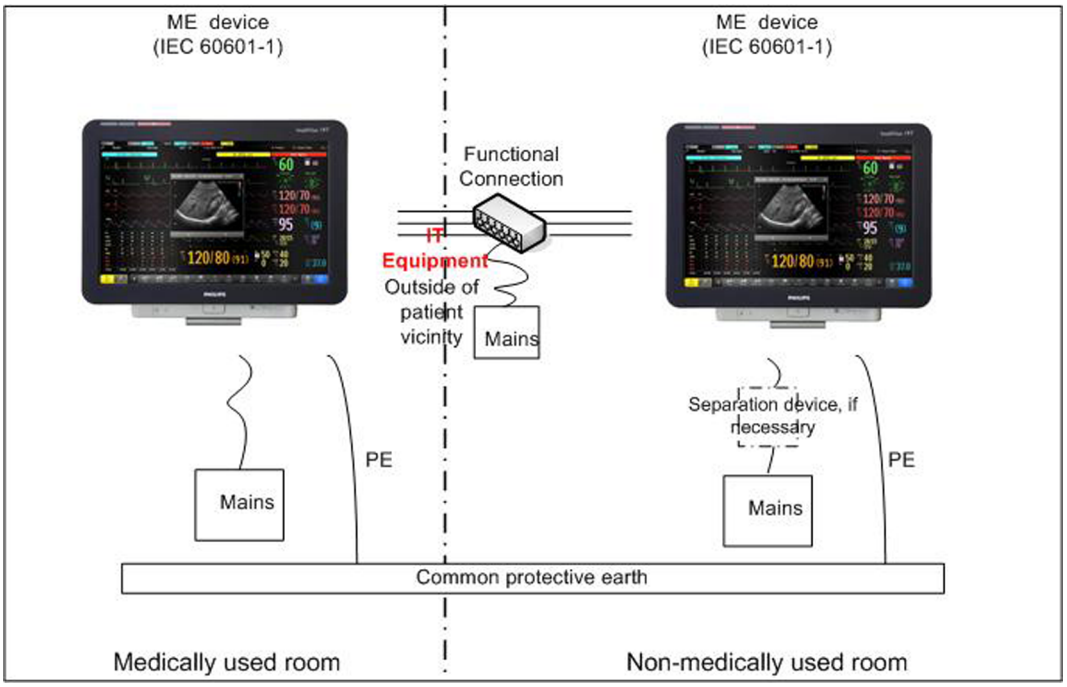


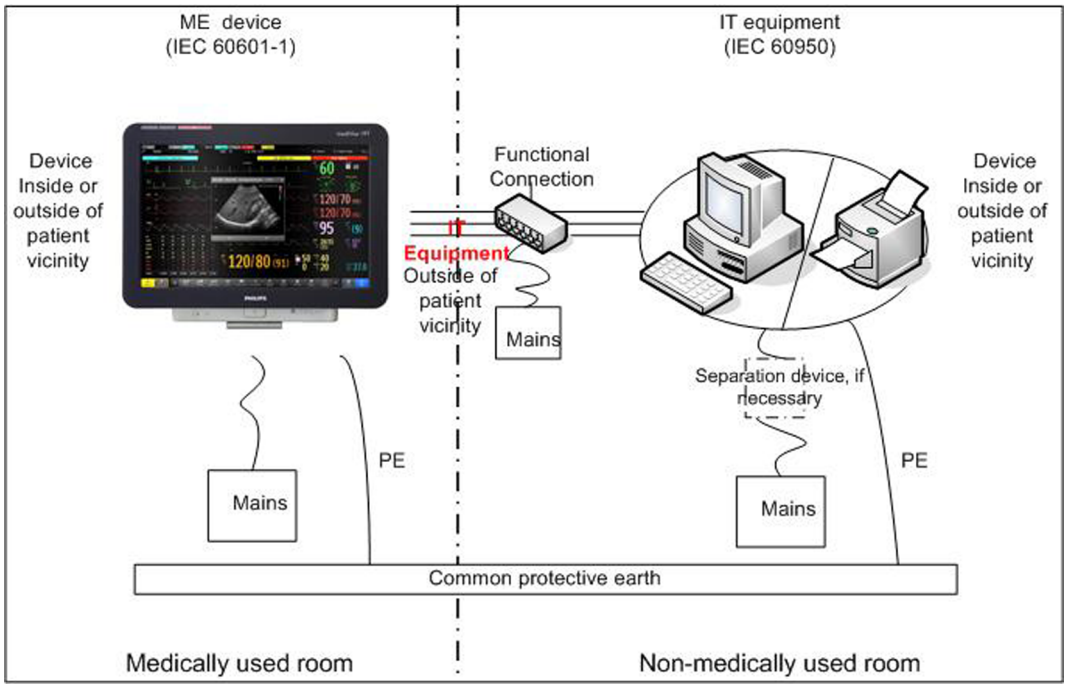

For any IT equipment (IEC60950-1) operated in patient vicinity ensure that the equipment leakage current does not exceed the limits described in IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16. Use a separation device to ensure compliance. After installation of IT equipment in patient vicinity,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



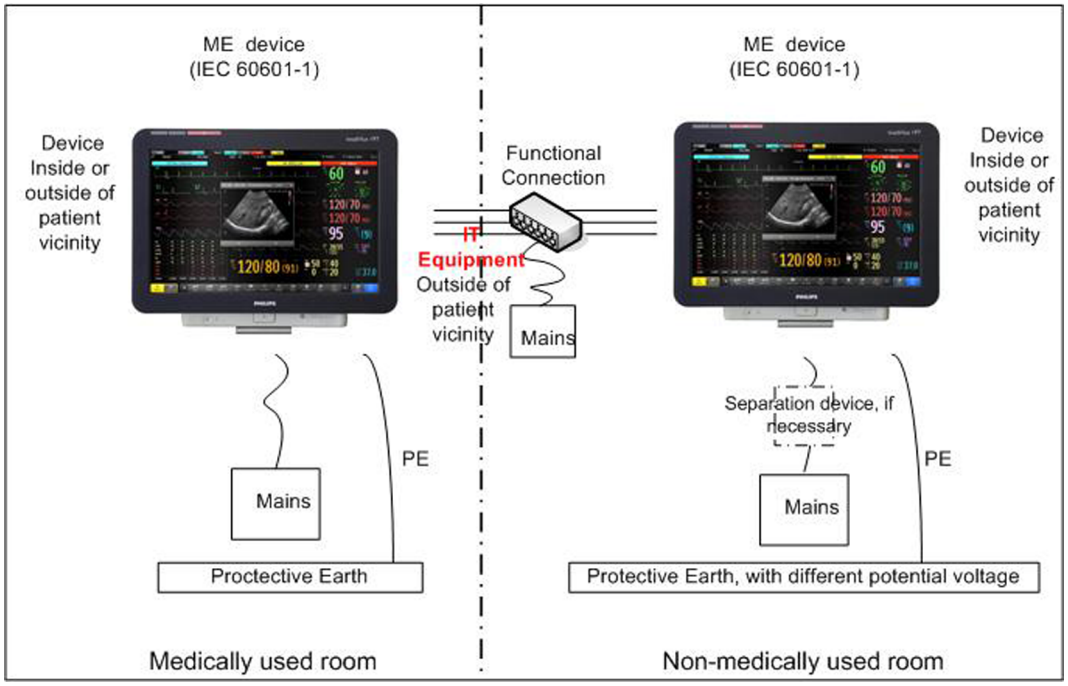
## Case 3: Medical Device Combined with a Medical or Non-Medical Device with one Device in a Non-Medically-Used Room

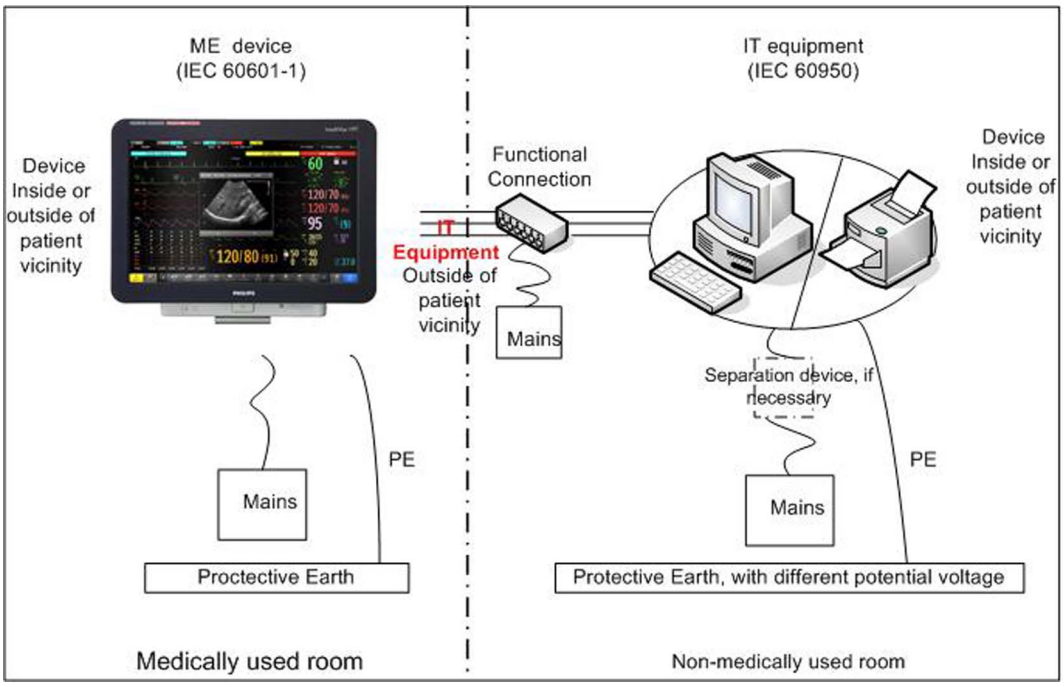
If you combine a medical device with a medical or non-medical device to form a medical electrical system according to IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16 using a common protective earth connection and one of the devices is located in a non-medically used room, additional protective measures 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 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16.






If you combine a medical device with a medical or non-medical device to form a medical electrical system according to IEC/EN 60601-1-1 or 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 60601-1-1 or 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 e.g. 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 medical electrical system has not been tested as a standalone device, the device has to be tested as 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 . Refer to 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 <= 300µA |

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

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

| Test | Expected test results |
|---|---|
| Protective Earth Leakage Current of Multiple Socket Outlets | Sys3 <= 300µA |

Refer to the documentation that accompanies 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 CO2 Calibration

Carry out the Microstream $CO_2$ calibration once a year or after 4000 hours of continuous use and following any instrument repairs or the replacement of any instrument parts.

# 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. Please refer to the section  for detailed information on when which test procedure is required.

**Procedure:**

Power on the monitoring system and go into demo mode. Check that each connected parameter (module, MMS, Gas Analyzer, IntelliBridge connected device) displays values.

## Full Performance Assurance Test

The following sections describe the full performance testing procedures i.e. detailed testing of each parameter with a patient simulator or specified tools. Please refer to 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 MMS/IntelliVue X2.
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 100bpm or 120 bpm+/- 2 bpm.

### 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<br>120 bpm +/- 2 bpm |
| Respiration Performance Test | 40 rpm +/- 2 rpm or<br>45 rpm +/- 2 rpm |

## ECG Out Performance Test

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 MMS 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 Check that the ECG signal is displayed.

| Test | Expected test results |
|---|---|
| ECG Out Performance Test | ECG signal is displayed (pass/fail) |

## SpO2 Performance Test

This test checks the performance of the $SpO_2$ measurement.

**Tools required:** none

1 Connect an adult SpO2 transducer to the $SpO_2$ connector.

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

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

| Test | Expected test results |
|---|---|
| SpO2 Performance Test | 95% and 100% |

## Measurement Validation

The SpO2 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% SaO2 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

**NOTE**

A functional tester cannot be used to assess the accuracy of a pulse oximeter monitor or sensor. However, it can 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.

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

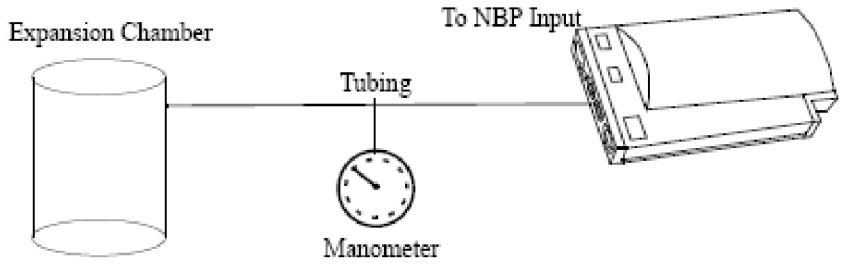
# NBP PerformanceTest

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

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 0.2% of reading.
- 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 MMS and to the expansion chamber.

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

3 Select **Close Valves: On**

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

5 Wait 10 seconds for the measurement to stabilize.

6 Compare the manometer values with the displayed values.

7 Document the value displayed by the monitor (**x1**).

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

9 To calibrate the MMS, select **Close Valves off** then **Calibrate NBP** and wait for the instrument to pump up the expansion chamber.Wait a few seconds after pumping stops until **EnterPrVal** is highlighted and then move the cursor to the value shown on the manometer. If one of the following prompt messages appears during this step, check whether there is leakage in the setup:
   – NBP unable to calibrate–cannot adjust pressure
   – NBP unable to calibrate–unstable signal

10 Press **Confirm**.

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

## 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 MMS or X2 or replace parts.

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

2 Watch the pressure value for 60 seconds.

3 Calculate and document the leakage test value (**x2**).
x2 = P1 - P2
where P1 is the pressure at the beginning of the leakage test and P2 is the pressure displayed after 60 seconds.
The leakage test value should be less than 6 mmHg.

## 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 (**x3**)

5 If the difference is greater than 3 mmHg, calibrate the MMS or X2 (see steps 9 to 10 in the accuracy test procedure).

### Valve Test

1 Raise the pressure again to 280 mmHg.

2 Select **Close valves: Off**.

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

4 Document the value displayed by the monitor (x4).

| Test | Expected test results |
|---|---|
| Accuracy test | x1 = 280 ± 3mmHg<br>Difference ≤ 3mmHg |
| Leakage test | x2 = leakage test value<br>x2 < 6 mmHg |
| Linearity test | x3 = 150 ± 3mmHg<br>Difference ≤ 3mmHg |
| Valve Test | x4 = value < 10 mmHg |

## Invasive Pressure Performance Test

This test checks the performance of the invasive pressure measurement.

**Tools required:** Patient simulator.

1 Connect the patient simulator to the pressure connector.

2 Set the patient simulator to 0 pressure.

3 Make a zero calibration.

4 Configure the patient simulator as P(static) = 200 mmHg.

5 Wait for the display.

6 The value should be 200 mmHg ± 5 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.

| Test | Expected test results |
|---|---|
| Invasive Pressure Performance Test | 200 mmHg ± 5 mmHg |

## Temperature Performance Test

This test checks the performance of the temperature measurement.

Tools required: Patient simulator (with 0.1°C or 0.2°F).

1 Connect the patient simulator to the temperature connector.

2 Configure the patient simulator to 40°C or 100°F.

3 The value should be 40°C ± 0.2°C or 100°F ± 0.4°F.

| Test | Expected test results |
|---|---|
| Temperature Performance Test | 40°C ± 0.2°C or 100°F ± 0.4°F |

# M3014A Capnography Extension Performance Tests

The procedures below describe the mainstream and sidestream CO2 performance tests for the M3014A Capnography Extension.

## Mainstream CO2 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 $CO_2$ sensor to the patient monitor. Attach an airway adapter to the sensor. Make sure that 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% CO2, balance N2 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 CO2 value. The expected value is 5% of the ambient pressure ±2mmHg

**NOTE**

Make sure that 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 CO2 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 CO2 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 CO2 sensor to the patient monitor. Attach the sample line and the cal tube to the sensor. Make sure that 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% CO2, balance N2 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 CO2 value. The expected value is 5% of the ambient pressure ±2mmHg

**NOTE**

Make sure that 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 CO2 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 CO2 Flow Check

Check the flow rate in the Sidestream CO2 extension as follows:

1 Connect the flowmeter to the sample line

2 Check on the flowmeter the flow that the Sidestream $CO_2$ 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 CO2 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 CO2 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 CO2 measurement. The Microstream CO2 measurement can either be integrated into the IntelliVue MP5 monitor or, for other IntelliVue monitors, into the M3015A/B MMS Extensions. The Microstream CO2 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. Refer to 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 ±2mbar or better
- Gas calibration equipment:
- Cal 1 gas 15210-64010 (5% $CO_2$)
- Cal 2 gas 15210-64020 (10% $CO_2$)
- 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 CO2 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.*
- Pump check*

- Flow check and calibration, if required
- Noise check
- CO2 Cal check and calibration, if required
- CO2 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.

## 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 $mCO_2$ 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 CO2** menu.

2 Connect a calibration line to the Microstream $CO_2$ 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 $mCO_2$ 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 $mCO_2$ outlet.

7 Open the MMS 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 MMS Extension or the $mCO_2$ 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 $mCO_2$ gas outlet.

2 Leave the calibration line connected to the M3015A inlet or the MP5 $mCO_2$ 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; proceed to the pump check.

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 $mCO_2$ 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 $mCO_2$ assembly of the MP5 must be exchanged.

| Test | Expected test results |
|---|---|
| Leakage Check Parts 1 and 2 | **x1** = value of part 1 leakage check on flowmeter (**x1**< 4.0 ml/min)<br>**x2** = value of part 2 leakage check on flowmeter (**x2**< 4.0 ml/min) |

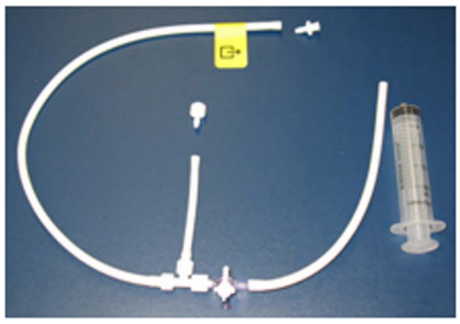
## Leakage Check for M3015B and M3015A with HW Rev C or M3015A with HW Rev. A/B without M1026-60144 Flowmeter

**Preparation of Leakage Test Kit:**

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

NOTE

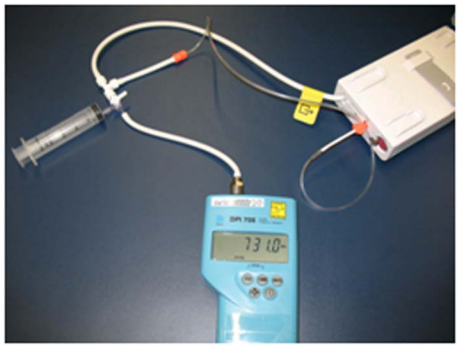
These Luer connectors are not required for the actual Leakage Check. However, you should keep them, as they are required for other tests (e.g. for the kit leak test as documented later in this section).



**Test Setup:**

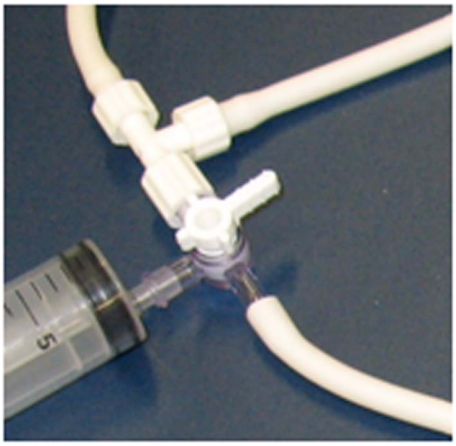
1 Connect the Calibration Line (M3015-47301) to the inlet of the M8105A/M3015A/B (the M8105A/M3015A/B must be switched off, either by disconnecting from the host monitor or by switching off the monitor).

2 Connect the leakage test tubing to the outlet of the M8105A/M3015A/B, to the digital barometer, to the calibration line, and the (empty) syringe as shown below. Make sure all connections have a tight fit!



**Test Procedure:**

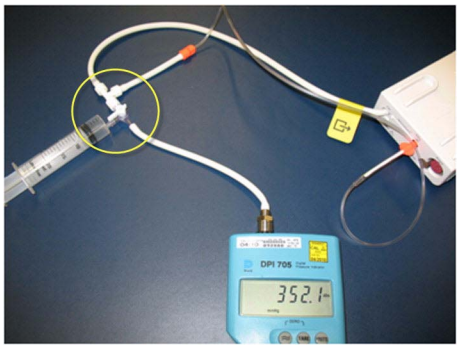
1 Open the 3-way stopcock for all three limbs.



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.



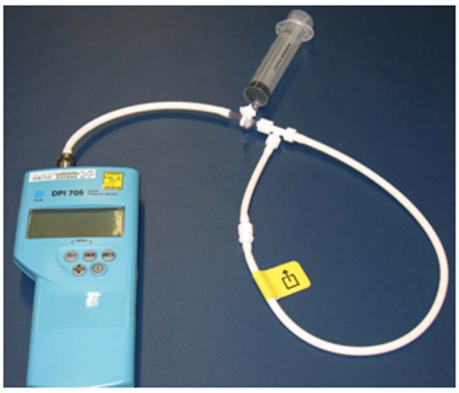
5 If the leakage test is NOT passed, check all connections once more and repeat the test.

| 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:

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



b. Connect the syringe to the 3-way stopcock and the digital barometer to the open tubing.

c. Draw at the syringe until the digital barometer shows approximately 350 mbar below ambient pressure.

d. Close the 3-way stopcock to the syringe and wait 5 - 10 seconds. In this time, the overall pressure should stabilize.

e. After 1 minute, check the pressure. The pressure should not increase more than 8 mbar in 1 minute for the test to pass.

f. If this test fails, exchange the leakage test kit.

## Barometric Pressure Check and Calibration

NOTE

The M3015A with HW Rev C and the M3015B do not require calibration of the barometric pressure. Therefore you will not be able to activate a barometric pressure calibration. If you are using a HW Rev C M3015A or M3015B, perform the barometric pressure check as described below, making sure that only a sample line is connected to the MMS Extension. If the pressure check fails, the M3015A/B needs to be exchanged.

Check the barometric pressure value in the M3015A/B MMS Extension or the MP5 as follows:

1 Go into service mode and select **Setup $CO_2$**menu.

2 Connect a calibration line to the Microstream $CO_2$ input. This activates the pump in the M3015A/B MMS Extension or the MP5.

3 The status line at the bottom of the screen displays "$CO_2$ pressure reading (ambient/cell) xxx/yyy" where xxx is the ambient pressure and yyy is the measured cell pressure. Check whether the ambient pressure value (**x3**) matches (within the acceptable tolerance of ±12mm Hg) the reference value you have received. If so, proceed to the leakage check.

If the value is not correct, calibrate as follows.

a. Select **$CO_2$** then select **Barom.Press** to activate a table of values.

b. Select the value in the table which matches the reference value received from a reliable local source (airport, regional weather station or hospital weather station). (The values are displayed with a resolution of 2 mmHg up to 500 mmHg and a resolution of 1 mmHg from 500 mmHg to 825 mmHg.) Note: the selected value must be within ±10% of the current measured ambient pressure, otherwise an error message will occur at restarting the monitor.

c. Confirm the barometric pressure setting.

d. Check that the ambient pressure displayed in the status line at the bottom of the screen is the same as the value which you selected from the list in step b.

| Test | Expected test results |
|---|---|
| Barometric Pressure Check | **x3** = difference between the reference pressure and the measured ambient pressure displayed on the monitor<br>(**x3**<12 mmHg) |

## Pump Check (M3015A HW A only)

1 Connect the flowmeter inlet to the m$CO_2$ gas outlet using a flexible connecting tube.

2 Connect the calibration line to the m$CO_2$ inlet.

3 Block the inlet of the calibration line using your fingertip and observe the cell pressure on the monitor display. The cell pressure (**x4**) should be more than 120 mmHg below the ambient pressure shown. If the pressure difference is less than 120 mmHg, the pump is not strong enough and you should replace it, irrespective of the Pump OpTime.

| Test | Expected test results |
|---|---|
| Pump Check | **x4** = difference in pressure between cell pressure and ambient pressure displayed on the monitor during occlusion (**x4** >120 mmHg) |

## Flow Rate Check and Calibration

Check the flow rate in the M3015A/B MMS Extension or the MP5 as follows:

1 Connect the calibration line to the m$CO_2$ inlet and the flowmeter outlet to the calibration line.

2 Check on the flowmeter the flow that the M3015A/B MMS Extension or MP5 mCO2 pump draws (**x5**). It should be 50 +15/-7.5 ml/min. If the value is within tolerance, proceed to the $CO_2$ Gas calibration check.

If the value is not within tolerance, calibrate as follows.

a. 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.

b. When you are satisfied that 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.

c. 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.

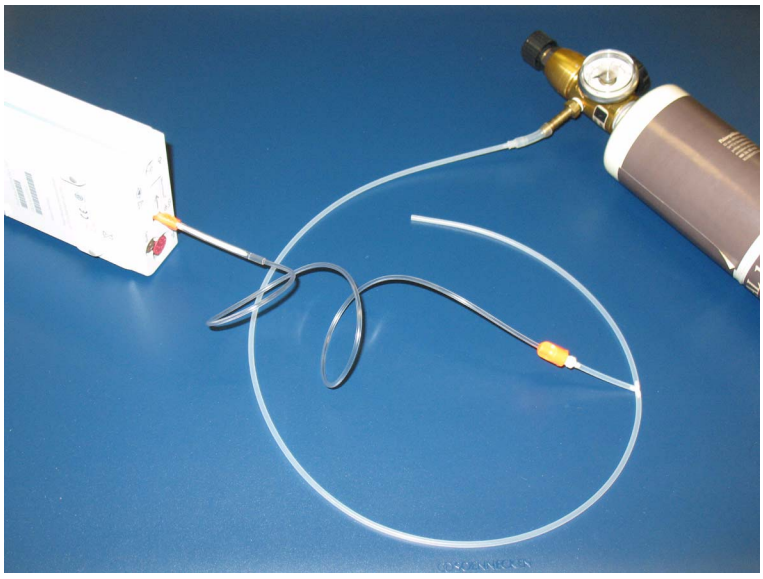
Note that the pump can only be replaced on M3015A with the old hardware Rev. A (i.e. Serial No. DE020xxxxx)

| 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 $CO_2$** menu.

2 Connect the calibration line, the cal tube, the flow regulator and the 5% calibration gas to the $mCO_2$ inlet.



3 Open the valve to apply the 5% calibration gas and wait until the value is stable.

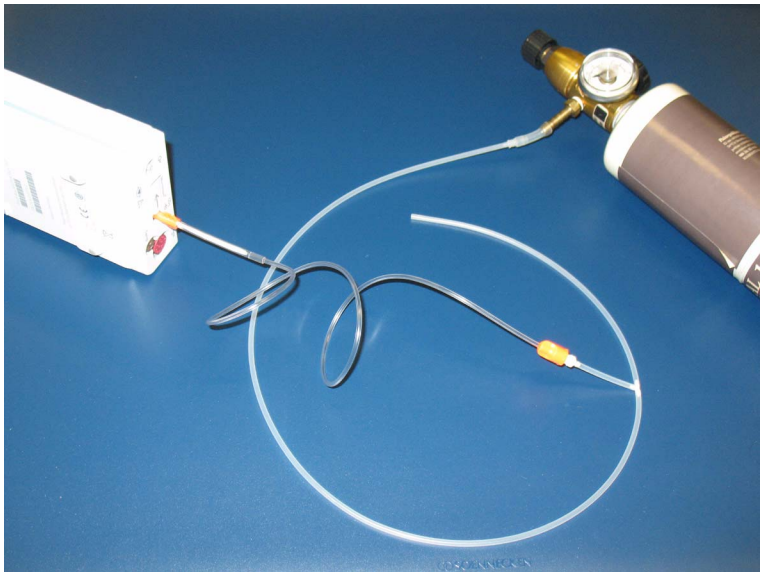
4 Check the noise index (**x6**) displayed next to the $CO_2$ value on the display (this indicates the level of noise on the $CO_2$ wave). If the value exceeds 3 mmHg, replace the measurement extension.

| Test | Expected test results |
|---|---|
| Noise Check | **x6** = noise index displayed on monitor (**x6**<3.0) |

## CO2 Cal Check and Calibration

After switching the measurement extension on, wait at least 20 minutes before checking the calibration. Check the calibration of the $CO_2$ gas measurement as follows:

1 Connect the calibration line, the cal tube, the flow regulator and the 5% calibration gas to the $mCO_2$ inlet.



2 Calculate the expected measurement value in mmHg as follows:
0.05 x (ambient pressure) = value mmHg
for example 0.05 x 736 = 36.8 mmHg (with an ambient pressure of 736 mmHg)

3 Open the valve on the flow regulator to allow 5% $CO_2$ 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 ± 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 x (ambient pressure) = value mmHg
±0.07 x (value mmHg) = tolerance
for example 0.1 x 737 mmHg = 73.7 mmHg (with an ambient pressure of 737 mmHg)
±0.07 x 73.7 mmHg = ±5.16 mmHg tolerance

7 Open the valve on the flow regulator to allow 10% $CO_2$ 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. $CO_2$**.

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

d. Open the valve on the calibration gas to allow $CO_2$ 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.

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

| Test | Expected test results |
|---|---|
| CO2 Cal Check | x7 = calculated mmHg value ±2.6 mmHg<br>x8 = calculated mmHg value within calculated tolerance |

## Calibration Verification

1 Keep the same setup as described in "CO2 Cal Check and Calibration" on page 76.

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 MMS Extension or the MP5 m$CO_2$ Assembly.

| Test | Expected Test Results |
|---|---|
| Leakage Check parts 1 and 2* | **x1** = value of part 1 leakage check on flowmeter (**x1**< 4.0 ml/min)<br>**x2** = value of part 2 leakage check on flowmeter (**x2**< 4.0 ml/min) |
| Leakage Check without Flowmeter | reading on the digital barometer change is less than 20 mbar for 30 seconds |
| Barometric Pressure Check | **x3** = difference between the reference pressure and the measured ambient pressure displayed on the monitor<br>(**x3**<12 mmHg) |
| Pump Check** | **x4** = difference in pressure between cell pressure and ambient pressure displayed on the monitor during occlusion (**x4** >120 mmHg) |
| Flow Check | **x5** = difference between measured value and 50.0 ml/min (**x5** = 50+15/-7.5 ml/min) |
| Noise Check | **x6** = noise index displayed on monitor (**x6**<3.0) |
| $CO_2$ Gas Calibration Check | **x7** = difference between measured $CO_2$ value and calculated value, based on 5% $CO_2$ cal. gas. (**x7** < 2.6 mmHg) |
| $CO_2$ Cal Verification | **x8** = difference between measured $CO_2$ value and calculated value, based on 10% $CO_2$ cal. gas. (**x8** < ± {0.07 x value calculated}) |

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

### Reset Time Counters

**NOTE**

This procedure only applies to M3015A with the old hardware Rev. A (i.e. Serial No. DE020xxxxx

You must check the time counters on the Microstream $CO_2$ extension before calibrating the instrument. As well, when parts are replaced, the appropriate counters must be reset to zero.

The counters for $CO_2$ pump, IR Src and Last Cal are displayed in the status line. The values are updated when entering the **Setup CO2** menu.

Observe the following guidelines:

- When calibrating the $CO_2$ extension, if no parts have been replaced, check the displayed values of **Reset PumpOpTime** and **Reset IRSourceTime** selections to make sure that they are within suggested guidelines for use (15, 000 hours of continuous use). If the counter time is greater than 15, 000 hours, replace the appropriate part. See Repair an*d Disassembly* for details.
- When calibrating the $CO_2$ extension, if parts have been replaced, reset the appropriate values using the **Reset PumpOpTime** and **Reset IRSourceTime** selections. See *Repair and Disassembly* for details.

Resetting the PumpOpTime generates the INOP: "$CO_2$ OCCLUSION". To clear this INOP you must perform a flow check and store the flow in service mode (select **Store Flow**).

### CO2 Pump / CO2 Scrubber Replacement

**NOTE**

This procedure only applies to M3015A with the old hardware Rev. A (i.e. Serial No. DE020xxxxx

Refer to the Repair and Disassembly section for the replacement procedures.

## 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. Make sure 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 ± 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 ± 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 cmH2O.

5 Verify that the pressure difference between Ppeak and Paw remains less than 10 cmH2O 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 cmH2O |

## 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 ± 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 ± 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 +/– 1 l/min.

| Test | Expected test results |
|---|---|
| Cardiac Output Performance Test | C.O. = 5 +/– 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 MMS 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 +/- 0.1°C

| Test | Expected test results |
|---|---|
| Cardiac Output Service Tool Procedure Version 1 | Tblood = 37.0°C +/- 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 MMS Extension 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 Make sure 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”

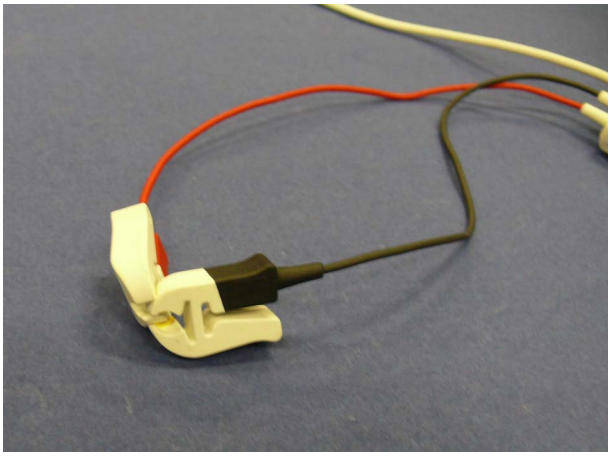
7 Enter the C.O. Procedure window and check the Tinj value. The expected result is:
Tinj = 0.0°C +/- 0.1°C

| Test | Expected test results |
|---|---|
| Cardiac Output Service Tool Procedure Version 2 | Tinj = 0.0°C +/- 0.1°C |

# 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 | **NMT Stimulation Output Test passed** 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. |

# 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 or run the test with the built-in EC10 I/O board.

2 Connect the Service PC to the IntelliBridge EC10 module or I/O board and make sure the correct drivers for the external devices are installed. (See the  chapter 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 or I/O board using the supplied cable.

5 Switch the external device on. The connection status LED will flash green until it has correctly identified the external device and started communication. Check that 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 We recommend that 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, refer to 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. Make sure you are using the correct paper.

| Test | Expected test results |
|---|---|
| Recorder Performance Test | Recording is printed correctly |

# EEG, SvO2 (SO2) and tcGas Performance Tests

The EEG and $SVO_2$ ($SO_2$) parameters do not require performance tests because the modules perform internal self-tests regularly. These tests suffice for performance testing of these three parameters.

Since the tcGas Module is calibrated regularly it also does not require a separate performance test.

# 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:

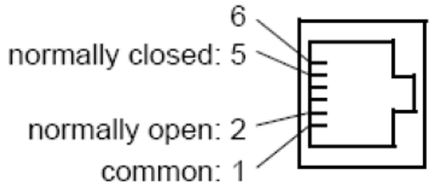
- Standard Operation—connector contact 1-2 open; 1-5 closed.
- Alarm Condition—connector contact 1-2 closed; 1-5 open.

**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.

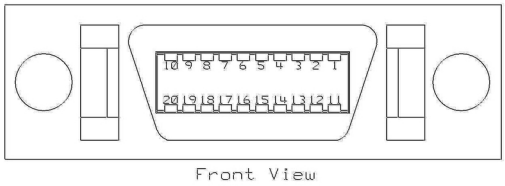



4 The expected test result is: Alarm condition - Connector contacts 1-2 are closed and connector contacts 1-5 are open.

| Test | Expected test results |
|---|---|
| Nurse Call Relay Performance Test | Alarm Condition—<br>Connector contacts 1-2 are closed and<br>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:




| 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 |

| Pin | Cable Color Coding | Relay |
|---|---|---|
| 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.

**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 The relay contacts should behave as described above. The behavior may vary depending on configuration choices. See the Configuration Guide for details on Alarm Relay settings.

4 The expected test results depend on the relay contact used. Please check that 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) |

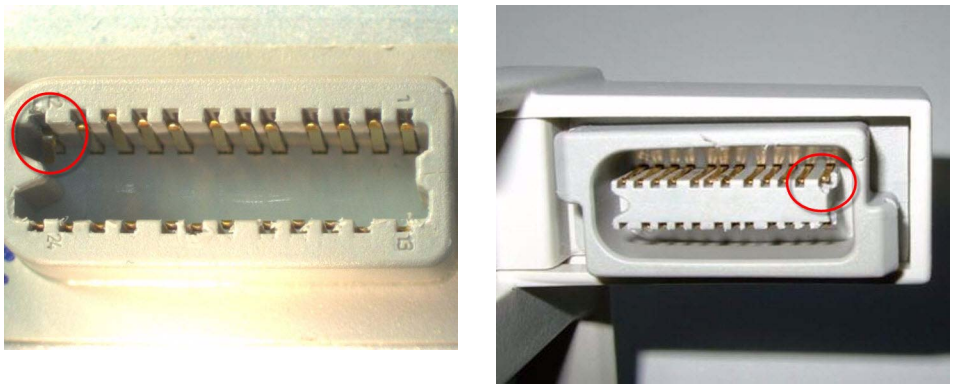
## MSL Assurance Test

Visually inspect all MSL connector sockets (cable/monitor/MMS).

1 Make sure that the pins of the connectors are not jolted.

2 Make sure that 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 |

## IntelliVue 802.11 Bedside Adapter Communication Test

1 Make sure 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 will automatically adjust 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 either **WEP, WPA(PSK)** or **WPA2(PSK)** to match your installation.
- Enter the required keys/passwords for **WEP**, **WPA(PSK)** or **WPA2(PSK)**.

NOTE

WPA2(PSK) was introduced with monitor software revision G.0.(Required WLAN adapter firmware for MP5-90: A.02.24, for MP2/X2: A.00.20)

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 (e.g. if the access point is mounted on the ceiling, place the monitor directly below). Wait until the **Conn.Status** field in the service window shows *Authenticatd (for* Rel. C.0 monitors) or *Connected* (for Rel D.0 or higher). 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 will fluctuate but should stay above 30 in a 5 m distance from the access point used. The wireless link should be active, i.e. the **Conn.Status** field should be *Authenticatd* (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.

6 Perform the Wireless Switch test blocks as described in the Philips IntelliVue 802.11 a/g Infrastructure Installation and Configuration Guide.

| Test | Expected test results |
|---|---|
| IntelliVue 802.11 Bedside Adapter Performance Test | RSSI value above 30 |

# IIT Communication Test

1 Make sure 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 ±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 ±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 fom 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 Make sure that 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 252.

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

Perform the Mounting Integrity Test

– whenever you have removed and reassembled a quick mount
– if one or both of the quick mount screws are loose
– if there is a clearance between the quick mount and the monitor bottom housing
– if the monitor mounting is unstable

Remove the monitor from the mount and disassemble the quick mount. Ensure that the threading of the MX400/450/500/550 is not damaged or separated from the chassis.

If the quick mount is damaged, exchange the quick mount.

Ensure that all quick mount screws are tight (1.3 Nm). 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.

If you notice any damage to the threading of the MX400/450/500/550 chassis, send the MX400/450/500/550 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 MX400/450/500/550. 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 that 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:<br>Name of testing person:<br>Date: | (Check one of the following three options)<br>Test before putting into service (reference value)<br>Recurrent Test<br>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<br>Difference <= 3mmHg | PN:P/X1 or<br>PN:F/X1 | |
| | Performance Leakage Test | X2 = leakage test value<br>X2 < 6 mmHg | PN:P/X2 or<br>PN:F/X2 | |
| | Performance Linearity Test | X3 = value displayed by monitor<br>Difference <= 3mmHg | PN:P/X3 or<br>PN:F/X3 | |
| | Performance Valve Test | X4 = value < 10 mmHg | PN:P/X4 or<br>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<br>PT: F/X1 | |

| Test | Test or Inspection to be Performed | Expected Test Results | Record the Results (mandatory for Philips Personnel only) | |
|---|---|---|---|---|
| | | | What to record | Actual Results |
| All other performance tests | Perform the remaining parameter performance tests, if applicable | See expected results in test procedures | P: P or<br>P: F | |
| Safety (1) | Perform Safety Test (1): Protective Earth Resistance | With mains cable:<br>Maximum impedance (X1):<br><=300 mOhms | S(1):P/X1 or<br>S(1):F/X1 | * |
| Safety (2) | Perform Safety Test (2): Equipment Leakage Current - Normal Condition. | With mains cable:<br>Maximum leakage current (X1):<= 100 µA | S(2): P/X1 or<br>S(2): F/X1 | * |
| Safety (3) | Perform Safety Test (3): Equipment Leakage Current - Single Fault Condition (Open Earth) | With mains cable:<br>Maximum leakage current (X2):<= 300 µA | S(3): P/X2 or<br>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):<br><=50 µA (CF) | S(4): P/X1 or<br>S(4): F/X1 | * |
| System (Sys 1-2) | Perform the system test according to subclause 19.201 of IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16, if applicable, after forming a system | Equipment Leakage Current:<br>Sys1 <= 100 µA (Normal Condition)<br>Sys2 <= 300µA (Single Fault Condition | Sys: PSys1/PSys2<br>or<br>Sys: FSys1/Fsys2 | * |
| System (Sys 3) | Perform the system test according to subclause 19.201 of IEC/EN 60601-1-1 or 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 Portable Socket Outlet:<br>Sys3 <= 300 µA | Sys: PSys3<br>or<br>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

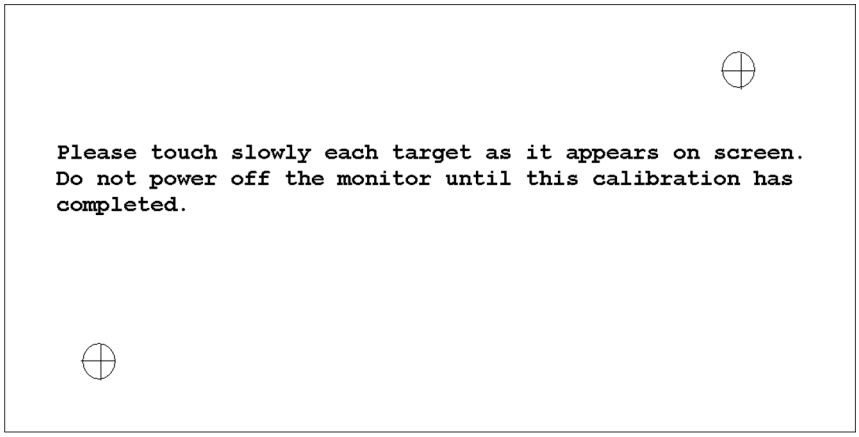
To access the touchscreen calibration screen:

1 Enter service mode

2 Select **Main Setup**

3 Select **Hardware**

4 Select **Touch Calibration**




*Touchscreen Calibration Screen*

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

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

Please refer to the documentation shipped with your selected display for further details on touchscreen calibration procedures.

**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

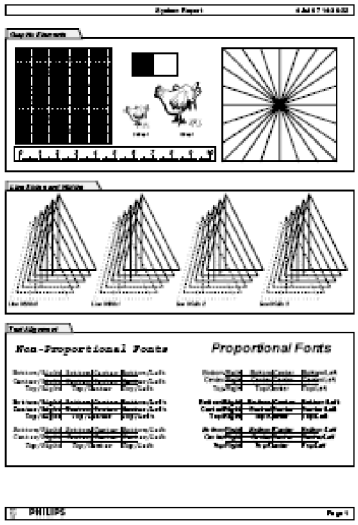
To *temporarily* disable touchscreen operation of the monitor, press and hold the **Main Screen** key. A padlock symbol will appear on the key. Press and hold the **Main Screen** key again to re-enable touchscreen operation.

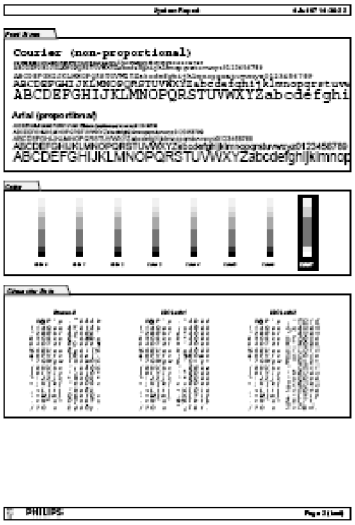
# Printer Test Report

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:




# Battery Handling, Maintenance and Good Practices

This section provides some information on how to handle and maintain the battery in order to get the best usage from it. Additionally, some good working practices are also given regarding the correct disposal of the batteries.

## Battery Care

Battery care begins when you receive a new battery and continues throughout the life of the battery. The table below lists battery care activities and when they should be performed.

| Activity | When to Perform |
|---|---|
| Perform a visual inspection | Before inserting a battery into the monitor |
| Charge the battery | Upon receipt, after use, or if a low battery state is indicated. To optimize performance, a fully (or almost fully) discharged battery should be charged as soon as possible. |
| Condition the battery | When the "battery requires maintenance" symbol appears |
| Store the battery in a state of charge in the range of 40% to 50% | When not in use for an extended period of time |

Refer to your monitor's Instructions for Use for details on how to perform battery care activities, including charging and conditioning. We recommend using the Philips Smart Battery Conditioner LG 1480 (865432)

## Handling Precautions

Lithium ion batteries store a large amount of energy in a small package.Use caution when handling the batteries; misuse or abuse could cause bodily injury and/or property damage.

