



Installation and Service Guide

IntelliVue Patient Monitor

MX100/X3

Release M.04

Patient Monitoring

PHILIPS

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Introduction

This Service Guide contains technical details for the IntelliVue MX100 Patient Monitor and the IntelliVue X3.

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 system so that engineers who repair them are better able to understand how it works.

Always use this guide in combination with the IntelliVue MX100/X3 Instructions for Use.

Who Should Use This Guide

This guide is for biomedical engineers or technicians responsible for installing, 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.

Responsibility of the Manufacturer

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

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

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

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1 Introduction

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 default passwords are listed below. Philips recommends that you change these passwords before putting the monitor into operation. This requires an Admin password.

Be sure to use secure passwords and to ensure that anyone requiring these passwords has access to them.

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

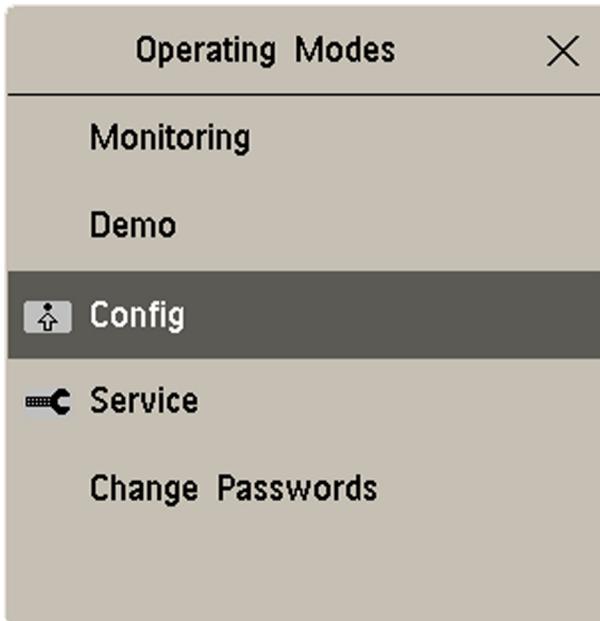
Default Admin Password: 2104

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

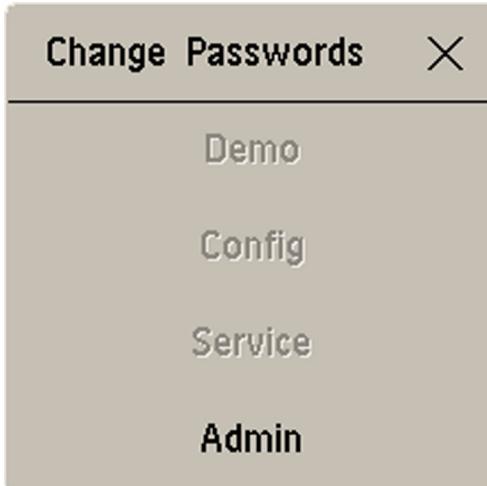
Changing Passwords

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

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

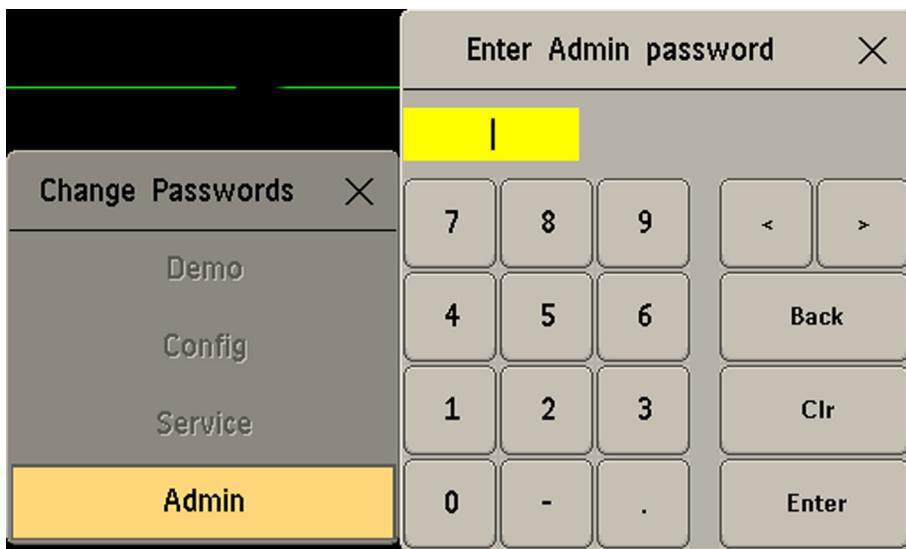


This will open the **Change Passwords** window.

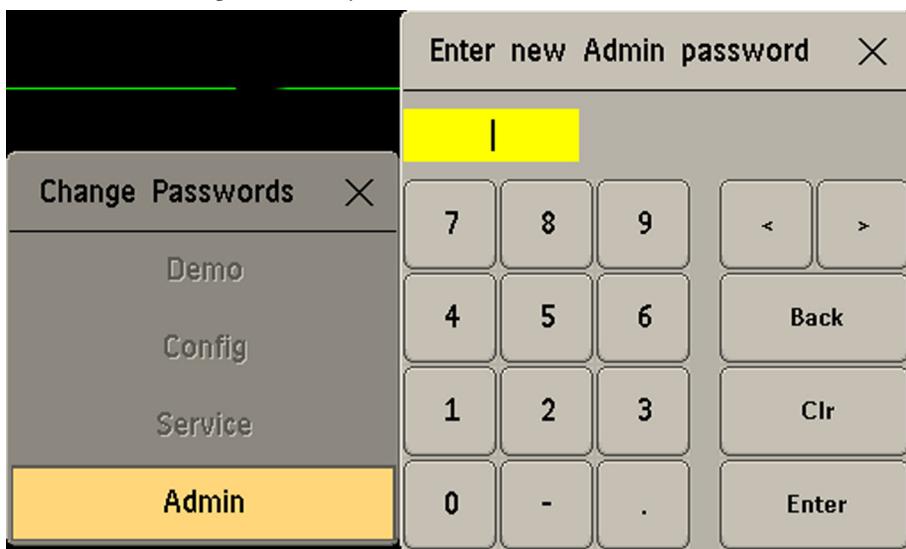


1 Introduction

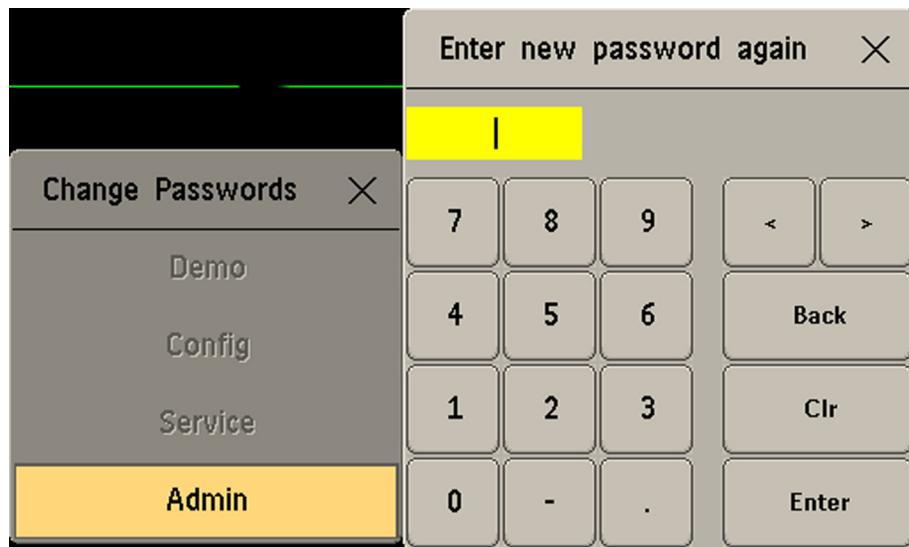
- 2 If you have already set your own Admin password, proceed to step 5. If you have not, all entries in the **Change Passwords** window except **Admin** will be greyed out. Select **Admin** and enter the default password 2104.



- 3 Enter a new Admin password of your choice.