- Do not short circuit - take care that the terminals do not contact metal or other conductive materials during transport and storage
- Do not crush, drop or puncture - mechanical abuse can lead to internal damage and internal short circuits which may not be visible externally
- Do not apply reverse polarity
- Do not expose batteries to liquids
- Do not incinerate batteries or expose them to temperatures above 60°C (140°F)
- Do not attempt to disassemble a battery.

If a battery has been dropped or banged against a hard surface, whether damage is visible externally or not:

- discontinue use
- dispose of the battery in accordance with the disposal instructions

**If a battery shows damage or signs of leakage, replace it immediately. Do not use a faulty battery in the monitor.**

## Storage

When storing batteries, make sure that the battery terminals do not come into contact with metallic objects, or other conductive materials.

If batteries are stored for an extended period of time, they should be stored in a cool place, ideally at 15°C (60°F), with a state of charge of 20% to 40%. Storing batteries in a cool place slows the aging process.

The batteries should not be stored at a temperature outside the range of -20°C (-4°F) to 60°C (140°F).

Do not store batteries in direct sunlight.

Stored batteries should be partially charged to 20% to 40% of their capacity every 6 months. They should be charged to full capacity prior to use.

**NOTE**

Storing batteries at temperatures above 38°C (100°F) for extended periods of time could significantly reduce the batteries' life expectancy.

## Battery Lifetime Management

The lifetime of a Lithium Ion battery depends on the frequency and duration of use. When properly cared for, the useful life is approximately 3 years or 500 charge-discharge cycles, whichever comes first. In addition, experience indicates that the incidence of failure may increase with battery service life due to the accumulated stresses of daily use. We therefore strongly recommend that lithium ion batteries be replaced after 3 years or 500 charge-discharge cycles.

The age of a lithium ion battery begins at the date of manufacture. To see the date of manufacture and the number of charge-discharge cycles, select the battery symbol on the patient monitor screen.

The date of manufacture and the number of charge-discharge cycles are listed with other battery data on the screen.

# Disposal

Batteries should be disposed of in an environmentally-responsible manner. Consult the hospital administrator or your local Philips representative for local arrangements.

Discharge the batteries and insulate the terminals with tape before disposal. Dispose of used batteries promptly and in accordance with local recycling regulations.

# About the Battery

The rechargeable Lithium-Ion batteries used in the monitor are regarded as Smart batteries because they have built-in circuitry. (This circuitry communicates battery status information to the monitor.)

Actual current/voltage: depends on smart battery request and monitor configuration. The approximate charging time is 3 hours with the monitor switched off and up to 5 hours during monitor operation, depending on the monitor configuration.

**NOTE**

Batteries will discharge within about 20 days if they are stored inside the monitor without AC power connection.

# Checking the Battery Status

When the Monitor is connected to the AC power supply, the battery charges automatically. The battery can be charged remotely from the Monitor by using the battery charger. Use only the 865432 Smart battery conditioner.

Battery status (level of charge) is indicated in several ways:

- LED on the front panel of the Monitor.
- Battery gauge.
- Display of battery time below gauge.
- Battery status window.
- INOP messages.

The AC Power LED is only on when the power cord is connected and AC power is available to the Monitor. In this case, the battery can be either charging or fully charged.

The battery LED can be green, yellow, or red depending on the following conditions:

| Battery LED Colors | If the monitor is connected to AC power, this means | If the monitor is running on battery power, this means |
|---|---|---|
| **Green** | battery full (≥90%) | |
| **Yellow** | battery charging<br>(battery power < 90%) | |
| **Red, flashing** | | ≤ 10 minutes power remaining |
| **Red, flashes intermittently** | battery or charger malfunction1,2 | battery or charger malfunction1,2 |
| **Red, flashing when on/ standby switch is pressed** | | not enough battery power left to power monitor |

1 indicated by malfunction symbol and INOP
2 for further details see Troubleshooting section

# Battery Status on the Main Screen


Battery status information can be configured to display permanently on all Screens. It shows the status of the battery and the battery power and battery time remaining. The battery time is only displayed when the monitor is not running on AC power. Note that the battery status information may take a few minutes after the monitor is switched on to stabilize and show correct values.

Battery power gauge:

This shows the remaining battery power. It is divided into sections, each representing 20% of the total power. If three and a half sections are shaded, as in this example, this indicates that 70% battery power remains. If no battery is detected, the battery gauge is greyed out.

Battery malfunction symbols:

If a problem is detected with the battery, these symbols are displayed. They may be accompanied by an INOP message or by a battery status message in the monitor information line (if battery window is open) providing more details.

| Battery Status Symbols | |
|---|---|
|  | Battery requires maintenance |
|  | Battery is empty |
|  | Battery not charging as the temperature is above or below the specified range |
|  | Charging stopped to protect the battery |
| Battery Malfunction Symbols | |
|  | Incompatible Battery |
|  | Battery Malfunction |
|  | Battery temperature too high |
|  | Battery has no power left |

Explanations of Battery Status and Malfunction Symbols:

*Battery requires maintenance*: The battery requires conditioning. Refer to “Conditioning Batteries” for details.

*Battery is empty*: The capacity of the battery is ≤10 min. Recharge the battery as soon as possible.

*Temperature outside specified range*: The charging of the battery is stopped if the temperature is below 15°C or above 50°C in order to protect the battery. Charging is resumed as soon as the temperature is within this range.

*Incompatible Battery*: The inserted battery is checked for certain battery internal parameters. If these are not correct, the incompatible battery symbol is displayed. Please use only M4605A batteries with the MX400/450 monitor. Note that the incompatible battery symbol may also appear if there is a communication problem between the battery and the battery board.

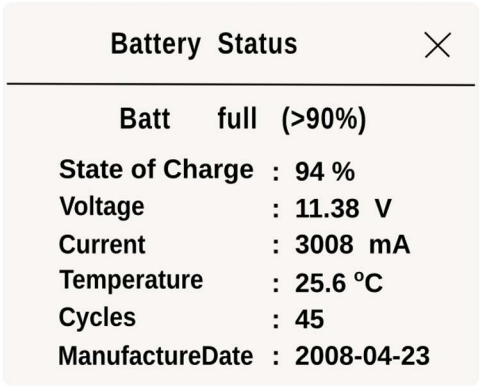
*Battery Malfunction*:Communication between the battery and the battery board could not be established or battery internal data indicates malfunction. Please see the "Troubleshooting" section for remedies.

*Battery Temperature too high*: This symbol is displayed if the battery temperature goes above 65°C. In addition the INOP message CHECK BATT TEMP is displayed. If the battery temperature increases further above 70°C the batteries will switch off for safety reasons. Allow the battery to cool down to avoid the monitor switching off.

*Battery has no power left*: If the monitor is not running on AC power: battery will switch off power delivery at any moment - in this case recharge the battery immediately - or, if the monitor is running on AC power, the battery is in deep discharge and requires pre-charging to restore communication. To avoid this condition charge batteries to 50% for storage. Note that the battery malfunction INOP will eventually be issued if the pre-charging does not restore battery communication within about 4 minutes.

## Battery Status Window

- To access the **Battery Status** window and its associated pop-up keys, select the battery status information on the Screen, or select **Main Setup** -> **Battery**.




**State of Charge** tells you the state of charge of the battery.

**Time To Empty** tells you approximately how long you can continue to use the monitor with this battery. Note that this time fluctuates depending on the system load (how many measurements and recordings you carry out), the age of the battery, and the remaining capacity of the battery. The time indication appears after AC has been unplugged for about 10 seconds (after finishing calculation of the Time to Empty)

**Time To Full** is shown in place of **Time To Empty** if the monitor is connected to AC power, and tells you how much time is left until the battery is charged to 90%. Please allow indication to stabilize for 3 to 5 minutes after beginning the charging cycle. If the battery is charged over 90% **Battery Full (>90%)** is displayed until they are charged to 100%. Then **Batt Fully Charged** is displayed.

### Documenting Battery Status

To print all battery information in the **Battery Status** window,

1 Select the battery status information on the Screen or select **Main Setup** -> **Battery** to open the **Battery Status** window

2 Select the **Record Status** pop-up key to print the information on a recorder
**or**
Select the **Print Status** pop-up key to print the information on a connected printer.

## Conditioning a Battery

### What is Battery Conditioning?

Battery conditioning recalibrates the battery to ensure that it has accurate information on the actual battery capacity.

### Why is Battery Conditioning Necessary?

The capacity of a battery decreases gradually over the lifetime of a battery. Each time a battery is charged its capacity decreases slightly. Therefore, the operating time of a monitor running on batteries also decreases with each charge cycle.

Battery conditioning ensures that the value stored in the battery for its full capacity takes account of this decrease, so that the remaining battery charge can be calculated accurately, and the low battery warning given at the right time.

### When Should Battery Conditioning be Performed?

Battery conditioning should be performed once per year or when indicated by the Battery Status.

**NOTE**

When the battery status signals a conditioning request, the displayed **Time to Full** or **Time to Empty** may not be reliable.

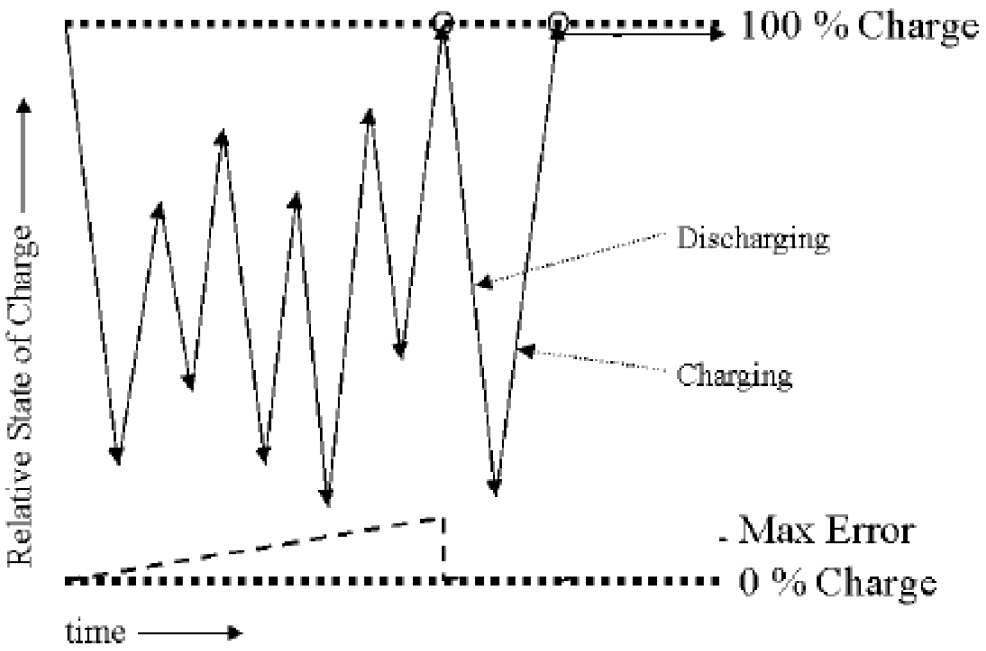
### What Causes the Conditioning Message on the Monitor?

In addition to the value for the full capacity, the battery also stores a value for the Max Error. The Max Error tracks the maximum possible deviation of the estimated charge of a battery from the actual charge.

If a battery is charged or discharged partially, or if it is charged while the monitor is being used, the accuracy of the "reference points" for the fully discharged and fully charged states decreases, causing an increase in the value for the Max Error (see diagram, below).

When the Max Error rises over a certain limit, a message is displayed prompting the user to condition the battery, as described in .

You can reset the value for the Max Error before the battery needs conditioning, by performing the steps described in"Conditioning Batteries". The minimum value of the Max Error after conditioning is 2%.




# Conditioning Batteries

Battery conditioning can either be performed in the monitor or with an external battery charger. Philips recommends using the 865432 Smart Battery Conditioner to condition batteries.

## Battery Conditioning in the Monitor

**CAUTION**

Do not use a monitor being used to monitor patients to condition batteries. The monitor switches off automatically when the battery is empty.

You should condition a battery when its "battery requires maintenance" symbol shows on the Screen. If conditioning is not performed immediately the monitor will still function according to specifications. However, the displayed time to empty and time to full will show increasing inaccuracy. Do not interrupt the charge or discharge cycle during conditioning. To condition a battery,

1 Insert the battery into a monitor connected to mains power.

2 Charge the battery until it is completely full. Switch the monitor off to decrease the charging time When the battery LED turns green i.e. the battery is >90% charged, switch on the monitor and open the **Battery Status** window. Check that the **Battery fully charged** message is displayed.

3 Disconnect the monitor from AC power, and let the monitor run until the battery is empty and the monitor switches itself off.

4 Reconnect the monitor to AC power and charge the battery until it is full for use or charge to 50% for storage.

### Battery Conditioning with an External Charger

You can use the 865432 Smart Battery Conditioner for external battery conditioning. For details please see the IfU for the Smart Battery Conditioner. Use only the 865432 Smart Battery Conditioner.

# After Installation, Testing or Repair

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

4

# 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 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.

**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 server 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 that you identify the Software Revision of your monitor. You can find the software revision along with other information, such as the system serial number, in the monitor revision screen.To access the monitor revision screen:

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

2 Select **Product**

3 Select **Software Revision**

4 Select the pop-up key for the device you want to check (e.g. **866060** or **M3001A)**

**NOTE**

The part numbers listed in the monitor revision screen do not necessarily reflect the part numbers required for ordering parts. Please refer to 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, please refer to the IntelliVue Compatibility Matrix on InCenter.

For further information on M3001A HW/SW compatibility, please refer to the *Parts* section.

## Compatibility with MMS/X2

The following table shows the compatibility between the monitor and MMS software revisions.

| Monitor Software | MMS/X2 Software | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A.2 | B.0 | B.1 | C.0 | D.0 | E.0 | F.0 | G.0 | H.x | J.x | K.x |
| K.x | No | No | No | No | No | No | No | No | Yes | Yes | Yes |

## Compatibility with Information Center

The following table shows the compatibility between the monitor and Information Center software revisions.

| Monitor Software | Information Center Software | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | H.0 | J.0 | K.0 | L.0 | M.0 | N.0/ N.01 | PIIC iX A.0 | PIIC iX A.0x |
| K.x | No | No | No | Yes | Yes | Yes | Yes | Yes |

# 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 refer to the Troubleshooting Tables.

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

## Checks for Obvious Problems

When first troubleshooting the 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 MMS and, if present, the MMS Extension connected correctly?

5 Are the parameter modules plugged into the 3-Slot 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, without battery:
  - AC Power LED is on (green).
- AC connected, with battery:
  - AC Power LED is on (green).
  - Battery LED is green if battery is fully loaded, yellow if battery is being charged.
  - Battery LED red and blinking signals battery or charger malfunction. See *Battery-related problems*.
- No AC connected, with battery:
  - All LEDs are off.

### Checks with the Instrument switched On, AC connected, without battery

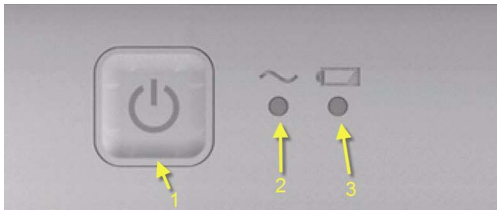
When the monitor is first switched on the AC Power LED switches on and stays on. The Power On/Error LED lights up red and then switches to green and stays on.

### Checks with the Instrument switched On, AC connected, with battery

When the monitor is first switched on the AC Power LED switches on and stays on. The Power On/Error LED lights up red and then switches to green and stays on. Battery LED is either green or yellow

## Checks with the Instrument switched On, AC not connected, with battery

When the monitor is first switched on the Power On/Error LED lights up red and then switches to green and stays on.




| No. | Description |
|---|---|
| 1 | Power On/Error LED (Green/Red) |
| 2 | AC Power LED (Green) |
| 3 | Battery LED (Green/Red/Yellow) |

## Initial Instrument Boot Phase

The following table describes 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 108 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. |
| 1 | The alarm LEDs are switched on with low intensity. Colors: Left LED: cyan; Middle LED: red; Alarm Suspend LED (right): red. |
| 10 | Boot Screen with the Philips Logo appears on the display. The red error LED is switched to green On/Standby LED. |
| 15 | Boot Screen with the Philips Logo disappears |
| 20 | Alarm LEDs are tested in the following sequence:<br>Cyan on-off (left LED only)<br>Yellow on-off (all LEDs)<br>Red on-off (all LEDs)<br>Fixed screen elements (for example smart keys, alarm fields) appear on the screen.<br>Test Sound is issued. |
| 22-30 | First measurement information appears on the screen,user input devices (for example Navigation Point, Mouse, Touch) are functional |

**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 | Cable between AC/DC and standard system interface board disconnected. | Check the cable connection between AC/DC and standard system interface board. |
| | Cable between main board and power switch/ECG sync out board disconnected | Check the cable connection between the main board and the power switch/ECG sync out board |
| | LED defective | Try to switch on the monitor. If it operates normally , the LED is defective => exchange Power Switch board |
| | Power supply defective | Remove power supply and check if output voltage is within the specifications (15V ± 3%). Exchange power supply if defective |
| | I/O board defective | Remove I/O board and check again |
| | Advanced System Interface board defective | Remove advanced system interface board and check again |
| | Panel adapter board defective | Remove panel adapter board and check again |
| | Recorder board or rack board defective | Disconnect recorder board or rack board and check again. |
| | Standard system interface board defective | Exchange standard system interface board |
| | Main Board defective | Exchange Main Board |

| Symptoms | Possible Causes of Failure | Failure Isolation and Remedy |
|---|---|---|
| Green Power On LED **and** Red Error LED remain off after pressing power on button | Power Switch Micro Controller hung | Unplug AC Mains and replug after 20 minutes. Try to switch on the monitor again |
| | Power switch/ECG sync out board not connected to the main board | Check if power switch/ECG sync out board is connected correctly to the main board |
| | Power switch/ECG sync out board defective | Exchange power switch/ECG sync out 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 |
| | Advanced system interface board defective | Remove advanced system interface board and check again |
| | IIT defective<br>WLAN board defective<br>Panel adapter board defective<br>Recorder board defective<br>Rack board defective | Disconnect all cables and boards (except Power Cable to the main board and to the standard system interface board and Power Switch cable):<br>- IIT<br>- WLAN<br>- panel adapter<br>- recorder<br>- rack board<br>then try to switch the monitor on again |
| | Standard system interface board defective | Exchange standard system interface board. |
| | 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. |
| | Advanced system interface board defective | Remove advanced system interface board and check again. |
| | IIT defective<br>WLAN board defective<br>Panel adapter board defective<br>Recorder board defective<br>Rack board defective | Disconnect all cables and boards (except Power Cable to the main board and Power Switch cable):<br>- IIT<br>- WLAN<br>- panel adapter<br>- recorder<br>- rack board<br>then try to switch the monitor on again |
| | Standard system interface board defective | Replace standard system interface board |
| | Main board defective | Exchange Main board |

| Symptoms | Possible Causes of Failure | Failure Isolation and Remedy |
|---|---|---|
| Power On/Off LED switches between red and yellow (indicating that ASW cannot be loaded) | Hardware or Software Failure | Connect Support Tool directly to monitor with crossover cable and start "search for defective devices"<br>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 | | Check for INOPS and follow instructions |
| | Cable between main board and panel adapter board not connected correctly or defective | Check cable connection between main board and panel adapter board. Replace cable if necessary. |
| | Cable between panel board and Alarm LED board not connected correctly or defective. | Check cable connection between panel adapter board and Alarm LED board. Replace cable if necessary. |
| | Alarm LED board is defective (MX450/MX500/MX550) | Exchange Alarm LED board |
| | Panel adapter board defective (MX400) | Exchange panel adapter board |
| | Main board defective | Exchange Main board |
| No Test Sound issued | | check for INOPs and follow instructions |
| | Speaker defective | Exchange speaker |
| | Power switch/ECG out sync board defective | Exchange power switch/ECG out sync board |
| | 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<br>(The information listed in this table is only valid if the boot phase has completed without error. See  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°C or below 5°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 cable or cable from panel adapter board to main board not connected | Check cable connection of panel adapter board to backlight and main board. |
| | Panel adapter board defective | Replace panel adapter board |
| | Ambient Light Sensor on Alarm LED board defective | Replace Alarm LED 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 |
| | Cable between main board and panel adapter board not connected | Check cable connection between panel adapter board and main 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:<br>1. Go into service mode<br>2. Enter the Main Setup Menu<br>3. Select Hardware<br>4. 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" |
| | Option #J15 (Adaptive Slave Display) is not installed | Install option #J15 to activate the DVI video interface |
| | 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 Touch Display not functioning

| Symptoms | Possible Causes of Failure | Failure Isolation and Remedy |
|---|---|---|
| External 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”. |
| | External Touch cable not connected | Check cable connection from external touch to Dual MIB I/O Board or RS232/5V interface on advanced connector board. |
| | External Touch driver configuration | Check MIB/RS232 configuration:<br>1. Enter Main Setup menu<br>2. Select Monitor<br>3. Select Hardware<br>4. Reconfigure MIB/RS232 drivers<br>5. if problem persists, proceed to the next step |
| | Dual MIB I/O board or advanced connector board defective | Replace MIB I/O board or advanced connector interface board |
| | External touch defective | Replace external touch |
| | Standard connector board defective | Replace standard connector board |
| | Main board defective | Replace Main board |
| Touch position invalid | Touch not calibrated | Perform touch calibration:<br>1. Enter Main Setup menu<br>2. Select Hardware<br>3. Select Touch Calibration |

## General Monitor INOP Messages

| INOP Message | Possible Causes of Failure | Failure Isolation and Remedy |
|---|---|---|
| Checkinternvoltage<br>Check Monitor Func | Problem with too low voltages (5V, -6V) in the monitor. Alarm lamps, display or interfaces may not function correctly.<br>ECG does not function properly | Remove all I/O boards, recorder board and advanced system interface board, 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. | Standard system interface board defective | Replace standard system interface 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. |

## Remote Control (wired)

| Symptoms | Possible Causes of Failure | Failure Isolation and Remedy |
|---|---|---|
| Remote Control not recognized by monitor | USB connector defective | If feasible, try the remote control with another monitor. If problem persists, try another USB port. If side USB connector is defective replace side USB. |
| | Advanced connector board defective | Replace advanced connector board. |
| | Standard system interface board defective | Replace standard system interface board |
| | Remote Control not plugged according to USB connection rules | See "Connection of USB Devices" in this service guide 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 | Make sure that the SRR option is built in and enabled. See also "Short Range Radio Interface Problems" on page 123 |
| | 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 |

## USB devices (e.g. Keyboard/Mouse) not functioning

| Symptoms | Possible Causes of Failure | Failure Isolation and Remedy |
|---|---|---|
| Keyboard/Mouse or other USB devices attached directly to the monitor not functioning | Device not connected properly | Check cabling |
| | Device defective | Replace Device (e.g. Keyboard/ Mouse) |
| | USB connector defective | Try another USB port. If side USB connector is defective replace side USB. |
| | Advanced system interface board defective | Replace advanced system interface board. |
| | Standard system interface board defective | Replace standard system interface board |

## 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<br>1. MONITOR is not assigned to a sector<br>2. There is another monitor on the network with the same "Equipment Label" |
|  |  | 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. |
|  | - | 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:<br>1. LAN cable was disconnected<br>2. Information Center was disconnected<br>3. Network infrastructure failure (switch, etc.)<br>4. Out of range (wireless MONITOR) |

## 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) | Set Monitor Label in Config Mode |
| | Problem with the Philips Information Center to Switch communication (if the beds are "port mapped" in the Philips Information center | Check PIC to Switch communication, Switch configuration and Firmware status |
| INOP "Unsupported LAN" is issued | Network failure | Check if switches, Philips Information Center and Database Server are all running and connected to the network |
| | Monitor connected to wrong network | Check if monitor has been connected for example to a different hospital network instead of the Philips Clinical Network |
| | IP address conflict after infrastructure re-installation | Reboot Database Server and Philips Information Center |
| | IIT is enabled but no IIT infrastructure can be found | Move the monitor into the range of the IIT infrastructure or disable IIT in the **Setup IIT** menu if no IIT infrastructure is available. |
| No connectivity to PIC, no prompt or error message on monitor | Hardware Defect | Check LAN cable connection |
| | | Check standard system interface board in Monitor |
| | | Check Switch |
| | Configuration problem | 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 | Check configuration in PIC regarding other bed overview (care group assignment) |
| | | Verify configuration of switch (setting of multicast filters) |
| | 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 make sure it is compatible. If the software revision of the IIC is incomaptible 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) |

## 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. | Ensure that the network infrastructure is functioning properly. See Troubleshooting tables in the IntelliVue 802.11 a/g Infrastructure Installation and Configuration Guide for details.<br>Check the antenna cable connection on the IntelliVue 802.11 Bedside Adapter.<br>Check that the IntelliVue 802.11 Bedside Adapter is correctly connected to the panel adapter board.<br>Check that the indicator behind the RSSI value (Main Setup -> Network -> WLAN Diagnostic -> RSSI) is rotating. If it is not, check IntelliVue 802.11 Bedside Adapter hardware.<br>Replace antenna or IntelliVue 802.11 Bedside Adapter if necessary. |
| | IntelliVue 802.11 Bedside Adapter not yet operational | Check menu line 'Wireless LAN' ( Main Setup -> Network -> WLAN Diagnostic -> 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.<br>If problem persists, check for an installed wired LAN cable. |
| | Configuration problem using WEP, WPA(PSK), WPA2(PSK). | Make sure that the Mode, SSID, Country and Security settings in the Setup WLAN menu match your installation |
| | Configuration problem using WPA Enterprise or WPA2 Enterprise | 1. Check the connection status.(Main Setup -> Network -> WLAN Diagnostics -> Conn.Status)<br>If the state only shows 'Scanning', make sure that the Mode, SSID, Country and Security settings in the Setup WLAN menu match your installation. |

| Symptoms | Cause of Failure | Failure Isolation and Remedy |
|---|---|---|
| | | 2. Check the connection status. If the device shows the state 'Authenticating', your SSID, Mode, Country and Security settings are correct.<br><br>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. |
| | | 3. As an investigation step, disable the CertificateCheck.<br><br>(Main Menu -> Network -> WLAN Setup -> CertificateCheck)<br><br>If authentication is now possible, proceed with step 4.<br><br>Otherwise double check your authentication server configuration, WLAN controller configuration and the user credentials (User Name, Password, Anonymous Identity).<br><br>Note:<br><br>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.<br><br>Note:<br><br>**Do not forget to re-enable the certificate check**. |

| Symptoms | Cause of Failure | Failure Isolation and Remedy |
|---|---|---|
| | | 4. Check the time setting of the device (Main Setup -> Date, Time). If not correctly set, the used certificates are detected as invalid. Adjust to the correct time. |
| | | 5. Check the installed CA certificate using the support tool. - Task -> Clone from Medical Device<br>- Open the cloned file using Configuration -> Configuration Editor<br>- In Configuration Editor check Configuration -> Hardware -> Network -> Certificate 1 for validity(Valid from, Valid until) |
| | | 6. Make sure that the installed CA certificate is the root certificate of your authentication server certificate chain. |

## 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 0000 | Check that RF Access Code is set correctly and the network is correctly set up.<br>Check the cable connection to the IIT module.<br>Check the antenna cable connection between the IIT module and the antenna.<br>Replace cable, antenna or IIT module if necessary. |
| | Incorrect RF Access Code. No IP Address. | Check that RF Access Code is set correctly. Make sure that network is set up correctly. |

## 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.<br>Replace defective SRR interface or cable, if necessary.<br>Make sure SRR interface is installed. |
| | SRR interface of telemetry transceiver defective or incompatible | Make sure the telemetry transceiver SRR interface is compatible and functional. |
| Measurement selection icon changes to SRR but Assignment of SRR device to monitor fails. **SRR Interference** 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. **SRR Interference** 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.<br>Check SRR Configuration Settings. |
| SRR communication aborted. **SRR Interference** or **SRR Invalid Chan** 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.<br>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. |

## Multi-Measurement Module

| Symptoms | Possible Causes of Failure | Failure Isolation and Remedy |
|---|---|---|
| Prompt message "Measurement Server Configuration not supported" is issued | An unsupported MMS Extension has been connected | Disconnect the MMS Extension |
| | MMS Extension is defective | Replace MMS Extension |
| | Measurement Server defective | Replace Measurement Server |
| INOP Message "MsmtSrv not Supp" is issued | Wrong Software Revison | Upgrade monitor and/or measurement server to a matching software version. Refer to  for a list of compatible measurement servers. |
| | Too many measurement servers connected | Disconnect unsupported measurement servers for proper operation. |
| | Unsupported type of measurement server (for example M3000A) connected. | Disconnect the unsupported measurement server. Refer to  for a list of compatible measurement servers. |
| Prompt message "Measurement Server not supported, unplug device, switch monitor off/on" and INOP "Bad Measurement Server are issued | M3000A Measurement Server Revision A is plugged. This Measurement Server is not compatible with the IntelliVue patient monitors.<br>Parameter board defective. | Disconnect the measurement server and cycle power.<br>Check if all measurements are displayed in the measurement selection window. Exchange MMS/Repair parameter board, if necessary. |

## MSL-related problems

| Symptoms | Possible Causes of Failure | Failure Isolation and Remedy |
|---|---|---|
| Measurement Server does not start up (no LEDs active), no INOP or prompt displayed | No Power | Check MSL cable and replace if necessary |
| | | Replace SRL board' standard connector board or main board. |
| Measurement Server does not start but LEDs are normal | Communication lines in MSL cable or MSL connector broken | Check MSL cable and MSL connectors |
| | Cable between MSL board and main board not connected correctly | Check connection between MSL board and main board. |
| | MSL board or Main board defective | Check MSL board and replace if necessary. If problem persists, replace main board. |

| Symptoms | Possible Causes of Failure | Failure Isolation and Remedy |
|---|---|---|
| MSL Power High INOP is issued<br>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 MMS connected to the monitor | Reduce to a limit of one MMS connected to the monitor. |
| MSL Power Off INOP is issued | Attached devices drawing too much power from the monitor. Too many MMS connected to the monitor | Disconnect all MMS from the monitor<br>Cycle power to restore power to the MSL devices.<br>If the message disappears, reconnect MMS one at a time, waiting 15 minutes between each device to see if message reoccurs. If yes, the respective MMS is faulty. See “Multi-Measurement Module” on page 124 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.<br>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. |
| 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 standard system interface board. |
| INOP Bad Server Link is issued | Unexpected data detected on MSL | Check cable and power cycle the monitor |
| | An MMS with an incompatible software revision is connected to the monitor. | Connect MMS with compatible software revsion |
| | Communication between the components not functioning | Check software versions and model number of devices for compatibility |

| Symptoms | Possible Causes of Failure | Failure Isolation and Remedy |
|---|---|---|
| INOP Message Serverlink Malf is displayed, audible indicator: a beep every two seconds | The hardware for communicating with the Multi-Measurement Server is faulty. | Check MSL cable, replace if necessary. |
| | | Check MSL board. Replace if necessary |
| 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 funcion | Hardware problem | Check MSL cable |
| | | Check ECG out hardware in the monitor (power switch/ECG sync out board) |
| | | Check the MSL connector in the measurement server and the main board. |

## Battery Related Problems

| Symptoms | Causes of Failure | Failure Isolation and Remedy |
|---|---|---|
| **Batt Empty** INOP tone, battery LED flashes<br>During this INOP, alarms cannot be paused or switched off. | The estimated remaining battery-powered operating time of the battery is ≤ 10 minutes. | Recharge the battery immediately.<br>If the condition persists, this INOP is re-issued two minutes after you acknowledge it. |
| **Batt Incompat** INOP tone | The indicated battery cannot be used with this monitor. | Replace with the correct battery (M4605A). |
| **Batt Low** INOP tone | The estimated battery-powered operating time remaining is less than 20 minutes. | Recharge the battery |

| Symptoms | Causes of Failure | Failure Isolation and Remedy |
|---|---|---|
| **Battery Malfunct** INOP tone, battery LED flashes<br>During this INOP, alarms cannot be paused or switched off if the monitor is not connected to AC power. | The monitor cannot determine the battery status or there is a communication problem between the battery and the battery board. | Replace the faulty battery. If the condition persists and the monitor is not connected to AC power, this INOP is re-issued two minutes after you acknowledge it.<br>Check the battery in a different monitor or in a battery charger. If the INOP persists the battery is faulty.<br>Check the battery board with known good batteries. If the INOP persists, replace battery board.<br>If the problem persists, replace main board. |
| **Charger Malfunct** INOP tone, battery LED may flash | There is a problem with the battery charger in the monitor. | Switch the monitor off and back on again. If the problem persists replace battery with known good battery. If the INOP is shown again replace the battery board. If the problem persists replace the main board. |
| **Check Batt Temp** INOP tone | The temperature of the battery is too high. | Check that monitor is not exposed to heat. |

## Alarm Lamps

| Symptoms | Possible Causes of Failure | Failure Isolation and Remedy |
|---|---|---|
| INOP Message Check Alarm Lamps is issued | Alarm LED board cable disconnected (MX450/500/550 only) | Reconnect Alarm LED board to panel adapter board |
| | Alarm LED board defective (MX450/500/550 only) | Replace Alarm LED board |
| | Cable between panel adapter and main board not connected correctly or defective | Check cable connection between panel adapter board and main board |
| | Panel adapter board defective. | Replace panel adapter board. |
| | Main board defective | Replace main board. |

| Symptoms | Possible Causes of Failure | Failure Isolation and Remedy |
|---|---|---|
| Alarm occurs, but no LED lights up | Environmental lighting too bright | Place monitor in a darker environment. |
| | Cable between main board and panel adapter board defective. | Replace cable. |
| | Alarm LED board cable disconnected | Reconnect Alarm LED board to panel adapter board |
| | Alarm LED board defective | Replace Alarm LED board |
| | Panel adapter board defective. | Replace panel adapter board. |
| | Main Board defective | Main board |

## Alarm Tones

| Symptoms | Possible Causes of Failure | Failure Isolation and Remedy |
|---|---|---|
| INOP Message **Speaker Malfunction** is displayed | Speaker cable disconnected | Reconnect speaker cable |
| | Cable between power switch/ ECG sync out board and main board disconnected. | Check connection between power switch/ECG sync out board and main board. |
| | 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 in the way in which the end user expected, please consult the Instructions for Use for possible setup issues or configuration settings which could affect alarm behavior.

## 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 MMS 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
- <Temp Label> Equip Malf
- NMT Equip Malfunct
- NMT Incompatible
- NMT Cal Failed

## 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<br>Paper size of printer does not match paper size of report | Enable the correct printer in the Setup Printers menu<br>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<br>Printer paper tray empty<br>Cabling not connected correctly<br>Standard system interface board defective<br>Advanced system interface board defective | Switch on printer power<br>Fill printer paper tray<br>Check cabling<br>Replace standard system interface board<br>Replace advanced system interface board |
| Status message "Print device Remote 1 (Remote 2, Remote 3) unavailable" is issued. Printer job is stalled | Print error on Philips Information Center<br>Network Connection to Philips Information Center not functioning | Print a test report on the Philips Information center. If this fails, refer to Philips Information Center documentation<br>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:<br>- Printer is not switched on<br>- Printer paper tray is empty | Switch on printer power<br>Fill printer paper tray |

| Symptoms | Cause of Failure | Failure Isolation and Remedy |
|---|---|---|
| Printouts are not as expected | Printer paper size is not correctly configured<br>Printer resolution is not correctly configured<br>Printer color support is configured to "On" although the printer does not support color<br>Printer not compatible | Configure the paper size according to the inserted print media<br>Configure the printer resolution according to the printer capabilities<br>Configure the printer color support to "Off"<br>Check specifications |

## Recorder

| Symptom | Possible Cause | Corrective Action |
|---|---|---|
| System thinks that door is open when it is not. | Recorder board defective | Replace recorder board |
| | Defective door switch. | Exchange recorder. |
| System thinks that the recorder is out of paper when it is not. | Paper-out sensor dirty. | Clean paper-out sensor. |
| | Recorder board defective | Replace recorder board |
| Recorder not communicating with System. | Poor connection to the 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. |
| | Recorder board defective | Replace recorder board |
| Recorder won't run. | Recorder interface not working correctly. | Remove the recorder. Reinstall it and try it again in a few seconds. |
| | Recorder board defective | Replace recorder board |
| Poor print quality. | Print head dirty. | Clean the print head. |
| | Print head failure. | Exchange the recorder. |
| Paper not feeding properly. | Paper roll off center. | Center paper roll on roller guides. |
| | Dirty roller. | Clean roller. |

## 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 the paper to make sure it is fixed tightly in the recorder. Make sure 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 |

## MIB/RS232 Interface on I/O board

| Symptoms | Cause of Failure | Failure Isolation and Remedy |
|---|---|---|
| Gas Analyzer connected to an RS232 port not functioning | The MIB/RS232 port is not configured for a Gas Analyzer | Check configuration of the MIB/RS232 ports in configuration mode |
| | The cable between the Gas Analyzer and the monitor is not connected correctly or defective | Check cable connection, replace cable if necessary |
| | 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 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 is defective | Check board and replace if necessary |
| Detailed Protocol Problem | | Consult the Data Export Protocol document. |

## RS232/5V Interface on Advanced System Interface Board

| Symptoms | Cause of Failure | Failure Isolation and Remedy |
|---|---|---|
| Gas Analyzer connected to RS232/5V port not functioning | The RS232/5V port is not configured for a Gas Analyzer | Check configuration of the RS232/5V port in configuration mode |
| | The wrong cable is being used | Use straight-through pinning cable |
| | The cable between the Gas Analyzer and the monitor is not connected correctly or defective | Check cable connection, replace cable if necessary |
| | The advanced system interface board is defective | Check board and replace if necessary |
| External device not receiving data | The RS232/5V port is not configured for data export | Check configuration of the RS232/5V port in configuration mode |
| | The wrong cable is being used. | Choose cross-over cable (or use an adapter) |
| | 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 advanced system interface board is defective | Check board and replace if necessary |
| Detailed Protocol Problem | | Consult the Data Export Protocol document. |

## Nurse Call Relay

| Symptoms | Cause of Failure | Failure Isolation and Remedy |
|---|---|---|
| INOP message Check Nurse Call Relay is issued | Advanced system interface board defective | Replace advanced system interface board |
| Monitor alarmed, Nurse Call did not activate | Incorrect configuration (Relay latency, Relay trigger) | Check monitor configuration (see configuration guide) |
| | Connection of cable to monitor or nurse call system not correct | Check cable connection |
| | Advanced system interface board defective | Replace advanced system interface board |
| | Standard system interface board is defective | Replace standard system interface board |

## Flexible Nurse Call Relay

| Symptoms | Cause of Failure | Failure Isolation and Remedy |
|---|---|---|
| INOP message Check Nurse Call Relay is issued | Flexible Nurse Call Relay I/O board defective | Replace Flexible Nurse Call Relay I/O board. |
| Monitor alarmed, Nurse Call did not activate | Incorrect configuration (Relay latency, Relay trigger) | Check monitor configuration (see the Configuration Guide) |
| | Connection of cable to monitor or nurse call system not correct | Check cable connections |
| | The Flexible Nurse Call Relay I/O board is defective | Replace 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. |

| Symptoms | Cause of Failure | Failure Isolation and Remedy |
|---|---|---|
| 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.<br>Exchange Power Switch/ECG Out Board if necessary.<br>If problem persists exchange main board. |

### Image Sticking

If a static image is displayed for a long time on an LCD display, image sticking, i.e. a temporarily retained image, may occur. To eliminate image sticking, switch off the display and switch it back on again. It is also recommended to use the moving image in standby mode.

## 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.

| Monitor | | | | |
|---|---|---|---|---|
| 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 measurement server).

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

The following pop-up keys overlay the SmartKeys:

| Clear StatLog | Revision | | 866060 | M3001A |
|---|---|---|---|---|

**Clear StatLog**

This key clears the currently displayed Status Log

**Revision**

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

**866060** (MX400), **866062** (MX450), **866064** (MX500), **866066** (MX550)

This key switches to the Monitor Revision Window

**M3001A**

This key switches to the Multi Measurement Server (MMS) 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).

## List of Error Codes

There are no error codes at this point.

## 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, please consult the Instructions for Use and configuration information.

If the instructions for use did not resolve an individual parameter problem, then another module or measurement server should be tried.

If you are getting questionable readings for individual measurements you may want to do 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 you may be asked about the configuration of the monitor to aid in troubleshooting.

5

# 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 MMS, MMS 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 MMS.

## Tools Required

- Torx screwdrivers (T10, T20)
- 1 small flat head screwdriver
- Needle Nose Pliers
- ESD mat and wrist strap

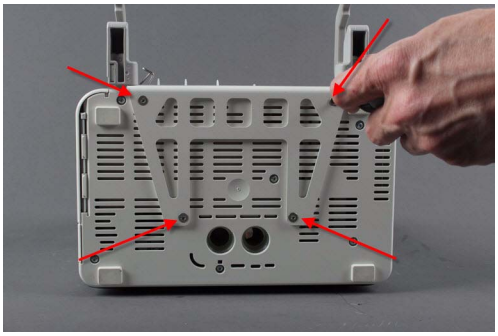
## Monitor Disassembly

**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 model and options ordered.

## Removing the Bedhanger

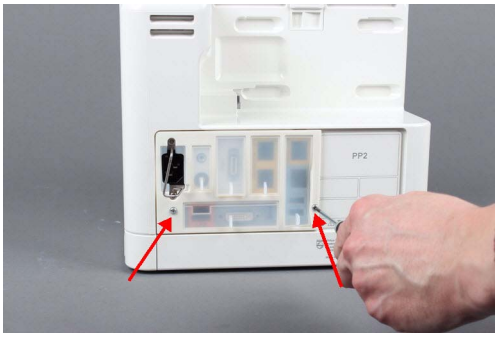
1 Remove the four screws securing the bedhanger from the bottom housing and remove the bedhanger.



2 When reinstalling the bedhanger, do not use the same screws, because their locking varnish will have been damaged. Use a new set of screws.

## Removing the Spillage Cover

1 Remove the two screws securing the spillage cover.



2 Remove the spillage cover by lifting it upwards.

# Removing the Battery Compartment Door

1 Slide the battery compartment door towards the rear of the monitor to open it.

2 Open the battery door all the way and apply a slight pressure to the hinges.

3 Pull off the battery door.

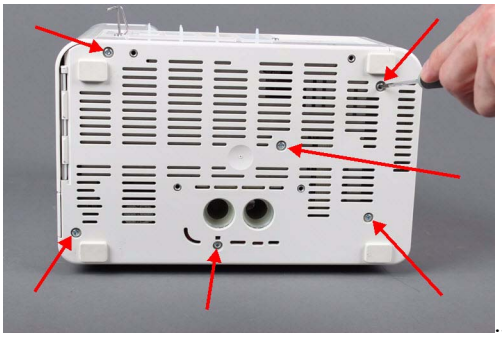
4 To reassemble the battery door, attach it to the outer hinge first, and then snap the other hinges into place.

5 Check that the battery door opens and closes properly, to ensure that it has been reassembled correctly.

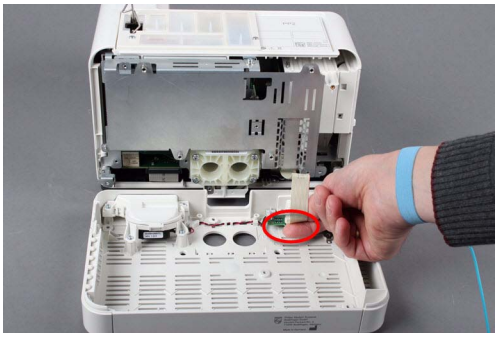
## Removing the Bottom Housing

1 Remove the battery from the monitor.

2 Remove the six screws and pull off the bottom housing.



3 Disconnect the cable connecting the power switch/ECG Sync Out board to the main board.

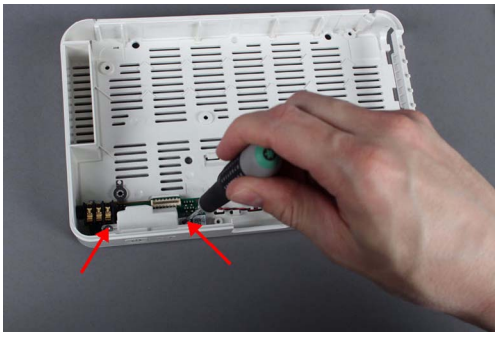


## Removing the Power Switch/ECG Sync Out Board and Power Button

1 Remove the bottom housing as described in “Removing the Bottom Housing” on page 140.

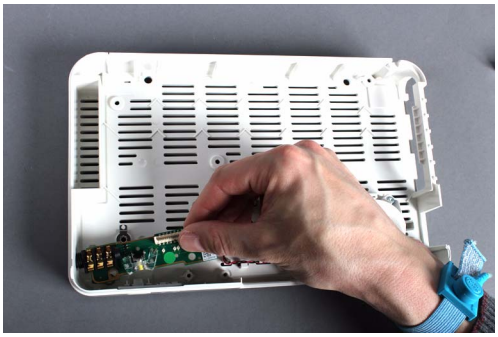
2 Unplug the speaker cable from the Power Switch/ECG Sync Out board.

3 Remove the two screws.

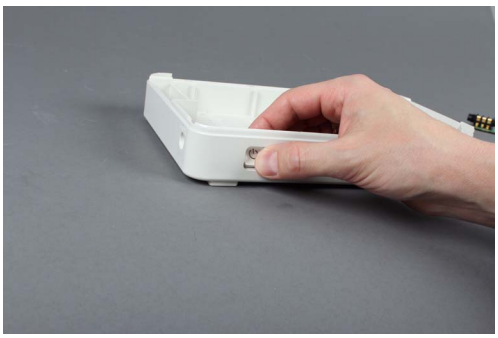


4 Remove the tappet guide.

5 Remove the power switch/ECG Sync Out board.



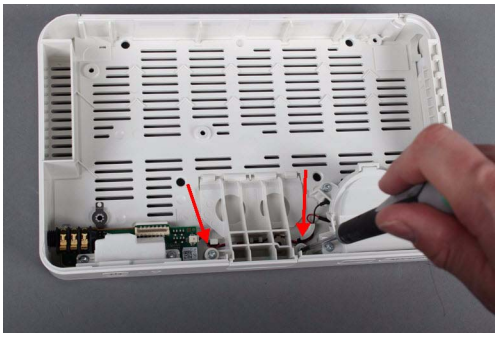
6 Push the power button in to remove it.



# Removing the Loudspeaker

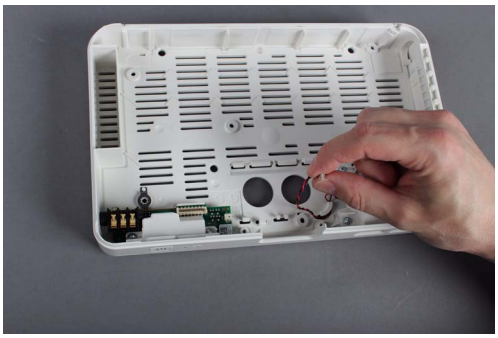
1 Remove the bottom housing as described in “Removing the Bottom Housing” on page 140.

2 If no quick mount is installed, you will have to remove the blank cover first. To do this, remove the two screws and pull out the blank cover.

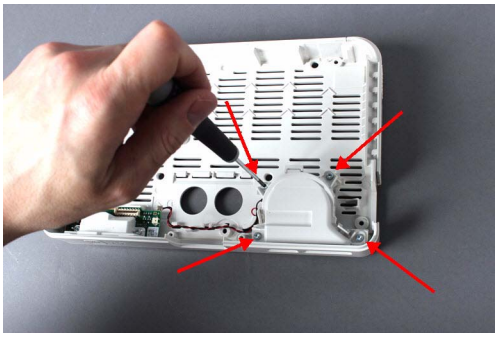


3 Disconnect the speaker cable from the power switch/ECG Sync Out board.

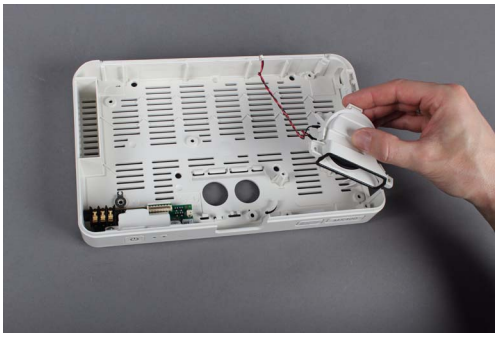
4 Remove the speaker cable from its guiding clasps.



5 Remove the four screws from the loudspeaker housing.



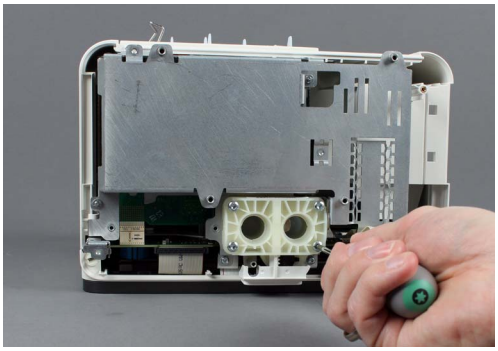
6 Remove the loudspeaker.



## Removing the Quick Mount

1 Remove the bottom housing as described in the section “Removing the Bottom Housing” on page 140.

2 Remove the four screws from the quick mount.

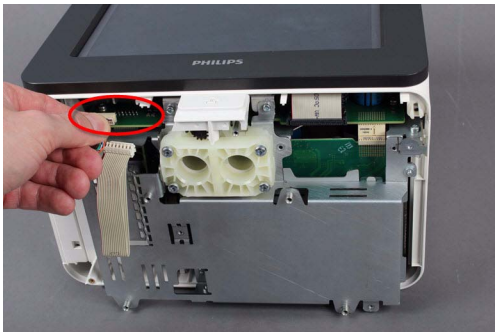


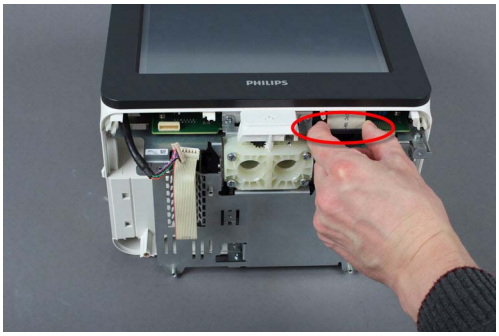
3 Remove the quick mount.

## Separating the Front and Back of the Monitor

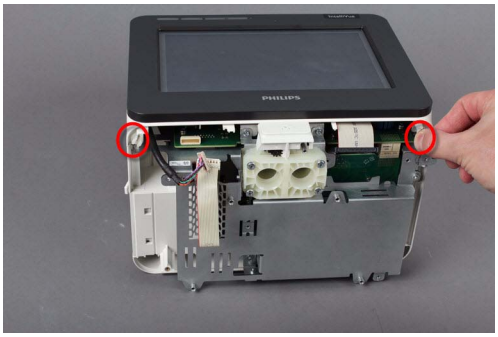
1 Remove the bottom housing as described in “Removing the Bottom Housing” on page 140.

2 Disconnect the two cables as shown below.

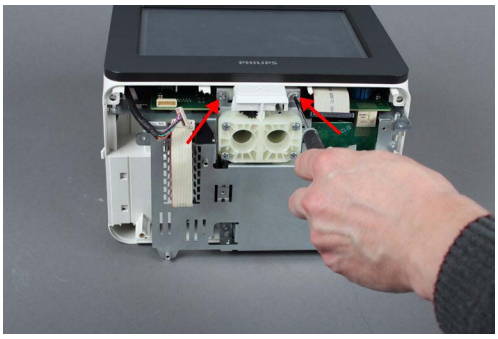


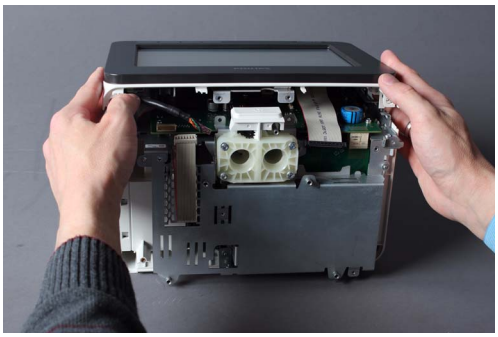
3 Remove the two pins.

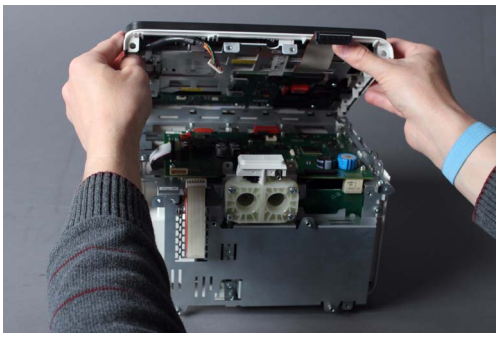


4 Remove the two screws as shown below.

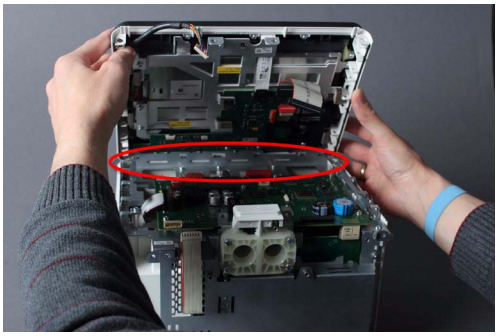


5 Lift off the front from the back of the monitor.





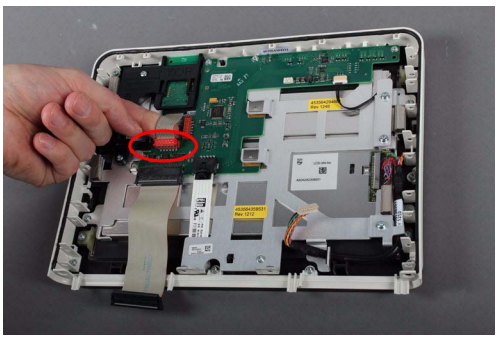
6 Reassemble the monitor by performing the above steps in reverse order. When reattaching the front to the back, the front must be positioned such that the latches snap into place.



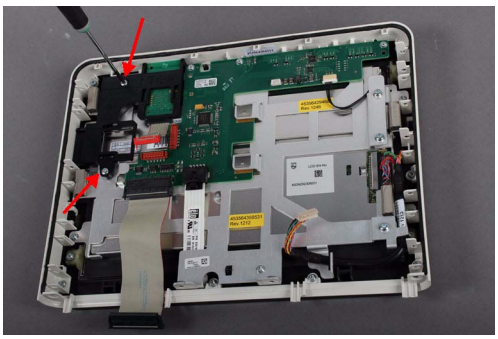
# Removing the Short Range Radio Board(s) (MX400)

1 Separate the front and back of the monitor as described in the section "Separating the Front and Back of the Monitor" on page 143.

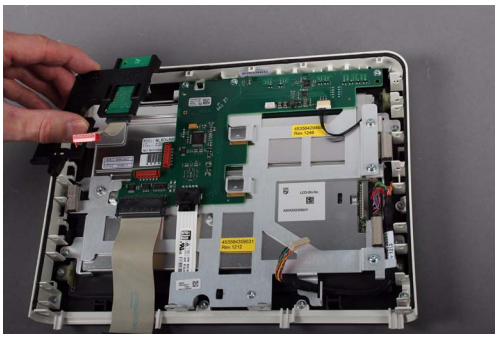
2 Disconnect the Short Range Radio connector(s) from the panel adapter board



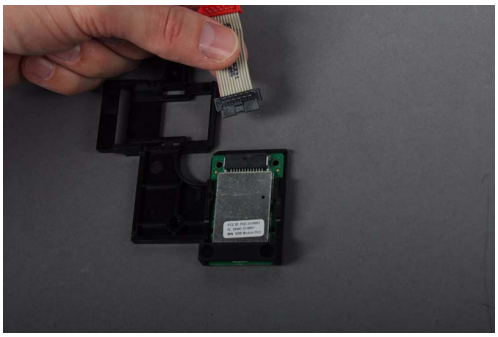
3 Remove the two screws from the Short Range Radio board holder.



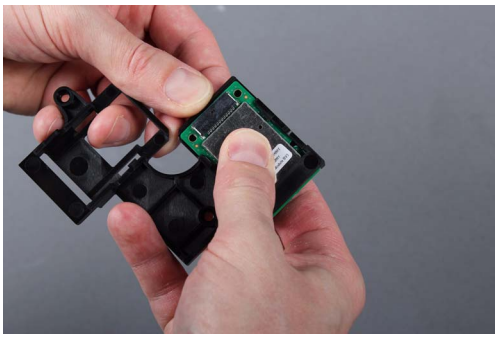
4 Lift out the Short Range Radio board holder with the Short Range Radio board(s).

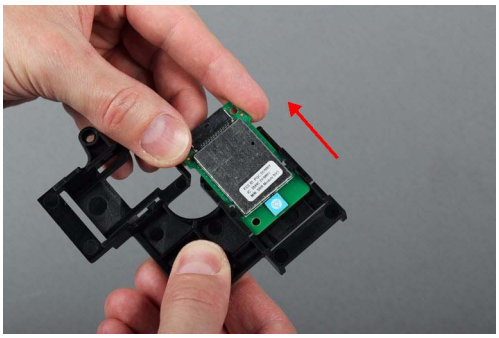


5 Disconnect the cable(s) from the Short Range Radio board(s).



6 Press against the holder with your thumb to release the Short Range Radio board(s) and then pull out the board(s).





7 Reassemble the monitor by performing the above steps in reverse order.

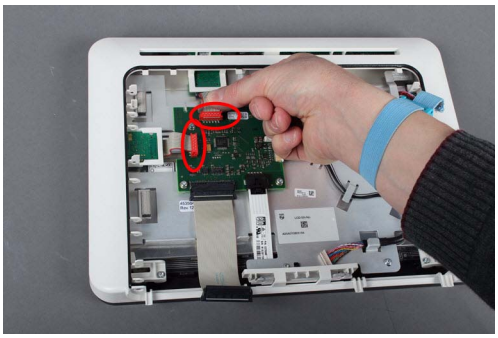
**NOTE**

When replacing the Short Range Radio board(s), the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

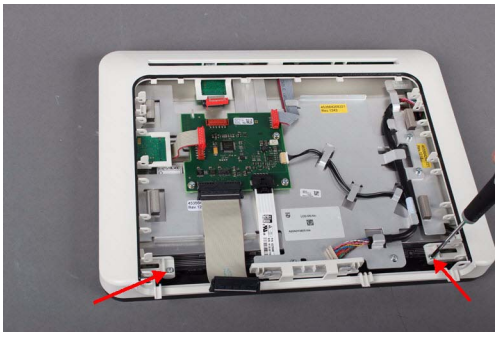
## Removing the Short Range Radio Board(s) (MX450/MX500)

1 Separate the front and back of the monitor as described in the section “Separating the Front and Back of the Monitor” on page 143.

2 Disconnect the Short Range Radio connector(s) from the panel adapter board.

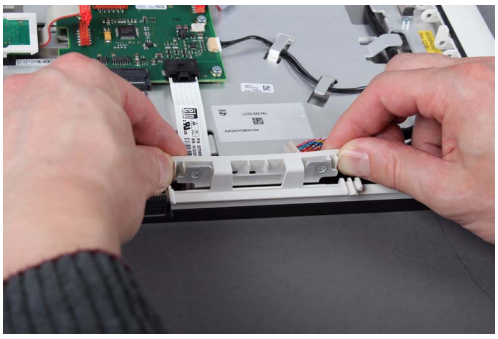


3 Remove the screws from the two clamps holding the display housing frame.

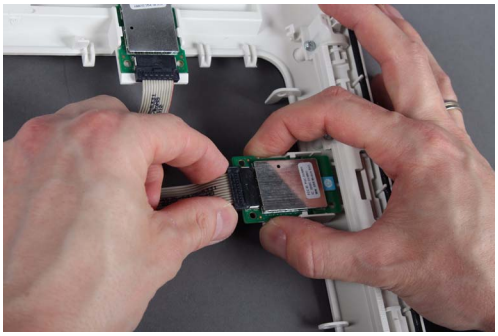


4 Release the two clamps by pushing them upwards.

5 Release the latch at the bottom of the frame by pushing it forwards, then lift up the frame.



6 The Short Range Radio board(s) are located in the display frame. Disconnect the cable(s) from the Short Range Radio board(s), press down the latch in the frame holding the board(s) and pull out the board(s)



7 Reassemble the monitor by performing the above steps in reverse order.

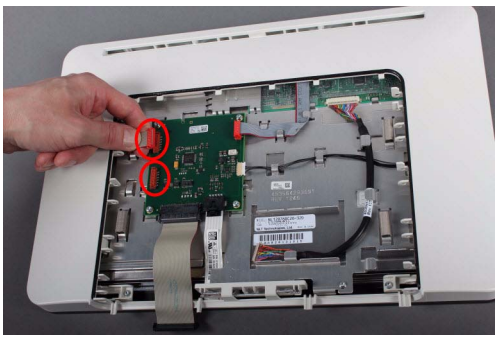
**NOTE**

When replacing the Short Range Radio board(s), the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

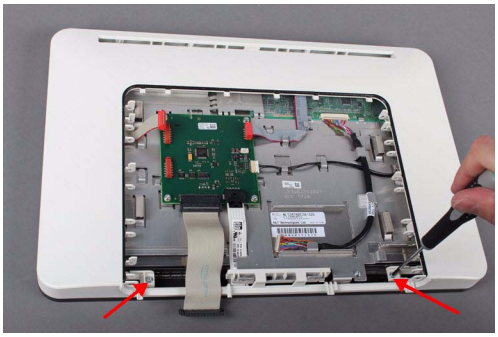
# Removing the Short Range Radio Board(s) (MX550)

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

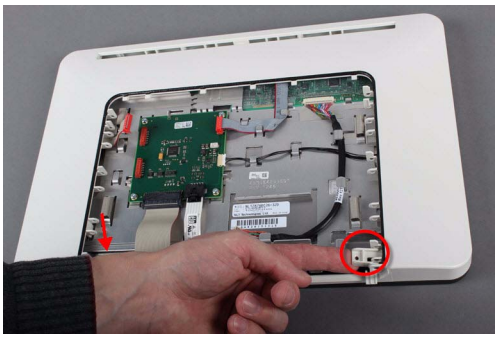
2 Disconnect the Short Range Radio connector(s) from the panel adapter board.



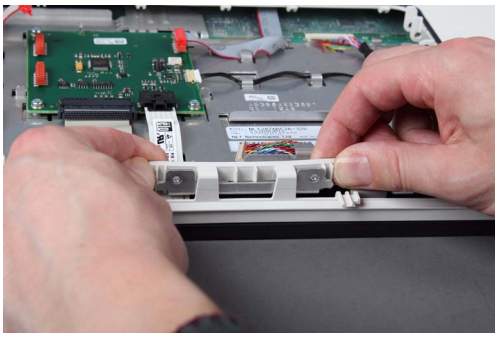
3 Remove the screws from the two clamps holding the display housing frame.



4 Release the two clamps by pushing them upwards.

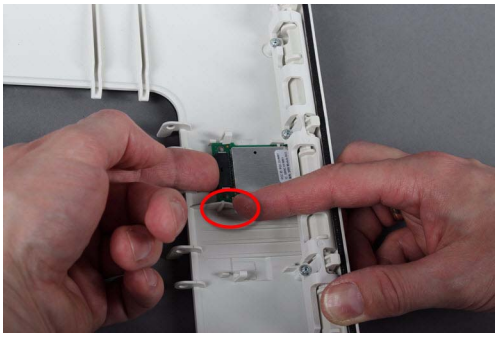


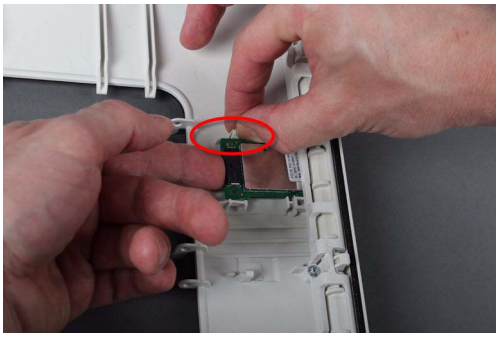
5 Release the latch at the bottom of the frame by pushing it forwards, then lift up the frame.



6 Disconnect the cable(s) from the Short Range Radio board(s). The Short Range Radio board(s) are located in the display frame.

7 Release the latches holding the SRR board one after the other by pushing them away from the board and releasing the board form underneath them.





8 Pull out the SRR board.

9 Reassemble the monitor by performing the above steps in reverse order.

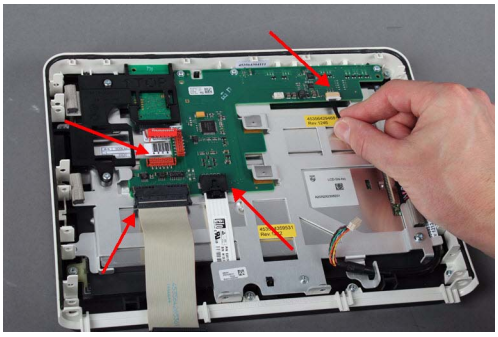
**NOTE**

When replacing the Short Range Radio board(s), the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

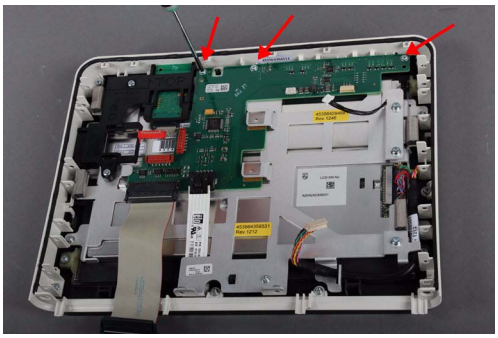
# Removing the Panel Adapter Board (MX400)

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

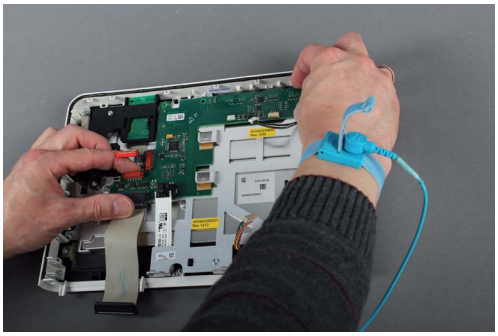
2 Disconnect all cables from the panel adapter board (the number of cables depends on the options installed).

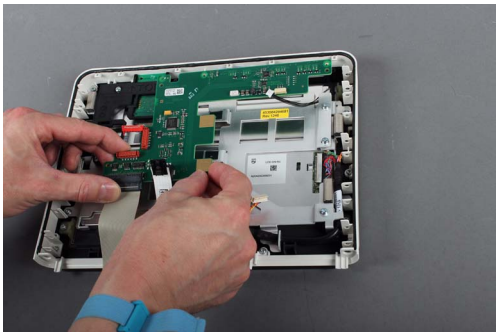


3 Remove the three screws from the panel adapter board.

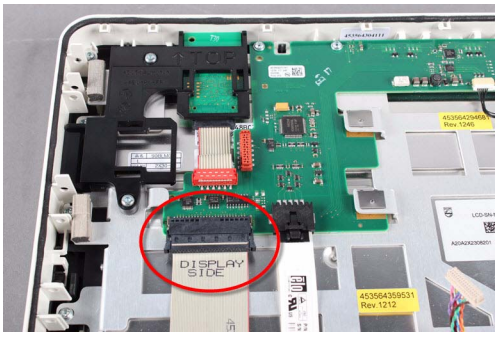


4 Slide the panel adapter board downwards towards you to release it from the latches and lift out the board.





5 Reassemble the monitor by performing the above steps in reverse order. When reconnecting the cables to the panel adapter board, make sure that the main board cable is connected with the connector marked "DISPLAY SIDE" to the panel adapter board as shown below.



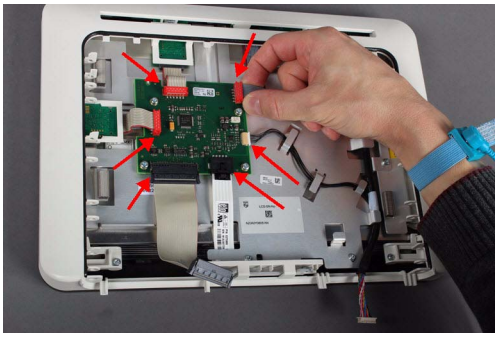

NOTE

When replacing the panel adapter board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

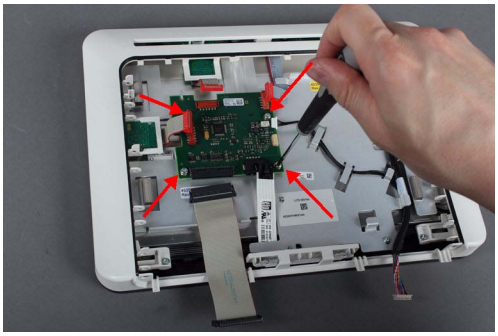
# Removing the Panel Adapter Board (MX450/MX500)

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

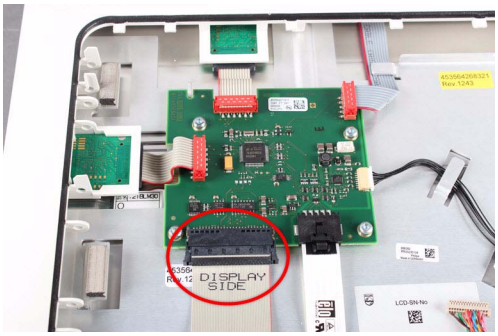
2 Disconnect all cables from the panel adapter board (the number of cables depends on the options installed).



3 Remove the four screws from the panel adapter board and remove the board.



4 Reassemble the monitor by performing the above steps in reverse order. When reconnecting the cables to the panel adapter board, make sure that the main board cable is connected with the connector marked "DISPLAY SIDE" to the panel adapter board as shown below.



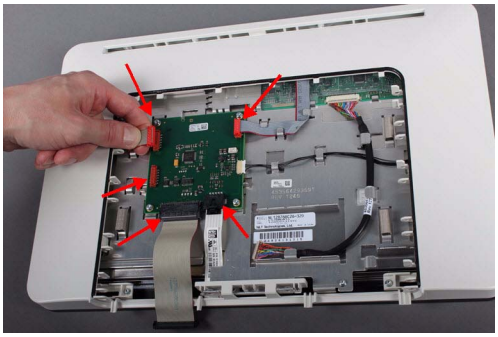

NOTE

When replacing the panel adapter board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

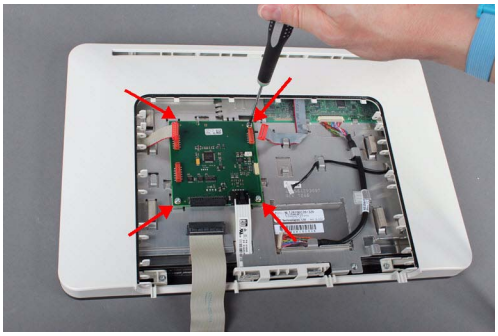
## Removing the Panel Adapter Board (MX550)

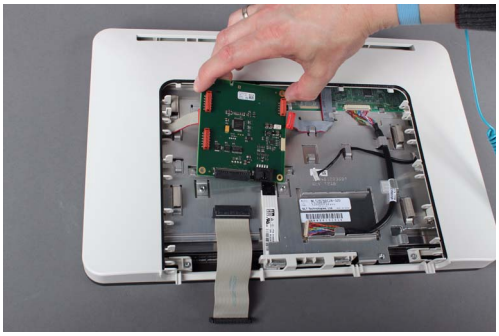
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

2 Disconnect all cables from the panel adapter board (the number of cables depends on the options installed).

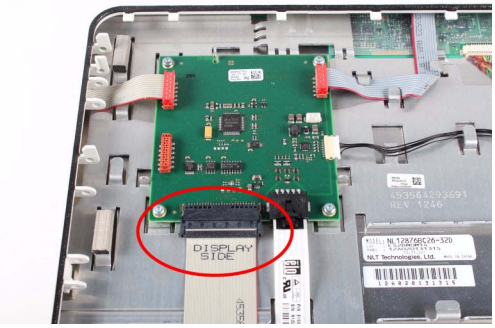


3 Remove the four screws from the panel adapter board and remove the board.





4 Reassemble the monitor by performing the above steps in reverse order. When reconnecting the cables to the panel adapter board, make sure that the main board cable is connected with the connector marked "DISPLAY SIDE" to the panel adapter board as shown below.



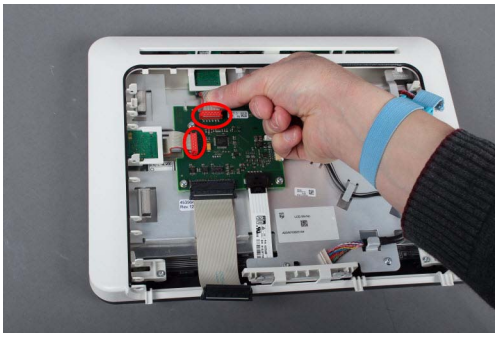

NOTE

When replacing the panel adapter board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

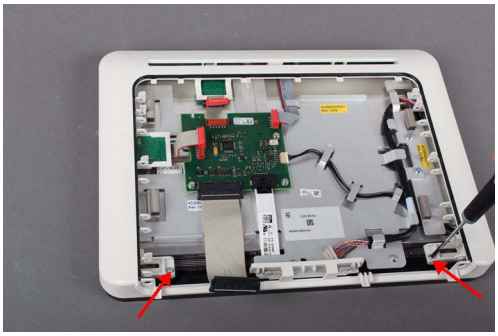
# Removing the Alarm LED Board (MX450/MX500)

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

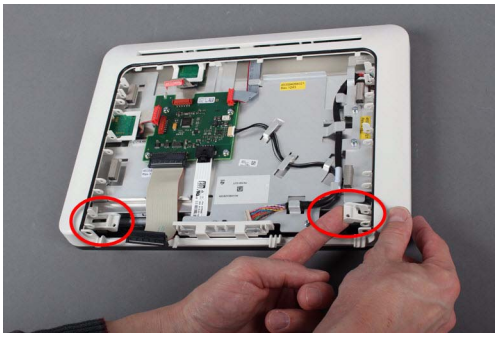
2 If Short Range Radio boards are installed, disconnect the Short range Radio connector(s) from the panel adapter board.



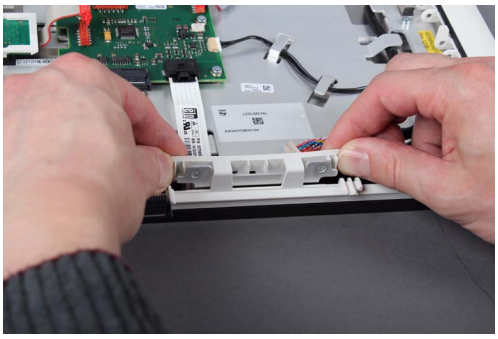
3 Remove the screws from the two clamps holding the display housing frame.



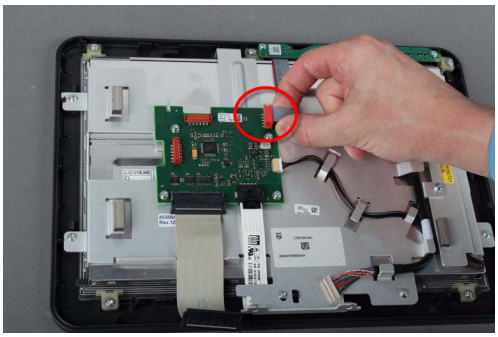
4 Release the two clamps by pushing them upwards.



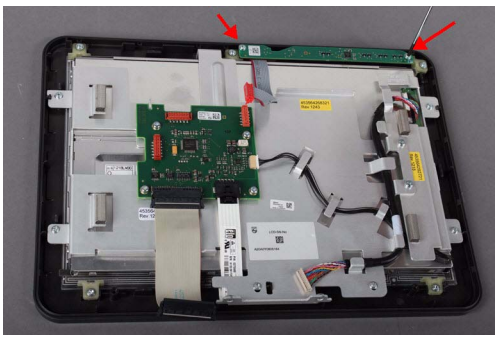
5 Release the latch at the bottom of the frame by pushing it forwards, then lift up the frame.



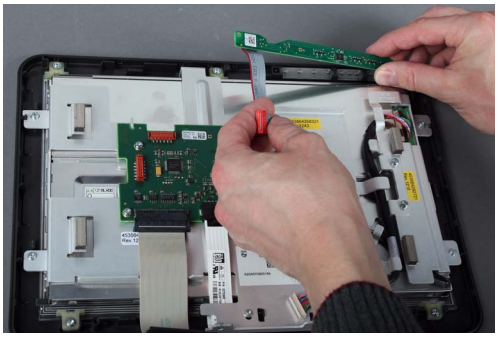
6 Disconnect the Alarm LED connector from the panel adapter board.



7 Remove the two screws from the Alarm LED board.



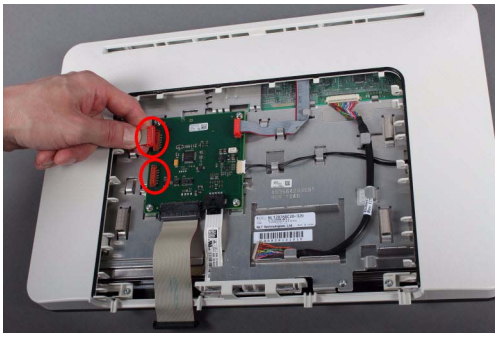
8 Remove the Alarm LED board.



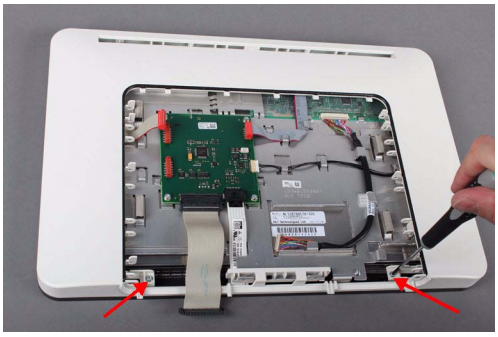
## Removing the Alarm LED Board (MX550)

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

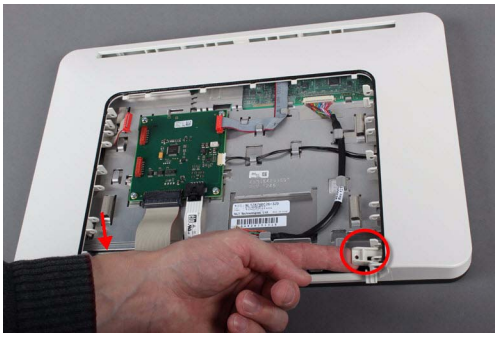
2 If Short Range Radio boards are installed, disconnect the Short Range Radio connector(s) from the panel adapter board.



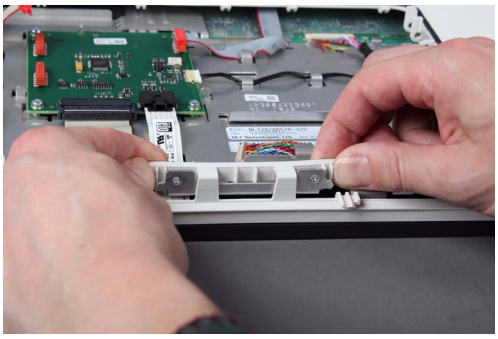
3 Remove the screws from the two clamps holding the display housing frame.



4 Release the two clamps by pushing them upwards.

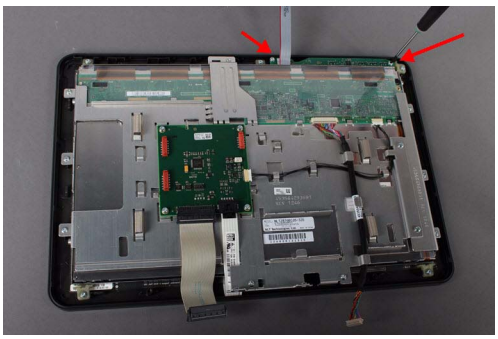


5 Release the latch at the bottom of the frame by pushing it forwards, then lift up the frame.

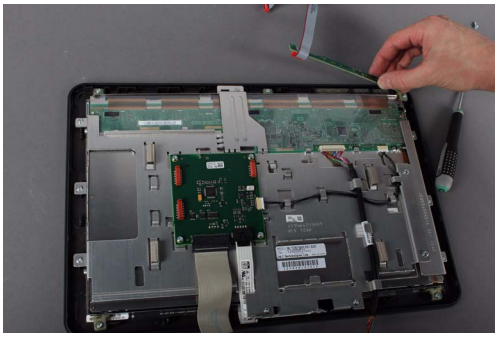


6 Disconnect the Alarm LED connector from the panel adapter board.

7 Remove the two screws from the Alarm LED board.



8 Remove the Alarm LED board.



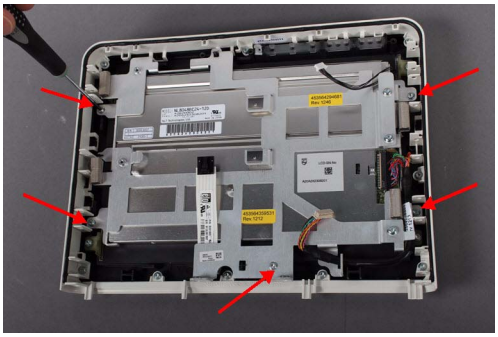
## Removing the LCD Panel (MX400)

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

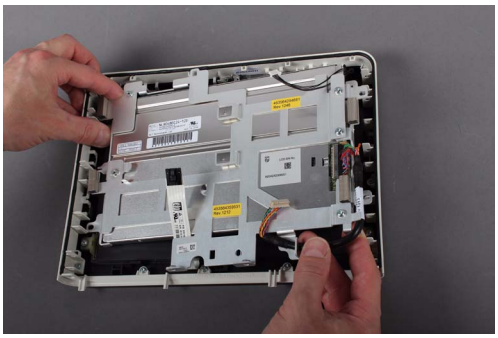
2 Remove the Short Range Radio Board(s) as described in “Removing the Short Range Radio Board(s) (MX400)” on page 145.

3 Remove the Panel Adapter Board as described in “Removing the Panel Adapter Board (MX400)” on page 150.

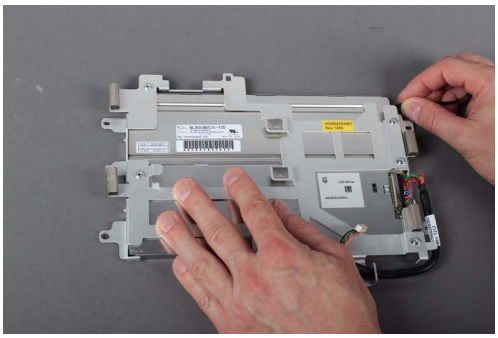
4 Remove the five screws from the LCD panel chassis.

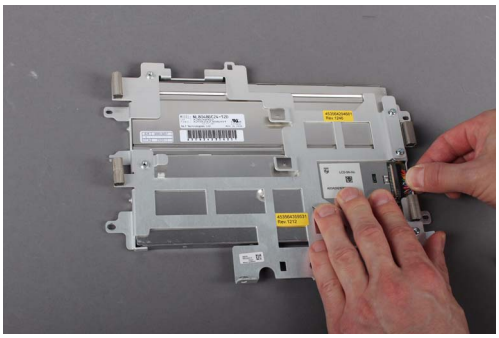


5 Lift out the LCD panel.



6 Unplug and remove the remaining two cables from the LCD panel so they can be used with the exchange panel.



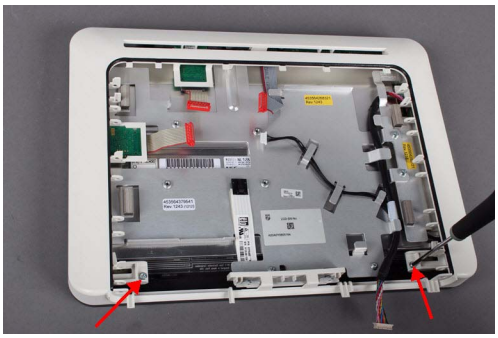


## Removing the LCD Panel (MX450/MX500)

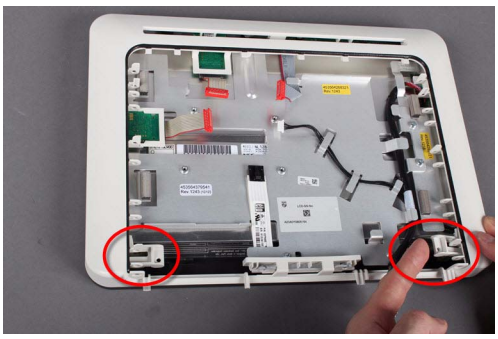
1 Separate the front and back of the monitor as described in the section "Separating the Front and Back of the Monitor" on page 143.

2 Remove the Panel Adapter Board as described in "Removing the Panel Adapter Board (MX450/MX500)" on page 151.

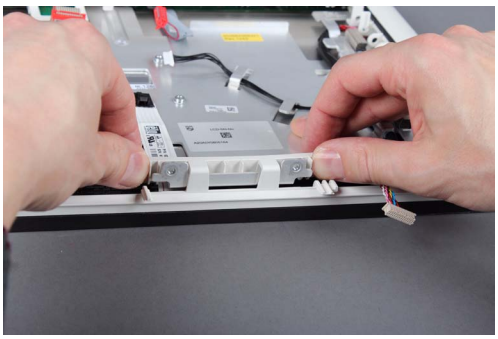
3 Remove the screws from the two clamps holding the display housing frame.

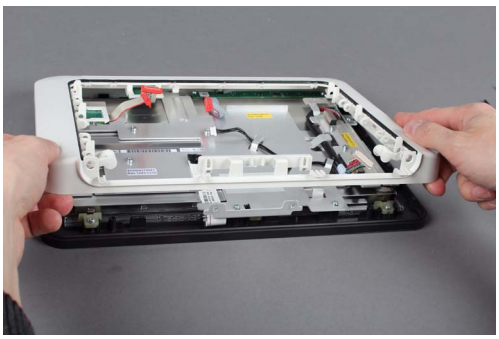


4 Release the two clamps by pushing them upwards.

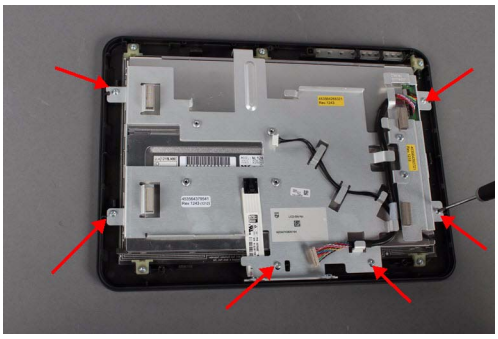


5 Release the latch at the bottom of the frame by pushing it forwards, then lift up the frame.

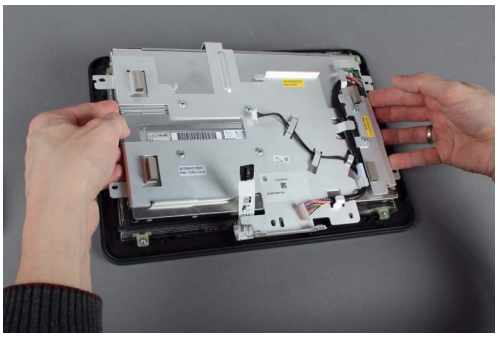




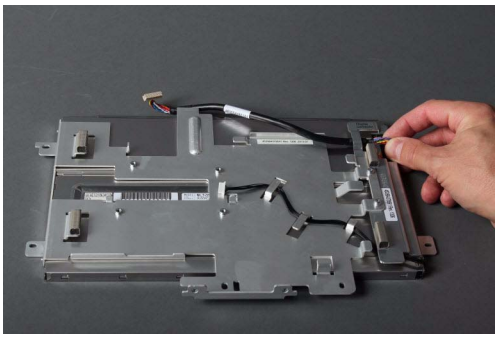
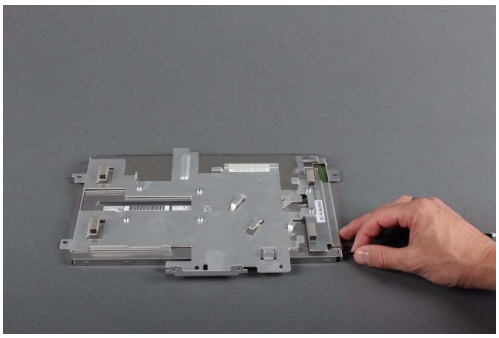
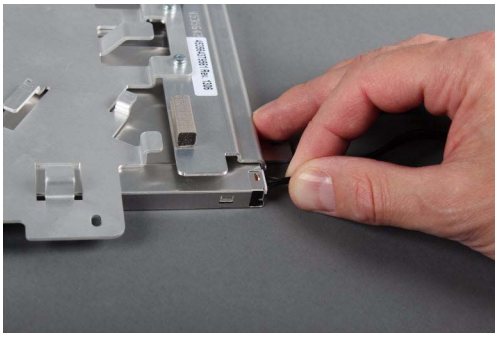
6 Remove the six screws from the back of the LCD Panel.



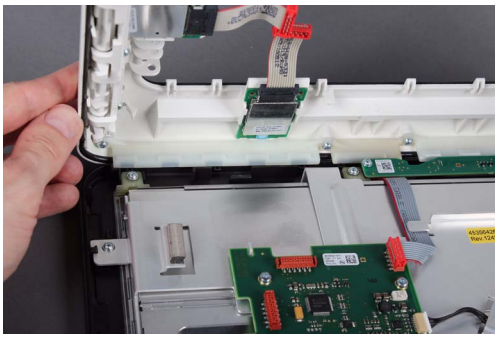
7 Lift out the LCD Panel.