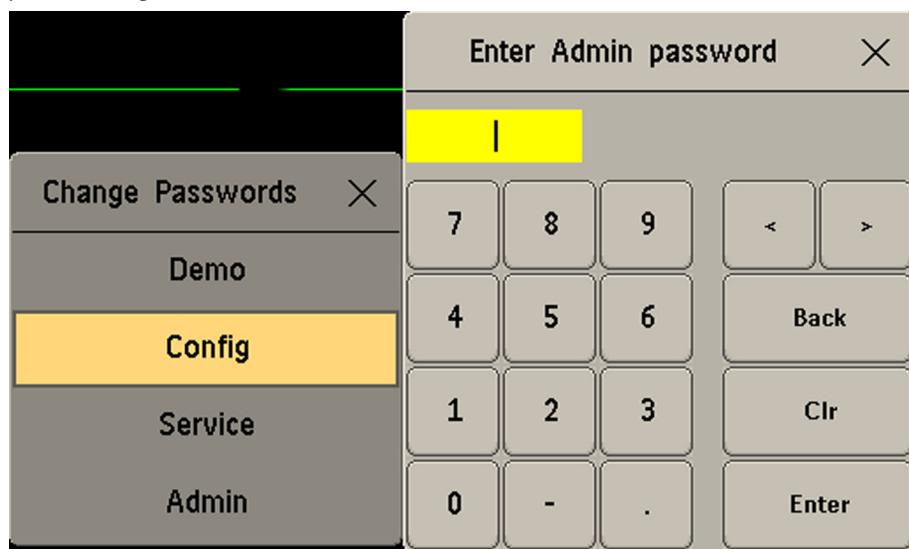


- 4 Confirm by re-entering the new password.



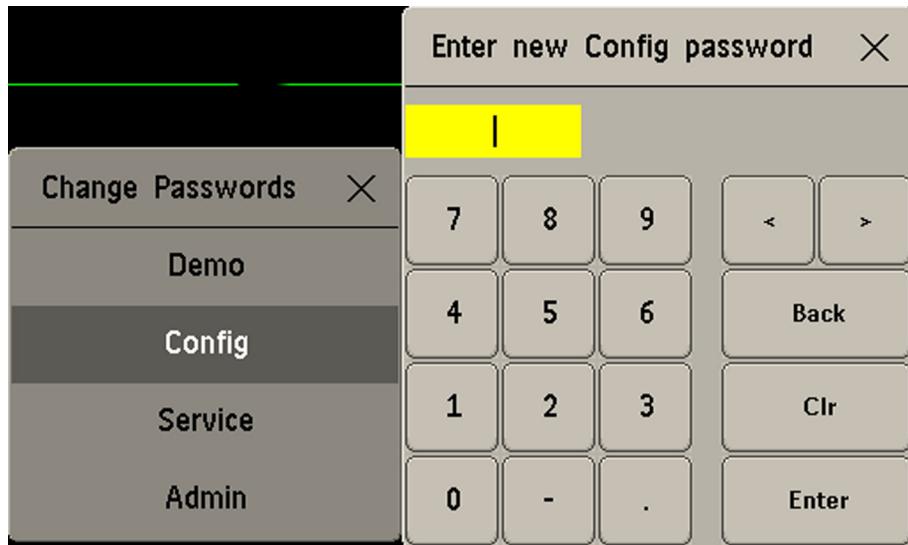
Once the Admin password has been set, you will be able to change the other passwords.

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

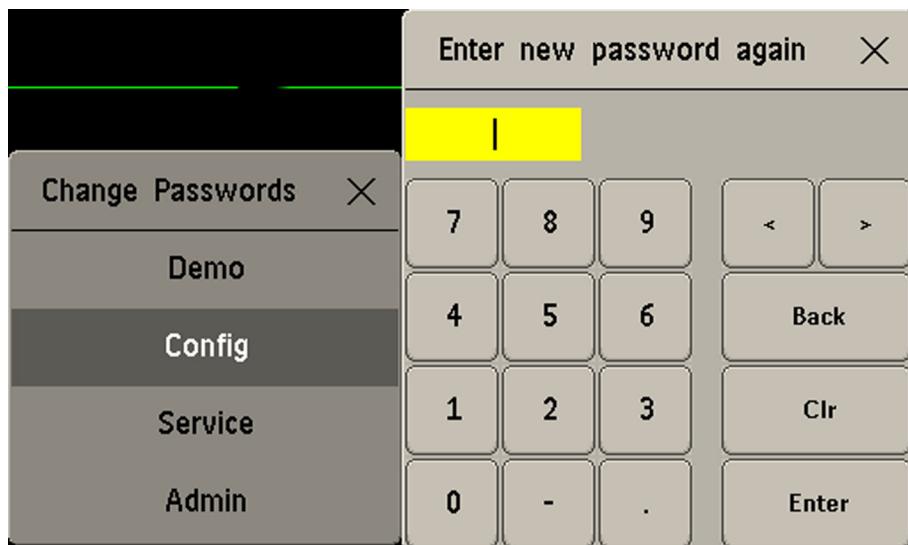


1 Introduction

- 6 Enter the new password for the operating mode.



- 7 Confirm the new password.



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

One-Time Access

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

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

NOTE

There is no one time access for the Admin password.

Obtaining One-Time Access

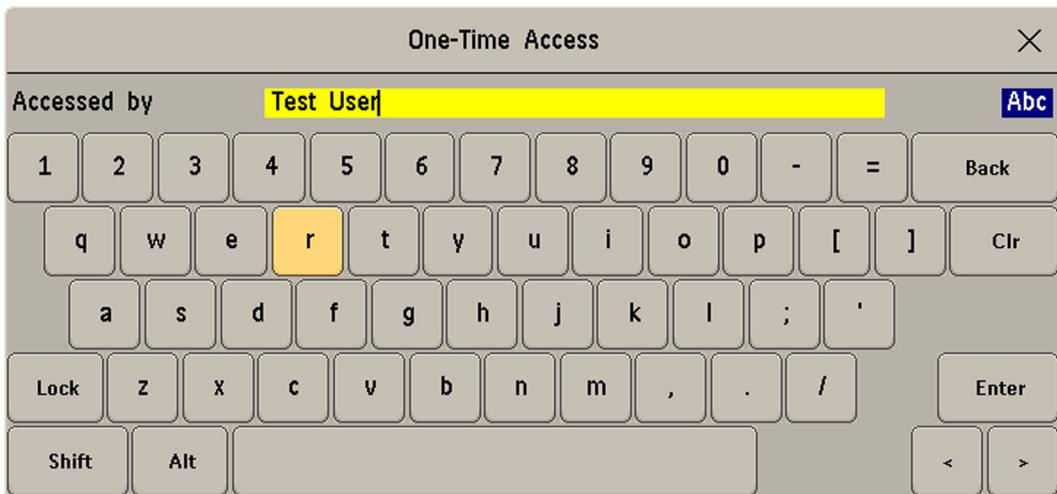
- 1 Instead of the password, enter --- (three minuses) and select **Enter**.
The following window will open and will provide a number with which you can contact your Philips representative to request your one-time access code (078 in the example below).

One-Time Access
To access the requested operating mode without a password, contact the Philips Response Center or your dealer and request the one-time access code of number 078. Note: This one-time access will be logged.

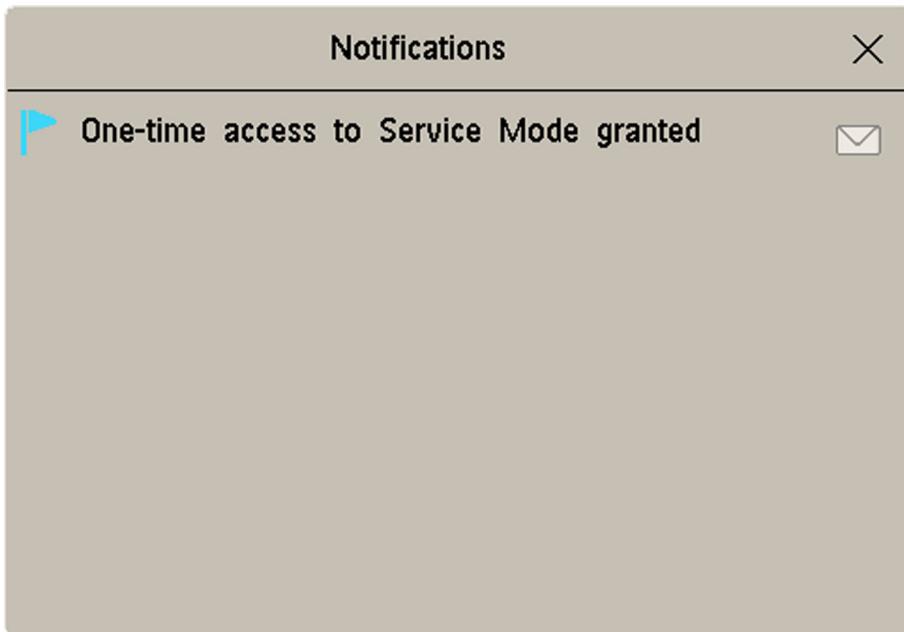
- 2 Contact your Philips Service Representative with this number. Your Philips representative will then provide you with the password for your one time access.
- 3 This password can only be used for a few minutes. If you enter the wrong password, you will have to start this procedure from the beginning.

1 Introduction

- 4 Once the one time access password has been entered, the following window will open. Enter your name and/or the reason for requesting One-Time Access.



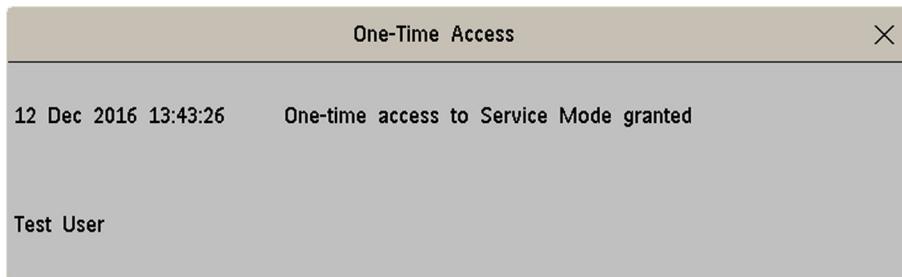
This will let you enter the requested operating mode. Once One-Time Access is granted, a notification is displayed persistently on the monitor.



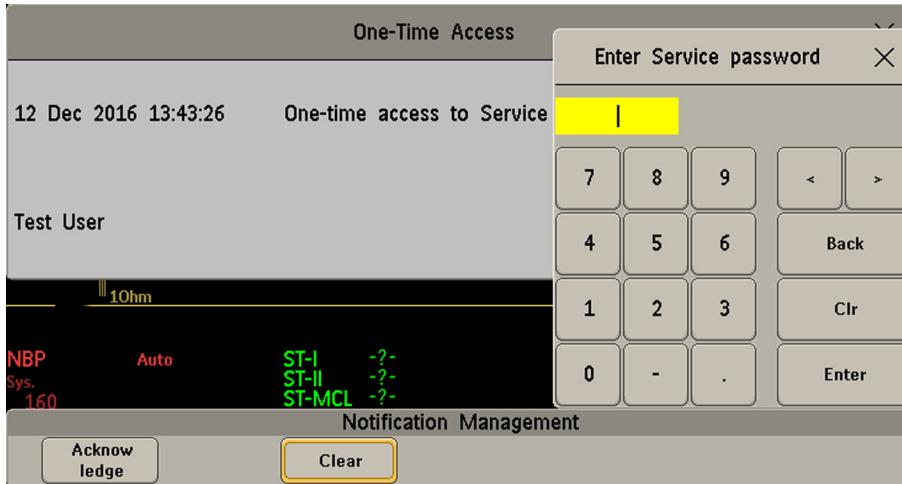
- 5 Once you have acknowledged the notification, the notification is marked with a check mark.



- 6 Click the notification for more details.



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



Safety Information

Warnings and Cautions

In this guide:

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

Electrical Hazards and Interference

WARNING

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

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

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

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

Consult your service personnel.

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

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 or in the presence of other flammable substances in combination with air, oxygen-enriched environments, or nitrous oxide. Use of the devices in such environments may present an explosion hazard.

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

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

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

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

The monitors are also not intended for use within an incubator. For use with a neonate in an incubator, always position the monitor outside of the incubator.

High Ambient Temperatures: Avoid prolonged contact with the monitor housing or display when the ambient temperature is high. When the monitor cannot cool down, the housing and display can become hot to the touch. Ensure that there is no contact between the monitor and the patient, especially during transport and with sedated or unconscious patients. In extreme cases, with very high ambient temperatures, prolonged contact could result in superficial burns.

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 cross-infection hazard.

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

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

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

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

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

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

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:

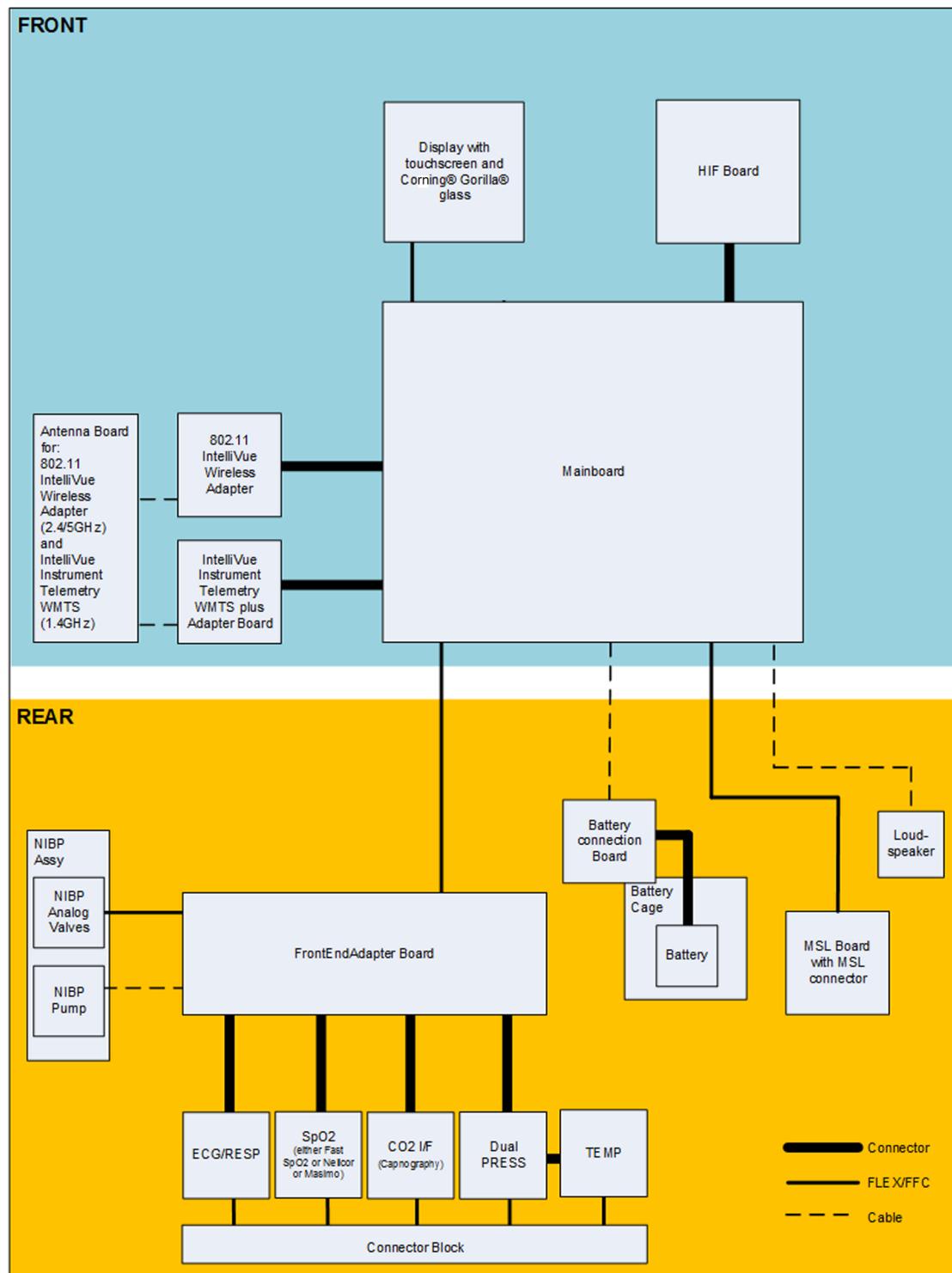
- To avoid contaminating or infecting personnel, the environment or other equipment, make sure you disinfect and decontaminate the monitor appropriately before disposing of it in accordance with your country's laws for equipment containing electrical and electronic parts.
 - For disposal of parts and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

General Information

Hardware Building Blocks

The following hardware building blocks make up the monitoring system:

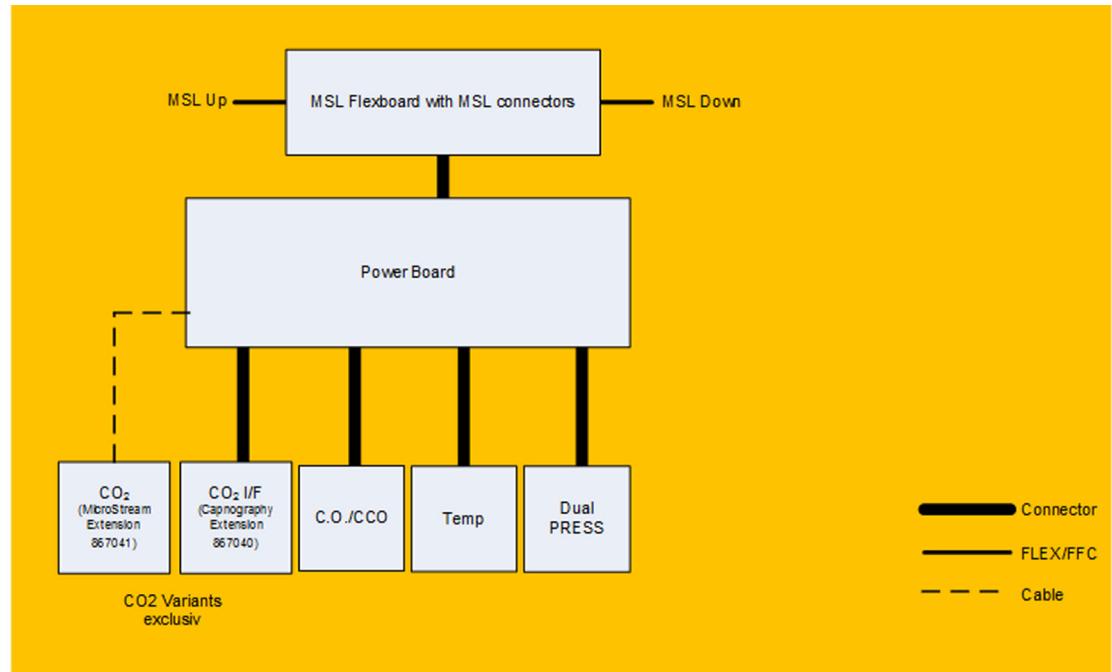
2 General Information



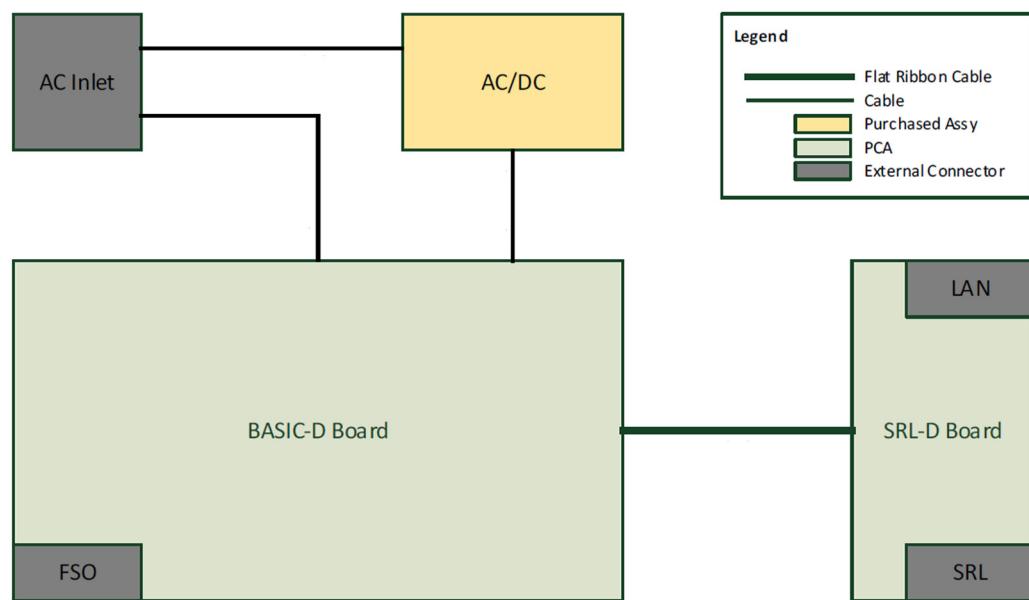
MX100/X3 Hardware Building Blocks

NOTE

- WLAN and IIT 1.4GHz can be built in to the monitor at the same time. You can select whether you want to use IIT or WLAN in the software.



867039, 867040, 867041 Extensions Hardware Building Blocks



867043 IntelliVue Dock Hardware Building Blocks

Compatible Devices

Current Generation	
867039 IntelliVue Hemodynamic Extension	
867040 IntelliVue Capnography Extension Note: PiCCO is not available for the 867040 Capnography extension in the USA and territories relying on FDA market clearance.	
867041 IntelliVue Microstream Extension Note: PiCCO is not available for the 867041 Microstream CO2 extension in the USA and territories relying on FDA market clearance.	
867043 IntelliVue Dock	
Previous Generation	

M3012A Hemodynamic Extension	 A silver rectangular medical device with a blue connector at the top. It has four circular ports labeled 'CO2', 'Temp', 'Press', and 'Temp' from left to right.
M3014A Capnography Extension	 A white rectangular medical device with a blue connector at the top. It has four circular ports labeled 'PCO2', 'CO2', 'Temp', and 'Temp' from left to right.
M3015A/B Microstream Extension	 A white rectangular medical device with a blue connector at the top. It has four circular ports labeled 'CO2', 'Temp', 'Press', and 'Press' from left to right.

2 General Information

865297 Battery Extension	
M8023A External Power Supply	

NOTE

- The M3012A, M3014A and M3015A/B Extensions are not supported if the IntelliVue MX100/X3 is powered from the internal battery. Although they can still be attached, they will not function in this case.
- The Flexible Sync Out is only available via the IntelliVue Dock.

How does the Support Tool Work with the Monitor

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

The purpose of the support tool is to upgrade, configure and diagnose all monitoring components in the system over the network.

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

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

At this time it is not possible to upgrade the MX100/X3 via a host monitor. Use the External Power Supply (M8023A), the IntelliVue Dock (867043) or the Network Service Adapter to upgrade the MX100/X3 software.

Note that configuration cloning and firmware upgrade *is* possible via a host monitor.

NOTE

The Network Service Adapter is intended for service use only. It is not for use on patients.

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

2 General Information

Testing and Maintenance

Introduction

This chapter provides a checklist of the testing and maintenance procedures to ensure the performance and safety of the monitor and the Measurement Extensions. For testing of the host monitor and the Module Rack, see the Service Guide of the host monitor.

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.

Testing of the MX100/X3 and the Measurement Extensions may be performed either on the MX100/X3 or Extension directly (with IntelliVue Dock or external power supply) or (for the X3) on the host monitor.

All tests shall be performed in such manner that no hazardous situations arise for testing personnel, patients or other individuals.

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 standard IEC 62353.

- **Medical System:** a medical electrical system is a combination of at least one medical electrical device and other electrical equipment, interconnected by functional connection or use of a multiple socket-outlet.
- **Patient Environment:** any area in which intentional or unintentional contact can occur between the patient and parts of the medical system or between the patient and other persons who have had contact with parts of the medical system. The patient environment is defined anywhere within 1.5m (5 feet) of the perimeter of the patient's bed and 2.5m (8.2 feet) from the floor.
- **Separation Device/Transformer:** a component or arrangement of components with input parts and output parts that, for safety reasons, prevent a transfer of unwanted voltage or current between parts of a medical system.
- **Multiple Socket-Outlet:** a combination of two or more socket-outlets intended to be connected to or integrated with flexible cables or cords, which can easily be moved from one place to another while connected to the power mains.

3 Testing and Maintenance

- **Functional Connection:** an electrical connection for transfer of signals and/or power.
- **Tests:** Safety or Performance Assurance test procedures which may consist of several steps.
- **Equipment Leakage Current:** total current flowing from mains parts to earth via:
 - a. the protective earth conductor and accessible conductive parts of the enclosure and applied parts (differential and alternative method), or
 - b. the accessible conductive parts of the enclosure and applied parts (direct method)
- **Patient Leakage Current:**
 - flowing from the patient connections via the patient to earth, or
 - originating from the unintended appearance of a voltage from an external source on the patient and flowing from the patient via the patient connections of an F-type applied part to earth
- **Protective Earth Resistance:**
 - resistance between any accessible conductive part which has to be connected for safety purposes to the protective earth terminal and the
 - protective connector of the mains plug, or
 - protective connector of the appliance inlet, or
 - protective conductor permanently connected to the supply mains;
 - resistance between protective connectors at each end of a detachable power supply cord
- **Touch Current:** leakage current flowing from the enclosure or from parts thereof, excluding patient connections, accessible to any operator or patient in normal use, through an external path other than the protective earth conductor, to earth or to another part of the enclosure

NOTE

The meaning of this term is the same as that of “Enclosure Leakage Current” in the first and second editions of IEC 60601-1. The term has been changed to align with IEC 60950-1 [3] and IEC62368-1 and to reflect the fact that the measurement now applies also to parts that are normally protectively earthed.