8 Unplug and remove the two remaining cables from the LCD Panel so they can be used with the exchange panel.

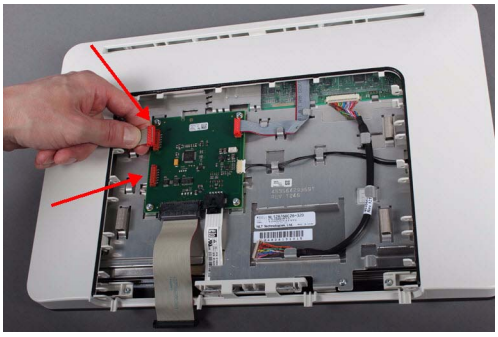




9 Reassemble the front of the monitor by performing the above steps in reverse order. When reinserting the frame, position it at a right angle so it correctly clicks into the housing. Press the frame and the housing together on all sides after reassembly to make sure that it is seated correctly.

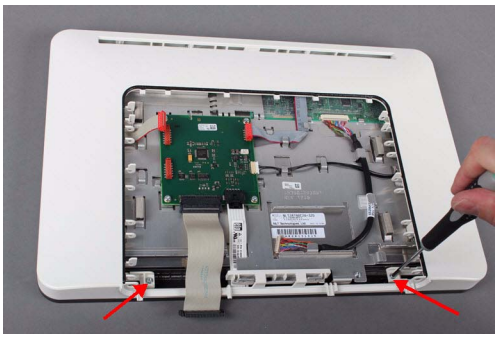



# Removing the LCD Panel (MX550)

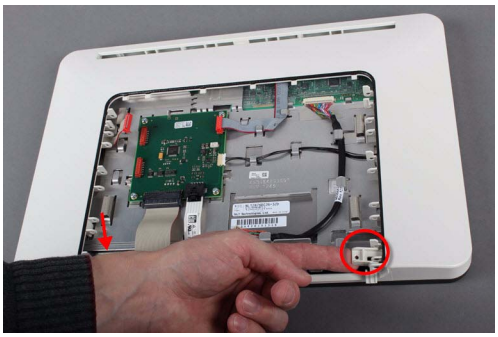
1. Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.
2. If Short Range Radio boards are installed, disconnect the Short Range Radio connector(s) from the panel adapter board.



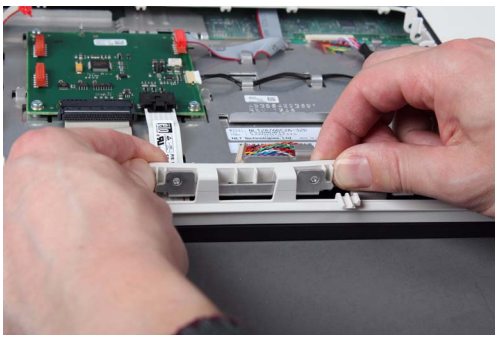
3. Remove the screws from the two clamps holding the display housing frame.



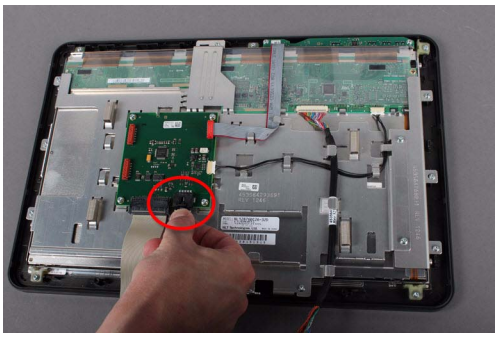
4. Release the two clamps by pushing them upwards.

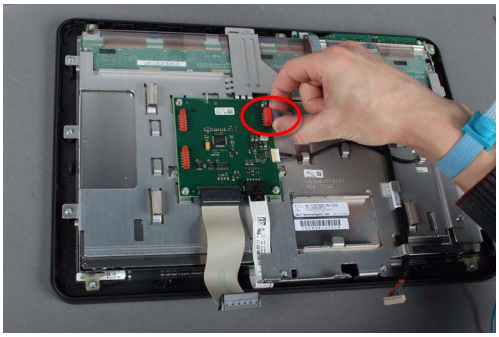


5. Release the latch at the bottom of the frame by pushing it forwards, then lift up the frame.

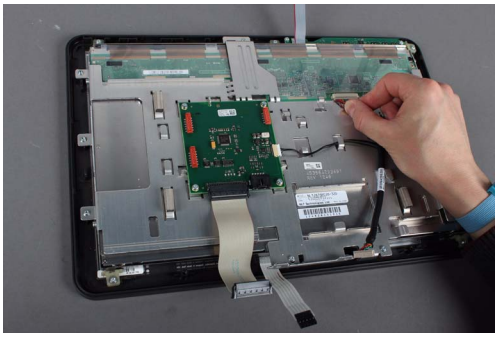


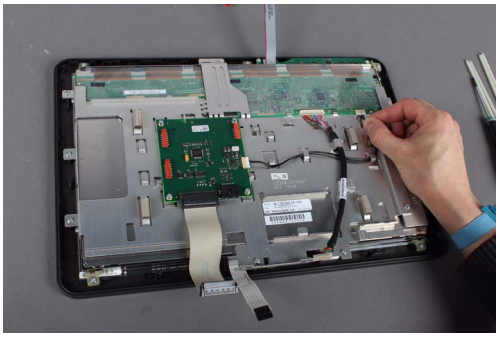
6 Remove the touch connector and the Alarm LED connector from the panel adapter board.



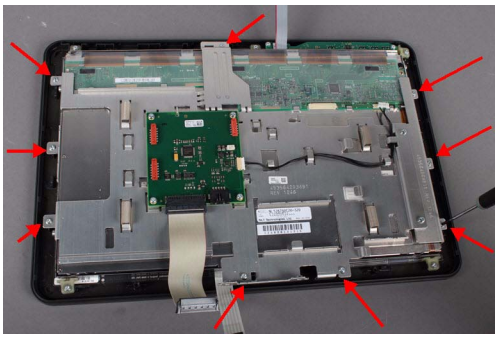


7 Remove the video cable and the backlight cable.

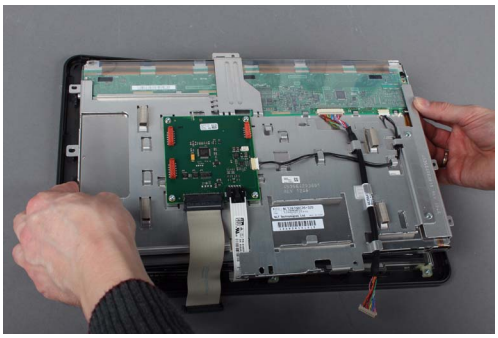




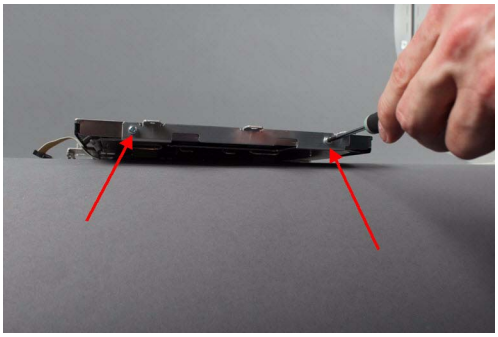
8 Remove the nine screws from the back of the LCD Panel.



9 Lift out the LCD Panel.



10 Remove the two screws on each side of the LCD panel chassis.



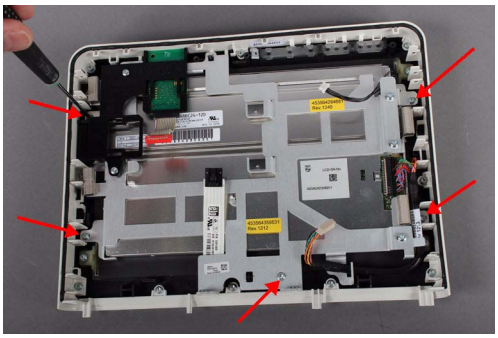
11 Separate the LCD panel from its chassis.

## Removing the Touch Bezel (MX400)

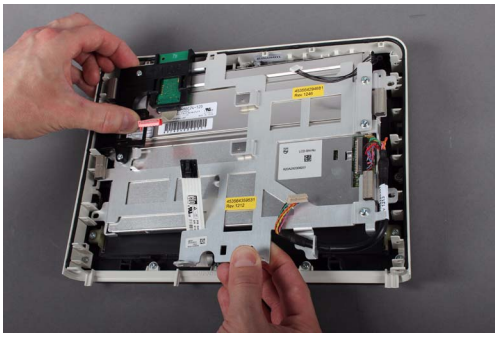
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

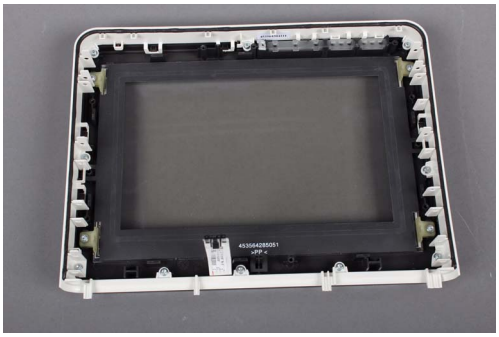
2 Remove the Panel Adapter Board as described in “Removing the Panel Adapter Board (MX400)” on page 150.

3 Remove the five screws from the LCD Panel chassis.



4 Lift out the LCD panel.





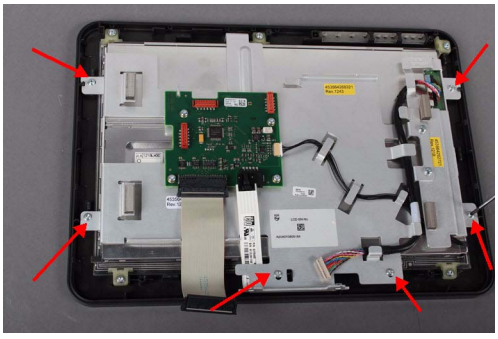
## Removing the Touch Bezel (MX450/MX500)

1 Separate the front and back of the monitor as described in the section "Separating the Front and Back of the Monitor" on page 143.

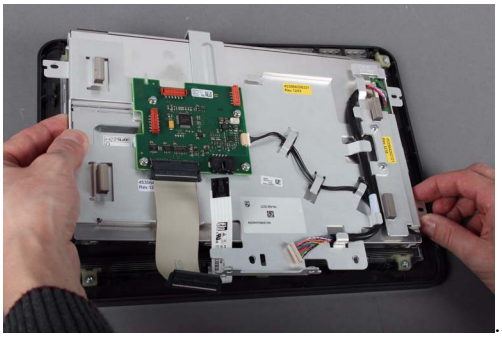
2 Remove the Alarm LED board as described in "Removing the Alarm LED Board (MX550)" on page 155.

3 Disconnect the touch connector from the panel adapter board.

4 Remove the six screws from the back of the LCD Panel.



5 Lift out the LCD Panel.

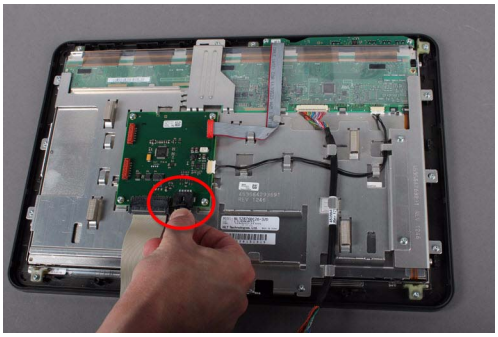


## Removing the Touch Bezel (MX550)

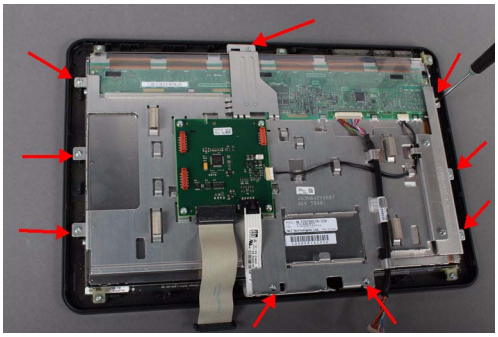
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

2 Remove the Alarm LED board as described in “Removing the Alarm LED Board (MX550)” on page 155.

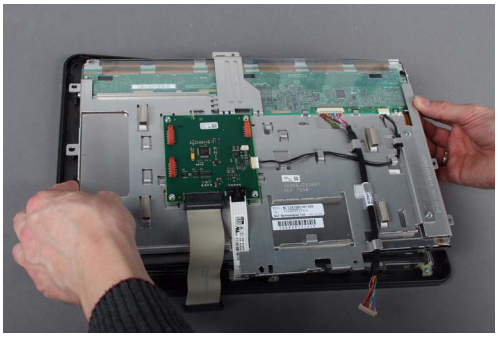
3 Disconnect the touch connector from the panel adapter board.



4 Remove the nine screws from the back of the LCD Panel.

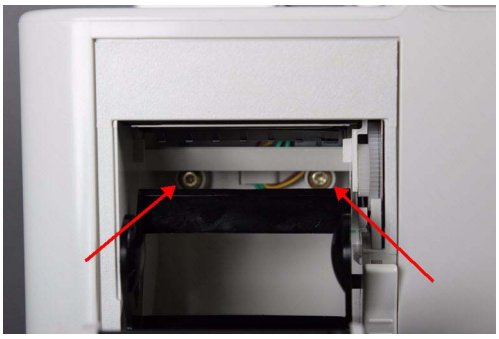


5 Lift out the LCD Panel.



## Removing the Internal Recorder (MX400/450)

1 Loosen the two screws inside the recorder.

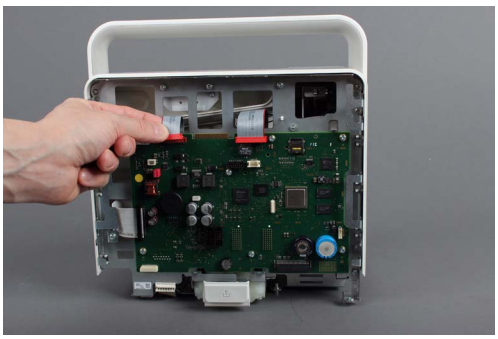


2 Pull out the internal recorder.

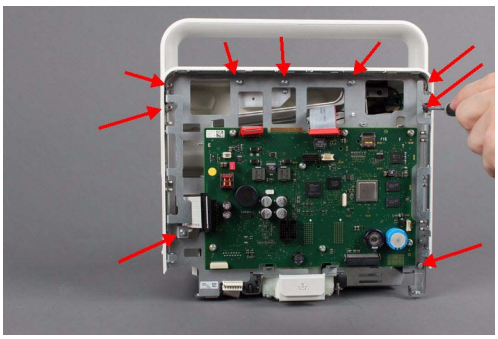
# Removing the Rear Housing

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

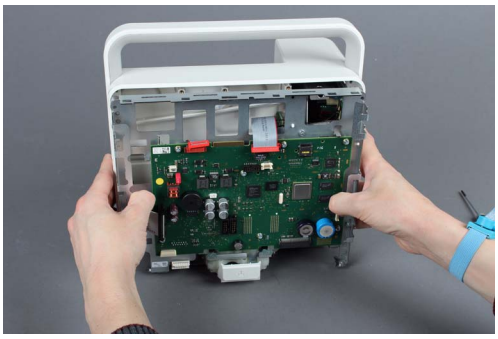
2 Disconnect all cables from the main board.

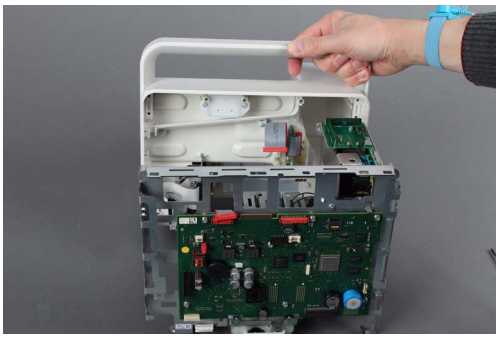


3 Remove the nine screws from the metal chassis.



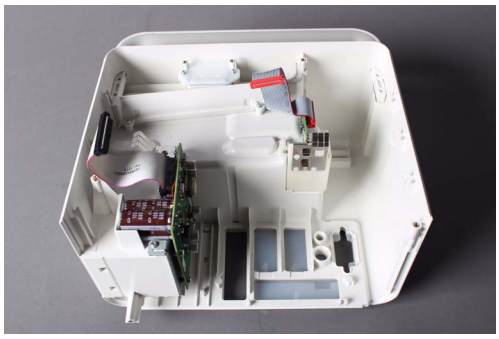
4 Pull the chassis out of the rear housing.



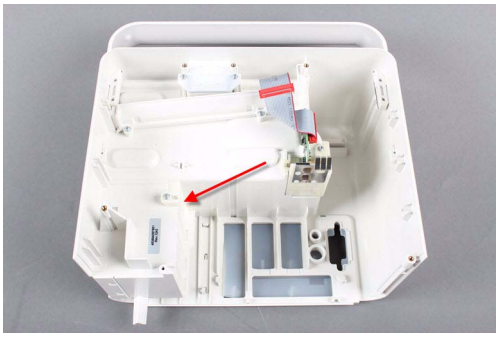


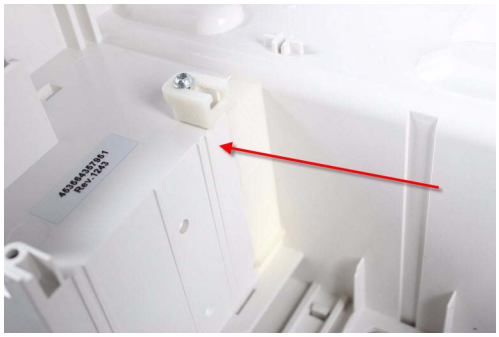
# Replacing the Rear Housing

When replacing the rear housing, make sure the regulatory plate, spillage cover, any blank covers for the I/O slots, the MSL connector and the recorder incl. recorder board from the old rear housing are reused.



For MX400/450 monitors without recorder, ensure that the internal blank cover from the old rear housing is reused.





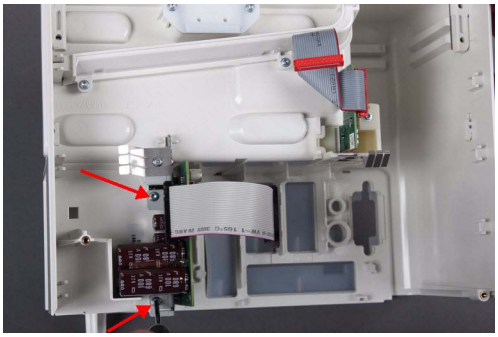
# Removing the Recorder Board (MX400/450)

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

2 Remove the Recorder as described in “Removing the Internal Recorder (MX400/450)” on page 166.

3 Remove the rear housing as described in “Removing the Rear Housing” on page 167.

4 Remove the two screws securing the recorder board assembly.



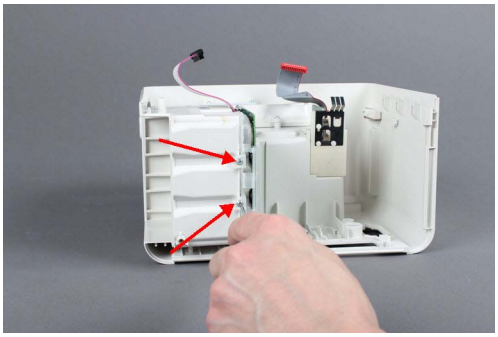
5 Pull out the recorder board assembly.

## Removing the Internal Module Rack Board (MX500/MX550)

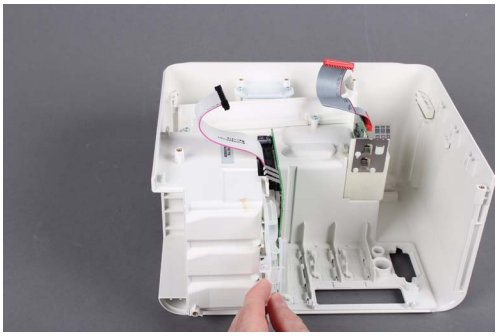
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

2 Remove the rear housing as described in “Removing the Rear Housing” on page 167.

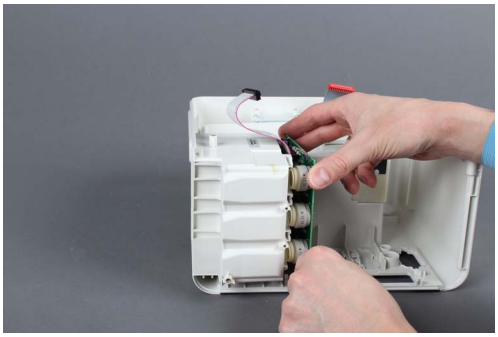
3 Remove the two screws at the bottom of the internal module rack.

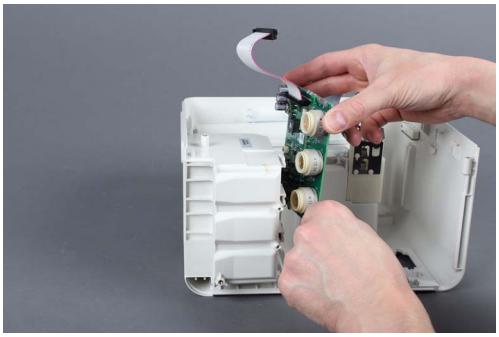


4 Pull out the plastic holder.



5 Carefully disconnect the rack board and pull it out.





6 Reassemble the monitor by performing the above steps in reverse order.

NOTE

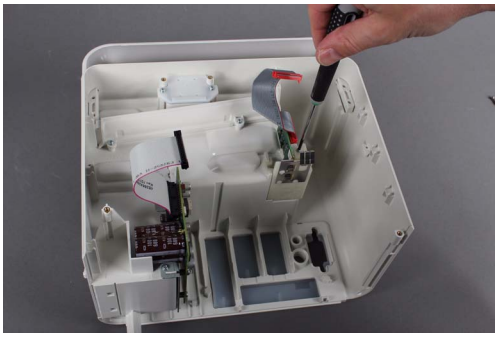
When replacing the rack board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

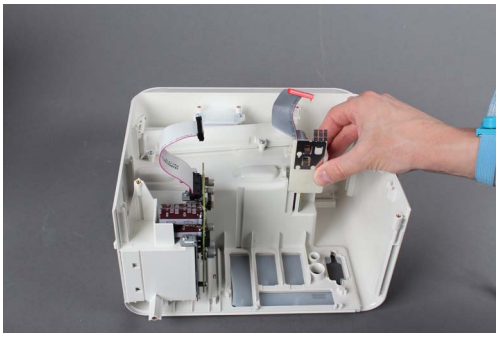
## Removing the MSL Board

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

2 Remove the rear housing as described in “Removing the Rear Housing” on page 167.

3 Remove the screw securing the MSL board holder and pull out the holder.





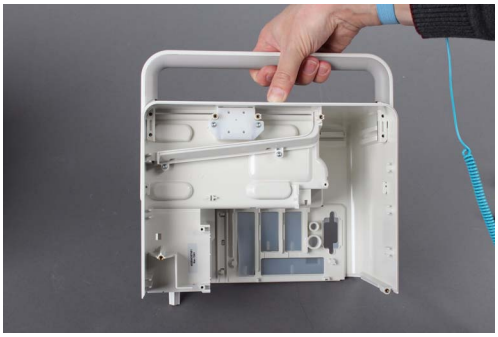
4 Pull out the MSL board

# Removing the Handle

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

2 Remove the rear housing as described in “Removing the Rear Housing” on page 167.

3 Pull the handle upwards.



4 Press the latches of the handle outwards and then pull the lower ends of the handle away from the housing to remove it completely.

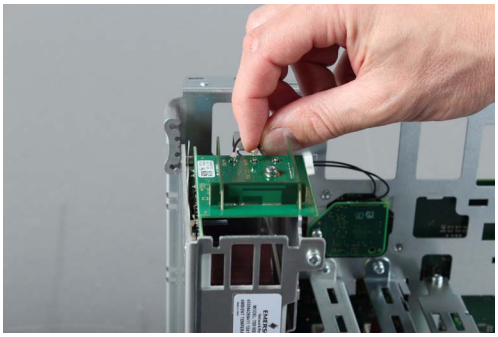
5 Before reinserting the new handle, make sure the metal threads of the handle are pointing towards the back of the rear housing.

# Removing the Antenna Board

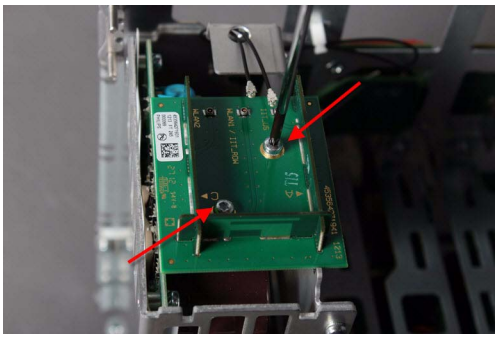
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

2 Remove the rear housing as described in “Removing the Rear Housing” on page 167.

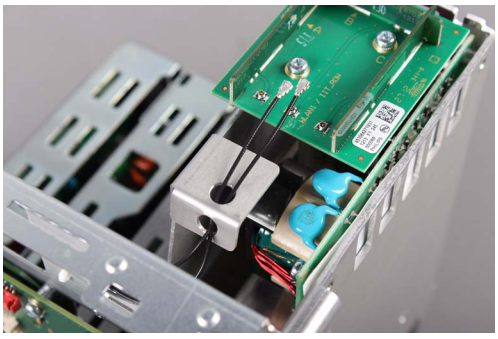
3 Disconnect all antenna cables from the antenna board.



4 Remove the two screws securing the antenna board and pull out the board.



5 Reassemble the monitor by performing the above steps in reverse order. Before connecting the antenna cables to the antenna board, make sure to pull them through both guidance holes in the metal sheet.

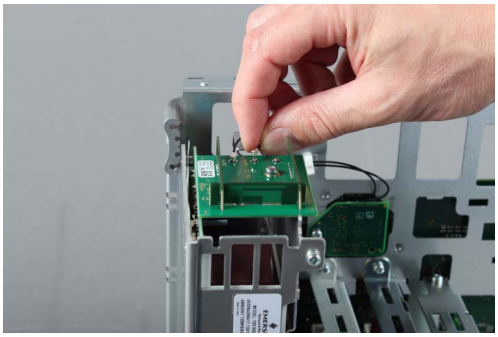


# Removing the WLAN board

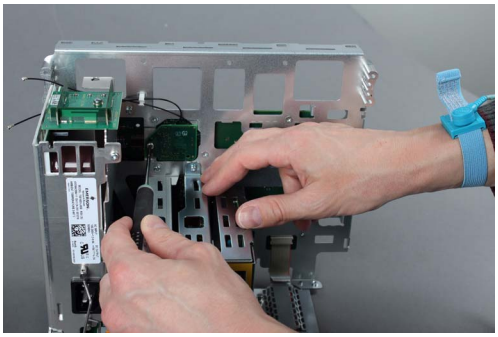
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

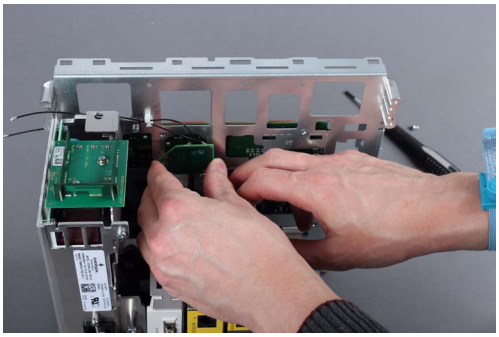
2 Remove the rear housing as described in “Removing the Rear Housing” on page 167.

3 Disconnect the WLAN antenna cables from the antenna board.

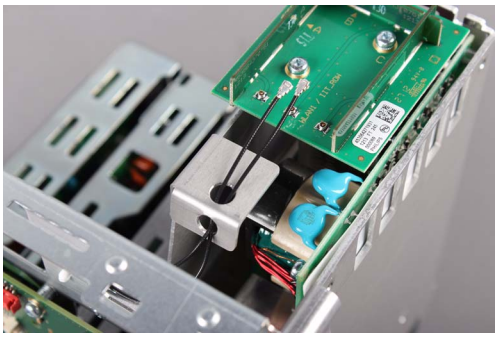


4 Remove the screw securing the WLAN board and pull out the board.





5 Reassemble the monitor by performing the above steps in reverse order. Before connecting the antenna cables to the antenna board, make sure to pull them through both guidance holes in the metal sheet.



**NOTE**

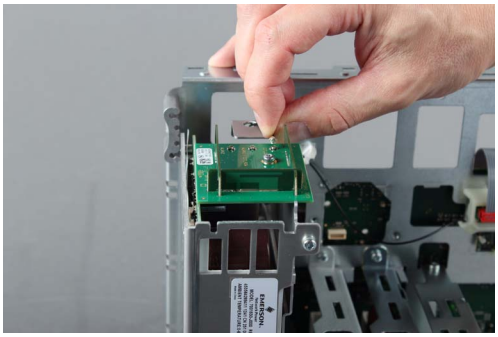
When replacing the WLAN board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

# Removing the IIT Board

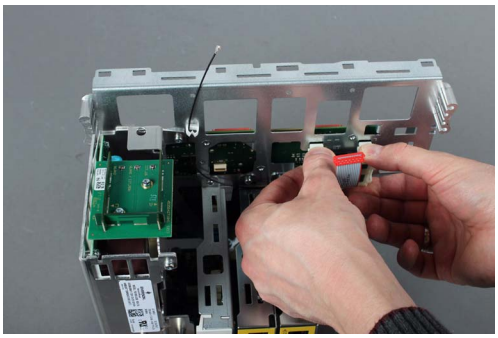
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

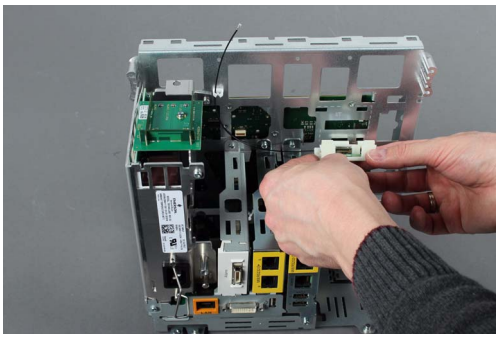
2 Remove the rear housing as described in “Removing the Rear Housing” on page 167.

3 Disconnect the IIT antenna cable from the antenna board.

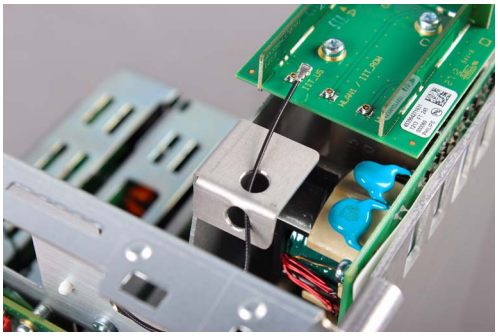


4 Press the IIT board holder together to release it from the chassis and then pull it out.





5 Reassemble the monitor by performing the above steps in reverse order. Before connecting the antenna cable to the antenna board, make sure to pull it through both guidance holes in the metal sheet. Connect the IIT antenna cable according to the IIT bandwidth used (1.4 GHz to IIT_US connector, 2.4 GHz to WLAN1/IIT_ROW connector).

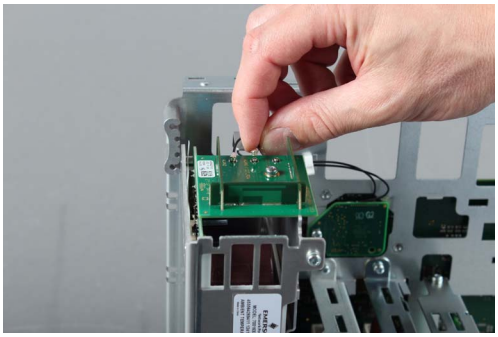


**NOTE**

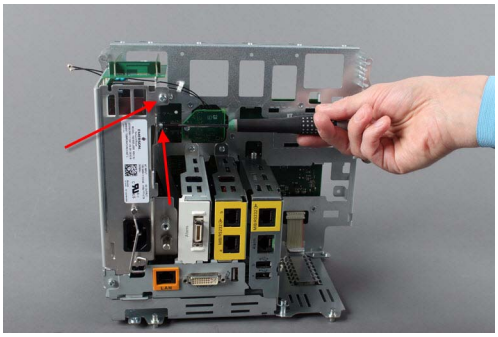
When replacing the IIT board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

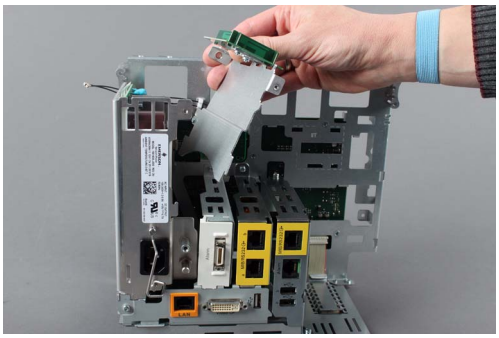
# Removing the Power Supply

1. Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.
2. Remove the rear housing as described in “Removing the Rear Housing” on page 167.
3. If a WLAN or IIT board is installed, disconnect the antenna cables from the antenna board.

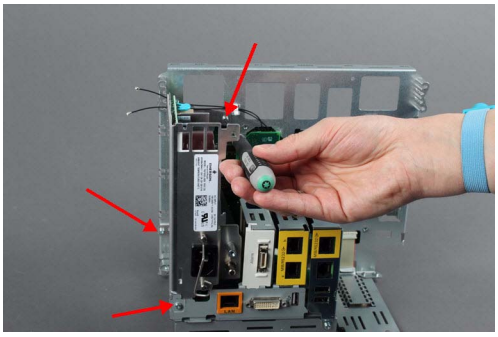


4. Remove the two screws securing the antenna assembly and remove the assembly.

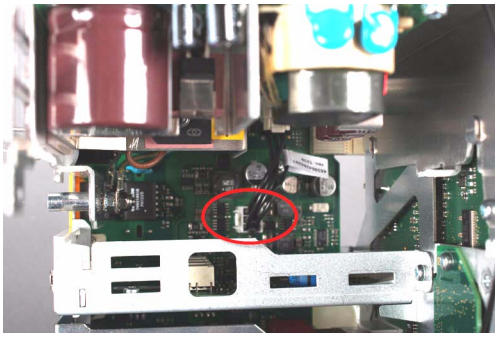




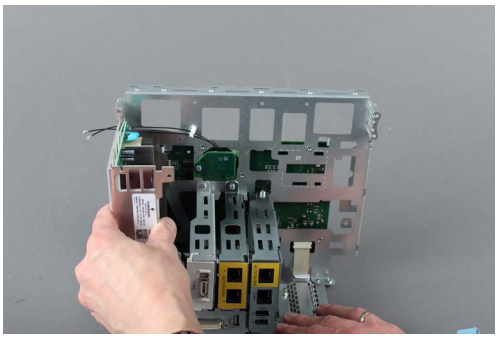
5. Remove the three screws from the power supply chassis.

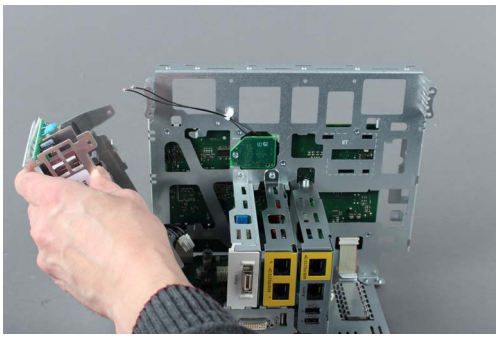


6 Disconnect the cable connecting the power supply to the standard system interface board.

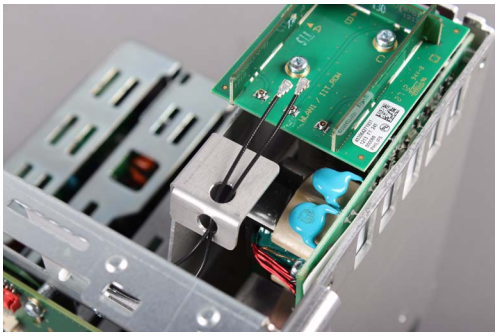


7 Remove the power supply.





8 Reassemble the monitor by performing the above steps in reverse order. Before connecting the antenna cables to the antenna board, make sure to pull them through both guidance holes in the metal sheet.

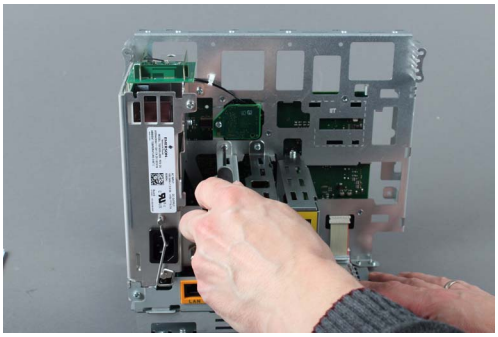


## Removing I/O Boards

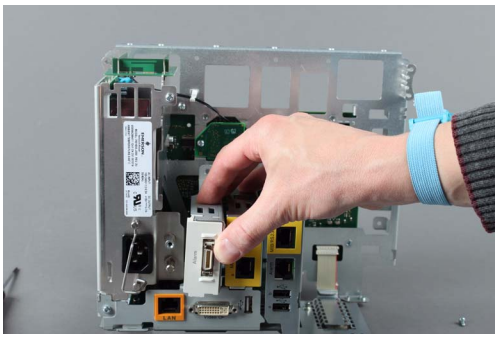
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

2 Remove the rear housing as described in “Removing the Rear Housing” on page 167.

3 Remove the screw securing the I/O board you wish to remove.



4 Remove the I/O board by pulling it towards you.



NOTE

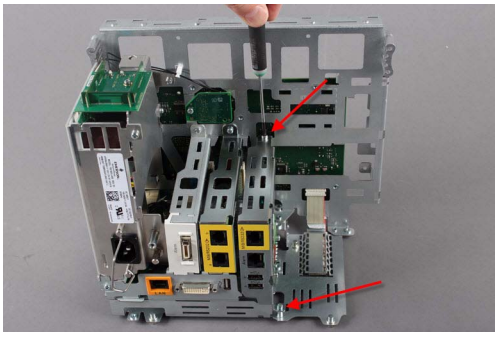
When replacing the I/O boards, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

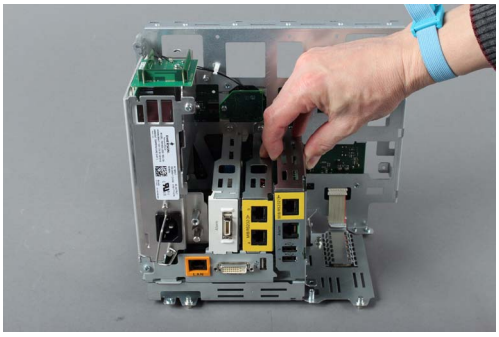
## Removing the Advanced System Interface Board

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

2 Remove the rear housing as described in “Removing the Rear Housing” on page 167.

3 Remove the two screws securing the advanced system interface board and lift the board upwards to remove it.





NOTE

When replacing the advanced system interface board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

# Removing the Standard System Interface Board

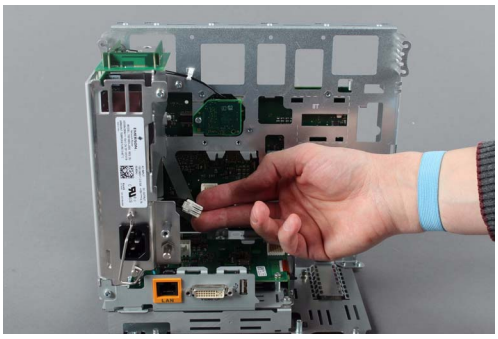
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

2 Remove the rear housing as described in “Removing the Rear Housing” on page 167.

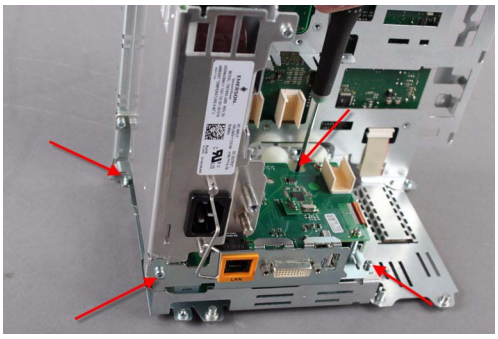
3 Remove all I/O boards as described in “Removing I/O Boards” on page 176.

4 Remove the Advanced System Interface Board as described in “Removing the Advanced System Interface Board” on page 177.

5 Disconnect the cable connecting the power supply to the standard system interface board.



6 Remove the four screws securing the standard system interface board.



7 Remove the standard system interface board.

8 When reassembling the standard system interface board, press against the main board connector so it clicks into place.

NOTE

When replacing the standard system interface board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

## Removing the Main Board

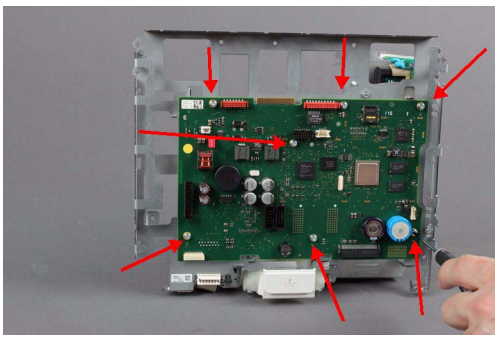
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

2 Remove the rear housing as described in “Removing the Rear Housing” on page 167.

3 Remove all I/O boards as described in “Removing I/O Boards” on page 176.

4 Remove the WLAN board as described in “Removing the WLAN board” on page 173.

5 Remove the seven screws securing the main board and remove the main board.



NOTE

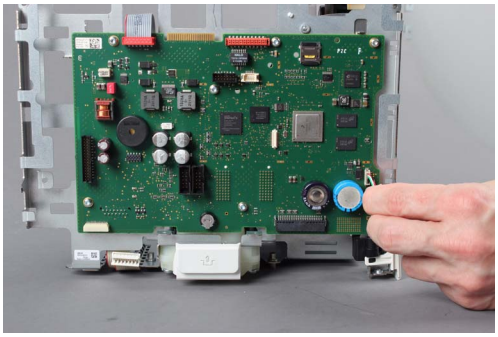
When replacing the main board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

## Removing the Side USB Connector

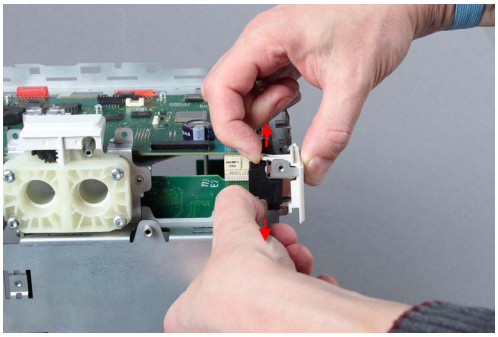
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 143.

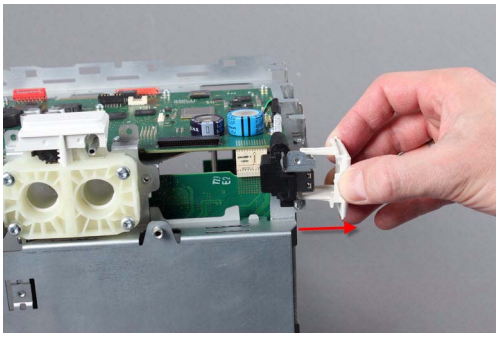
2 Remove the rear housing as described in “Removing the Rear Housing” on page 167.

3 Disconnect the side USB connector cable from the main board.



4 Pull the latches of the side USB cover apart and remove the cover.

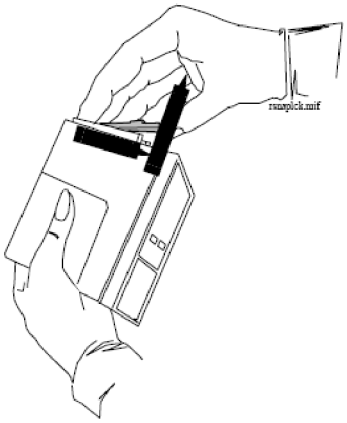


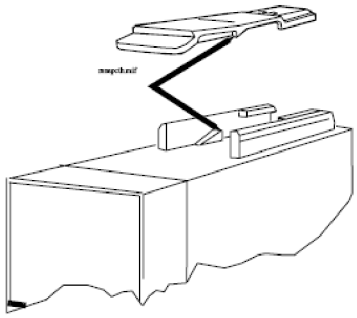


5 Pull out the side USB connector from the main metal chassis.

# 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.

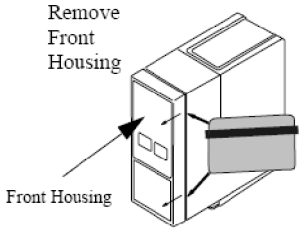
To replace the snap lock:

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.




*Removing the Module Front 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.

To disassemble a plug-in module:

Remove the front housing.

- 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 2 tabs securing the front housing to the module housing.
- Pull the edge of the front housing away from the module housing.
- 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.

To reassemble a plug-in module:

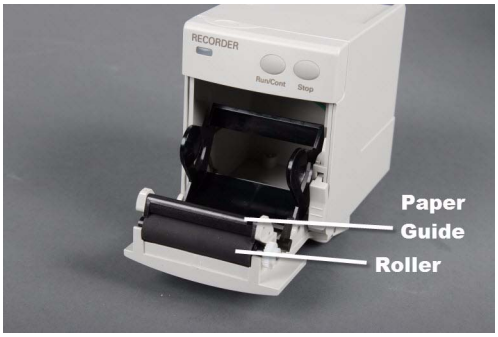
Snap-fit the front housing onto the front of the module case so the openings in the front housing match the LEDs and keys.