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

Recommended Frequency

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

Table 1 Suggested Testing Timetable

Tests		Frequency	
Preventive Maintenance	NBP Performance	Once every two years, or more often if specified by local laws	
	Microstream CO ₂ Calibration	<ul style="list-style-type: none"> • Once a year, or • After 4000 hours of continuous use, or • 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.	
	SpO ₂ Performance		
	NBP Performance		
	Invasive Pressure Performance		
	Temperature Accuracy		
	Capnography Extension Performance Tests		
	Microstream CO ₂ Performance Test		
	C.O. Performance Test		
	MSL Assurance Test		
	IntelliVue Dock Flexible Sync Out Performance		
Safety Tests	Battery Performance Test		
	Visual	Visual Inspection	After each service event.
	Electrical	Protective Earth	<ul style="list-style-type: none"> • Once every two years, or • After repairs where the MSL board, front end adapter board or any of the measurement boards have been removed or replaced, or • The monitor has been damaged by impact.
		Equipment Leakage Current	
		Patient Leakage Current	
	System Test	Once every two years	

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 its host monitor.**

Table 2 When to perform tests

Service Event (When performing...)	Tests Required ...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 monitor with IntelliVue Instrument Telemetry (IIT)	Perform Visual Inspection, Power On and IIT communication test
Installation of monitor with WLAN	Perform Visual Inspection, Power On and WLAN Communication Test
Installation of networked monitor (LAN)	Perform Visual Inspection Power On and LAN Communication Test
Preventive Maintenance	
Preventive Maintenance	Perform preventive maintenance tests and procedures: <ul style="list-style-type: none">• NBP calibration• Microstream CO2 calibration
Other Regular Tests and Tasks	
Visual Inspection	Perform Visual Inspection test block
Power On Test	Perform Power On test block
Repairs	
Repairs where the monitor has been damaged by impact, liquid ingressation, fire, short circuit or electrical surge.	Perform Visual Inspection, Power On, all Safety Tests and Full Performance Assurance Tests
Repairs where the MSL board, front end adapter board or any of the measurement boards have been removed	Perform Visual Inspection, Power On, all Safety Tests and Basic Performance Assurance Test. If a certain parameter seems suspicious, perform Full Performance Assurance Test for this parameter.
Repairs of IntelliVue Instrument Telemetry (IIT) board	Perform Visual Inspection, Power On Test Block and IIT communication test
Repairs of WLAN board	Perform Visual Inspection, Power On and WLAN Communication Test
Repairs where the NBP pump has been replaced	Perform Visual Inspection, Power On, all Safety Tests, Basic Performance Assurance Test and NBP Performance Test and Calibration
Repairs where the NBP pump has been removed	Perform Visual Inspection, Power On, all Safety Tests, Basic Performance Assurance Test and NBP Performance Test

Service Event (When performing...)	Tests Required ...Complete these tests)
Repairs of the Measurement Extensions	Perform Visual Inspection, Power On, all Safety Tests, Full Performance Assurance Test
Repairs of the IntelliVue Dock	Perform Visual Inspection, Power On, all Safety Tests, Full Performance Assurance Test
All other IntelliVue Monitoring System repairs	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, Basic Performance Assurance Test and NBP Performance Test (only if the NBP pump has been removed) unless otherwise specified in the Upgrade Installation Notes shipped with the upgrade.
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 WLAN is installed	Perform Visual Inspection, Power On Test, Basic Performance Assurance Test and WLAN Communication Test
Installation of Interfaces or Hardware Upgrades where the parameter boards need to be removed.	Perform Visual Inspection, Power On Test, Full Performance Tests of all removed parameters and all Safety 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

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.

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 Test the monitor either as a standalone device with battery or connect the monitoring system to external power (IntelliVue Dock, external power supply or host monitor) and switch it on. This includes any connected displays and extensions.
- 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

The following safety test needs to be performed on the monitoring system:

- applied part leakage current
- system test (if required)

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 of the monitoring system 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.

Accessories of the monitoring system 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.

Electrical safety tests for MX100/X3 and Measurement Extensions can be performed either on the individual device (MX100/X3 with or without Extensions) connected to the IntelliVue Dock or the external power supply or on a connected host monitor (e.g. MX800). Note that if the electrical safety tests are performed with a host monitor the protective earth resistance and equipment leakage current come mainly from the host monitor. The earthing of MX100/X3 is for functional purposes and does not provide protection against electric shock. The protection against electric shock in this device is provided by double and/or reinforced insulation. The protective earth resistance and equipment leakage current measurements for MX100/X3 are optional.

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 information on standards compliance, please refer to the Instructions for Use.
- Local regulations supersede the testing requirements listed in this chapter.
- If a non-medical electrical device is connected to a medical electrical device, refer to the section for compliance and testing requirements.
- Perform safety tests as described on the following pages.

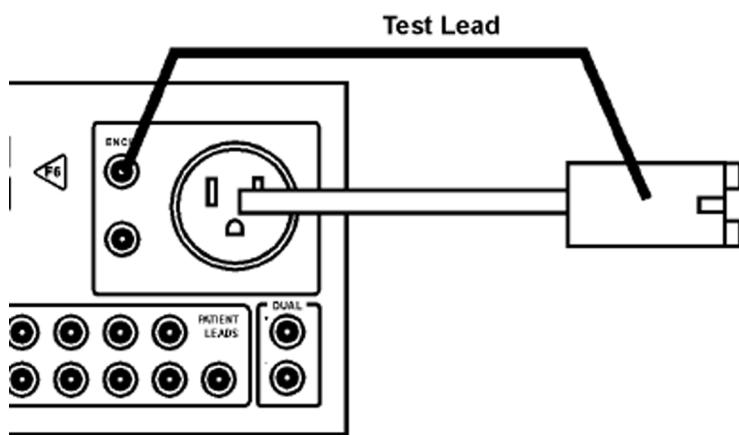
Hints for Correct Performance of Safety Tests

- 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.
- Equipment shall be measured in the operating conditions (e.g. switch positions) that influence the leakage current. The highest value and the related condition, if relevant, shall be documented. Functions that initiate an intended physiological effect shall not be activated.
- When testing a medical electrical system, where possible, test it such that potential ground voltage variations are present as they may be during actual use.

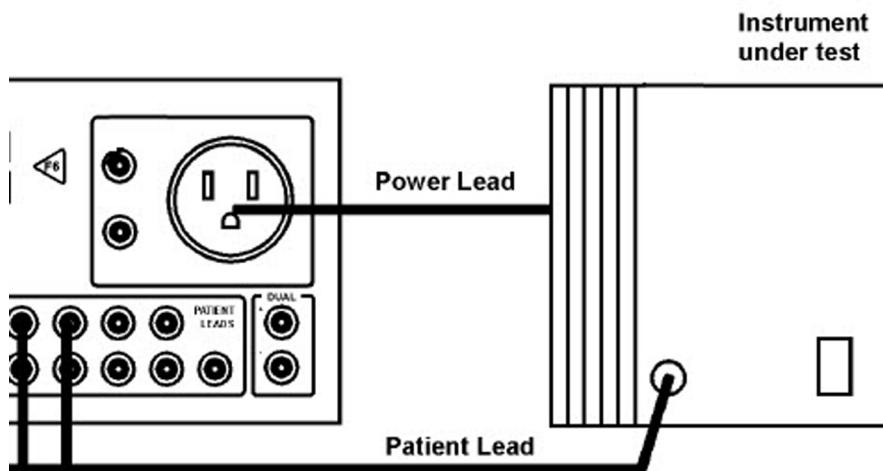
Guideline for Performance of Safety Tests

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

Connect the detachable power cord of the device under test to the safety analyzer's test mains port. For testing the detachable power cord protective earth, use the setup provided with your safety analyzer. 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.



Detachable Power Cord Protective Earth Test - Setup Example



Applied Part Current Test - Setup Example

NOTE

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

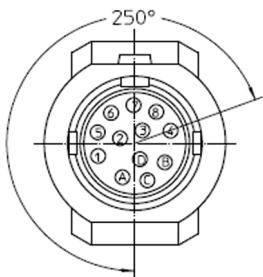
Safety Test Adapter Cable - Schematics

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

NOTE

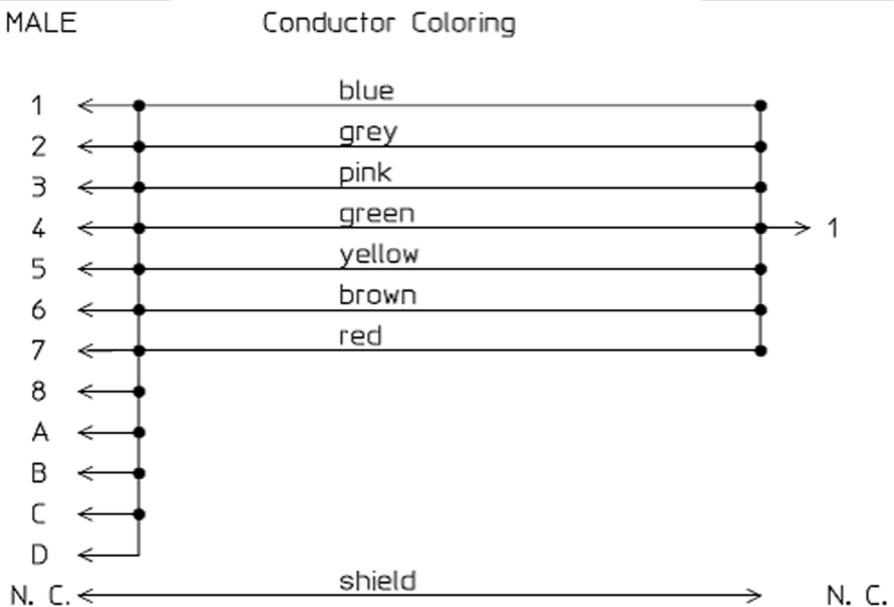
You may not need all of the cables displayed below for electrical safety testing of your respective monitor.

ECG

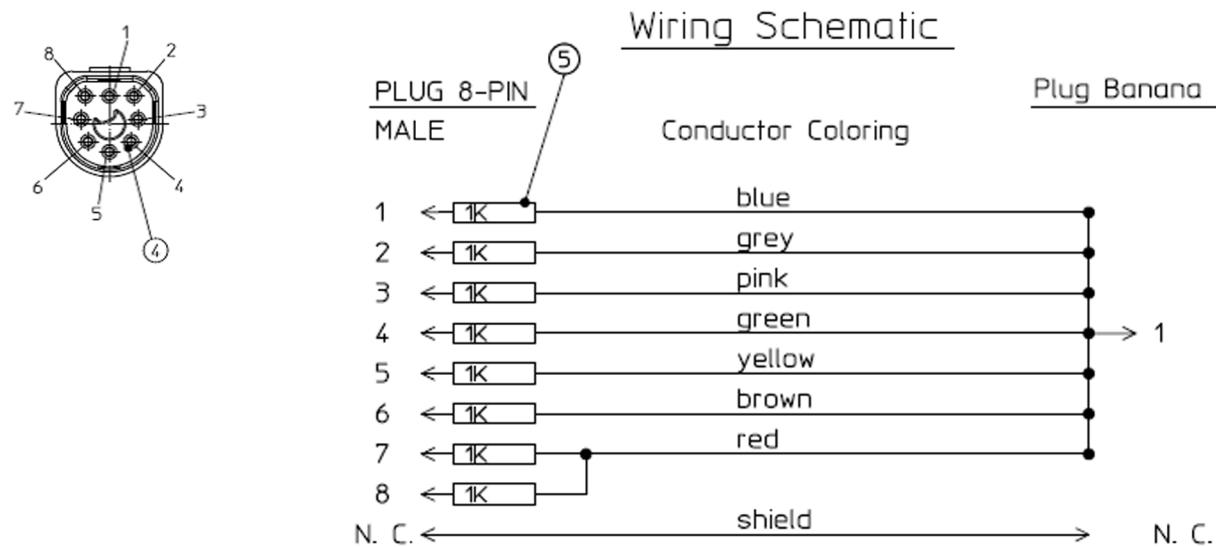


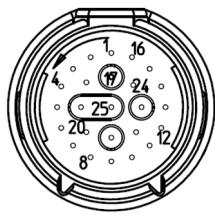
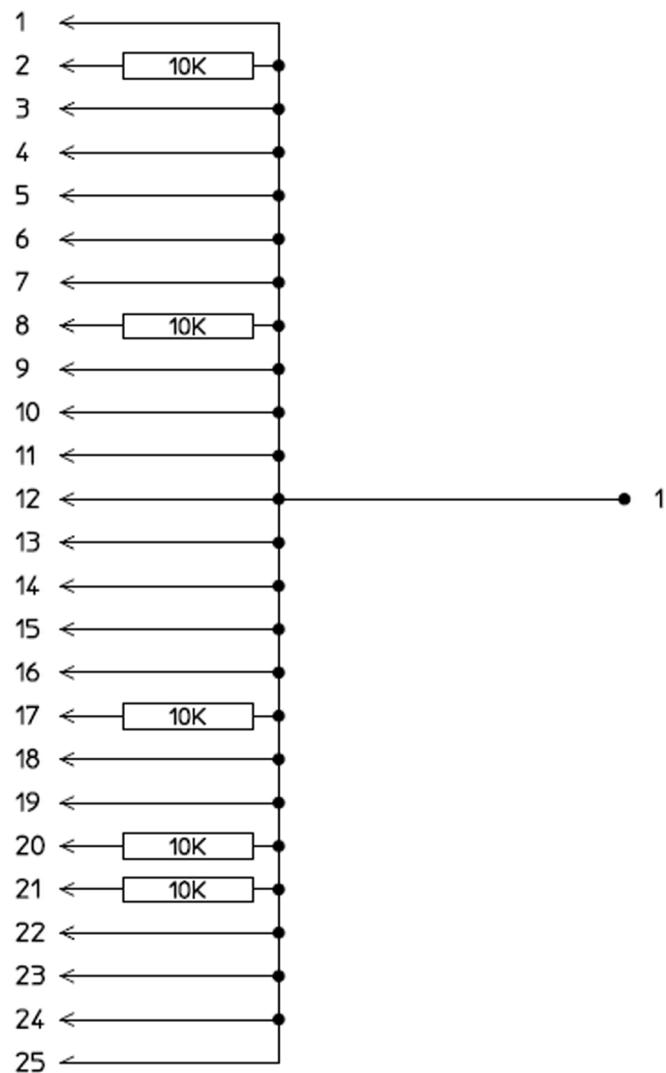
PLUG 12-PIN
MALE

Wiring Schematic

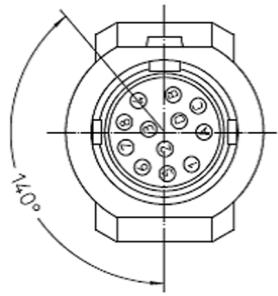


SpO2 (MX100/X3/MMX #SP1 & #SP6, MP2/X2/M3001A/M3001AL/M1020B #A01 - #A04, MP5 #SP1 - #SP4, 867192 SP #3)



Masimo rainbow SET (X2/M3001AL #A05, MP2/MP5/MX100/X3/MMX/867191 #SP5Wiring SchematicConnector, 25-ContactsPlug Banana

Invasive Pressure



PLUG 12-PIN
MALE

Wiring Schematic

Conductor Coloring

A	blue		
B	grey		
C	pink		
D	green		
1	yellow	1	
5	brown		
8	red		
N. C.	shield		N. C.