## Recorder Module Disassembly (M1116C)

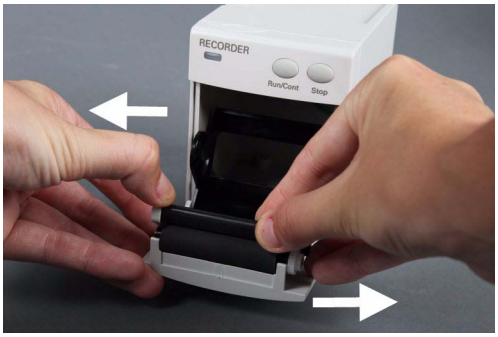
Please follow the disassembly procedures below, do not disassemble the recorder past the point described.

### 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 Make sure that all parts click into place.

### Disassembly of the Snap Lock

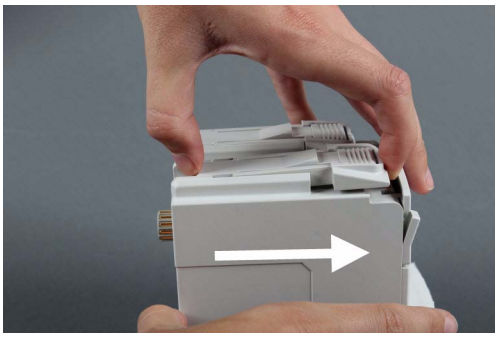
NOTE

Do not use snap locks other than the snap lock kit 453564456791 for the M1116C recorder. Using any other snap lock will result in the recorder door not being able to be opened anymore.

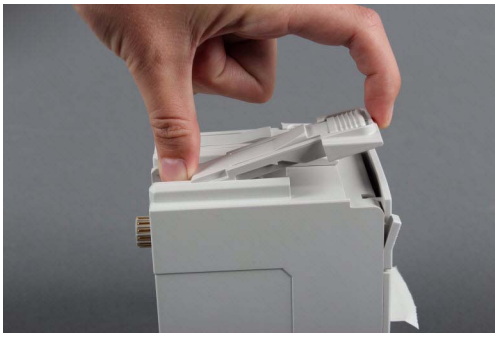
1 Turn the recorder upside down, with the snap locks facing upwards.

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.

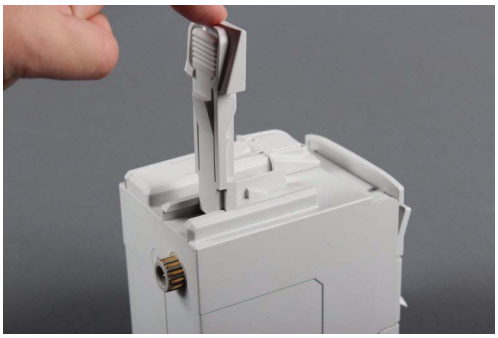


4 Lift the snap lock up in order to remove it.



**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.

# Multi-Measurement Module (MMS) Disassembly

Please 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
- 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 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 Mounting Pin

1 Position the MMS with the connectors facing towards you. There are four long mounting pins threaded into the MMS in each of the four corners under the cover. Locate the heads of the two long mounting pins on the 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 mounting pins, the MMS will not function properly

## Removing the Top Cover

Begin by gently pulling the top cover away from the MMS. The 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.

## Exchanging / Removing the DC/DC Board

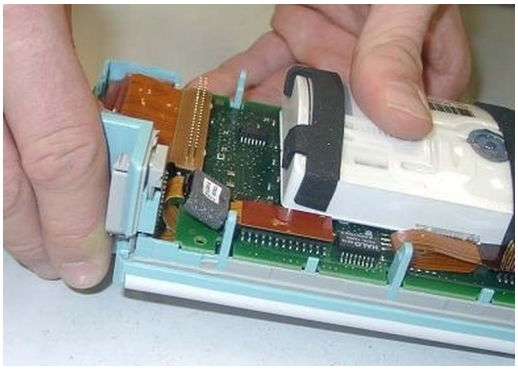
NOTE

The HW Rev C MMS (S/N prefix DE610xxxxx) does not have a separate DC/DC board anymore.

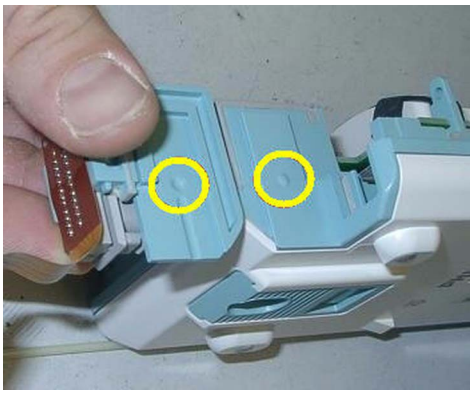
The DC/DC board is connected to the main board. Loosen the pin connection to the main board and remove the DC/DC board by gently lifting it up. Avoid touching the surface of the board. Set it aside where it is ESD protected.

# Removing the MSL Flex Assembly

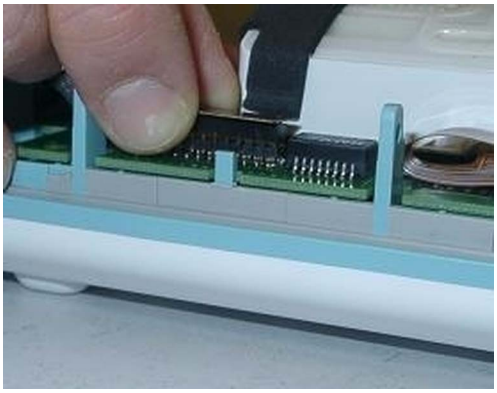
1 After the DC/DC board is removed, lift up the MSL frame connector to which the MSL Flex is attached.



At the beginning there might be resistance due to the special fixing mechanism shown in the picture below.

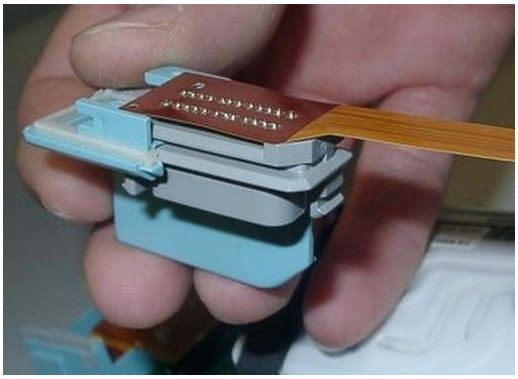


2 Lift up the flex connector carefully. Do not bend the connector pins on the main board.

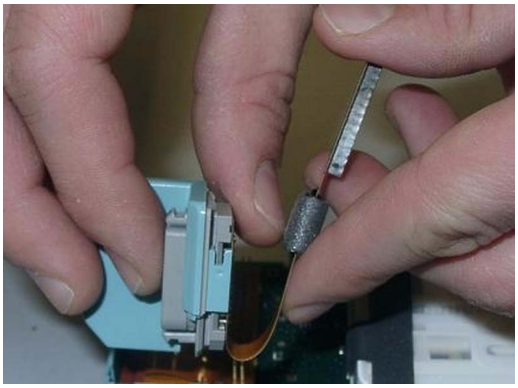


# Reassembling the MSL Flex Assembly

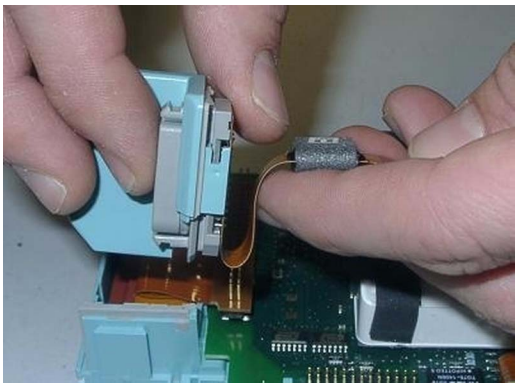
1 Insert the MSL Flex layer into the frame connector as shown below by moving it into the appropriate dove tail.



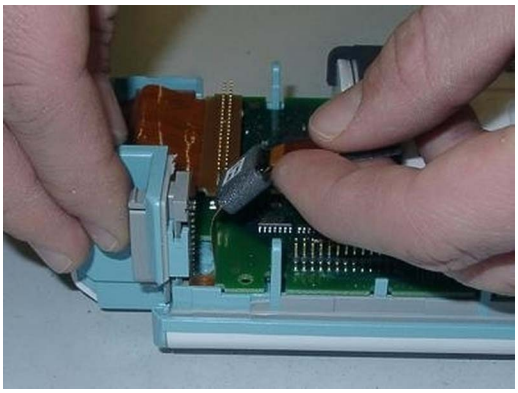
2 To insert the MSL Flex into the MMS, it has to be bent carefully. Bend the MSL Flex in a 180 degree angle as shown below. Do not crease the flex.



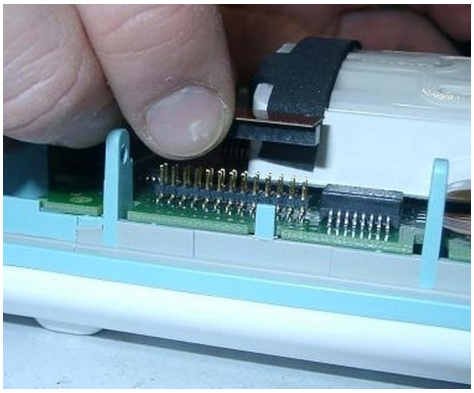
3 The second bend has to be done as shown below. To be able to connect the MSL flex to the main board afterwards, the flex has to be bent in a 90 degree angle as shown in the picture. Do not crease the flex.



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.



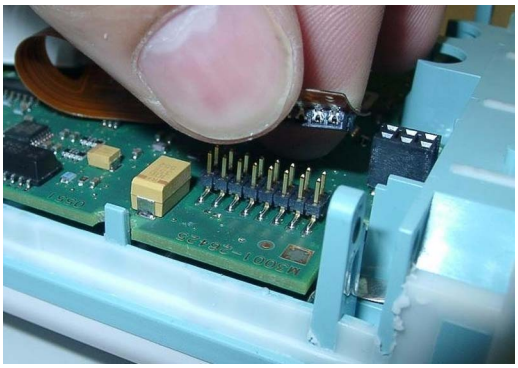
5 Position the connector correctly and push it into place.



## Removing the NBP pump

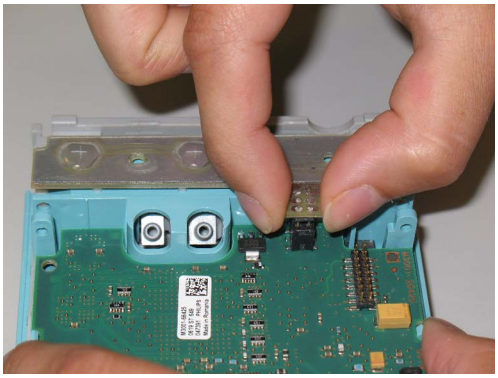
1 Remove the pump by lifting it up. Set the pump aside. Also remove the old silicon tubes.

2 Remove the connector of the NBP pump assembly. The connector may sit tightly. Gently loosen the connector.



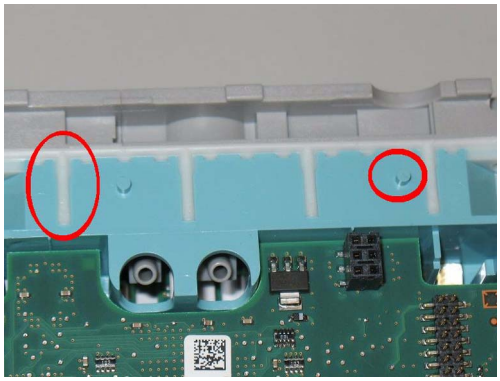
## Removing the Keypad

1 Remove the keypad by lifting it straight up.



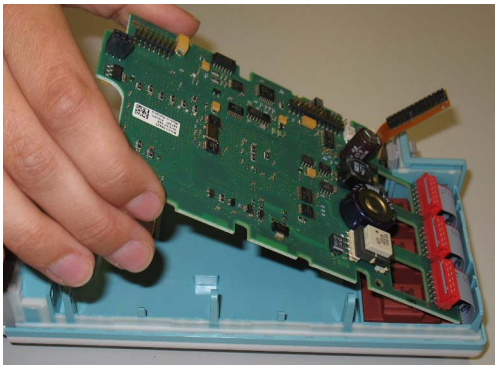
NOTE

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.

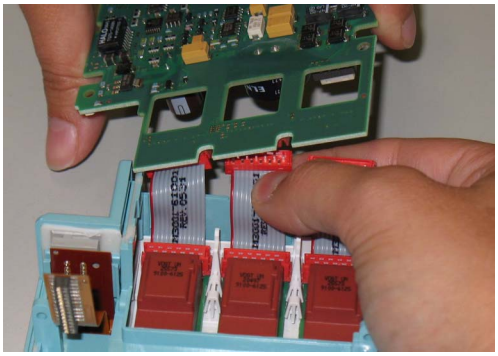


## Removing the Main Board

1 Lift up the main board as shown below. Then turn it over and continue with step 2.



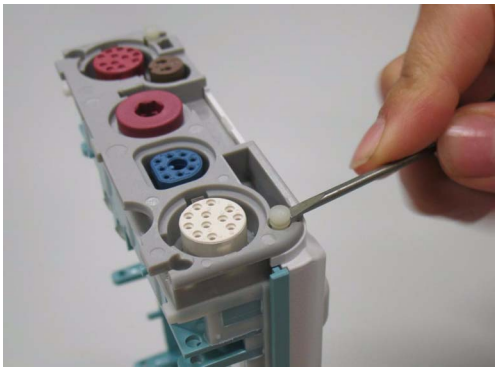
2 Remove the connectors to the main board starting from the right side.



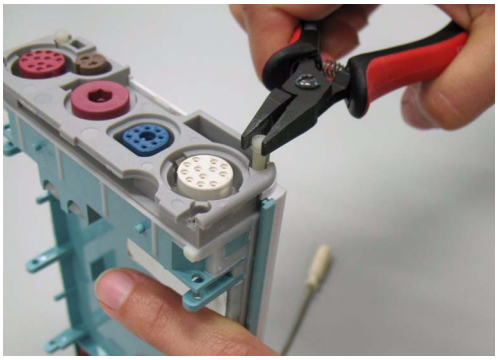
## Removing the Measurement Board

1 Position the MMS with the connectors facing towards you. There are four long mounting pins threaded into the MMS in each of the four corners under the cover. Locate the heads of the two long mounting 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.

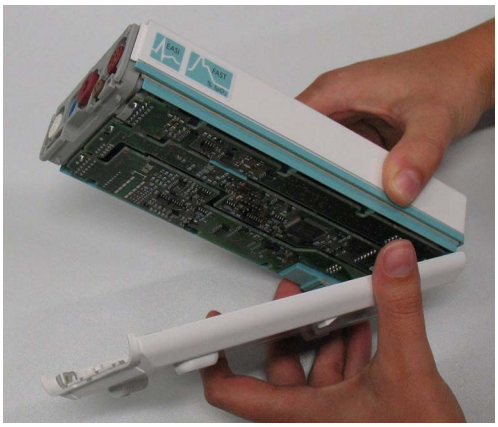


NOTE

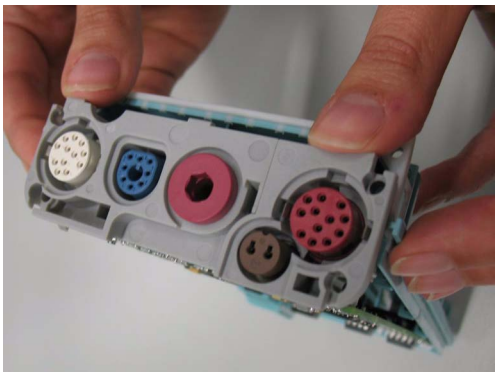
Without these long mounting pins, the MMS will not function properly.

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.**

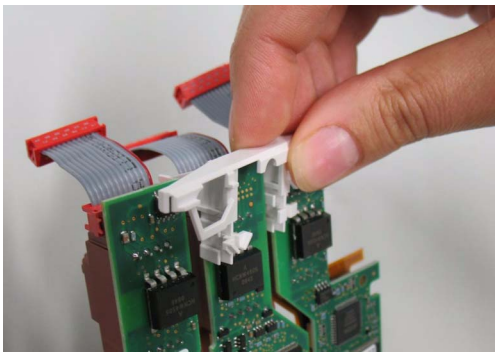
5 Remove the bottom cover. There may be a slight resistance when opening the cover.



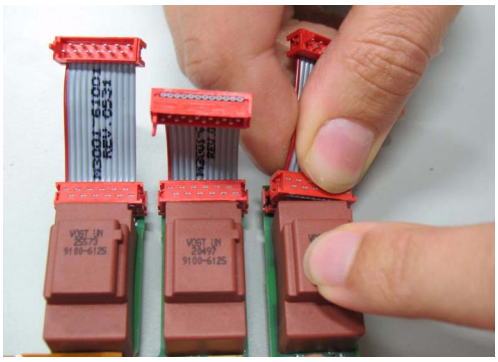
6 Loosen the measurement block by pushing the it block forward while holding plastic chassis. Then remove the measurement block.



7 The spacer keeps the measurement boards in place. Remove the spacer by lifting it up.



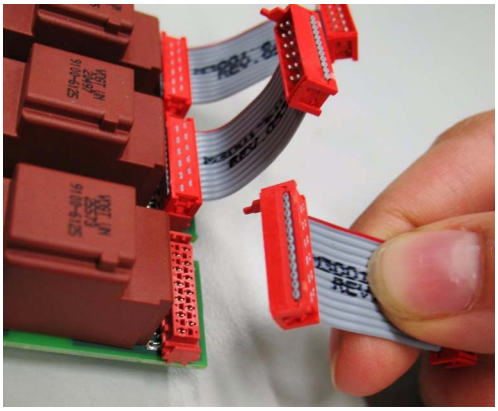
8 Remove the measurement ribbon cable. Twist the cable slightly in order to loosen it.



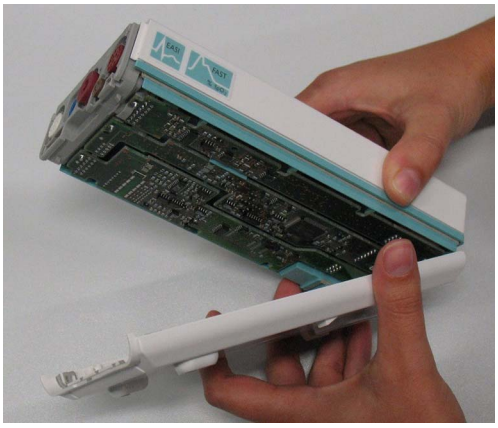
# Reassembling the Measurement Block

1 Insert the spacer to keep the measurement block in place.

2 Make sure that you insert the measurement cable correctly. Please refer to the picture below for the appropriate orientation. A cable inserted incorrectly may cause a <Measurement>Malfunction INOP.

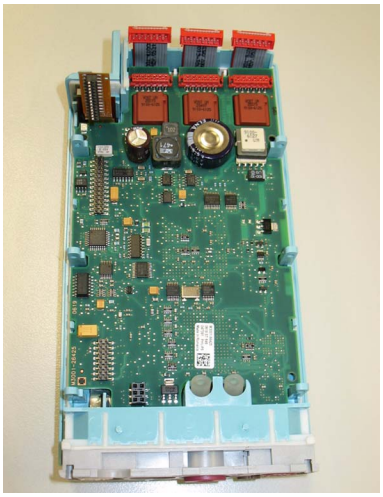


3 Make sure the measurement block is inserted as shown below. Make sure that there is no gap between the chassis and the bottom.

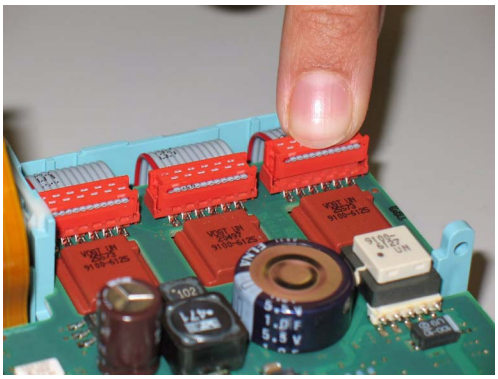


## Refitting the Main Board

1 Insert the new main board. Make sure the main board is seated correctly.

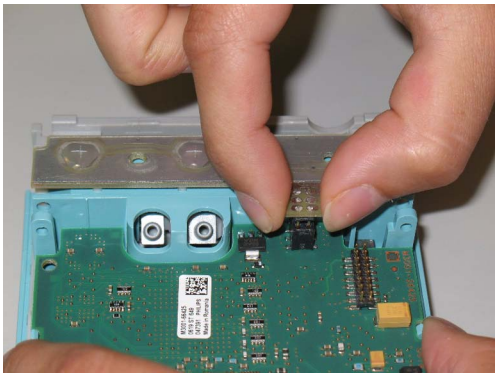


2 Re-establish the connection to the measurements. Make sure the connection is tight. If it is not connected correctly, a corresponding measurement malfunction INOP may occur.



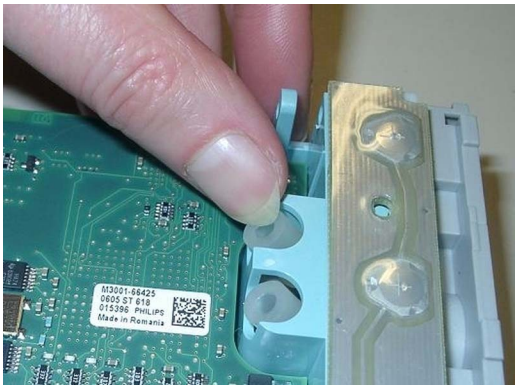
## Refitting the Keypad

1 Reinsert the key pad. Make sure it is positioned correctly.

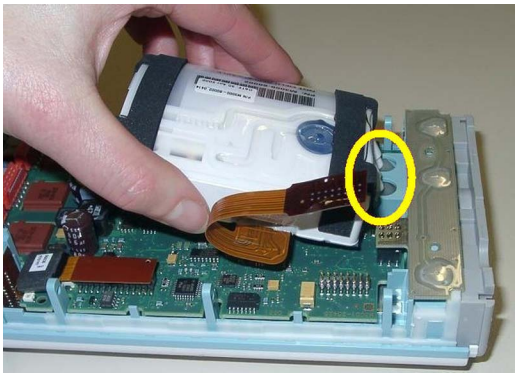


# Refitting the new NBP Pump

1 Insert new silicon tubes. Make sure they are seated correctly by pressing them into their position.

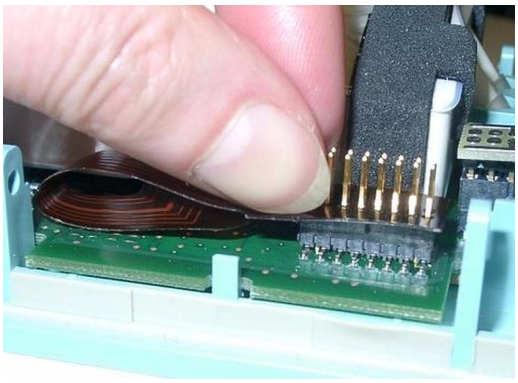



2 Insert the new pump assembly. Lift up the back and press the airways onto the silicon tubes.



3 Make sure the airways have a tight connection to the silicon tubes.

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.

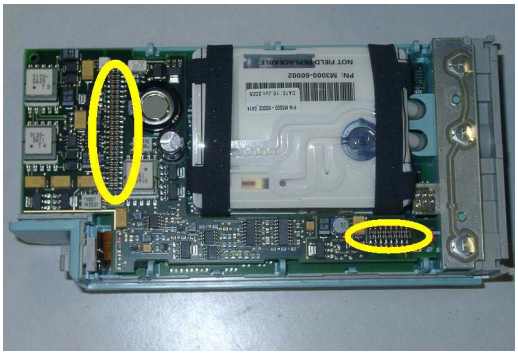


## Refitting the DC/DC board

**NOTE**

This step only has to be done on HW A/B

Position the DC/DC board and press it down gently. Make sure it is connected properly to both connectors indicated in the picture.



## Refitting the Cover

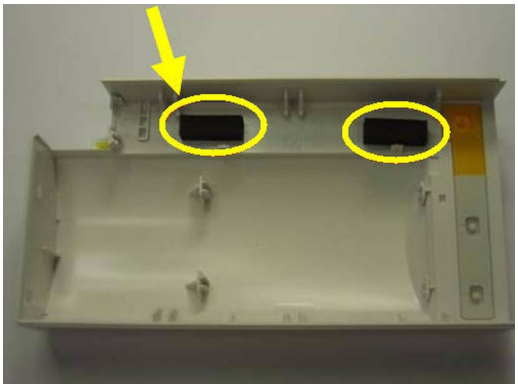
**NOTE**

To change the top cover of a HW Rev C MMS (S/N prefix DE610xxxxx) you have to attach the two cushions which are part of the Top Cover Assembly. These two cushions secure the connection of the MSL Flex and the NBP Flex.

**NOTE**

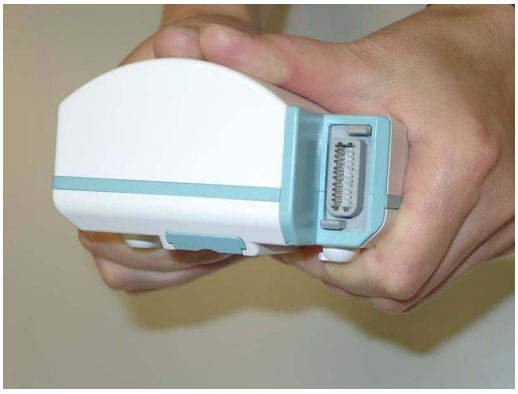
Perform the following two steps only on an MMS HW Rev C

1 Stick the two cushions onto the marked positions inside the top cover.

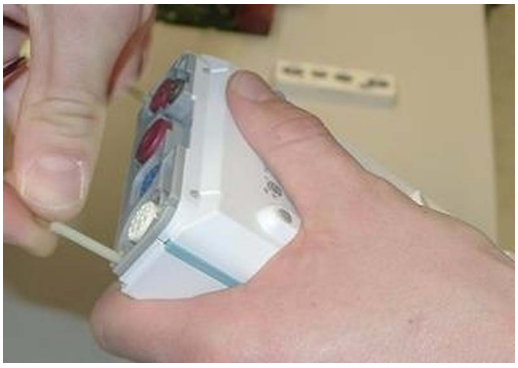


2 Position the top cover, then press it back into place until you hear a click or there is no longer a gap between the two covers.

3 The cover has a rubber seal, press the cover firmly together.



4 Holding the bottom cover firmly in place, slide the two long mounting pins completely back into the MMS. Make sure there is no gap between the top and bottom cover.



## Refitting the Front Cover

To refit the front cover, 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 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 that the MMS is functioning correctly, you must perform safety tests and a performance check on it. Please refer to the "Testing and Maintenance" chapter of this service guide.

**WARNING**

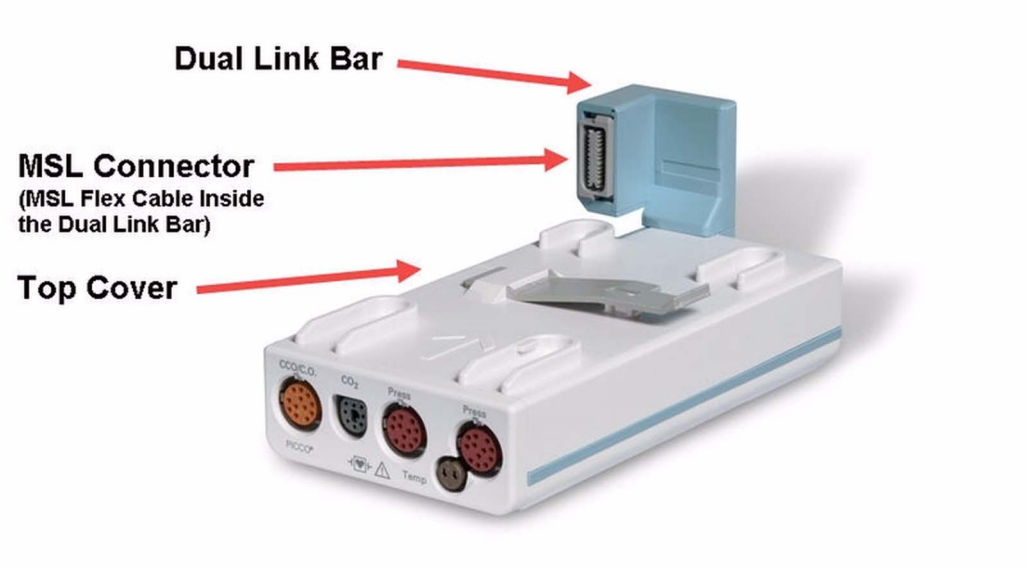
When you disassemble/assemble an MMS, an applied part leakage current test must be performed before it is used again for monitoring.

# MMS Extensions - Exchanging the Top Cover, MSL Flex Cable and the Dual Link Bar

This section describes the exchange procedures for:

- The Top Cover with new release mechanism
- The Dual Link Bar incl. the MSL Flex Cable.

for all MMS Extension (MSE) types (M3012A, M3014A, M3015A, M3016A).




# Exchange Procedures

**NOTE**

Please 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, you must perform a performance check on it. Please refer to the "Testing and Maintenance" chapter of this service guide .

## Removing the Front Cover

1 Position the thin-bladed screwdriver in the small slot provided for this purpose. The front cover (Bezel) then clicks away from the Extension. Remove the front cover

**NOTE**

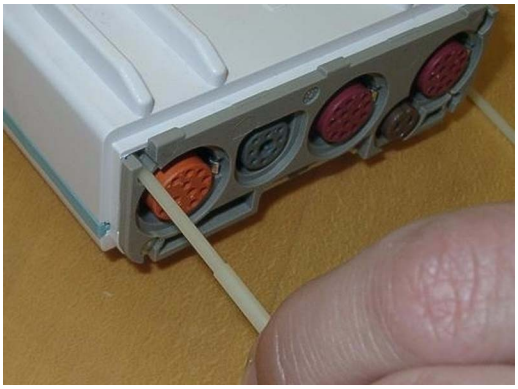
There might be a slight resistance when you remove the front cover.


## Removing the Mounting 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 mounting pins threaded into the MSE in each of the four corners under the cover. Locate the heads of the two long mounting 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.

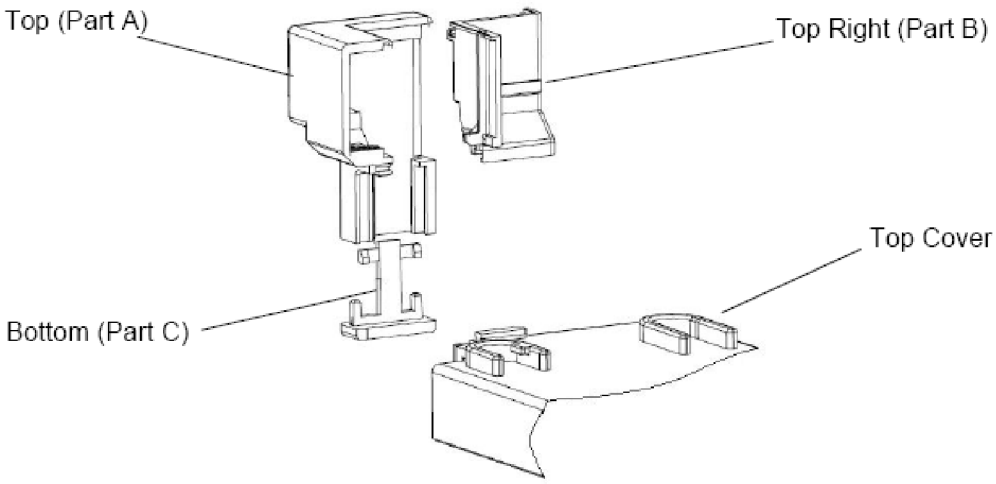


NOTE

Without these long mounting 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.

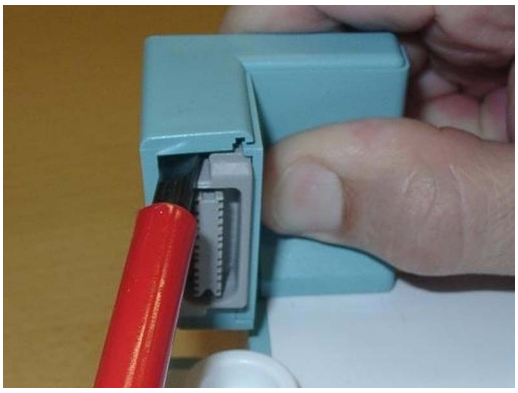



**CAUTION**

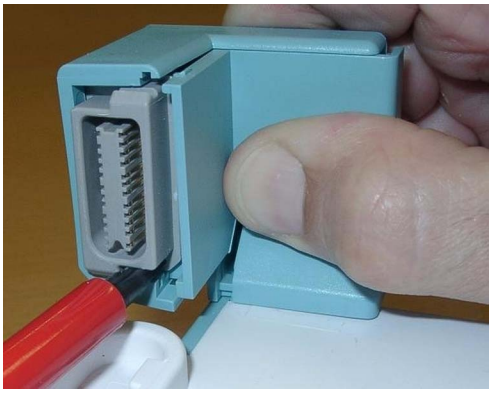
Do not try to remove the link bar with force as this can damage the MSL Flex Cable

1 Position the MSE with the measurement connector hardware facing towards you.

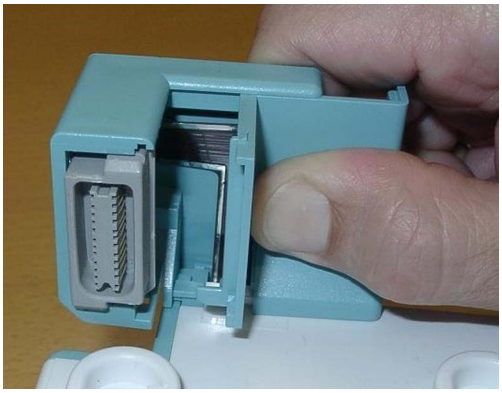
2 Hold the link bar as shown below. While pressing gently on part B, insert a thick-bladed screwdriver between the MSL connector and part A. Twist the screwdriver to the left and at the same time slide part B to the right, so it is released at the top.



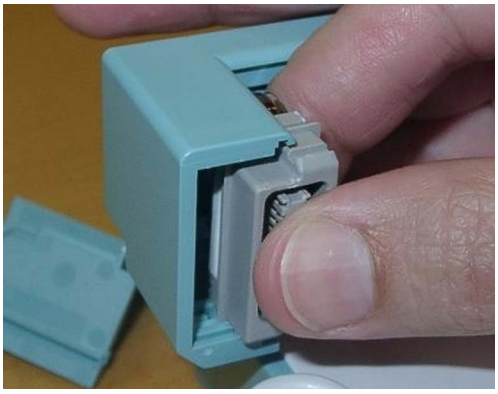
3 Repeat Step 2 at the bottom.



4 Slide part B to the right. If part B fails to move to the side, please repeat steps 2 and 3.



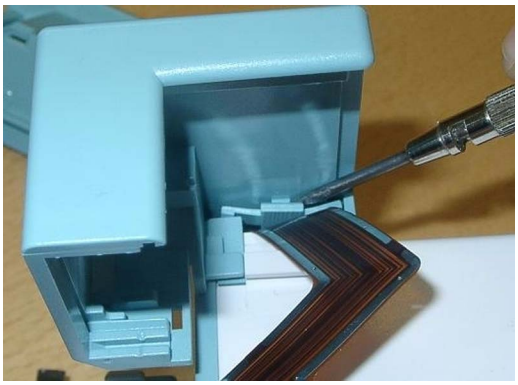
5 Now the MSL Flex connector can be moved to the right.



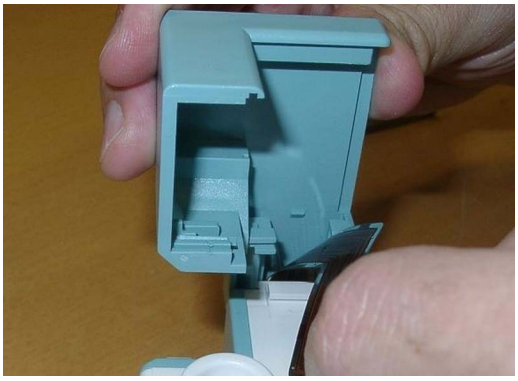
NOTE

Make sure that the movement of the screwdriver does not pinch the MSL flex cable.

6 Insert the thin-blade 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

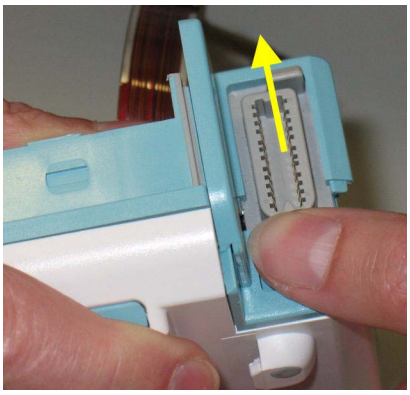
Begin by gently pulling away the top cover from the MSE. The top cover is press-latched at the link bar end. Remove it slowly, without hitting or touching the inside of the MSE.

## Replacing the Flex Cable Assembly

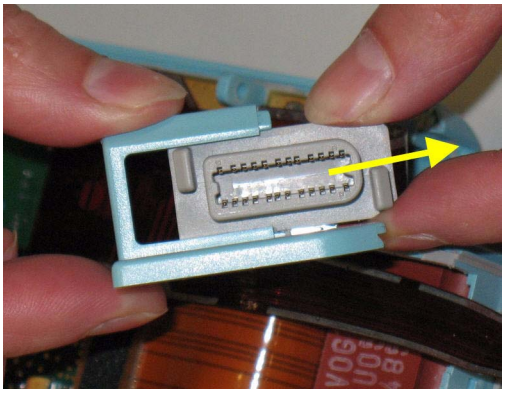
1 Hold the Extension firmly and push upwards against the connector. Then slide connector (together with the connector holder) out of the dovetail connection.

**NOTE**

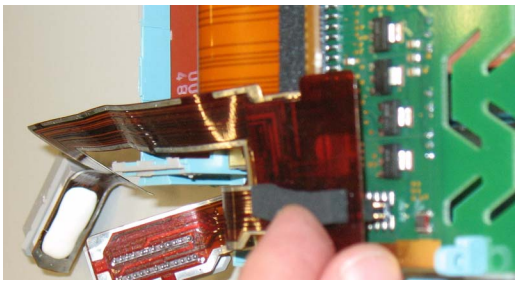
You will probably need to apply some more force at first until the holder slides out of its mechanical lock.



2 Slide the connector out of its holder.

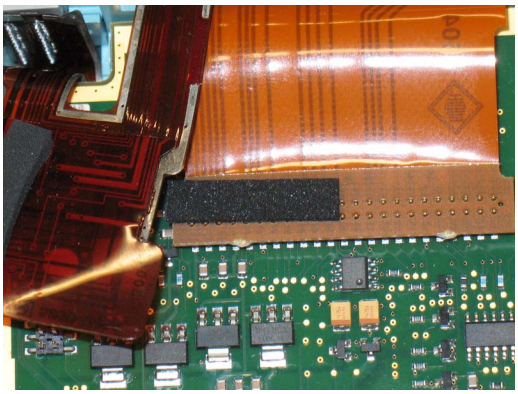


3 Remove the flex cable connector on the MSE board. Be careful not to bend any pins on the female part of the MSE connector.

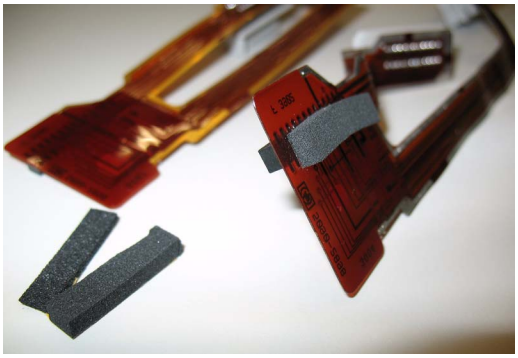


NOTE

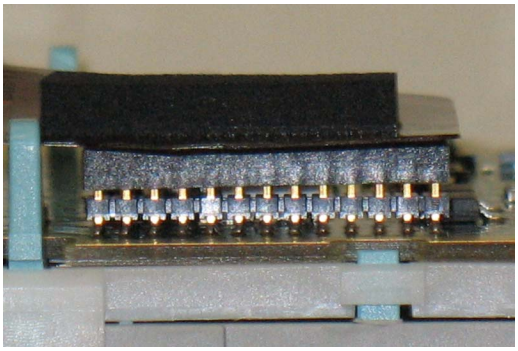
Some units may have a foam pad on the connector of the inner flex cable of the MSEs (as shown below) and some units may not. This has no impact on the functionality of these units.

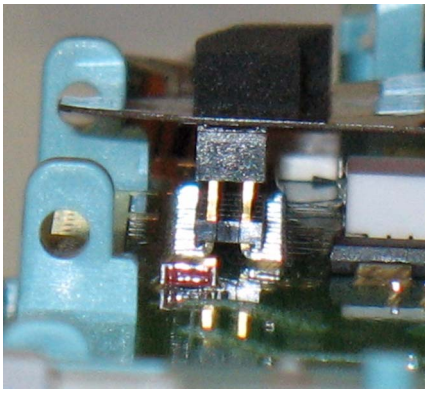


4 Stick the correct foam pad on the rear side of the inner connector. Use the thick pad for : M3012A, M3014A, M3016A. Use the thin pad for: M3015A. You can also check the old flex cable for the correct pad.



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.**

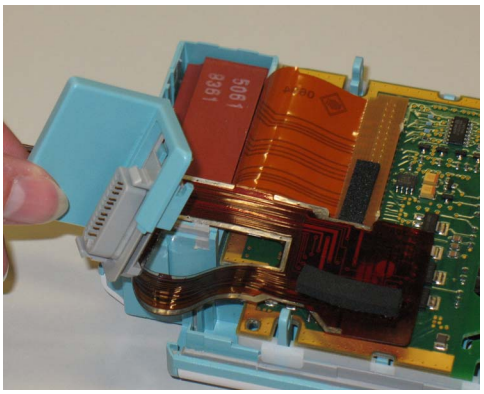




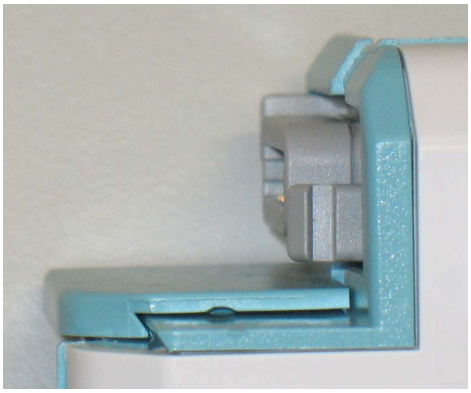
**WARNING**

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.



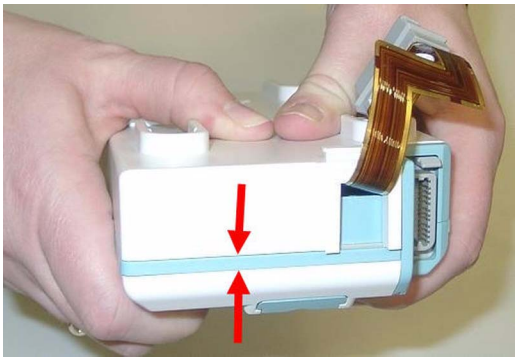
## Refitting the Top Cover

**NOTE**

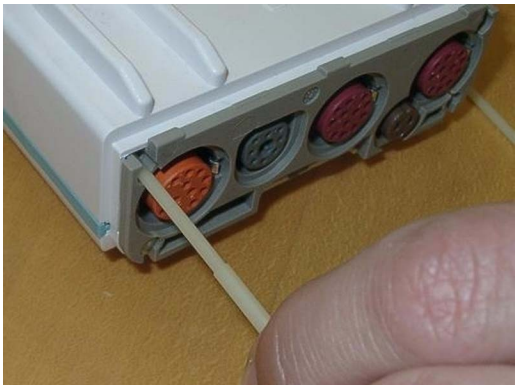
Be careful with the MSL Flex cable. Make sure it does not get stuck between the covers.

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 make sure there is no gap between the top and bottom cover.