Plug Banana



Plug 2-Contact
Male

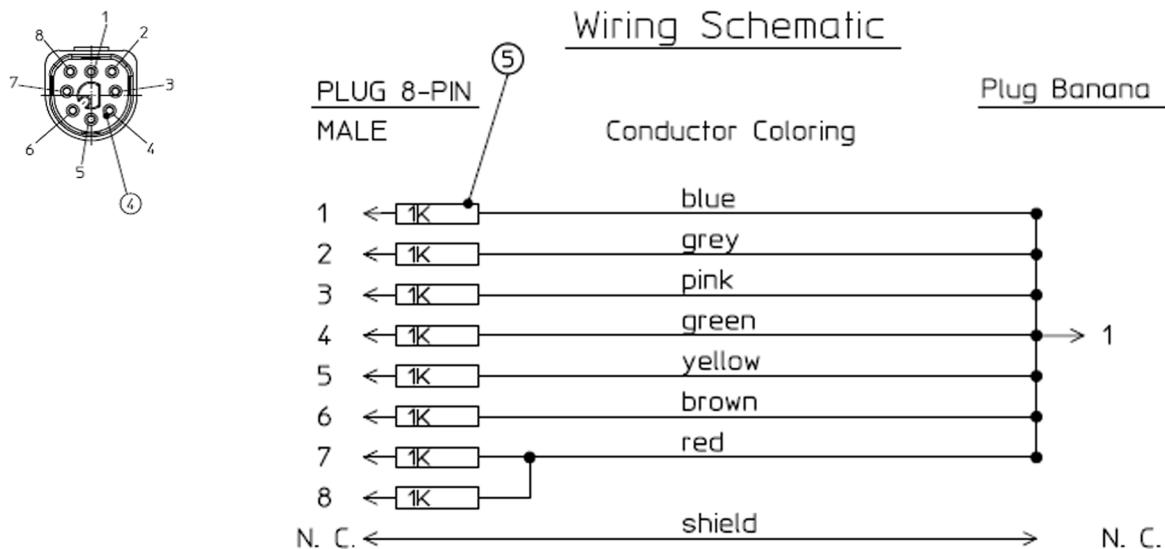
Wiring Schematic

Conductor Coloring

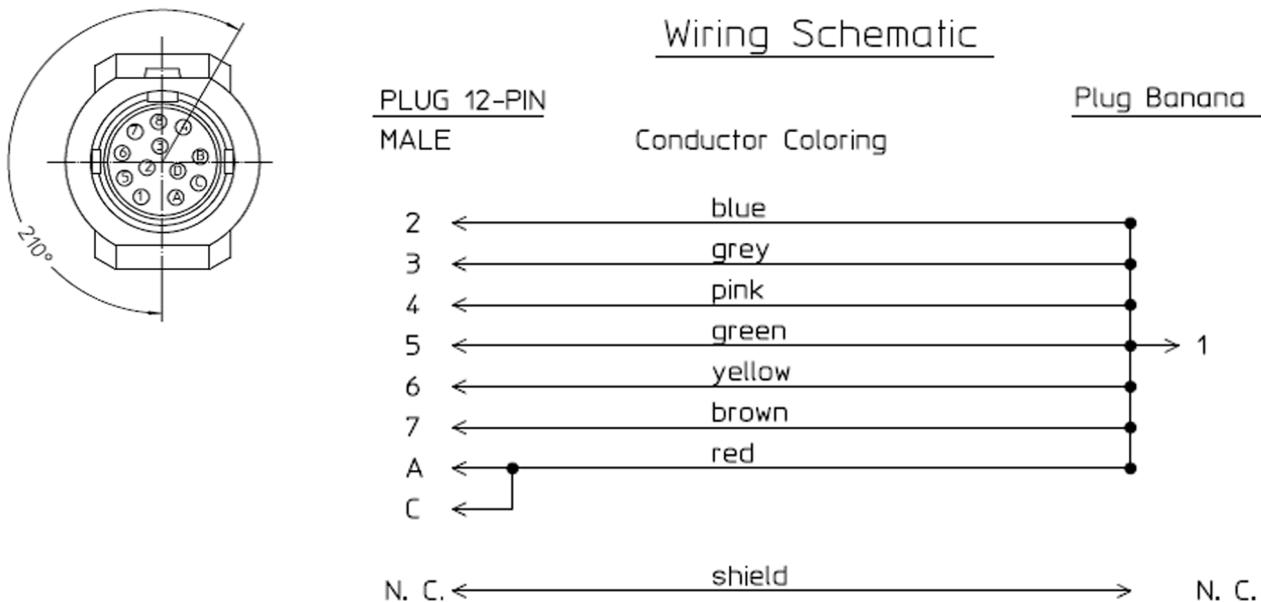
1	<		→ 1
2	<		

Plug Banana

C02



Cardiac Output

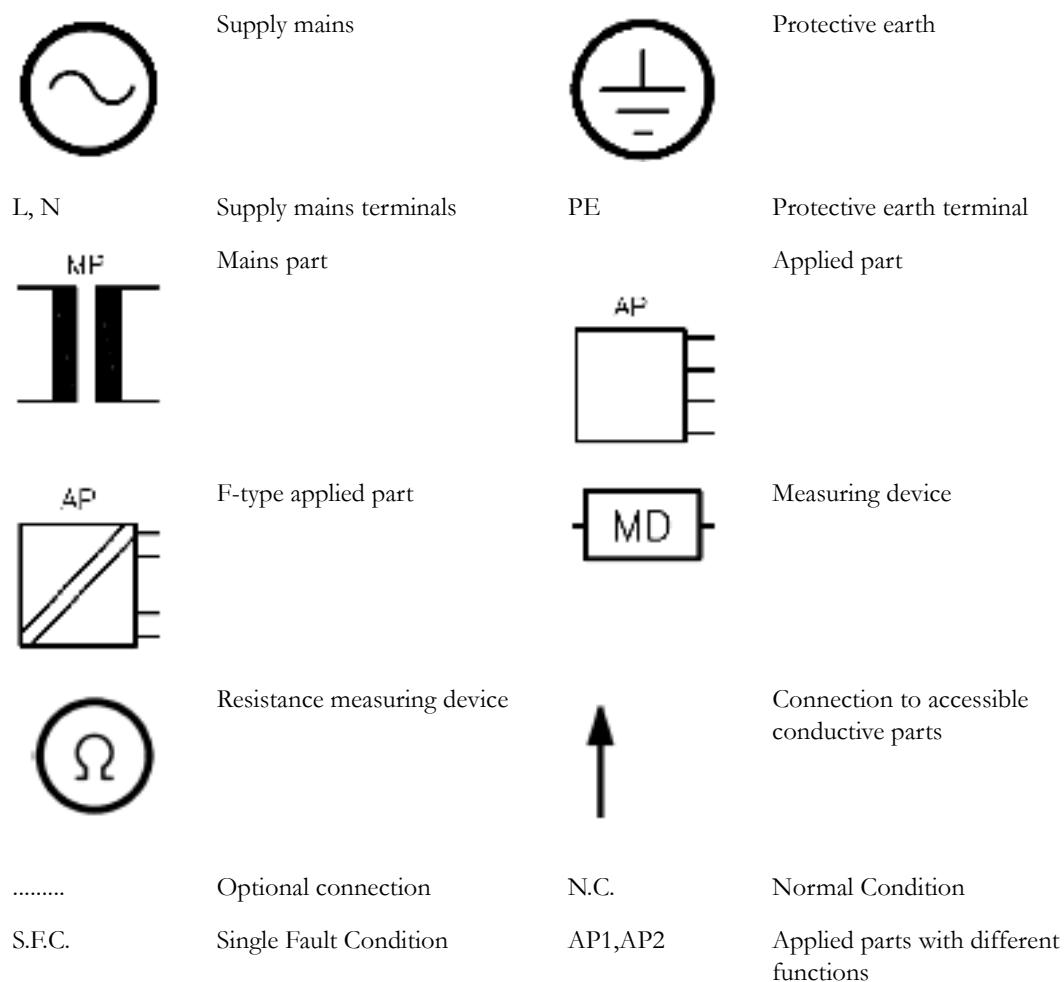


Safety Test Procedures

Use the test procedures outlined here **only** for verifying and recording the initial values prior to or at installation, safe installation or service of the product, and for periodic recurrent testing. The setups used for these tests and the acceptable ranges of values are derived from local and international standards but may not be equivalent. These tests are not a substitute for local safety testing where it is required for an installation or a service event. If using an approved safety tester, perform the tests in accordance with the information provided by the manufacturer of the tester and in accordance with your local regulations, for example IEC/EN 60601-1, ANSI/AAMI ES606601-1, IEC/EN 62353. 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:



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.
-

S(1): Detachable Power Cord Protective Earth Test (optional)

This test can be performed upon request by the customer.

Test to perform:

Use an Ohmmeter or any other adequate measuring device (e.g. electrical safety tester) to measure the earth wire resistance of the detachable power cord.

This safety test is based on IEC/EN 62353.

While low current tests (up to 1 A) are recommended, tests using up to 25 A may be used.

When using direct current, the measurement shall be repeated with opposite polarity. Either value measured shall not exceed the allowable value. The highest value shall be documented.

Report the highest value (X1).

Test	Expected test results
Protective Earth Resistance Test	X1 <= 100mOhms

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.
- 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.
- The functional earth conductor of the IntelliVue Dock and the M8023A power supply is required for EMC purposes. It has no protective function against electrical shock. The protection against electrical shock is provided by double and/or reinforced insulation.
- Medical electrical systems, with or with usage of a multiple socket outlet, must comply to the above referenced expected test results as well.

S(2): Equipment Leakage Current Test

Measurement of the equipment leakage current is not recommended, since the IntelliVue Dock 867043, the Power Supply M8023A and the 867033 (MX100) or 867030 (X3) (if connected to the 867043 or M8023A) are electrical class II type devices with double insulation and no accessible conductive parts which are protectively earthed.

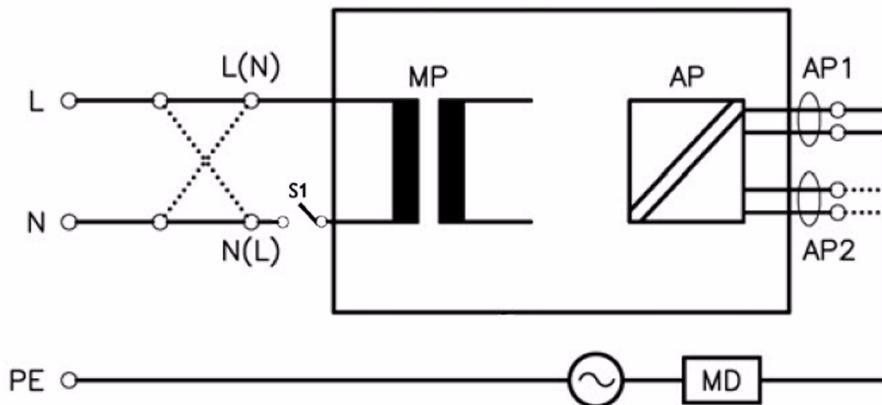
If the 867030 (X3) is connected to a host monitor (e.g. MX600-MX800) the equipment leakage current measurement is driven mainly by the host monitor and shall be performed with 867030 (X3) according to the host monitor's testing and maintenance procedure as described in the service guide.