3 Holding the bottom cover firmly in place, slide the two long mounting pins completely back into the MSE.

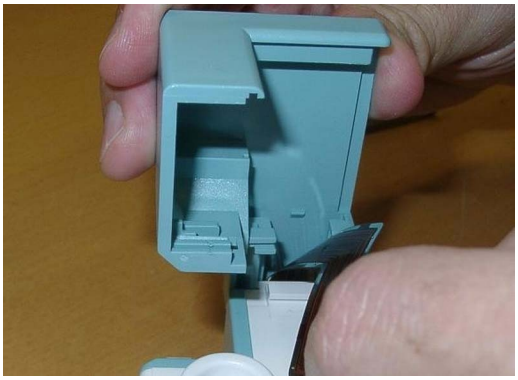


## Assembling the dual Link Bar

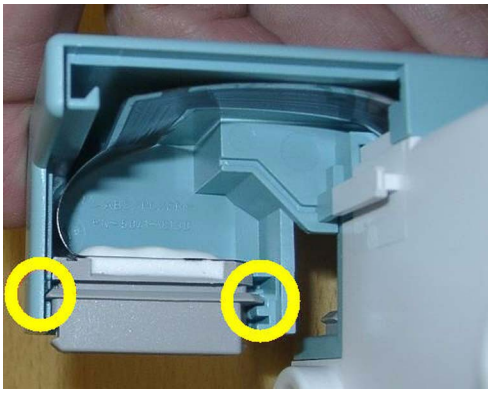
**CAUTION**

Do not try to assemble any part of the link bar with force as this can damage the MSL Flex Cable.

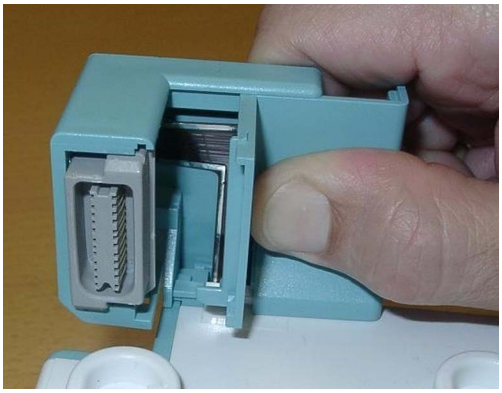
1 Position part A into the dovetail and slide it down.



2 Make sure 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 flex cable 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 Cover

To refit the front cover, 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. Please refer to the "Testing and Maintenance" chapter of this service guide.

**WARNING**

When you disassemble/assemble an MMS Extension, an applied part leakage current test must be performed before it is used again for monitoring.

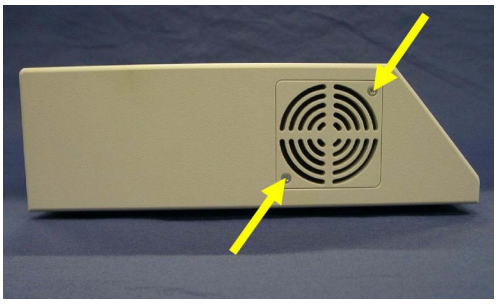
## Smart Battery Conditioner LG1480 (865432)

You should clean both air filter mats on a regular basis. Depending on the frequency of use and the environmental conditions (dust etc.), the interval can range from 6 to 24 months.

### Cleaning the Air Filter Mats

The air filters are located on the right and left side of the battery conditioner. Perform the procedure below for each side.

1 Remove the 2 screws securing the filter cover and take off the cover.

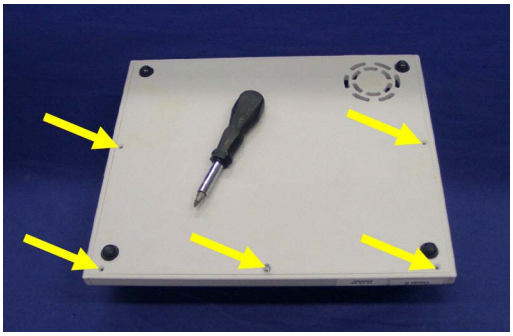


2 Remove the filter mat and clean the dust out by shaking.

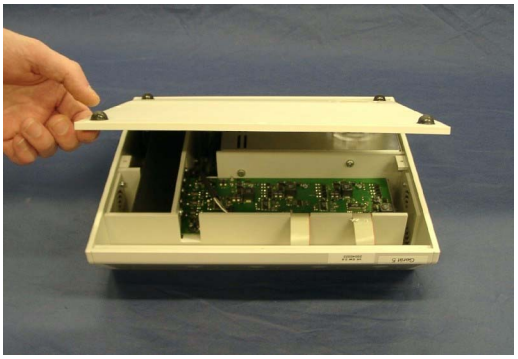
3 Re-insert the mat and refit the cover and screws.

## Replacing the Fan

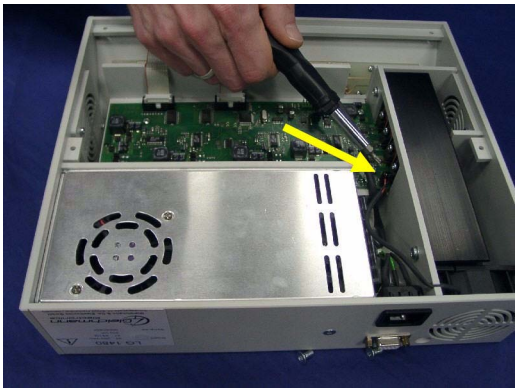
1 Turn the battery conditioner upside down and remove the 5 screws at the bottom with a T20 screwdriver.



2 Lift the bottom cover up at the front and pull it off.

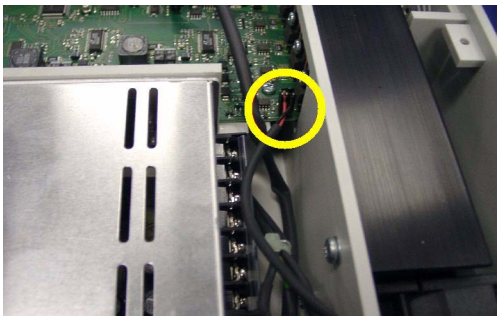


3 Unplug the fan connector from the main board.



4 Lift the fan out of the battery conditioner housing.

5 When replacing the fan make sure the connector is plugged in correctly as shown in the photograph below.

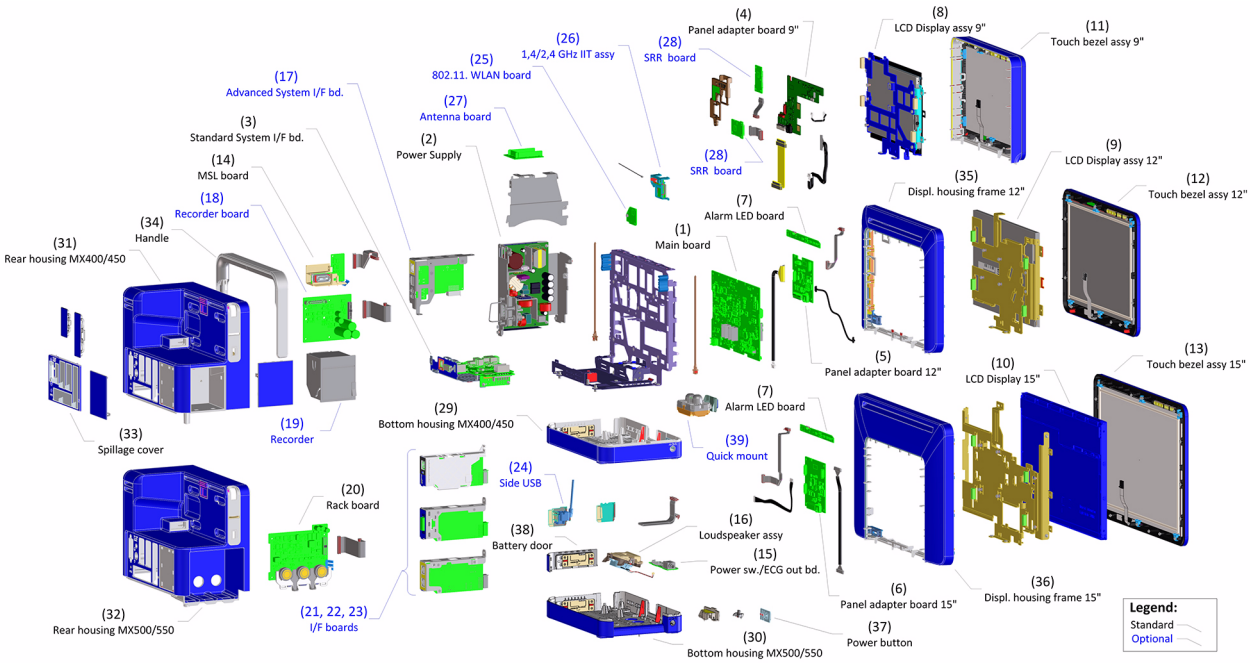


6

# Parts

This section lists the replacement and exchange parts for the following Philips IntelliVue Patient Monitoring System components:

# MX400/450/500/550 Parts




## Exchange Parts

| Part Number | Description | No. in Diagram |
|---|---|---|
| 453564406331 | IV2-FLEX Main board | 1 |

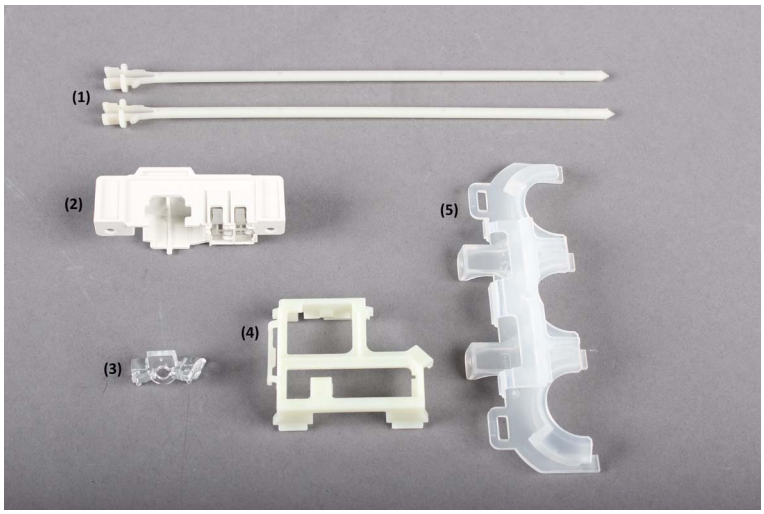
## Replacement Parts

| Part Number | Description | No. in Diagram |
|---|---|---|
| 453564281221 | IV2-FLEX ASSY-PWR AC/DC Power Supply | 2 |
| 453564407911 | IV2-FLEX I/F; Standard System I/F board | 3 |
| 453564407921 | IV2-FLEX Panel adapter board MX400 | 4 |
| 453564407931 | IV2-FLEX Panel adapter board MX450/500 | 5 |
| 453564407941 | IV2-FLEX Panel adapter board MX550 | 6 |
| 453564407961 | IV2-FLEX Alarm LED board MX450/500/550 | 7 |
| 453564406301 | IV2-FLEX DSPL LCD assembly MX400 | 8 |
| 453564406311 | IV2-FLEX DSPL LCD assembly MX450/500 | 9 |
| 453564406321 | IV2-FLEX DSPL LCD assembly MX550 | 10 |
| 453564406271 | IV2-FLEX Touch bezel assembly MX400 | 11 |
| 453564406281 | IV2-FLEX Touch bezel assembly MX450/500 | 12 |
| 453564406291 | IV2-FLEX Touch bezel assembly MX550 | 13 |

| Part Number | Description | No. in Diagram |
|---|---|---|
| 453564408531 | IV2-FLEX MSL assembly with holder | 14 |
| 453564407981 | IV2-FLEX Power switch/ECG sync out bd | 15 |
| 453564406631 | IV2-FLEX MECHASY Loudspeaker assembly | 16 |
| 453564407901 | IV2-FLEX I/F; Advanced System I/F board | 17 |
| 453564408301 | IV2-FLEX Recorder bd. assembly MX400/450 | 18 |
| 453564408311 | IV2-FLEX Recorder MX400/450 | 19 |
| 453564408291 | IV2-FLEX Rack bd. with holder MX500/550 | 20 |
| 453564407971 | IV2-FLEX I/F; Intellibridge board | 21 |
| 453564407891 | IV2-FLEX I/F; Flexible Nurse Call | 22 |
| 453564407881 | IV2-FLEX I/F; Dual MIB/RS232 | 23 |
| 453564408541 | IV2-FLEX Side USB cable kit | 24 |
| 453564408321 | IV2-FLEX WLAN board | 25 |
| 453564408341 | IV2-FLEX IIT assembly 1.4 GHz | 26 |
| 453564408351 | IV2-FLEX IIT assembly 2.4 GHz | 26 |
| 453564408431 | IV2-FLEX Triband antenna for IIT/WLAN | 27 |
| 453564408281 | IV2-FLEX SRR board | 28 |
| 453564407991 | IV2-FLEX MECHASY Bottom housing MX400/450 | 29 |
| 453564408001 | IV2-FLEX MECHASY Bottom housing MX500/550 | 30 |
| 453564408021 | IV2-FLEX MECHASY Rear housing MX400/450 | 31 |
| 453564408031 | IV2-FLEX MECHASY Rear housing MX500/550 | 32 |
| 453564408381 | IV2-FLEX Spillage cover assembly | 33 |
| 453564408991 | IV2-FLEX MECHASY Handle assembly | 34 |
| 453564408261 | IV2-FLEX MECHASY Display Frame MX450/500 | 35 |
| 453564408271 | IV2-FLEX MECHASY Display Frame MX550 | 36 |
| 453564409041 | IV2-FLEX KBD Power Button | 37 |
| 453564408011 | IV2-FLEX MECHASY Battery door assembly | 38 |
| 453564408251 | IV2-FLEX MECHASY Quick mount | 39 |
| 453564409001 | IV2-FLEX Small parts kit 1 | |
| 453564409011 | IV2-FLEX Small parts kit 2 | |
| 453564409031 | IV2-FLEX Cable kit basic | |
| 453564415331 | IV2-FLEX Cable kit MX400 | |
| 453564415341 | IV2-FLEX Cable kit MX450/500 | |
| 453564415351 | IV2-FLEX Cable kit MX550 | |
| 453564434051 | IV2-FLEX Screw Kit | |

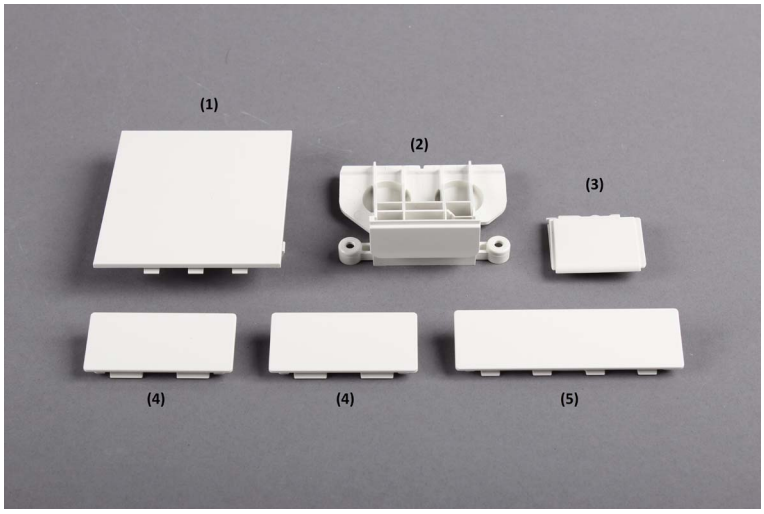
| Part Number | Description | No. in Diagram |
|---|---|---|
| 989803135861 | BATTERY 10.8V 6Ah LiIon | |
| 453564239731 | IV2 MECHASY Table Mount Kit | |

**IV2-FLEX Small Parts Kit 1 (453564409001) Contents:**



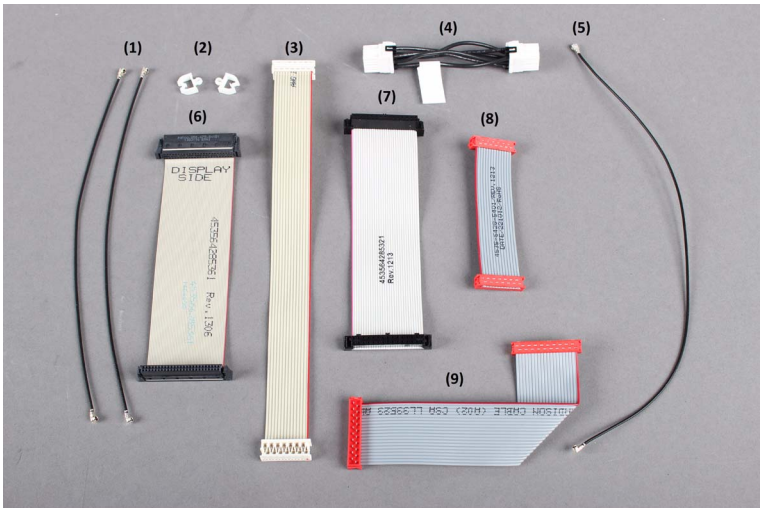

| Item | Quantity | No. |
|---|---|---|
| Plastic Pin | 2 | 1 |
| Tapped-Guide | 1 | 2 |
| Lightguide Power-Status | 1 | 3 |
| Plastic Holder IIT | 1 | 4 |
| Plastic Holder Rack Board | 1 | 5 |

**IV2-FLEX Small Parts Kit 2 (453564409011) Contents:**



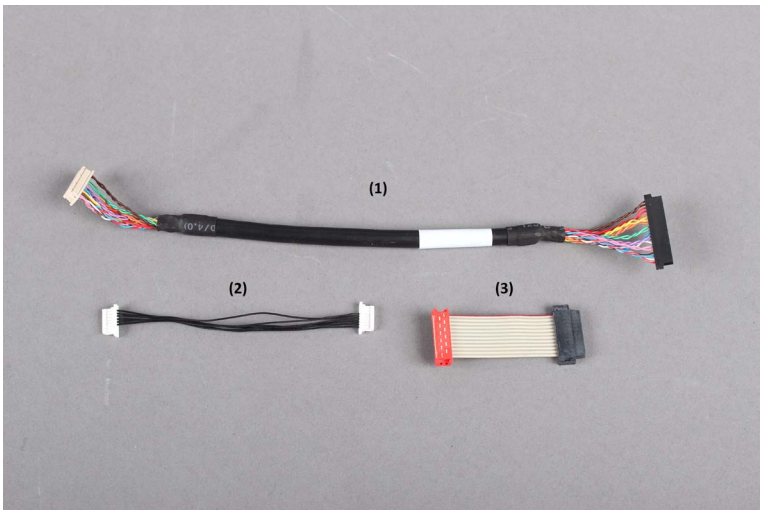
| Item | Quantity | No. |
|---|---|---|
| Blank Cover Recorder | 1 | 1 |
| Blank Cover Quickmount | 1 | 2 |
| Blank Cover Side USB | 1 | 3 |
| Blank Cover I/O Boards | 2 | 4 |
| Blank Cover Advanced System Interface Board | 1 | 5 |

**IV2-FLEX Cable Kit Basic (453564409031) Contents:**



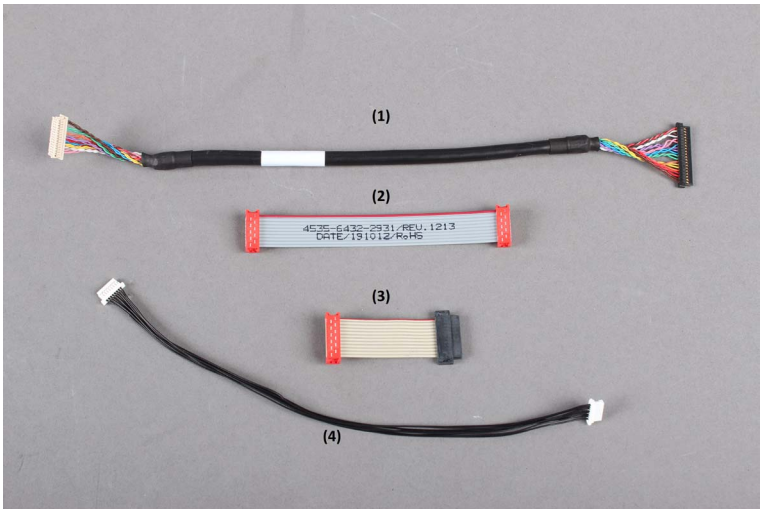

| Item | Quantity | No. |
|---|---|---|
| Antenna Cable 802.11 WLAN | 2 | 1 |
| Plastic Holder Antenna Cable | 2 | 2 |
| Cable Power Switch/ECG Sync Out Board -> Main Board | 1 | 3 |
| Cable Power Supply -> Standard System Interface Board | 1 | 4 |
| Antenna Cable IIT | 1 | 5 |
| Cable Main Board -> Panel Adapter Board | 1 | 6 |
| Cable Main Board -> Recorder Board | 1 | 7 |
| Cable Main Board -> IIT Assy | 1 | 8 |
| Cable Main Board -> MSL Connector | 1 | 9 |

**IV2-FLEX Cable Kit MX400 (453564415331) Contents:**



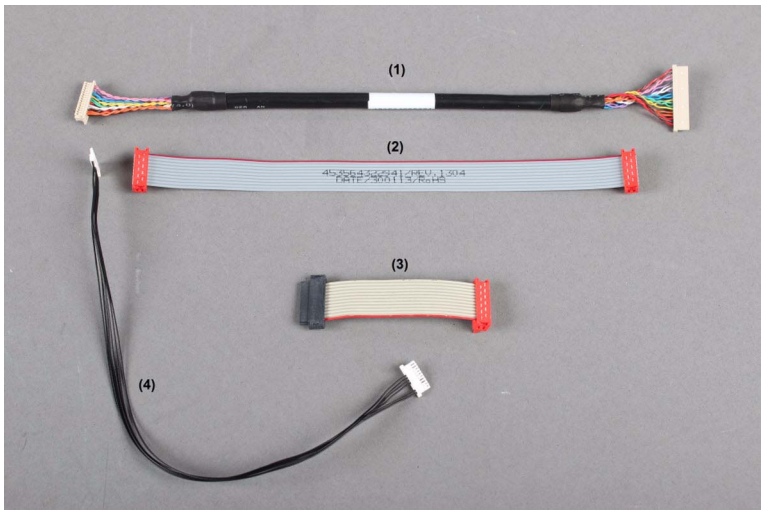

| Item | Quantity | No. |
|---|---|---|
| Cable Main Board -> 9" Display | 1 | 1 |
| Cable Panel Adapter Board -> 9" LED Backlight | 1 | 2 |
| Cable Panel Adapter Board -> Short Range Radio Board | 1 | 3 |

**IV2-FLEX Cable Kit MX450/500 (453564415341) Contents:**



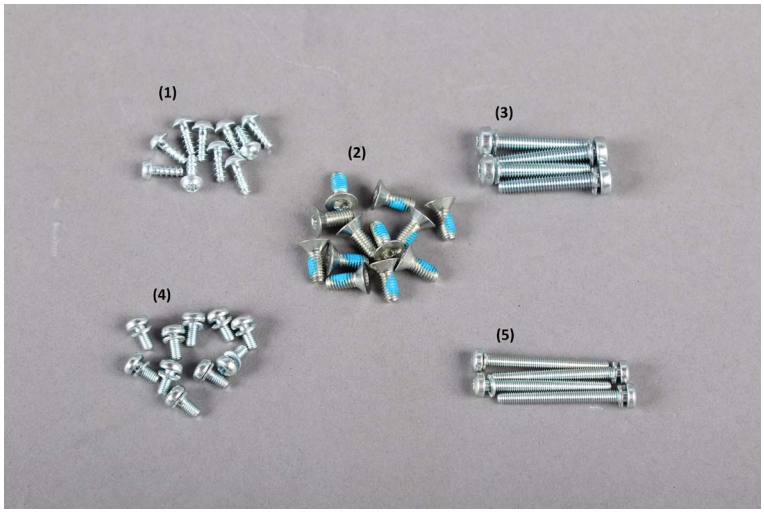

| Item | Quantity | No. |
|---|---|---|
| Cable Main Board -> 12" Display | 1 | 1 |
| Cable Panel Adapter Board -> Alarm LED Board | 1 | 2 |
| Cable Panel Adapter Board -> Short Range Radio Board | 1 | 3 |
| Cable Panel Adapter Board -> 12" LED Backlight | 1 | 4 |

**IV2-FLEX Cable Kit MX550 (453564415351) Contents:**




| Item | Quantity | No. |
|---|---|---|
| Cable Main Board -> 15" Display | 1 | 1 |
| Cable Panel Adapter Board -> Alarm LED Board | 1 | 2 |
| Cable Panel Adapter Board -> Short Range Radio Board | 1 | 3 |
| Cable Panel Adapter Board -> 15" LED Backlight | 1 | 4 |

**IV2-FLEX Screw Kit (453564434051) Contents:**



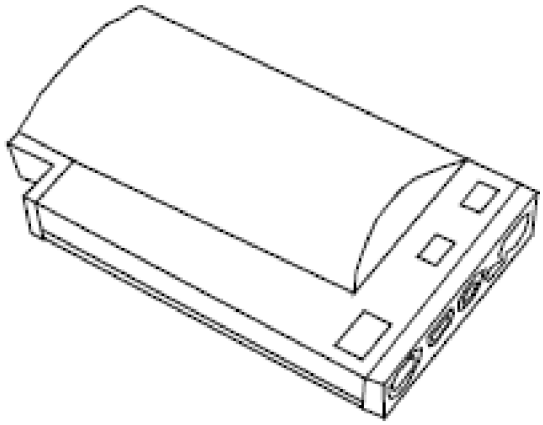

| Item | Quantity | No. |
|---|---|---|
| Self-tapping screw M3 x 1.34 8mm long | 10 | 1 |
| M3 x 10 with Nylon Prelock used for Bed Hanger | 12 | 2 |
| M4 x 25 incl. Safety Washer used for Quick Mount | 4 | 3 |
| M3 x 6 incl Safety Washer | 10 | 4 |
| M3 x 30 incl Safety Washer used for Handle | 4 | 5 |

# 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 USB cable for Remote Control |
| 453564262641 | 453564262641 | IV2-RC CBL Tethering cable |

# Multi-Measurement Module (MMS) Parts

The primary support strategy for the Multi-Measurement Module is a unit exchange. However, some exchange parts are available. In order to determine which exchange parts need to be ordered check the serial number and the option string of the MMS as described below.



*M3001A Multi-Measurement Module*

## MMS Part Number Overview and Identification

Identify the correct MMS part number by checking the serial number prefix and the option string on the label on the rear of the MMS 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 Option Description |
|---|---|
| #A01 | Philips FAST SpO$^2$ |
| #A02 | Nellcor OxiMax compatible |
| #A03 | Masimo SET Technology |
| #A04 | Nellcor OxiMax Technology |
| (#C00) | Standard |
| #C06 | Add Pressure/Temp |
| #C12 | Add 12 Lead ECG (only older revisions - see table below |
| (#C18) | (Add Pressure/Temp and 12 Lead ECG) **old** |

With Rel. G.0 option #C18 is split into #C06#C12

| HW Revision | Possible MMS Software Revision | Serial Number Prefix | SW of monitor the MMS is connected to | Option String | Exchange MMS (for 12NC information please refer to tables in the following sections) |
|---|---|---|---|---|---|
| HW A | A.0 to H.0 | DE227 | A.0, A.1 | --, C06, C12, C18, C06C12 | M3001-68x10 |
| | | DE441 | A.0, A.1 | A01, A01C06, A01C12, A01C18, A01C06C12 | |
| | | DE227 | >=A.2 | --, C06, C12, C18, A01C06C12 | M3001-68x02 |
| | | DE441 | >=A.2 | A01, A01C06, A01C12, A01C18, A01C06C12 | |
| HW B | B.1 to H.0 | DE441 | >=A.2 | A02, A02C06, A02C18, A01C06C12 | M3001-68113 M3001-68x03 |
| | | DE512 | >=A.2 | A02, A02C06, A02C18, A01C06C12 | |
| | | | >=A.2 | A01,A01C06, A01C12, A01C18, A01C06C12 | M3001-68114 M3001-68x04 |

| HW Revision | Possible MMS Software Revision | Serial Number Prefix | SW of monitor the MMS is connected to | Option String | Exchange MMS (for 12NC information please refer to tables in the following sections) |
|---|---|---|---|---|---|
| HW C | D.0 to H.0 | >=DE610 | >=A.2 | A01, A01C06, A01C18, A01C06C12 | M3001-68x05 |
| | | | >=A.2 | A02, A02C06, A02C18, A01C06C12 | M3001-68x08 |
| | | >=DE632 | >=A.2 | A03, A03C06, A03C18, A01C06C12 | M3001-68x07 |
| | | >=DE907 | >=A.2 | A04, A04C06, A04C06C12 | M3001-68x06 |

For further compatibilty information please refer to the Software Compatibilty Matrix in the Troubleshooting section.

Exchange Multi-Measurement Modules 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 MMS into operation.

# MMS Firmware

**NOTE**

Multi-Measurement Modules (MMS) with HW Rev. A have a fixed firmware that cannot be upgraded. HW B and HW C MMSs allow upgrading of the SpO2 and ECG firmware.

To perform a FW upgrade, the MMS must have SW Revision C.0 or higher and be connected to an IntelliVue patient monitor.

## SpO2

| Option | HW Revision | SpO2 FW Rev | Comment |
|---|---|---|---|
| #A01 | HW A | A.01.04 | The HW and its interface do not allow a FW upgrade |
| #A01 #A02 | HW B | (A.01.41) -> A.01.46 | Must be upgraded to A.01.46 - see internal Field Notification |
| | | (A.01.42) -> A.01.47 | |
| #A01 #A02 | HW C | A.01.48 | |
| | HW C (B.03.00) | A.04.16 | Currently shipped FW |
| #A03 | HW C | Masimo SET FW | Not upgradeable by Philips |
| #A04 | HW C | Nellcor OxiMax FW | Philips upgradeable |

### ECG

| Option | HW Revision | ECG FW Rev | Comment |
|---|---|---|---|
| #A01 | HW A | C.00.13 | The HW and its interface do not allow a FW upgrade |
| #A01 | HW A | C.01.19 | |
| #A01<br>#A02<br>#A03<br>#A04 | HW B/C | D.01.70 | Upgradeable - see internal Field Notifications |
| | | D.01.76 | |
| | | D.01.77 | |
| | | D.01.78 | |
| | | D.01.89 | |
| | | D.02.02 | |
| | | D.02.05 | Currently shipped FW (requires MMS SW Revision F.0) |

## MMS Part Numbers - Front Bezels

| Part number | 12NC | Description | Options |
|---|---|---|---|
| 453564187321 | 453564187321 | MS_X1 Housing Bottom MMS HW C & MSE | |
| 453564270591 | 453564270591 | MS_X1 Housing Bottom MMS HW A/B | |
| 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 |

## MMS Support Parts

| Part number | 12NC | Description | Comments |
|---|---|---|---|
| M3000-66541 | 453564107971 | MS_X1 PCA DC/DC Board for HW A/B | |
| M3001-64050 | 451261016391 | MS_X1 MMS MSL Connector Assy | |
| M3001-64500 | 451261020561 | MS_X1 NBP Assembly for X1/X2/MP2 | |
| M3001-68557 | 451261020751 | MS_X1 PCA ECG-5ld/Fast SpO2 | HW C only |
| 453564186021 | 453564186021 | MS_X1 PCA ECG-5ld/Fast SpO2/w PressTemp | HW C only |
| M3001-68553 | 451261020771 | MS_X1 PCA ECG-5ld/Masimo SpO2 | HW C only |

| Part number | 12NC | Description | Comments |
|---|---|---|---|
| 453564186051 | 453564186051 | MS_X1 PCA ECG-5ld/Masimo SpO2/w PT | HW C only |
| M3001-68555 | 451261020791 | MS_X1 PCA ECG-5ld / Nellcor SpO2 | HW C only |
| 453564186081 | 453564186081 | MS_X1 PCA ECG-5ld/Nellcor SpO2/w PT | HW C only |
| M3001-68425 | 453564177921 | MS_X1 Main board for HW C | HW C only |
| 5041-8114 | 453563100081 | MS_X1 Mounting Pin | |
| 453564423471 | 453564423471 | MS_X2 CONN NiBP Inlet X1/X2/MP2/ MP5 (5ea) | |

## MMS 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 |

# MMS Exchange Part Numbers

**NOTE**

The MMS always ships with the latest Software Revision. In order to make it compatible with the respective monitor the MMS may need to be upgraded or downgraded. From Support Tool version E.03.01 onwards the MMS can be up- or downgraded with every support tool license key (except general).

| Part number | 12NC | Description |
|---|---|---|
| **X1 HW Rev: B; Option: A01; SN Prefix: DE512; SW Rev: Latest SW** | | |
| M3001-68114 | 451261006041 | MS_X1 Std 5ld w/o P/T-Eng - HW B |
| M3001-68204 | 451261006061 | MS_X1 5ld w P/T-Eng - HW B |
| M3001-68304 | 451261006081 | MS_X1 12ld w/o P/T #C12-Eng - HW B |
| M3001-68404 | 451261006101 | MS_X1 12ld w P/T-Eng - HW B |
| M3001-68504 | 451261006121 | MS_X1 5ld w/o P/T-Sym - HW B |
| M3001-68604 | 451261006141 | MS_X1 5ld w P/T-Sym - HW B |
| M3001-68704 | 451261006161 | MS_X1 12ld w/o P/T #C12-Sym - HW B |
| M3001-68804 | 451261006181 | MS_X1 12ld w P/T-Sym - HW B |
| **X1 HW Rev: C; Option: A01; SN Prefix: DE610 <= ; SW Rev: Latest SW** | | |
| M3001-68105 | 451261013041 | MS_X1 5ld w/o P/T-Eng - HW C |
| M3001-68205 | 451261013061 | MS_X1 5ld w P/T - Eng - HW C |
| M3001-68305 | 453564146221 | MS_X1 12ld wo P/T-Eng - HW C |
| M3001-68405 | 451261013081 | MS_X1 12ld w P/T -Eng - HW C |
| M3001-68505 | 451261013101 | MS_X1 5ld w/o P/T-Sym - HW C |
| M3001-68605 | 451261013121 | MS_X1 5ld w P/T -Sym - HW C |
| M3001-68705 | 453564146241 | MS_X1 12ld w/o P/T-Sym - HW C |
| M3001-68805 | 451261013141 | MS_X1 12ld w P/T - Sym - HW C |
| **X1 HW Rev: C; Option: A04; SN Prefix: DE907 <= ; SW Rev: Latest SW** | | |
| 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 |
| **X1 HW Rev: C; Option: A03; SN Prefix: DE632 <= ; SW Rev: Latest SW** | | |
| M3001-68107 | 451261013281 | MS_X1 5ld w/o P/T-Eng-Masimo-HWC |
| M3001-68207 | 451261013301 | MS_X1 5ld w P/T-Eng-Masimo-HWC |

| Part number | 12NC | Description |
|---|---|---|
| M3001-68307 | 453564146301 | MS_X1 12ld wo P/T-Eng - Masimo HW C |
| M3001-68407 | 451261013321 | MS_X1 12ld w P/T -Eng-Masimo-HWC |
| M3001-68507 | 451261013341 | MS_X1 5ld w/o P/T-Sym-Masimo-HWC |
| M3001-68607 | 451261013361 | MS_X1 5ld w P/T -Sym-Masimo-HWC |
| M3001-68707 | 453564146321 | MS_X1 12ld w/o P/T-Sym- Masimo-HWC |
| M3001-68807 | 451261013381 | MS_X1 12ld w P/T - Sym-Masimo-HWC |
| **X1 HW Rev: C; upgrade program** | | |
| 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 |

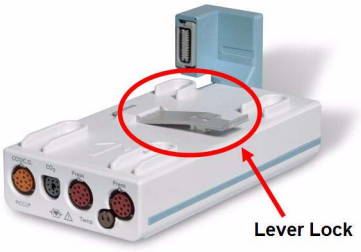
# MMS Extension Parts (M3012A, M3014A, M3015A/B)

Exchange MMS 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 MMS extension into operation.

The part numbers in the following parts table below, are used to order parts from your Philips representative.

## MMS Extension General Support Parts

| Part number | 12NC | Description | Comments |
|---|---|---|---|
| M3014-64200 | 451261012731 | MS_RCO2 MMS Ext Clips+Springs, 10ea | Old top housing |
| M3012-64600 | 451261012721 | MS_HMS MMS Ext. Lever Locks (5ea) | Grey lever release mechnanism |
| 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 Mounting Pin | |


## MMS Extension Front Bezels and Accessories

| Part number | 12NC | Description |
|---|---|---|
| **M3012A BEZELS** | | |
| 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 |
| **M3012A Misc** | | |
| 14454A | 453563057651 | I.V POLE MOUNT |
| **M3014A Bezels** | | |
| 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 |
| **Canpnograhpy Sensors** | | |
| M2741-68000 | 451261011291 | SNSR M2741A Sidestream Sensor |
| M2501-68000 | 451261006391 | MS_MCO2 M2501A Mainstream Sensor |
| M2741-60000 | 451261011731 | Mounting Bracket Replacement |
| **M3015A Bezel** | | |
| 451261024601 | 451261024601 | MS_SCO2 Bezel CO2 w P/T Eng. Text |

| Part number | 12NC | Description |
|---|---|---|
| 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 |
| **M3015B Bezel** | | |
| 453564270051 | 453564270051 | MS_SCO2 Bezel Symbols M3015B CO2. P, P, T |
| 453564270061 | 453564270061 | MS_SCO2 Bezel Text M3015B CO2. P, P, T |
| **Repair Kit M3015A** | | |
| M3015-29303 | 453563332261 | MS_SCO2 OEM M3015A pump kit +C02scrb |

## 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 MMS Extension.

| Part number | 12NC | Description |
|---|---|---|
| **M3012A** | **862111** | **Hemodynamic Measurement Server Extension** |
| M3012-6801A | 451261000201 | MS_HMS OEM EXCH.UNIT ENGLISH (#C00) |
| M3012-6831A | 451261000341 | MS_HMS OEM EXCH.UNIT ENGLISH (#C05) |
| M3012-6861A | 451261000491 | MS_HMS OEM EXCH.UNIT ENGLISH (#C10) |
| **M3014A** | **862187** | **Capnography extension** |
| M3014-6801A | 451261009281 | MS_RCO2 OEM EXCH.UNIT ENGLISH (#C00) |
| M3014-6831A | 451261009311 | MS_RCO2 OEM EXCH.UNIT ENGLISH (#C05) |
| M3014-6861A | 451261009601 | MS_RCO2 OEM EXCH.UNIT ENGLISH (#C10) |
| M3014-6891A | 451261009461 | MS_RCO2 OEM EXCH.UNIT ENGLISH (#C07) |
| **M3015A** | **862393** | **Microstream CO2 Extension** |
| M3015-6802A | 451261005311 | MS_SCO2 M3015A Unit with P/T (HW Rev. B) |
| 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) |
| 453564293891 | 453564293891 | MS_SCO2 Exch. Unit without P/T (HW Rev. C) |
| 453564312801 | 453564312801 | MS_SCO2 Housing Bottom HW Rev A,B |
| 453564312871 | 453564312871 | MS_SCO2 Top Cover Assy HW Rev C |
| **M3015B*** | **865377** | **Microstream CO2 Extension** |
| 453564270041 | 453564270041 | MS_SCO2 M3015B with CO2,P, P and T |
| 453564312871 | 453564312871 | MS_SCO2 Top Cover Assy HW Rev C |

* Requires SW Rev. H or higher

# IntelliVue X2 Part Numbers

Please refer to the IntelliVue X2 Service Guide for IntelliVue X2 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 |
| 5040-4249 | 453563099411 | PLAST Housing Module Rear new color |
| 5040-4250 | 453563099421 | PLAST Housing Module Front new color |
| 5040-4247 | 453563099401 | PLAST Snap Lock (CV color) |

## M1006B Invasive Blood Pressure Module

| Part number | 12NC | Description |
|---|---|---|
| M1006-69601 | 453563463061 | M_PRS IP Mod multilanguage |
| M1006-69603 | 453563462811 | M_PRS IP Mod German |
| M1006-69604 | 453563461771 | M_PRS IP Mod Dutch |
| M1006-69605 | 453563461781 | M_PRS IP ModSpanish |
| M1006-69607 | 453563461791 | M_PRS IP Mod Norwegian |
| M1006-69608 | 453563461731 | M_PRS IP Mod Swedish |
| M1006-69609 | 453563461741 | M_PRS IP Mod Finnish |
| M1006-69610 | 453563461751 | M_PRS IP Mod Japanese |
| M1006-69613 | 453563461761 | M_PRS IP Mod Chinese |
| M1006-69614 | 453563461271 | M_PRS IP Mod Portugese |
| M1006-69615 | 453563461281 | M_PRS IP Mod Greek |
| M1006-69619 | 453563461291 | M_PRS IP Mod Czech |
| M1006-69620 | 453563461301 | M_PRS IP Mod Polish |
| **Front Housings** | | |
| M1006-60201 | 453563462101 | M_PRS Frt Housg Assy Press, ENG |
| M1006-60203 | 453563461551 | M_PRS Frt Housg Assy Press, GER |
| M1006-60204 | 453563461581 | M_PRS Frt Housg Assy Press, DUT |
| M1006-60205 | 453563461591 | M_PRS Frt Housg Assy Press, SPA |
| M1006-60207 | 453563461601 | M_PRS Frt Housg Assy Press, NOR |
| M1006-60208 | 453563461611 | M_PRS Frt Housg Assy Press, SWE |
| M1006-60209 | 453563461621 | M_PRS Frt Housg Assy Press, FIN |
| M1006-60210 | 453563461631 | M_PRS Frt Housg Assy Press, JAP |

| Part number | 12NC | Description |
|---|---|---|
| M1006-60213 | 453563461641 | M_PRS Frt Housg Assy Press, PRC |
| M1006-60214 | 453563461651 | M_PRS Frt Housg Assy Press, POR |
| M1006-60215 | 453563461661 | M_PRS Frt Housg Assy Press, GRK |
| M1006-60219 | 453563461671 | M_PRS Frt Housg Assy Press, CZE |
| M1006-60220 | 453563461681 | M_PRS Frt Housg Assy Press, POL |
| **Modules with analog out** | | |
| M1006-69651 | 453563463071 | M_PRS IP Mod multi, w. Analog-out |
| M1006-69653 | 453563461241 | M_PRS IP Mod German, w. Analog-out |
| M1006-69654 | 453563461251 | M_PRS IP Mod Dutch., w. Analog-out |
| M1006-69655 | 453563461261 | M_PRS IP Mod Spanish, w. Analog-out |
| M1006-69657 | 453563460031 | M_PRS IP Mod Norwegian, w. Analog-out |
| M1006-69658 | 453563460041 | M_PRS IP Mod Swedish, w. Analog-out |
| M1006-69659 | 453563460051 | M_PRS IP Mod Finnish, w. Analog-out |
| M1006-69660 | 453563460061 | M_PRS IP Mod Japanese, w. Analog-out |
| M1006-69663 | 453563459011 | M_PRS IP Mod Simpl. Chin, w. Analog-out |
| M1006-69664 | 453563458321 | M_PRS IP Mod Portugese, w. Analog-out |
| M1006-69665 | 453563459021 | M_PRS IP Mod Greek, w. Analog-out |
| M1006-69669 | 453563459031 | M_PRS IP Mod Czech, w. Analog-out |
| M1006-69670 | 453563459041 | M_PRS IP Mod Polish, w. Analog-out |
| **Front Housings with analog out** | | |
| M1006-60251 | 453563462091 | M_PRS Frt Housg Assy Press C01, ENG |
| M1006-60253 | 453563461691 | M_PRS Frt Housg Assy Press C01, GER |
| M1006-60254 | 453563461701 | M_PRS Frt Housg Assy Press C01, DUT |
| M1006-60255 | 453563461711 | M_PRS Frt Housg Assy Press C01, SPA |
| M1006-60257 | 453563461721 | M_PRS Frt Housg Assy Press C01, NOR |
| M1006-60258 | 453563461821 | M_PRS Frt Housg Assy Press C01, SWE |
| M1006-60259 | 453563461831 | M_PRS Frt Housg Assy Press C01, FIN |
| M1006-60260 | 453563461841 | M_PRS Frt Housg Assy Press C01, JAP |
| M1006-60263 | 453563461851 | M_PRS Frt Housg Assy Press C01, PRC |
| M1006-60264 | 453563461861 | M_PRS Frt Housg Assy Press C01, POR |
| M1006-60265 | 453563461871 | M_PRS Frt Housg Assy Press C01, GRK |
| M1006-60269 | 453563461881 | M_PRS Frt Housg Assy Press C01, CZE |
| M1006-60270 | 453563461891 | M_PRS Frt Housg Assy Press C01, POL |
| **Bezel** | | |
| M1006-42202 | 453563463211 | M_PRS PLAST Bezel Press-Round |
| M1006-42201 | 453563469771 | M_PRS PLAST Bezel Press-Square |

| Part number | 12NC | Description |
|---|---|---|
| **Cables** | | |
| M1006-61689 | 453563225911 | M_PRS CBL ADPTR M1006B#C01 1/4" phone JK |

## 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 |
|---|---|---|
| M1012-69601 | 453563458801 | M_CO Module C.O., ENG |
| M1012-69602 | 453563458761 | M_CO Module C.O., FRC |
| M1012-69603 | 453563458771 | M_CO Module C.O., GER |
| M1012-69605 | 453563458781 | M_CO Module C.O., SPA |
| M1012-69610 | 453563458791 | M_CO Module C.O., JAP |
| M1012-69613 | 453563458831 | M_CO Module C.O., PRC |
| M1012-69615 | 453563460931 | M_CO Module C.O., GRK |
| **Front housing** | | |
| M1012-60201 | 453563462021 | M_CO Frt Housg Assy C.O., ENG |
| M1012-60202 | 453563460161 | M_CO Frt Housg Assy C.O., FRC |
| M1012-60203 | 453563460171 | M_CO Frt Housg Assy C.O., GER |
| M1012-60205 | 453563460181 | M_CO Frt Housg Assy C.O., SPA |
| M1012-60210 | 453563460191 | M_CO Frt Housg Assy C.O., JAP |
| M1012-60213 | 453563460201 | M_CO Frt Housg Assy C.O., PRC |
| M1012-60215 | 453563460211 | M_CO Frt Housg Assy C.O., GRK |
| **Module with Picco** | | |
| M1012-69651 | 453563463011 | M_CO Module C10 PiCCO, ENG |
| M1012-69652 | 453563460941 | M_CO Module C10 PiCCO, FRC |
| M1012-69653 | 453563464731 | M_CO Module C10 PiCCO, GER |
| M1012-69655 | 453563460311 | M_CO Module C10 PiCCO, SPA |

| Part number | 12NC | Description |
|---|---|---|
| M1012-69660 | 453563460321 | M_CO Module C10 PiCCO, JAP |
| M1012-69663 | 453563460331 | M_CO Module C10 PiCCO, PRC |
| M1012-69665 | 453563460341 | M_CO Module C10 PiCCO, GRK |
| **Front housing** | | |
| M1012-60251 | 453563462031 | M_CO Frt Housg Assy C.O. PiCCO, ENG |
| M1012-60252 | 453563460221 | M_CO Frt Housg Assy C.O. PiCCO, FRC |
| M1012-60253 | 453563460141 | M_CO Frt Housg Assy C.O. PiCCO, GER |
| M1012-60255 | 453563460151 | M_CO Frt Housg Assy C.O. PiCCO, SPA |
| M1012-60260 | 453563462051 | M_CO Frt Housg Assy C.O. PiCCO, JAP |
| M1012-60263 | 453563462061 | M_CO Frt Housg Assy C.O. PiCCO, PRC |
| M1012-60265 | 453563462041 | M_CO Frt Housg Assy C.O. PiCCO, GRK |
| **Bezel** | | |
| 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 |
| **Front housing** | | |
| M1014-60201 | 451261014491 | M_SPR Frt Housg Assy Spiro, ENG |
| M1014-60202 | 451261014501 | M_SPR Frt Housg Assy Spiro, SYMBOL |
| **Bezel** | | |
| M1014-42201 | 451261014511 | M_SPR PLAST Bezel Spiro |
| **Misc** | | |
| M1014-64100 | 451261014521 | M_SPR TUBING Leak Test Kit Spiro |

## M1020B Pulse Oximetry Module

| Part number | 12NC | Description |
|---|---|---|
| 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 |
| **OxiMax Compatible Module** | | |
| M1020-69652 | 451261000101 | M_SpO2 M1020B NELLCOR Oxi |

| Part number | 12NC | Description |
|---|---|---|
| M1020-60252 | 451261000121 | M_SpO2 Frt Housg Assy M1020B NELLCOR |
| **Masimo SET Module** | | |
| M1020-69653 | 451261000131 | M_SpO2 OEM M1020B Masimo |
| **Nellcor OxiMax Module** | | |
| 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 |
| M1027-61601 | 453563231141 | M_EEG CBL EEG MODULE TEST DEVICE |
| 1252-2663 | 453563050481 | CONN SPCL PURPOSE 12 MALE CONTACTS |

## M1029A Temperature Module

| Part number | 12NC | Description |
|---|---|---|
| M1029-69601 | 453563459291 | M_TMP Temp Module multilanguage |
| M1029-69609 | 453563460581 | M_TMP Temp Module Finish |
| M1029-69610 | 453563460561 | M_TMP Temp Module Japanese |
| M1029-69613 | 453563460571 | M_TMP Temp ModuleChinese Simpl. |
| M1029-69615 | 453563459891 | M_TMP Temp Module Greek |
| M1029-69619 | 453563459901 | M_TMP Temp Module Czech |
| **Front housing** | | |
| M1029-60201 | 453563461451 | M_TMP Frt Housg Assy Temp, ENG |
| M1029-60209 | 453563462161 | M_TMP Frt Housg Assy Temp, FIN |
| M1029-60210 | 453563462171 | M_TMP Frt Housg Assy Temp, JAP |
| M1029-60213 | 453563462181 | M_TMP Frt Housg Assy Temp, PRC |
| M1029-60215 | 453563462191 | M_TMP Frt Housg Assy Temp, GRK |
| M1029-60219 | 453563462201 | M_TMP Frt Housg Assy Temp, CZE |

| Part number | 12NC | Description |
|---|---|---|
| **Bezel** | | |
| M1029-42201 | 453563463631 | M_TMP PLAST Temp Module Bezel |

## M1116B Thermal Array Recorder Module

| Part number | 12NC | Description |
|---|---|---|
| M1116-68603 | 453563466701 | 2" RECDR ECMS EXCH ENGLISH |
| M1116-68604 | 453563466711 | 2" RECDR ECMS EXCH GERMAN |
| M1116-68605 | 453563466721 | 2" RECDR ECMS EXCH SPANISH |
| M1116-68606 | 453563466731 | 2" RECDR ECMS EXCH FRENCH |
| M1116-68607 | 453563466741 | 2" RECDR ECMS EXCH SWEDISH |
| M1116-68608 | 453563466751 | 2" RECDR ECMS EXCH CHINESE |
| M1116-68609 | 453563466761 | 2" RECDR ECMS EXCH JAPANESE |
| M1116-68610 | 453563466771 | 2" RECDR ECMS EXCH ITALIAN |
| M1116-68620 | 453563466781 | 2" RECORDER ECMS EXCH FINNISH |
| M1116-68621 | 453563466791 | 2" RECORDER ECMS EXCH PORT |
| **Front housing** | | |
| M1116-60203 | 453563462301 | PLAST Front Housing English |
| M1116-60204 | 453563489221 | PLAST Front Housing German |
| M1116-60205 | 453563462311 | PLAST Front Housing Spanish |
| M1116-60206 | 453563462321 | PLAST Front Housing French |
| M1116-60207 | 453563489231 | PLAST Front Housing Swedish |
| M1116-60208 | 453563462331 | PLAST Front Housing Chinese |
| M1116-60209 | 453563462341 | PLAST Front Housing Japanese |
| M1116-60210 | 453563462351 | PLAST Front Housing Italian |
| M1116-60220 | 453563489241 | PLAST Front Housing Finnish |
| M1116-60221 | 453563489251 | PLAST Front Housing Assembly Portuguese |
| M1116-60301 | 453563243911 | HSG Rear DBL (CV COLOR |
| M1116-80040 | 453563244171 | PLAST Left Half Chassis |
| M1116-80230 | 453564017111 | PLAST Right Half Chassis |
| 5040-4255 | 453563099431 | PLAST Housing Double Module |
| 5040-4256 | 453563099441 | PLAST Housing Double Module |
| M1116-40041 | 453563243811 | Housing Top (CV color) |
| M1116-40230 | 453563243851 | PLAST Front Housing English |
| M1116-40240 | 453563243861 | Front Door (CV color) |
| 1500-0802 | 453563059491 | MECH Flat Belt |
| 1810-1339 | 453563064911 | ASSY Thermal Print Head |

| Part number | 12NC | Description |
|---|---|---|
| M1116-00030 | 453563243781 | MET Spring Leaf |
| M1116-40060 | 453563243821 | MACH Timing Pulley |
| M1116-40070 | 453563243831 | MECHASY Drive Roller |
| M1116-40095 | 453563243841 | SWITCH CAP EXTENDER |
| M1116-41050 | 453563243871 | STAMPING Buff Cam |
| M1116-60200 | 453563243881 | EMCH Drive Motor |
| M1116-60201 | 453563243891 | Printhead Cleaning Kit |
| M1116-83002 | 453563244191 | LBL Inside Door |
| 0515-0890 | 453563480701 | SCRW MACH M3 X 0.5 6MM-LG 90-DEG-FLH-HD |
| M1001-60620 | 453563224011 | M_ECG PLAST RECORDER FRONT ASSY, BLANK |

## 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 |
| **Support Parts** | | |
| 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 |

## 865383 NMT Module

| Part number | 12NC | Description |
|---|---|---|
| 453564279141 | 453564279141 | M_NMT Module NMT, US |
| 453564279161 | 453564279161 | M_NMT Module NMT, Intl |
| 453564257851 | 453564257851 | M_NMT PLAST Bezel |
| 453564279181 | 453564279181 | M_NMT Frt Housg Assy NMT, US |
| 453564279191 | 453564279191 | M_NMT Frt Housg Assy NMT, Intl |
| 989803174581 | 989803174581 | CBL NMT Patient Cable* |

* Not orderable via SPS. Must be ordered through Supplies.

# Smart Battery Charger Part Numbers

| Part number | 12NC | Description |
|---|---|---|
| M8043-68000 | 453563498911 | BAT Smart Battery Conditioner (LG1480) |
| M8043-60010 | 451261001281 | EMCH Repl Kit 2 Air-Fan+2 Filter-Mats |
| M8043-60011 | 451261001291 | FLTR Repl. Kit: 2 Filter-Mats |

# External Display Part Numbers

| Part number | 12NC | Description |
|---|---|---|
| **865299** | **865299** | **19 in. TFT Touch (S)XGA Display** |
| 453564116741 | 453564116741 | ASSY-PWR - E539821 Power Brick - 12V |
| 453564192181 | 453564192181 | IV DSPL 19" Medical Grade w Touch 865299 |
| M8031-64001 | 451261001931 | IV ASSY Pwr Supply Holder 15”/19” displ |

[1] Must be ordered together with 453564192181 IV DSPL 19" Medical Grade w Touch 865299

# 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) |

| Part number | 12NC | Description |
|---|---|---|
| 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 |
| 453564127771 | 453564127771 | CBL Cable AY. ScvO2 |
| M1012-61601 | 453563227731 | M_CO CONN Test Adapter Cardiac Output |
| 453564331451 | 453564331451 | CBL NMT safety Test |

**Table 6 Capnography - Respironics Mainstream**

| Part number | 12NC | Description |
|---|---|---|
| M2506A | | GAS Verification Gas |
| M2505A | | GAS CYLINDER REGULATOR |

**Table 7 Capnography - Respironics Sidestream**

| Part number | 12NC | Description |
|---|---|---|
| M2267A | 989803106081 | Calibration Regulator |
| 13907A | 989803100361 | Calibration Tube Assembly |
| M1026-60144 | 453563230731 | M_AGM Electronic Mass FlowMeter |
| 453564178121 | 453564178121 | M_AGM Flowmeter TSI |
| M2506A | | GAS Verification Gas |
| M2776A | | Straight Sample Line |

**Table 8 Capnography - Microstream Oridion**

| Part number | 12NC | Description |
|---|---|---|
| M1026-60144 | 453563230731 | M_AGM Electronic Mass FlowMeter |
| 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 |
| M1013-64002 | 451261014851 | M_G1 IV G1/G5 Leakage Test Kit (only required for leakage test without M1026-60144 flowmeter) |

# 6 Parts

7

# Installation Instructions

The information contained in this chapter should enable the MX400/450/500/550 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 should be carried out by qualified service personnel, either by the hospital's biomedical department, or by Philips Support.

The monitor is suitable for use in all medically used rooms which fulfill the requirements regarding electrical installation according to IEC60364-7-710 "Requirements for special installations or locations- Medical locations, or corresponding local regulations.

For mechanical and electrical installation, you need technically qualified personnel with a knowledge of english. Additionally, for monitor configuration, you need clinically qualified personnel with a knowledge of the use environment.

**As the first step in preparing the monitor for use, follow the installation instructions given in this chapter.**

## Electromagnetic Emissions

The monitor is suitable for use in the electromagnetic environment specified in the table below. You must ensure that it is used in such an environment.

| Emissions test | Compliance | Avoiding Electromagnetic Interference |
|---|---|---|
| Radio Frequency (RF) emissions | Group 1 | The monitor uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment |
| RF emissions CISPR 11 | Class A | The monitor is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes |
| Harmonic emissions IEC 61000-3-2 | n/a | |
| Voltage fluctuations IEC 61000-3-3 | n/a | |

**WARNING**

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

# Installation Checklist

Use this checklist to document your installation. Please file this installation record

| Step | Task | Check Box when Task Done |
|---|---|---|
| 1 | Perform initial inspection of delivery, unpack and check the shipment | o |
| 2 | Mount the monitor as appropriate for your installation | o |
| 3 | Connect the monitor to AC mains using the supplied power cord | o |
| 4 | Perform Visual, Power On and Functional test blocks | o |
| 5 | Perform Safety Tests, if required by local laws and regulations | o |
| 6 | Load paper into the recorder, if present | o |
| 7 | Check/set the time and date | o |
| 8 | Check that the country-specific default settings are appropriate | o |
| 9 | Perform System Test as necessary | o |

# 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:

- MMS and user manuals
- Parameter modules
- MMS Extensions and accessories

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* 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* section 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.

### Repackaging for Shipment or Storage

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

# Installing the MX400/450/500/550 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

- Every type of compatible mounting solution is delivered with a complete set of mounting hardware and instructions. Refer to 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).

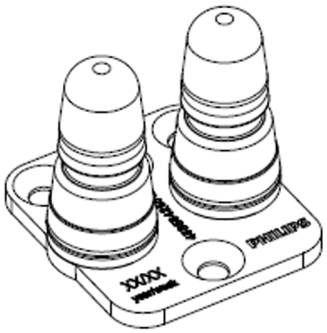
**WARNING**

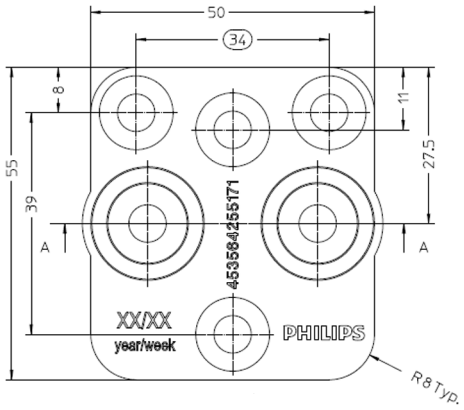
- It is the customer's responsibility to have the attachment of the mounting hardware to the ceiling, wall, or mounting rail and the construction of the ceiling, wall, or mounting rail evaluated for structural integrity and compliance with all local, state and any other required codes by a registered,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

Please 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.

For instructions on how to mount the monitor using the Quick Mount table mount refer to the Assembly Instructions delivered with the mounting kit M8000-64100 or 453564239731.

An alternative mounting solution is the Fix Mount, which 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.



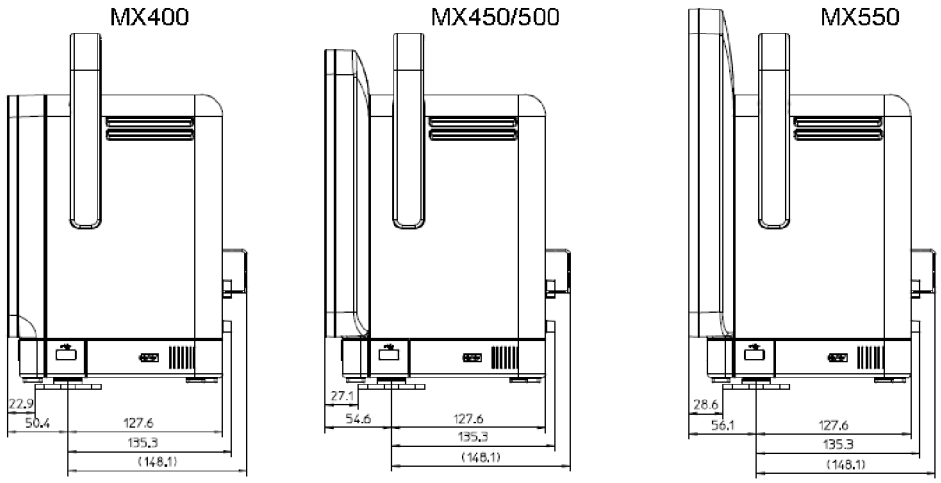
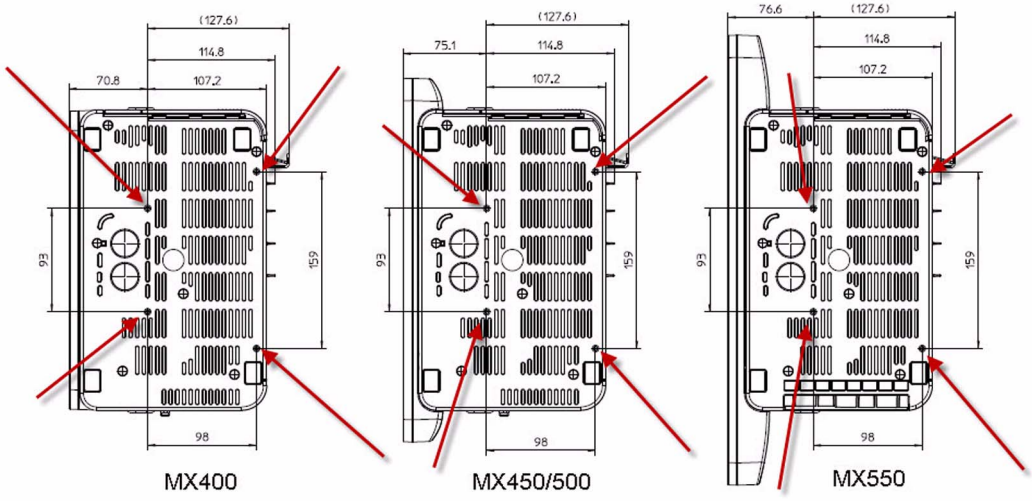



*Table Mount (453564239731)*




*Position of Fix Mount*

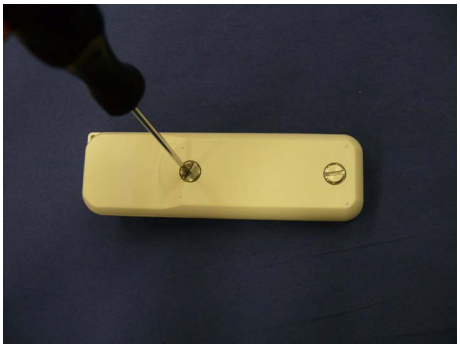
The Quick Mount is optional, the Fix Mount solution is shipped as standard.

# Installing the Wired Remote Control

The remote control comes with a cradle and USB cable.

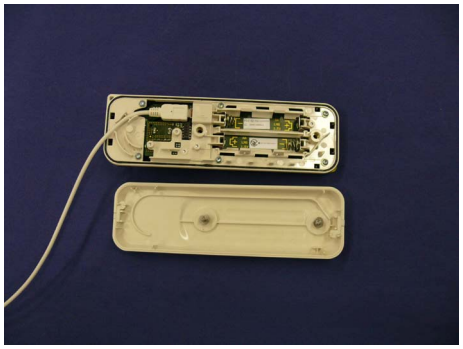
To install the remote control:

1 Remove the two screws on the back of the remote control.

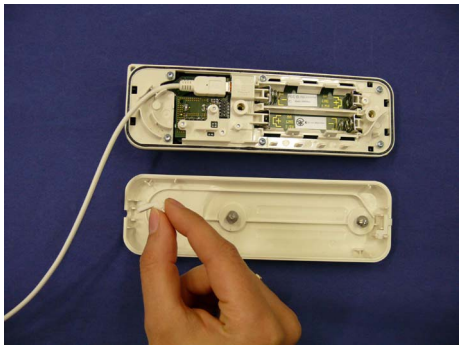
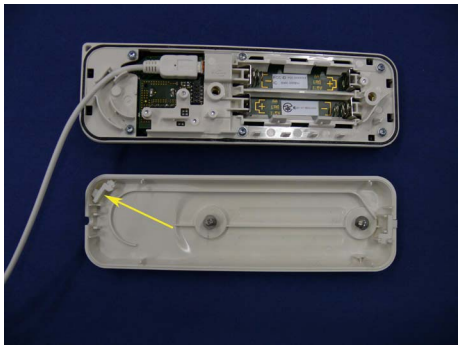


2 There are two ways to install the USB cable - at the top of the remote control or at the bottom. If you want to install the cable at the bottom of the remote control, proceed to step 3. To install the cable at the top of the remote control:

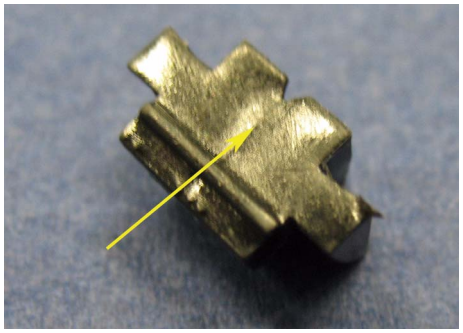
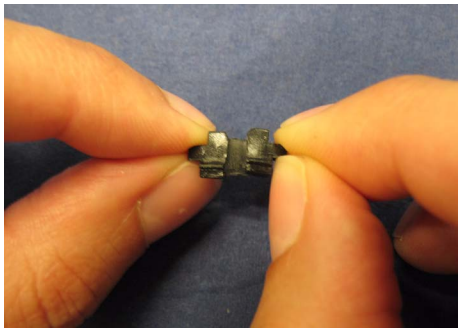
   a. Plug the USB cable and lead it through the remote control housing as shown below.



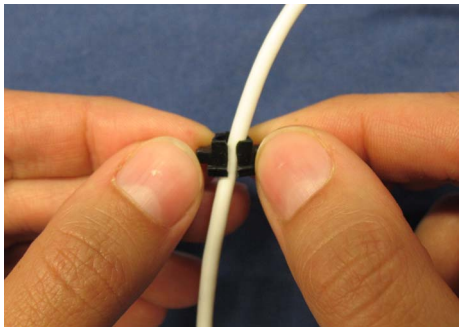
b. Remove the plastic cover from the top of the remote control rear housing and reinsert it in the corner of the housing as shown below.

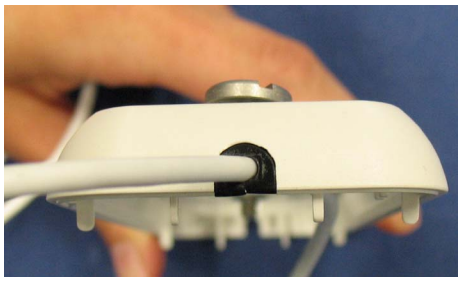
c. Break open the rubber seal for the USB cable at the perforation as shown below.

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.

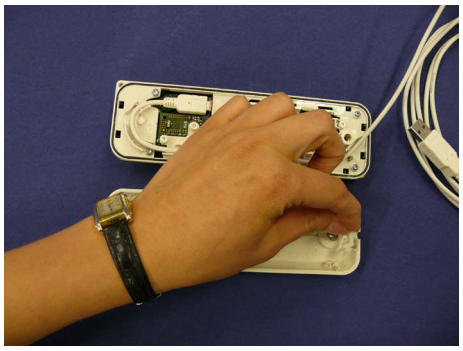
a. Put the housing of the remote control back together and reinsert the screws.

b. Perform a functional test to make sure the remote control is functioning correctly.

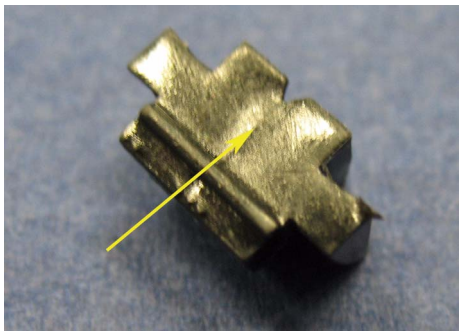
3 To install the cable at the bottom of the remote control:

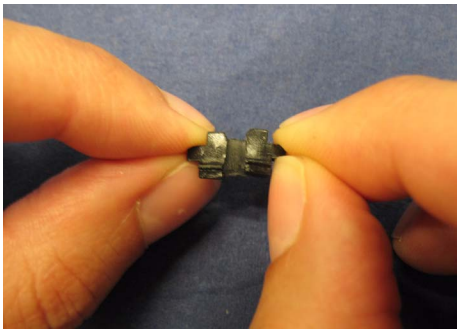
a. Plug the USB cable and lead it through the remote control housing as shown below.

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.

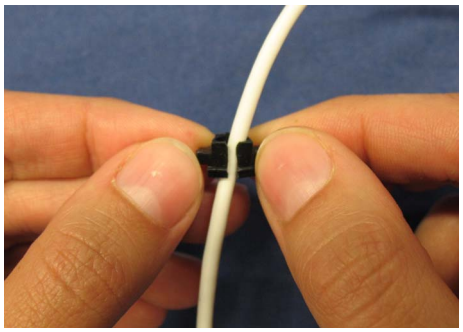


c. Break open the rubber seal for the USB cable at the perforation as shown below.

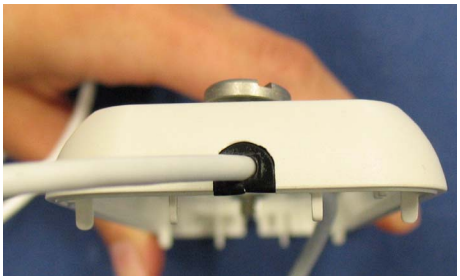




d. Insert the USB cable into the rubber seal.



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.

a. Put the housing of the remote control back together and reinsert the screws.

b. Perform a functional test to make sure the remote control is functioning correctly.

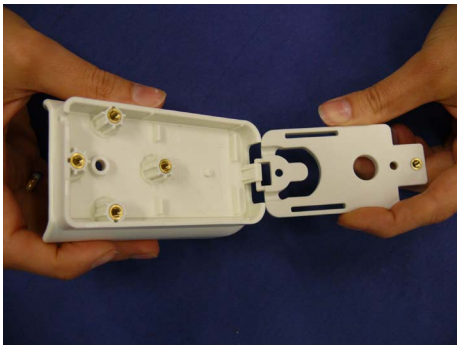
## Mounting the Wired Remote Control

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.



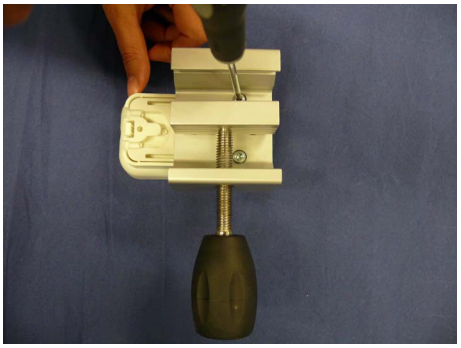
3 Insert the USB cable into the holder on the back plate at the desired length.

4 Screw the holder back plate to a wall and then reattach the holder to the back plate.

To mount the remote control using the Universal Mounting Clamp:

1 Make sure 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

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.

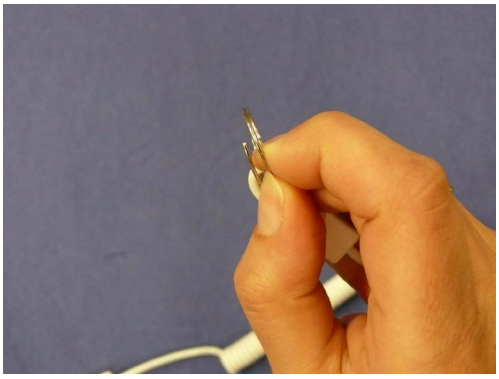
## Wireless Remote Control Assignment Rules

- Only one remote control can be assigned to a monitor at a time. If you want to assign another remote control, you must unassign the remote control which is already assigned first.
- If you switch from wireless remote control to USB connected remote control operation with the same remote control, the assignment to the monitor will be lost. If you switch back to wireless remote control operation you will have to reassign the remote control.
- 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

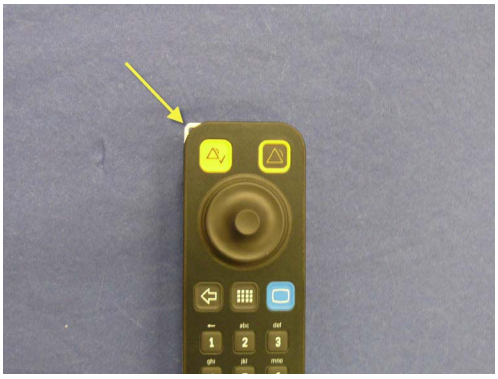
## Installing the Tethering Cable

To attach the tethering cable to a remote control:

1 Pull apart the ring on one end of the tethering cable.



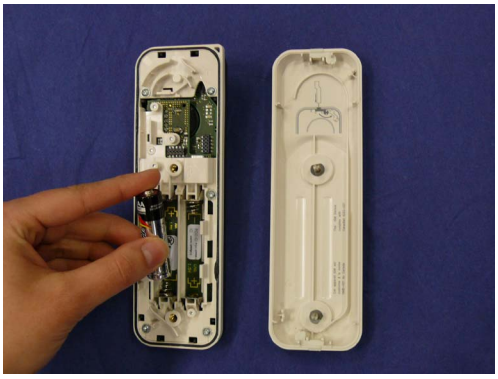
2 Insert the end of the metal ring spiral into the hole at the top left corner of the remote control.

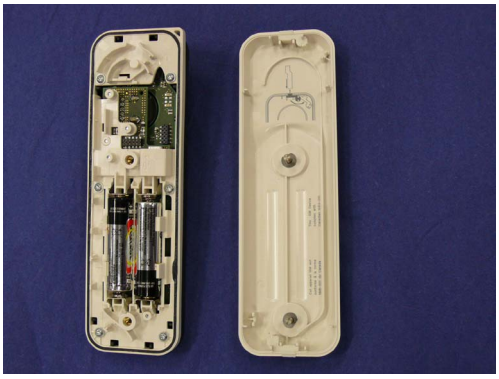


## Exchanging the Remote Control Battery

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 make sure the remote control is functioning correctly.

# Connecting the Monitor to AC Mains

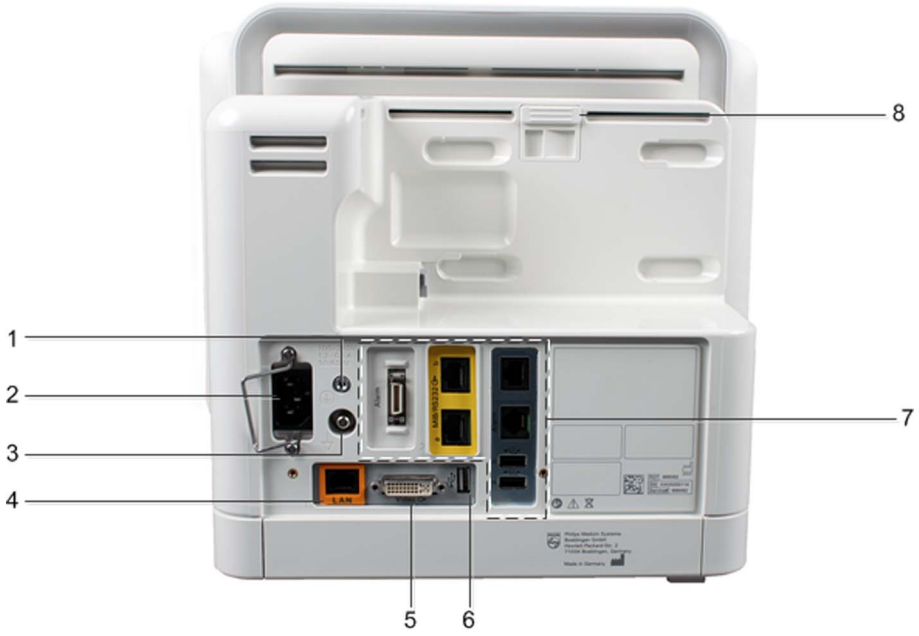
The monitor has a wide-range power supply that allows you to operate the monitor from an AC (alternating current) power source of 100 V to 240 V (± 10%) and 50/60 Hz (± 5%).

**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 unearthed AC mains socket.
- Do not use AC mains extension cords or multiple portable socket-outlets. If a multiple portable socket-outlet without an approved isolation transformer is used, the interruption of its protective earthing may result in enclosure leakage currents equal to the sum of the individual earth leakage currents, so exceeding allowable limits.
- Do not connect any devices that are not supported as part of a system.
- Any non-medical device placed and operated in the patient's vicinity must be powered via an approved isolation transformer that ensures mechanical fixing of the power cords and covering of any unused power outlets.

# Connections

The following figure shows the cable and interface board connections:




| | |
|---|---|
| 1 | Protective earth screw hole |
| 2 | AC power input with clamp |
| 3 | Equipotential ground connector |
| 4 | Wired network connector (color-coded in orange) |
| 5 | Video out connector (digital/analog) |
| 6 | USB rear connector (for remote control, keyboard, pointing devices, printer) |
| 7 | Optional interfaces |
| 8 | Release switch for connected measurement modules |

## Optional Interfaces

| Optional Interface | Description |
|---|---|
|  | Flexible nurse call interface card |
|  | Dual medical information bus (MIB) RS232 Interface card (color-coded yellow) |
|  | IntelliBridge EC10 interface board (color-coded dark gray) |
| **Old Labeling**<br>  <br>**New Labeling**<br>  | Advanced system interface:<br>Single RS232/5V Interface card<br>Nurse call<br>Additional USB slots |

## Connection of Devices via the RS232/5V Interface or MIB/RS232 I/O Board

The configuration of a specific 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 RS232 port select **Main Setup** then **Hardware** then **Interfaces.** You can configure **GM**, **Data Out**, **Touch 1** or **Touch 2** to the RS232 port.

**Data Ou**t can be configured up to two times (on two or more RS232 interfaces). Note that only one RS232 port configured to **Data Out** (i.e. the first one to receive a request) provides wave export. The other MIB/RS232 port configured to **Data Out** will only export numerics. If the RS232/5V interface is used for Data Out, a cross-over cable is required.

**GM** can only be configured **once** to an RS232 port.

**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.

# Connection of USB Devices

The USB ports support the following USB devices:

- printer (restrictions apply. See “Compatible Printers” on page 259 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.
- A remote control is treated as a keyboard.

**CAUTION**

The USB ports do not provide an electrical separation. When connecting a USB device which uses an additional power supply e.g. printer, a separation device according to EN/IEC 60601-1-1 is required. After installation a system test is required to ensure that the resulting equipment leakage current does not exceed the limits of EN/IEC 60601-1-1. For detailed information see the Testing and Maintenance chapter.

### Compatible Printers

Printers connected to the USB port of the monitor need to have 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 that 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 needs to be disabled. For further details on how to disable the "HP Smart Install" feature, please refer to the documentation which ships with the printer. After disabling the "HP Smart Install" feature, the printer needs to 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. We recommend testing the functionality of any printer before installation.
- Printing a report on both sides of a page is not supported.

### Configuring the USB Interface for Use with a Programmable Barcode Scanner

**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.

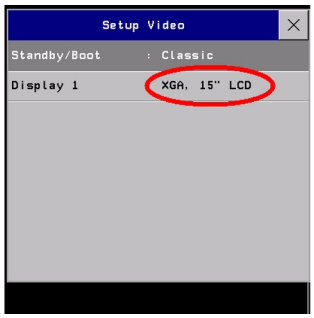
## Installing Remote Devices

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 you make to the hardware settings configuration are automatically stored, there is no need to save them in an extra step. Hardware settings must be entered for each monitor individually, they are stored in the monitor, and they are not cloned. To enter the hardware settings menu, select **Main Setup** -> **Hardware**.
- Keyboard - this setting allows you to select the language of the keyboard connected via USB. See USB Keyboard/Mouse *section* 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  section in this chapter for details.

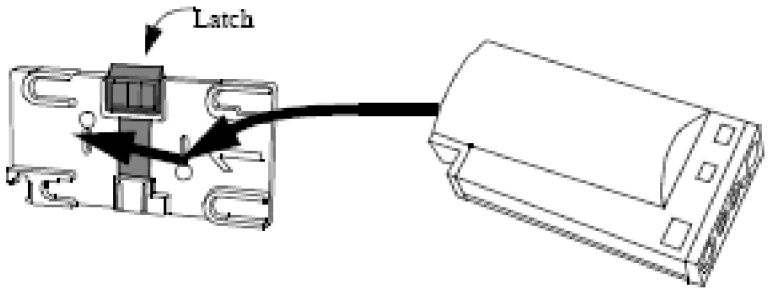
## Multi-Measurement Module

## Attaching the MMS to a Mount

1 Make sure the Measurement Server is oriented correctly relative to the mount (see the picture below).

2 Place the Measurement Server 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 Measurement Server forward until it clicks into place.




## Detaching the Measurement Server from a Mount

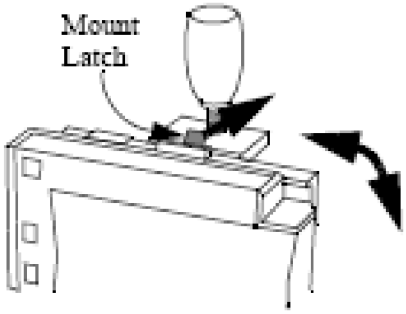
1 Press and hold the latch (in the middle at the top of the mount) away from the Measurement Server.

2 Slide the Measurement Server off the mount in the direction of the measurement connectors.

## Positioning the Measurement Server on a Clamp Mount

If you have your Measurement Server 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 Measurement Server and mount until you get it to the position you want.

2 Release the mount latch, and make sure it is clicked into one of the four slots on the back of the mount.

## Connections

The cable specifications and part numbers for through wall solutions of the M3001A 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 measurement server 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.

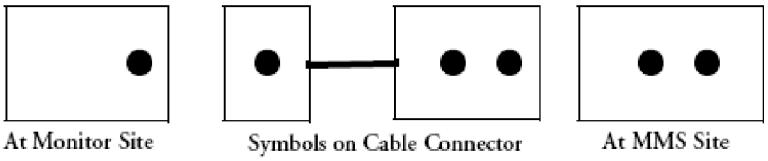
1 Draw the MSL cable through the wall from the site of the monitor to the site of the measurement server.

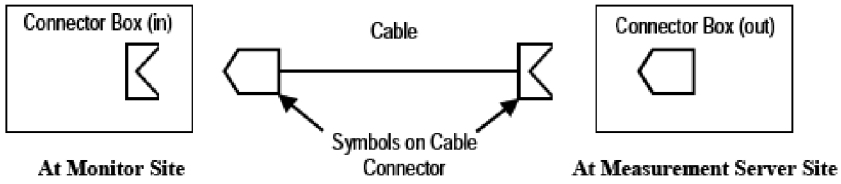
Each MSL face plate kit contains two connector boxes; one in-going and one out-going. (The US version contains an additional rectangular wall-mounting plate).

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:  is connector box (in) and must be placed at the monitor site.

Symbol:  is connector box (out) and must be placed at the measurement server site.

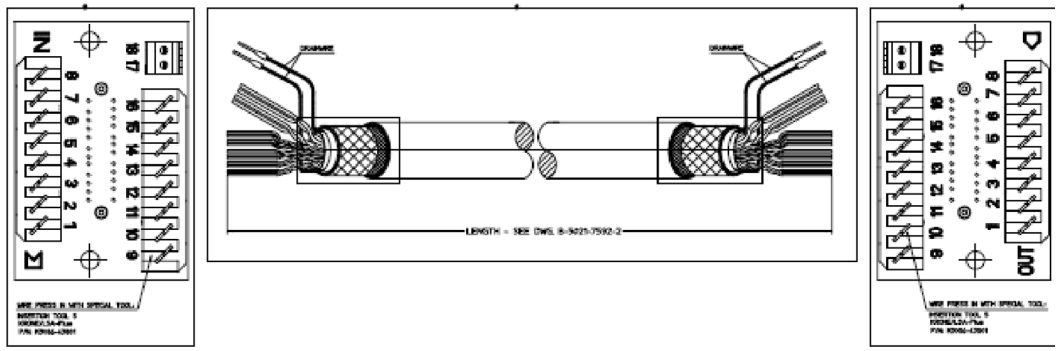
The correct connector cable (M3081-61601, M3081-61602 or M3081-61603) has the opposite symbol:

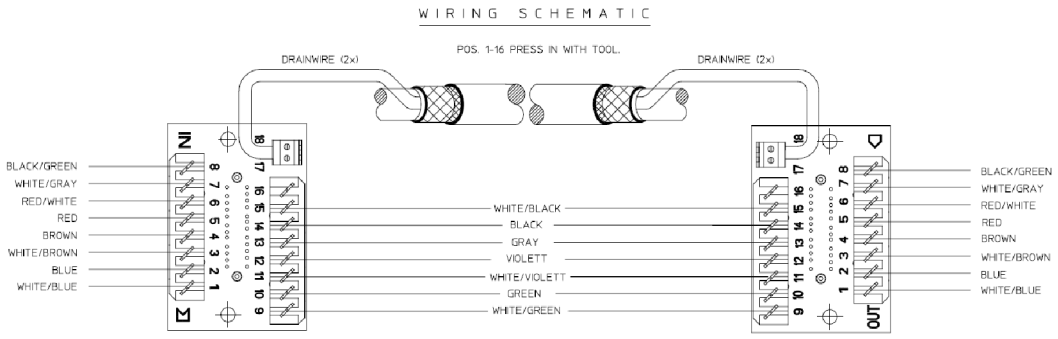
2 Detach the PCB assembly (in/out) from the metallic mounting flange.

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.

**NOTE**

The Insertion Tool should be set to cutting mode on.






*Wiring Schematic*

1 Use a small screwdriver to connect the two drain wires to the PCB, see the wiring schematic in .

2 Slide the PCB back on to the metallic mounting flange.

3 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.

4 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.

5 Connect the monitor and the measurement server to the wall installation.

6 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

# Philips Clinical Network (Wired)

Installation of the Philips Clinical Network should be performed by Philips service personnel. Use unshielded twisted pair (UTP) cables for installation of the clinical network. Refer to the installation instructions in the M3185A Installation Manual for further details.

# Philips Clinical Network (Wireless)

Refer to the installation instructions in the M3185A Philips Clinical Network Installation Manual for network installation instructions when using the wireless ethernet adapter. For instructions on connecting the wireless ethernet adapter, please refer to the instruction sheet shipped with the mounting device for the adapter.

**NOTE**

The wireless ethernet adapter is not waterproof and therefore should not be installed anywhere where liquid could spill onto it.

Refer to the IntelliVue 802.11 a/g Infrastructure Installation and Configuration Guide for network installation instructions when using the IntelliVue 802.11 Bedside Adapter. For instructions on connecting the IntelliVue 802.11 Bedside Adapter, please refer to the Hardware Upgrade Guide for your bedside monitor.

# 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 865241/865242 #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 way the coordination process is executed as of today, it will need to be repeated twice for the M4840A system; once for the 1395-1400 MHz band, and then again for the 1427-1432 MHz band, both of which are used concurrently by the Philips product. There is a separate fee for each coordination request, which varies between $250 and $2000, depending upon the number of transmitting devices used and the band/s of operation. Coordination is executed by a company named Comsearch, on behalf of ASHE.

To fill in the frequency coordination forms, you'll need to know the following:

- 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* 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: 866060/866062/86606064/866066 #J45 IntelliVue Instrument Telemetry adapter used with 866060 (MX400), 866062 (MX450), 866064 (MX500) or 866066 (MX550)
- 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

Please refer to 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 a 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.

Refer to 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 (except for the US). 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 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.

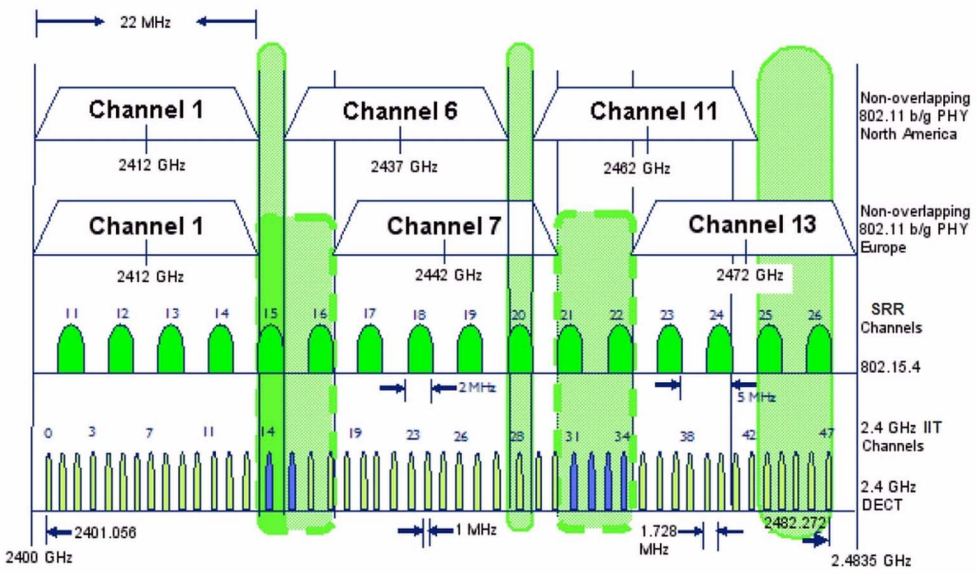
3 Determine SRR groups. An SRR group may contain a maximum of two monitors which share the same SRR channel. Monitors belonging to an SRR group should be located close to each other.

4 For each SRR group, assign the same SRR channel to all monitors belonging to a group.

**SRR Channel Restrictions with WLAN, IIT, and DECT Devices**

The following table and graphic show the restrictions of WLAN, IIT, or DECT Device 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 date 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, IIT, and DECT Devices. For example, if the site uses European 802.11 channel 1 for WLAN and has no IIT or DECT devices 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 we recommend that you use 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.

# ECG Out Functionality

## Connections

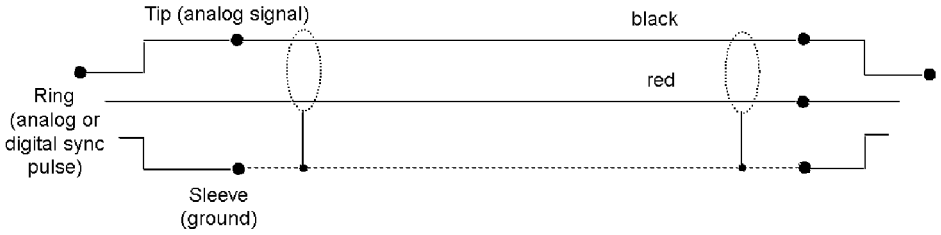
*ECG Out Connector*

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.

# Computer Client or Hospital Network connected to MX400/450/500/550 Internal LAN

The Computer Client and network infrastructure devices typically are not classified as medical devices and must be located outside the patient vicinity. The patient vicinity is defined as an area within 5ft (1.5m) of the perimeter of the patient's bed or within 8ft (2.5m) of the floor.

If the Computer Client is installed in the patient vicinity and connected to the monitoring device, it must be correctly isolated from the mains power supply by an isolation transformer.

If the Computer Client is installed in the patient vicinity and a network switch or hub is used to connect it to a monitoring device, it must be correctly isolated from the mains power supply by an isolation transformer.

**WARNING**

All external devices in the patient vicinity must comply with IEC 60601-1:1988 +A1:1991 +A2:1995 / EN 60601-1:1990+A1:1993 +A2:1995 (Ed.2) or IEC 60601-1:2005/EN 60601-1:2006+A1:2012 (Ed.3) including any national deviations. This applies also to all signal connections, entering the patient vicinity. Additional safety equipment, e.g. isolation transformers might be used.

The installation procedures e.g. for electrical connections as documented in the Instructions for Use must be strictly followed.

# 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 that the configuration meets your requirements, especially patient category, alarm limits and paced setting.

If you need 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 be sure to 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, we recommend that 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.

## Setting Altitude and Line Frequency

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.

## 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 configuration guide for further details.

## Setup Network

**Main Setup** => **Network** => **Setup Network**

| Network Setup | |
|---|---|
| IP Config | BOOTP |
| Dynamic IP | Mandatory |
| IP Address | 0.0.0.0 |
| Subnet Mask | 0.0.0.0 |
| Default Gateway | 0.0.0.0 |
| IGMP | Off |
| CI Mode | Broadcast |
| CI Address | 0.0.0.0 |
| CI TTL | 1 |
| QoS State | Off |
| QoS Level | 0 |
| Directory Mode | Broadcast |
| Directory Addr | 0.0.0.0 |

The Setup Network Menu allows you to configure the following items:

**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 announce 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**. Defaults to **Off**.

**QoS Level** The QoS Level (DSCP CoS value) can be entered between 0 and 7. Defaults to 0.

**Directory Mode** The mode in which Directory Service requests are received (Broadcast, Multicast)

**Directory Addr Mode** Multicast address for Directory Service requests (if Directory Mode set to Multicast).

**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.

## Network Status Window

The network status window provides network status information which can be used for troubleshooting purposes.

**Main Setup** => **Network** => **Network Status**

| Network Status | |
|---|---|
| Network Type | LAN |
| MAC Address | 0030 D301 376B |
| MAC IIT | 0097 3498 87EC |
| RF Access Code | 2 |
| IP Config | BOOTP |
| Dynamic IP | Mandatory |
| IP Address | 172.31.10.03 |
| Subnet Mask | 255.255.0.0 |
| Default Gateway | 172.31.20.10 |
| BOOTP Server | 172.31.10.165 |
| Server IP | 172.31.10.200 |
| IPv6 Address | FE80::0209:FBFF:FE6E:D163 |
| IGMP | Off |
| CI Mode | Broadcast |
| CI Address | 172.31.255.255 |
| CI TTL | 1 |
| QoS State | Off |
| QoS Level | 0 |
| Directory Mode | Broadcast |
| Directory Addr. | 172.31.255.255 |

**Network Type** Displays the current active network type (**LAN, IIT, WLAN**)

**IP Config** Shows the IP Configuration mode. 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** the bedside monitor will issue an INOP if an IPv4 address could not be acquired.

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.

## 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, 802.11g, Auto or None. None indicates that no wireless connection should be estab-lished 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.

NOTE

For MX400/450, only WEP Key Index 1 can be used. WEP Key Indices 2-4 can be configured, but will be ignored.

**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 use 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.

**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.

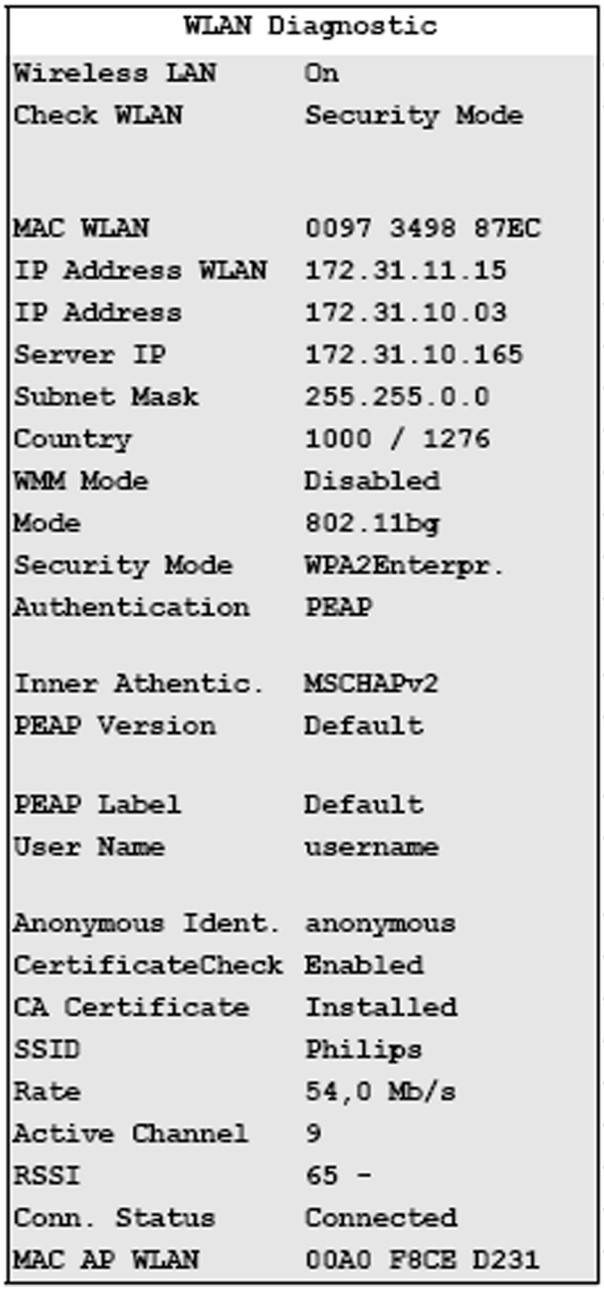
**CA Certificate** Indicates that the certificate of the Certification Authority (CA) has been installed on the device. The CA certificate is the root certificate of the server delivered certificate chain. The certifcate chain ends with the server certificate, which contains the key material used to 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.

**Country** The configured country code and the dynamically chosen country code based on access point setting.

**WMM Mode** The WMM mode being used.

**RSSI** Received Signal Strength Indicator.

**Conn. Status** Current wireless LAN connection status (**None, Scanning, Authenticating, Authenticated Shared, Associating, Connected, Link Problem)**.

**Active Channel** Current radio channel.

**Rate** Currently selected transmission rate (adapts dynamically based on wireless signal propagation behavior).

**MAC AP WLAN** The MAC address of the access point to which a connection has been established.

## 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 Coutry 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

## 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.

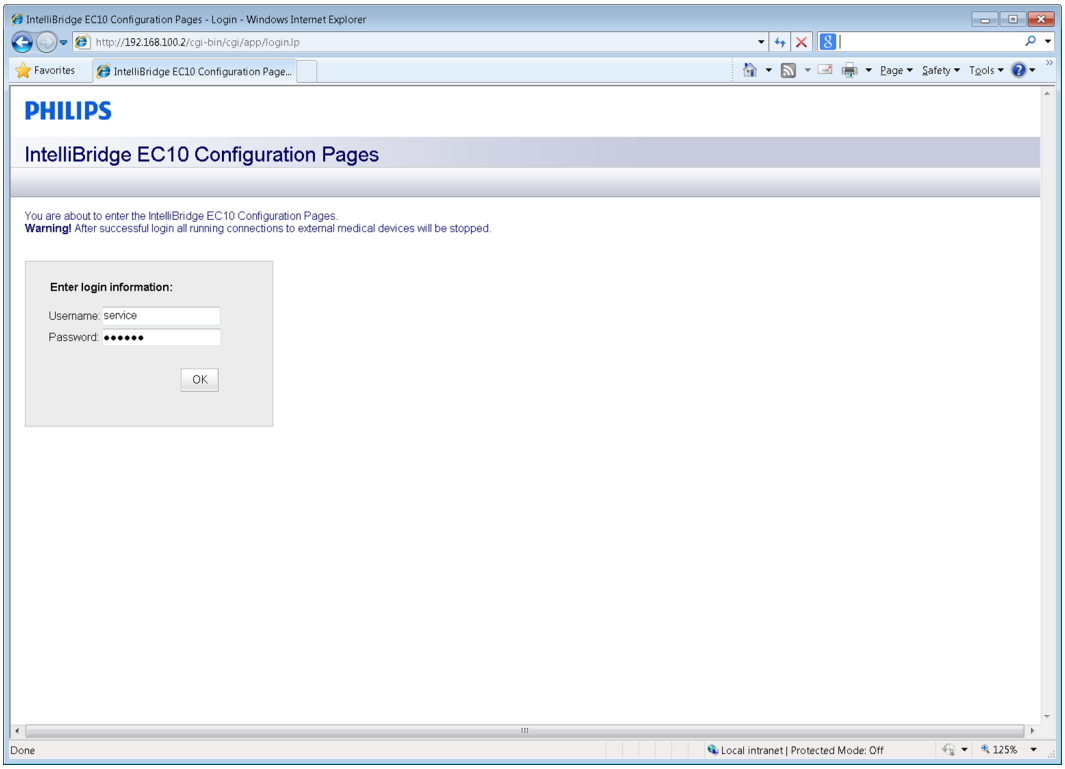
2 Make sure that the TCP/IP settings of your Local Area Connection Properties on the Service PC are set to **"obtain IP Address automatically"**.

3 Open your Internet Browser. Internet Explorer 8 and Firefox 3.5 are supported. Newer versions of these 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:

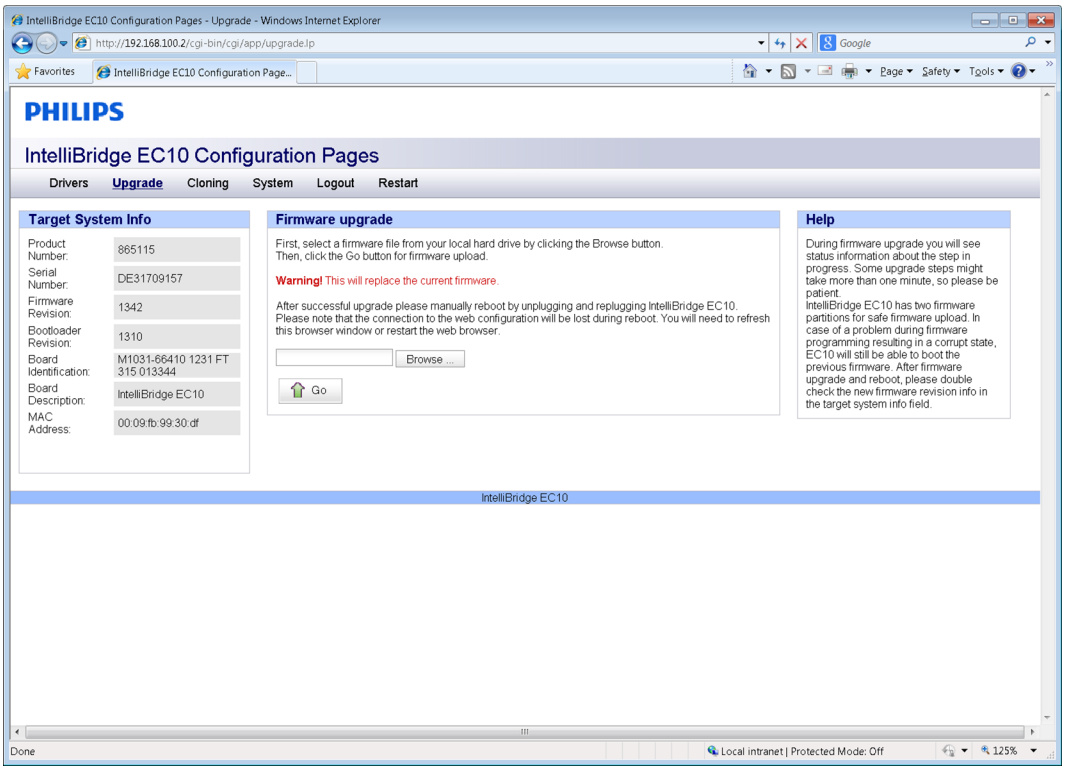
Username: service
Password: IBEC10



## 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**.

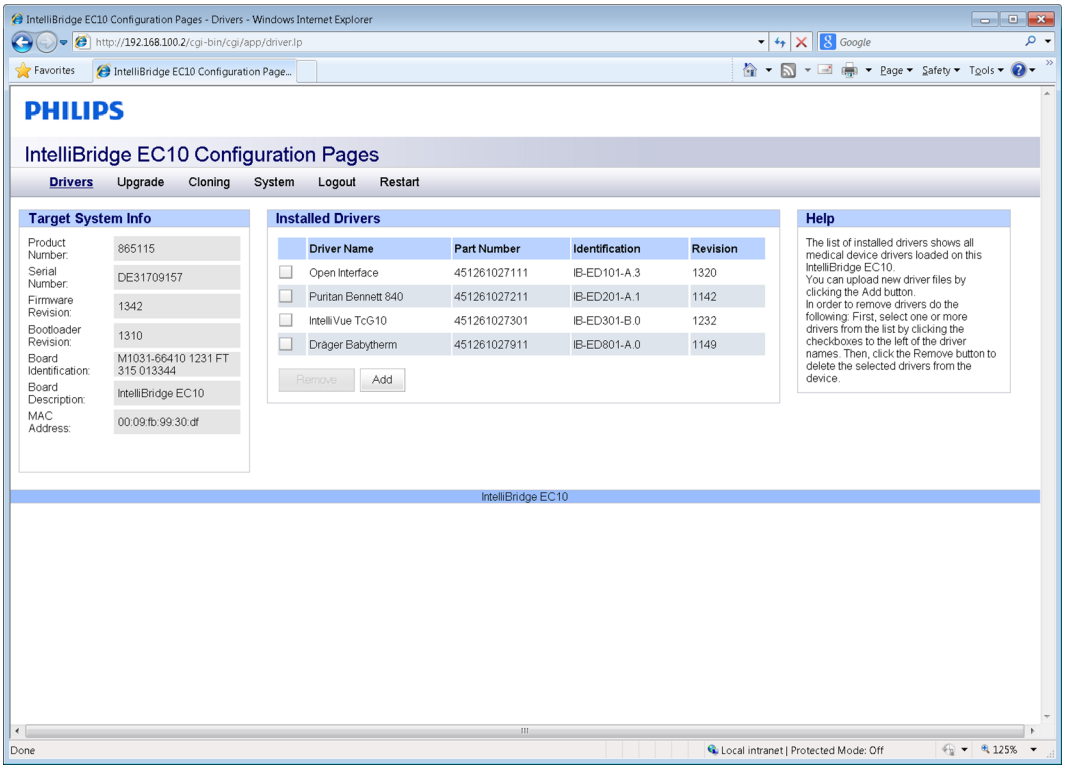
5 After you are finished with the upgrade, make sure to restart the IntelliBridge EC10 device by either clicking on **Restart** (located on the tab bar, if available) or, if you are using an IntelliBridge EC10 module, by unplugging and replugging the module.

## 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.



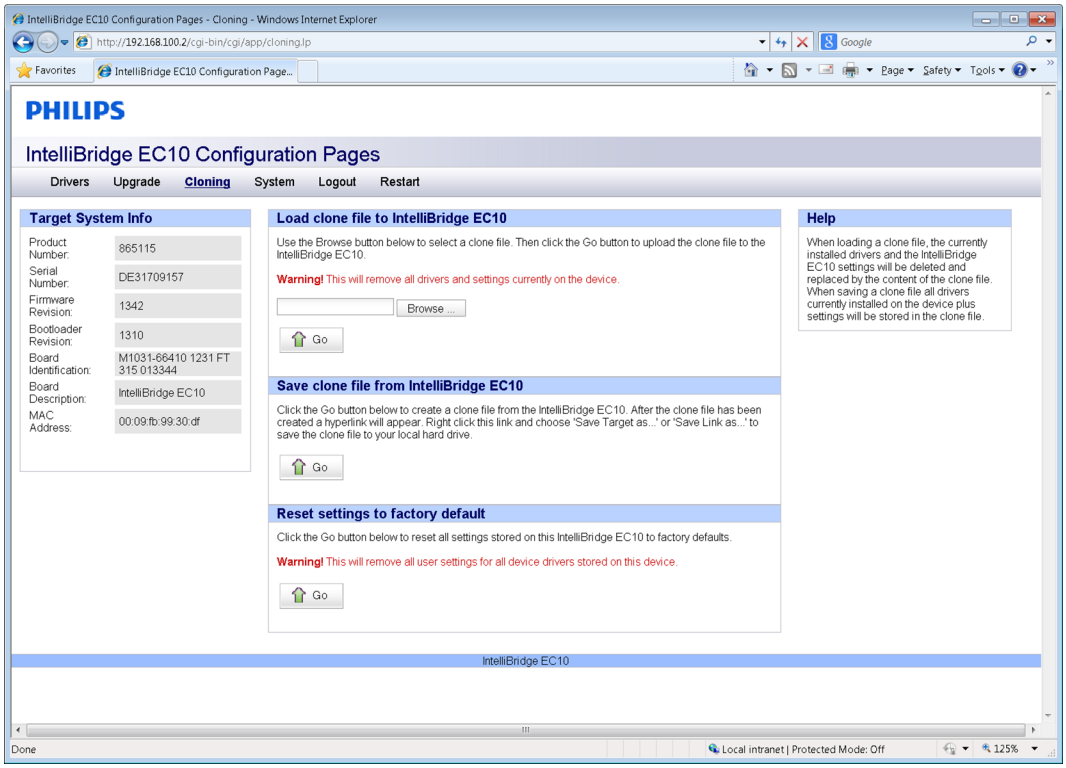

4 When you are finished with the configuration, make sure to click **Logout** on the tab bar.

## 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.

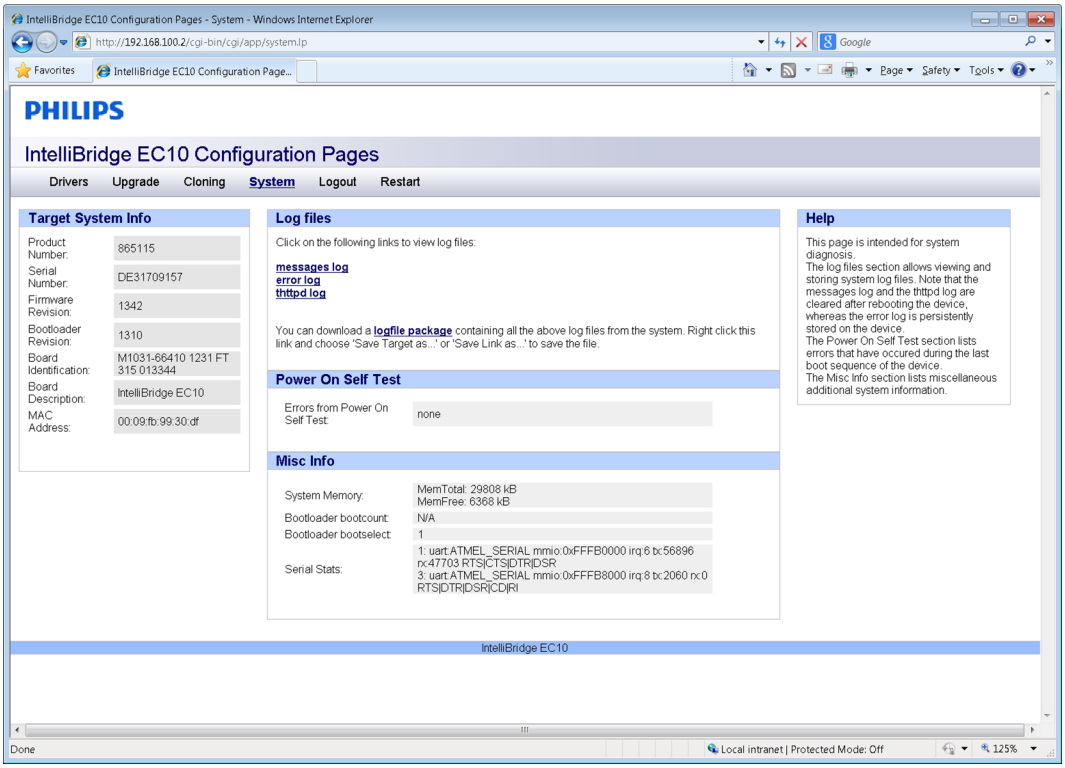
3 To upload a clone file click the **Browse** button in the *Load Clone File to IntelliBridge EC10* window and select the clone file. Then click **Go**.




4 When you are finished with the configuration, make sure to click **Logout** on the tab bar.

## Viewing System Information

1 In the EC10 Configuration Screen, select the **System** Tab. This screen allows you to view Log files and other system information.




2 When you are finished with the configuration, make sure to click **Logout** on the tab bar.

# Handing Over the Monitor

If you are handing over the monitor to the end-users directly after configuration, make sure that it is in Monitoring mode.

Ensure that the users have access to the following materials:

- Training Program in the Philips Learning Center (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.

Please refer to 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.

# 7 Installation Instructions

8

# 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 that all preparations are completed when the system is delivered.*

The site planning phases prior to equipment installation are:

**Location**: Planning the location of the various system components.

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

**System Capabilities**: Explaining the possibilities for system expansion.

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

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

### Roles & Responsibilities

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

#### Site Preparation Responsibilities

Local Staff

- Ensure that all safety, environmental and power requirements are met.

- Provide power outlets.
- Prepare mounts.
- 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 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:

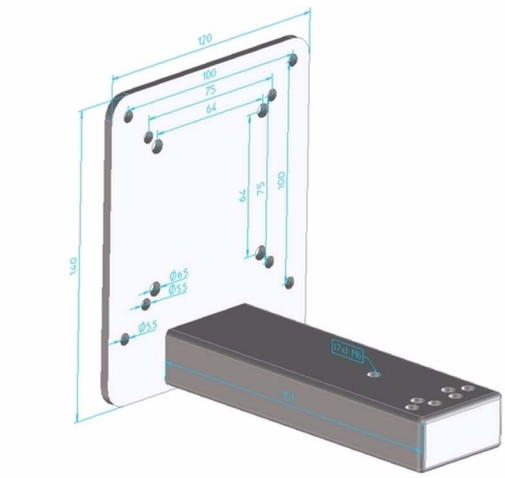
  – Providing and installing all hardware which is required to install the mounting hardware supplied by Philips as detailed in the installation notes.
  – Making sure that all ceilings, walls, and mounting rails that supports mounting hardware are suitable for their proposed load.

**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  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 that the customer has completed all necessary preparations outlined in the previous section, "Procedures for Local Staff."

# Monitor MX400/450/500/550 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:

| Monitor Model | Size (W x H x D) | Weight |
|---|---|---|
| MX400 | 274mm x 288mm x 178mm | 5kg (±5%) |
| MX450 | 327mm x 288mm x 182mm | 5.6kg (±5%) |
| MX500 | 327mm x 288mm x 182mm | 5.7kg (±5%) |
| MX550 | 404mm x 308mm x 184mm | 7kg (±5%) |

## Environmental Requirements

The environment where the MX400/450/500/550 monitor will be used should be reasonably free from vibration, dust and corrosive or explosive gases. The ambient operating and storage conditions for the MX400/450/500/550 monitor must be observed. If these conditions are not met, the accuracy of the system will be affected and damage can occur.

### Temperature

Operating: 0 to 40ºC (32 to 104ºF), 0 to 35°C (32 to 95°F) when charging battery or M3002A is mounted on the back of the monitor or with IntelliVue Instrument Telemetry Adapter

Storage: -20 to 60ºC (-4 to 140ºF)

### Humidity

Operating: 15% to 95% Relative Humidity (RH) (non-condensing)

Storage: 5% to 95% Relative Humidity (RH)

### Altitude

Operating: -500m to 3000m (10000 ft.)

Storage: -500m to 4600m (15000 ft.)

# 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 MX400/450/500/550 monitor uses < 70 W.

Line Voltage

The MX400/450/500/550 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.

Multi-Measurement Module

Remote Display

Remote Control

Where more than one site is used for locating equipment (a remote installation), the following sections should be considered for EACH device:

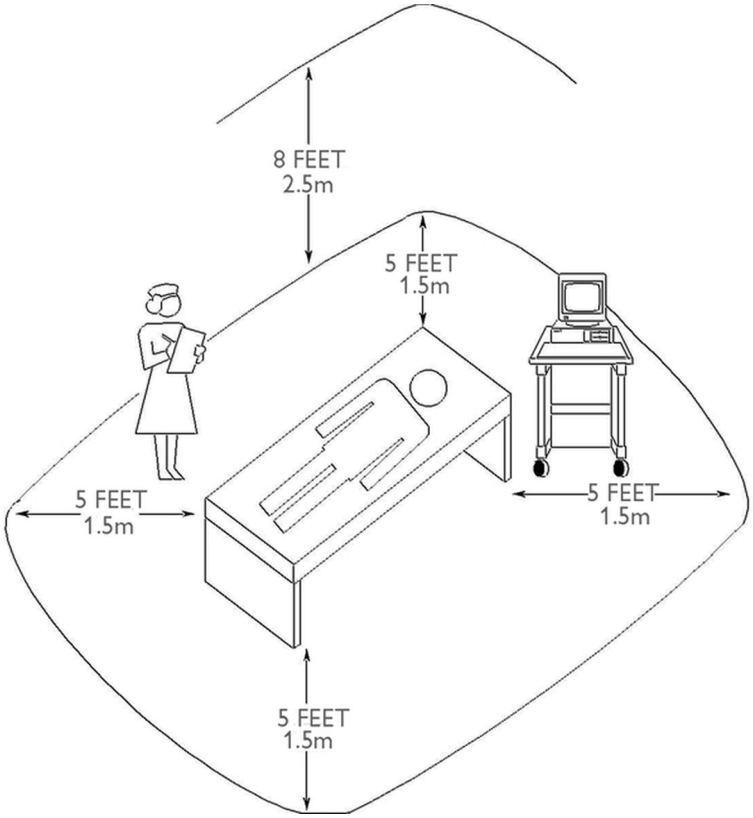
- Space Requirements
- Environmental Requirements
- Mounting
- Electrical and Safety Requirements
- Cabling Options and Conduit Size Requirements

## Connecting Non-Medical Devices

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

**WARNING**

Do not use a device in the patient vicinity if it does not comply with IEC-60601-1. The whole installation, including devices outside of the patient vicinity, must comply with IEC-60601-1-1; one reasonable solution may be the use of an isolation transformer.




*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.

# Multi-Measurement Module (MMS) M3001A, IntelliVue X2 M3002A or Remote Control 865244

## Space Requirements Multi-Measurement Module M3001A

Size (W x D x H)

188.0mm x 96.5 mm x 51.5 mm

(7.40” x 3.80” x 2.03”)

Weight

650g (1.4 lb)

## Space Requirements IntelliVue X2 M3002A

Size (W x D x H)

188.0mm x 99 mm x 86 mm

(7.4” x 3.9” x 3.4”)

Weight

1.5 kg (3.3 lb)

## Space Requirements Remote Control 865244

Size (W x H x D)

53 mm x 165 mm x 23 mm

(2.1" x 6.5" x 0.9")

Weight

<250 g (0.55 lb)

## Environmental Requirements Multi-Measurement Module M3001A

Temperature

Operating: 0 to 45ºC (32 to 113ºF)

Storage: -40 to 70ºC (-40 to 158ºF)

Humidity

Operating: 95% relative humidity (RH) max. @ 40ºC (104ºF)

Storage: 90% relative humidity (RH) max. @ 65ºC (150ºF)

Altitude

Operating: -500m to 4600m (-1600 to 15000 ft.)

Storage: -500m to 15300m (-1600 to 50000 ft.)

## Environmental Requirements IntelliVue X2 M3002A

Temperature

Operating: 0 to 40ºC (32 to 100ºF)
0 to 35°C (32 to 95°F) (while charging batteries or when equipped with IIT or IntelliVue 802.11 Bedside Adapter)

Storage: -20 to 60ºC (-4 to 140ºF)

Humidity

Operating: 15 to 95% relative humidity (RH) max. @ 40ºC (104ºF)

Storage: 5 to 95% relative humidity (RH) max. @ 65ºC (150ºF)

Altitude

Operating: -500m to 3000m (-1600 to 10000 ft.)

Storage: -500m to 4600m (-1600 to 15000 ft.)

## Environmental Requirements Remote Control 865244

Temperature

Operating: 0 to 40ºC (32 to 100ºF)

Storage: -20 to 60ºC (-4 to 140ºF)

Humidity

Operating: 15% to 95% relative humidity (RH) (non-condensing)

Storage: 5% to 90% relative humidity (RH)

Altitude

Operating: -500m to 3000m (-1600 to 10000 ft.)

Storage: -500m to 4600m (-1600 to 15000 ft.)

## Cabling Options and Conduit Size Requirements

The following table describes the cabling options for the MMS.

**Table 9 M3001A and M3002A Cables**

| Part number | 12NC | Description | Conduit sizes | Bend Radius | Connector Size (L x W) |
|---|---|---|---|---|---|
| **Both ends are terminated with MSL conntectors** | | | | | |
| M3081-61626 | 453563474781 | CBL MSL 0.75m | 72mm$^2$ | 40 mm | 40 mm x 17 mm |
| M3081-61601 | 453563402721 | CBL MSL 1m | 72mm$^2$ | 40 mm | 40 mm x 17 mm |
| M3081-61602 | 453563377851 | CBL MSL 2m | 72mm$^2$ | 40 mm | 40 mm x 17 mm |
| M3081-61603 | 453563402731 | CBL MSL 4m | 72mm$^2$ | 40 mm | 40 mm x 17 mm |
| M3081-61627 | 453563484501 | CBL MSL 10m | 72mm$^2$ | 40 mm | 40 mm x 17 mm |
| M3081-61628 | 453563484511 | CBL MSL 15m | 72mm$^2$ | 40 mm | 40 mm x 17 mm |
| M3081-61629 | 453563484521 | CBL MSL 25m | 72mm$^2$ | 40 mm | 40 mm x 17 mm |
| **Both ends are unterminated, use faceplates** | | | | | |
| M3081-61615 | 453563484481 | CBL MSL Instal.15m unterminated | 72mm$^2$ | 40 mm | 40 mm x 17 mm |
| M3081-61625 | 453563484491 | CBL MSL Instal.25m unterminated | 72mm$^2$ | 40 mm | 40 mm x 17 mm |
| **Faceplates** | | | | | |

| Part number | 12NC | Description | Conduit sizes | Bend Radius | Connector Size (L x W) |
|---|---|---|---|---|---|
| M3081-68707 | 453563484531 | CBL MSLFace Plate pair of boxes NON US | 72mm$^2$ | 40 mm | 40 mm x 17 mm |
| M3081-68708 | 453563484541 | CBL MSL Face Plate pair of boxes US | 72mm$^2$ | 40 mm | 40 mm x 17 mm |
| **Insertion Tool** | | | | | |
| M3086-43801 | 453563484771 | MSL Insertion Tool for unterminated CBL | 72mm$^2$ | 40 mm | 40 mm x 17 mm |
| 453564277211 | 453564277211 | IV PLAST MSL Cable Clamp Kit | | | |

### Mounting

**Table 10 M3001A Multi-Measurement Module (MMS) and M3002A IntelliVue X2 Mounts**

| Product Option Number | Part Number 12NC Part No. | Description |
|---|---|---|
| M3080A #A01 | n/a | Wall Mounting Plate |

## Remote Displays (865299)

### Space Requirements

**Size (W x H x D)**

429mm x 359mm x 61mm (16.89” x 14.13” x 2.4”)

Weight

6.1 kg (13.45 lbs.)

### Environmental Requirements

Temperature

Operating: 0 to 40ºC (32 to 104ºF)

Storage: -20 to 60ºC (-4 to 140ºF)

Humidity

Operating: 30 to 70% RH (Non-condensing)

Storage: 10 to 90% RH (Non-condensing)

Altitude

Operating: Up to 4000m (13123.36 ft.)

Storage: Up to 12000m (39370,08 ft.)

## Electrical and Safety Requirements

Voltage ranges:

100V to 240V

Voltage selection:

Wide range input, no voltage selection required

Power consumption: ~48W

## Cabling Options and Conduit Size Requirements

The following table describes the cabling options for the M8031A/B 15”, the M8033A/B 17” and the 865299 19" TFT Medical Grade Touch Displays.

**Table 11 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$^2$ | 25 mm | 35 x 16 mm |
| M8081-61011 | 451261006561 | IV CBL Touch, 3m | 30mm$^2$ | 25 mm | 35 x 16 mm |
| M8081-61012 | 451261006571 | IV CBL Touch, 10m | 30mm$^2$ | 25 mm | 35 x 16 mm |
| M8081-61013 | 451261006581 | IV CBL Touch, 15m | 30mm$^2$ | 25 mm | 35 x 16 mm |
| M8081-61014 | 451261006591 | IV CBL Touch, 25m | 30mm$^2$ | 25 mm | 35 x 16 mm |

# 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$^2$ | 25 mm | 15 x 15 mm |
| M8081-61002 | 453563484601 | IV CBL 3m LAN/RS232 straight | 30 mm$^2$ | 25 mm | 15 x 15 mm |

| Part number | 12NC | Description | Conduit Sizes | Max. Bend Angle | Connector Size (L x W) |
|---|---|---|---|---|---|
| M8081-61003 | 453563484611 | IV CBL 10m LAN/ RS232 straight | 30 $mm^2$ | 25 mm | 15 x 15 mm |

## Local Printer

See printer documentation

# RS232/MIB/LAN Interface

**Table 12 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 $mm^2$ | 25 mm | 15 x 15 mm |
| M8081-61002 | 453563484601 | IV CBL 3m LAN/RS232 straight | 30 $mm^2$ | 25 mm | 15 x 15 mm |
| M8081-61003 | 453563484611 | IV CBL 10m LAN/ RS232 straight | 30 $mm^2$ | 25 mm | 15 x 15 mm |
| M8081-61004 | 453563484621 | IV CBL 15m LAN/ RS232 straight | 30 $mm^2$ | 25 mm | 15 x 15 mm |
| M8081-61005 | 453563484631 | IV CBL 25m LAN/ RS232 straight | 30 $mm^2$ | 25 mm | 15 x 15 mm |

*Cable and Adapter Set*

# Nurse Call Paging Cable

| Part number | 12NC | Description | Conduit Sizes | Bend Radius | Connector Size |
|---|---|---|---|---|---|
| 453564214531 | 453564214531 | CBL Nurse paging cable 3m | 0.125 $mm^2$ | 12 mm | 9 x 12 mm<br>One end terminated with 6P6C connector. one end without connector. |
| 453564220531 | 453564220531 | CBL Nurse paging cable 10m | 0.125 $mm^2$ | 12 mm | 9 x 12 mm<br>One end terminated with 6P6C connector. one end without connector. |
| M8087-61001 | 453563484741 | IV CBL 10m flex nursepaging MDR&open con | 40 $mm^2$ | 30 mm | 35 x 16 mm<br>One end terminated with straight MDR connector, one end without connector |

# ECG Out Interface

**Table 13 ECG Out Cable**

| Part number | 12NC | Description | Conduit Sizes | Bend Radius | Diameter | Comments |
|---|---|---|---|---|---|---|
| 8120-1022 | 453563198151 | CBL ECG Out 3m Phone plug terminated | 40 $mm^2$ | 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:<br>25 m raw cable,<br>2 x 1/4” socket,<br>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 |

| Part number | 12NC | Description | Conduit Sizes | Bend Radius | Diameter | Comments |
|---|---|---|---|---|---|---|
| M5526A | 989803129001 | 24' Sync Cable | | | | one end is terminated with ECG 12 pin and one end is terminated with phone plug |

# 8 Site Preparation

# 9

# Gas Analyzers

For details on the M1013A IntelliVue G1 and the M1019A IntelliVue G5, please refer to the respective Service Guides on the Gas Analyzers' documentation CD.

For details on configuring the RS232/MIB port for the gas analyzers, see“Connection of Devices via the RS232/5V Interface or MIB/RS232 I/O Board” on page 258 in the Installation Instructions chapter

10

# Specifications

## Essential Performance Characteristics

This chapter defines the Essential Performance for IntelliVue patient monitors, in combination with Multi-Measurement-Modules (MMSs), MMS Extensions, Flexible Module Racks (FMSs), 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 ±10% or ±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 ≤ 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. |

| Parameter | Essential Performance |
|---|---|
| Invasive Pressure | Measurement of systolic, diastolic and mean blood pressure within ±4% or ±4 mmHg, whichever is greater, and pulse rate within ±10% or ±5 bpm, whichever is greater. |
| | Alarming on systolic, diastolic and mean blood pressure and pulse rate limit violations. |
| 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 ($CO_2$, $O_2$, $N_2O$, Anesthetic Agents) | Measurement of respiratory gases within the following measurement accuracy ranges:<br>**Halogenated agent**:<br>± (0,2 % absolute + 15 % of reading)<br>**CO2**:<br>± (0,43 % absolute + 8 % of reading)<br>**Nitrous oxide**:<br>± (2,0 % absolute + 8 % of reading)<br>**O2**:<br>± (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. |

| Parameter | Essential Performance |
|---|---|
| $SpO_2$ | Measurement of oxygen saturation within $4\%_{RMS}$ over the range from 70 to 100% and pulse rate within $10\%_{RMS}$ or 5 $bpm_{RMS}$, 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. |
| $tcpO_2/tcCO_2$ | Measurement of partial pressure $O_2$ within ±6 mmHg over the range from 40 to 100 mmHg and partial pressure $CO_2$ within ±6 mmHg over the range from 30 to 60 mmHg. |
| | Alarming on transcutaneous partial pressure $O_2$ and $CO_2$ 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)

| Parameter | Essential Performance |
|---|---|
| All | After electrostatic discharge, fast transients / bursts, surges and electro surgery interference the equipment returns to previous operation mode within 30 seconds (tcpO2/tcpCO2: 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. |

# WLAN Adapter Specifications

| IntelliVue 802.11 Bedside Adapter Specifications | |
|---|---|
| **Type** | Internal wireless adapter |
| **Technology** | IEEE 802.11a/b/g |
| **Frequency Band** | USA: 2.400 – 2.483 GHz, 5.15 - 5.35 GHz, 5.725 - 5.825 GHz<br>Europe: 2.400 – 2.483 GHz, 5.15- 5.35 GHz, 5.47 - 5.725 GHz<br>Japan: 2.400 – 2.483 GHz, 5.150 – 5.250 GHz, 5.25 – 5.35 GHz, 5.470 – 5.725 GHz<br>China: 2.400 – 2.483 GHz, 5.725 -5.85 GHz |
| **Modulation Technique** | 802.11b/g<br>DSSS (DBPSK, DQPSK, CCK)<br>OFDM (BPSK, QPSK, 16-QAM, 64-QAM)<br>802.11a<br>OFDM (BPSK, QPSK, 16-QAM, 64-QAM) |
| **Bandwidth** | 20 MHz (nominal) |
| **Effective Radiated Power (Max. ERP)**[a] | 2.400 - 2.483 GHz:<br>16 dBm (40 mW)<br>5.150 - 5.725 GHz:<br>15 dBm (32 mW)<br>5.745 – 5.825 GHz:<br>13 dBm (20 mW) |

[a] actual power depends on country-specific radio regulations

## WLAN Infrastructure

For operation with full capacity, a WLAN infrastructure is recommended that provides:

- A minimum RF signal (RSSI) level of -67dBm (or higher) in all areas of monitor use.
- A minimum signal-to-noise ratio (SNR) of 25 dB in all areas of monitor use.

The recommended separation distances for WLAN operation can be found in the Instructions for Use, in the Specifications chapter.

# MDD Classification

According to the Council Directive 93/42/EEC (Medical Devices Directive) the device classification is 2B, Rule 10.

# Safety and Regulatory Information

For details about safety and regulatory information refer to the Instructions for Use.

# 10 Specifications

# IntelliVue MX400-550 Product Structure

| Required Additional Purchases | | MX400 | MX450 | MX500 | MX550 |
|---|---|---|---|---|---|
| **Application Areas** | | | | | |
| H01 | General Care Software | Default | Default | Default | Default |
| H11 | Intensive Care software | Optional | Optional | Optional | Optional |
| H21 | Neonatal Care Software | Optional | Optional | Optional | Optional |
| H31 | Anesthesia Software | Optional | Optional | Optional | Optional |
| H41 | Cardiac Care software | Optional | Optional | Optional | Optional |
| **Waveform capability** | | | | | |
| A03 | 3-Wave Capability | Default | n/a | n/a | n/a |
| A04 | 4-Wave Capability | Optional | Default | Default | Default |
| A05 | 5-Wave Capability | Optional | n/a | n/a | n/a |
| A06 | 6-Wave Capability | n/a | Optional | Optional | Optional |
| **Optional Additional Purchases** | | **Rev. K.1** | **Rev. K.1** | **Rev. K.1** | **Rev. K.1** |
| **Clinical Packages** | | | | | |
| CP1 | Extended Clinical Apps | Optional | Optional | Optional | Optional |
| CP2 | Extended ECG Capabilities | Optional | Optional | Optional | Optional |
| **Clinical Applications** | | | | | |
| C05 | Drug Calculator | Optional | Optional | Optional | Optional |
| C06 | Basic Event Surveillance | Optional | Optional | Optional | Optional |
| C07 | Adv. Event Surveillance | n/a | Optional | Optional | Optional |

| | | | | | |
|---|---|---|---|---|---|
| C09 | Parameter Histograms | Optional | Optional | Optional | Optional |
| C15 | Full Networking | Optional | Standard | Standard | Standard |
| C21 | PV Loops | Optional | Optional | Optional | Optional |
| **Protocol Watch** | | | | | |
| P01 | Severe Sepsis Screening | Optional | Optional | Optional | Optional |
| P02 | SSC Sepsis Protocol | n/a | n/a | Optional | Optional |
| P05 | IntelliVue Guardian EWS | Optional | Optional | Optional | Optional |
| **Measurement support** | | | | | |
| M05 | Support 1 adtl. IBPs | Optional | Optional | n/a | n/a |
| M06 | Support 2 adtl. IBPs | n/a | n/a | Optional | Optional |
| M12 | Cardiac Output | Optional | Optional | Standard | Standard |
| M20 | Support 1 adtl. SpO2 | n/a | n/a | Optional | Optional |
| **Hardware Add-Ons** | | | | | |
| E00 | Remote Control | Optional | Optional | Optional | Optional |
| E05 | Integrated Recorder | Optional | Optional | n/a | n/a |
| E21 | Bedhanger Mount | Optional | Optional | Optional | Optional |
| E22 | Quick Release Mount | Optional | Optional | Optional | Optional |
| E24 | One LiIon Battery | Optional | Optional | Optional | Optional |
| **Wired Interfaces** | | | | | |
| J13 | RS232/MIB interface | Optional | Optional | Optional | Optional |
| J15 | Adaptive Slave Display | Optional | Optional | Optional | Optional |
| J25 | USB Interface | Optional | Optional | Optional | Optional |
| J30 | Flexible Nurse Call IF | Optional | Optional | Optional | Optional |
| J32 | IntelliBridge IF board | Optional | Optional | Optional | Optional |
| J40 | Advanced System Interface | Optional | Optional | Optional | Optional |
| **Wireless Interfaces** | | | | | |
| J35 | 802.11 Wireless IF | Optional | Optional | Optional | Optional |
| J45 | Smart Hopping IF 1.4 GHz | Optional | Optional | Optional | Optional |
| J46 | Short Range Radio | Optional | Optional | Optional | Optional |
| J47 | Smart Hopping IF 2.4 GHz | Optional | Optional | Optional | Optional |

Part Number 453564436301
Published in Germany 11/2013

PHILIPS