If testing is requested, perform the equipment leakage current testing according to IEC 62353, direct method, or IEC 60601-1 and use expected test results as given by these standards.

For IEC 62353 the expected test results are N.C. 100µA and S.F.C. 100µA.

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

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.

When testing medical electrical equipment with multiple applied parts, connect them each in turn. applied parts not part of the measurement shall be floating.

This safety test is based on IEC/EN 62353

For measurement limits and test voltage, refer to test block Safety (4).

Report the highest value. (X1).

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

NOTE

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

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

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

Protective Earth resistance of power cord: 100mOhms

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

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

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, 3rd Edition.

What is a Medical Electrical System?

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

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

General Requirements for a System

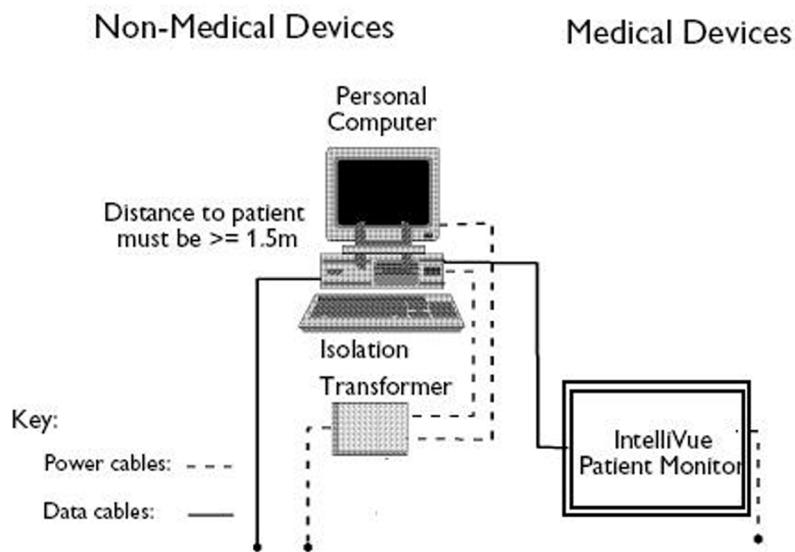
After installation or subsequent modification, a system must comply with the requirements of the system standard IEC/EN 60601-1+A1 Ed.3 clause 16. Compliance is checked by inspection, testing or analysis, as specified in the IEC/EN 60601-1+A1 Ed.3 clause 16 or in this book.

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

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

System Example

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



WARNING

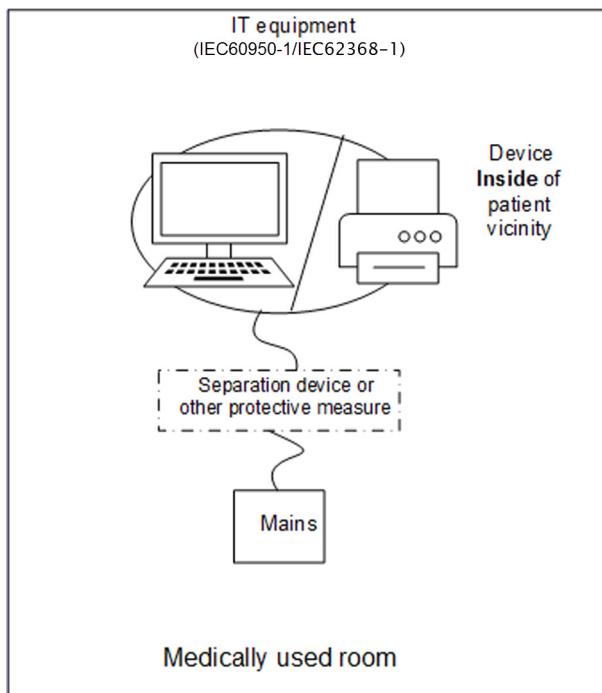
- Do not use additional AC mains extension cords or multiple socket-outlets. If a multiple socket-outlet is used, the resulting system must be compliant with IEC/EN 60601-1+A1 Ed.3 clause 16. Do not place multiple socket-outlets on the floor. Do not exceed the maximum permitted load for multiple socket-outlets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

System Installation Requirements

- Ensure 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 socket-outlets.
- Any multiple socket outlets used must be compliant with IEC 60884-1 and IEC 60601-1 edition 3 clause 16.
- Ensure that any part of the system connected to multiple socket-outlets is only removable with a tool, i.e. the multiple socket-outlet provides a locking mechanism to prevent power cords from being plugged or unplugged unintentionally. Otherwise, the multiple socket-outlet must be connected to a separation device. Multiple Socket Outlets used within the medical electrical system must only be used for powering medical electrical equipment which is part of the system.
- Ensure that any functional connections between parts of the medical electrical system are isolated by a separation device according to IEC 60601-1 edition 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.

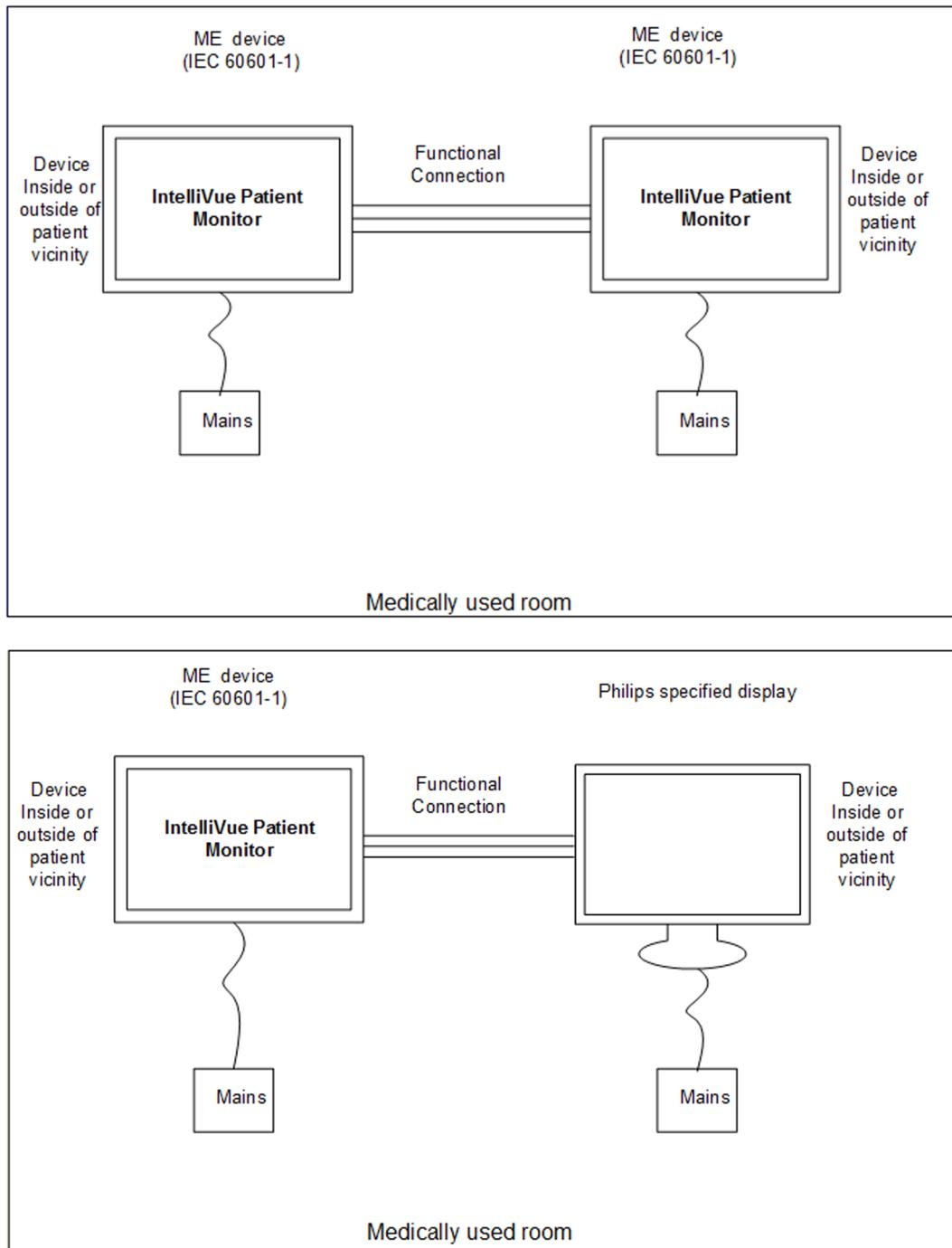
Required Protective Measures at System Installation

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



Case 1: Medical Device Combined with Medical Device

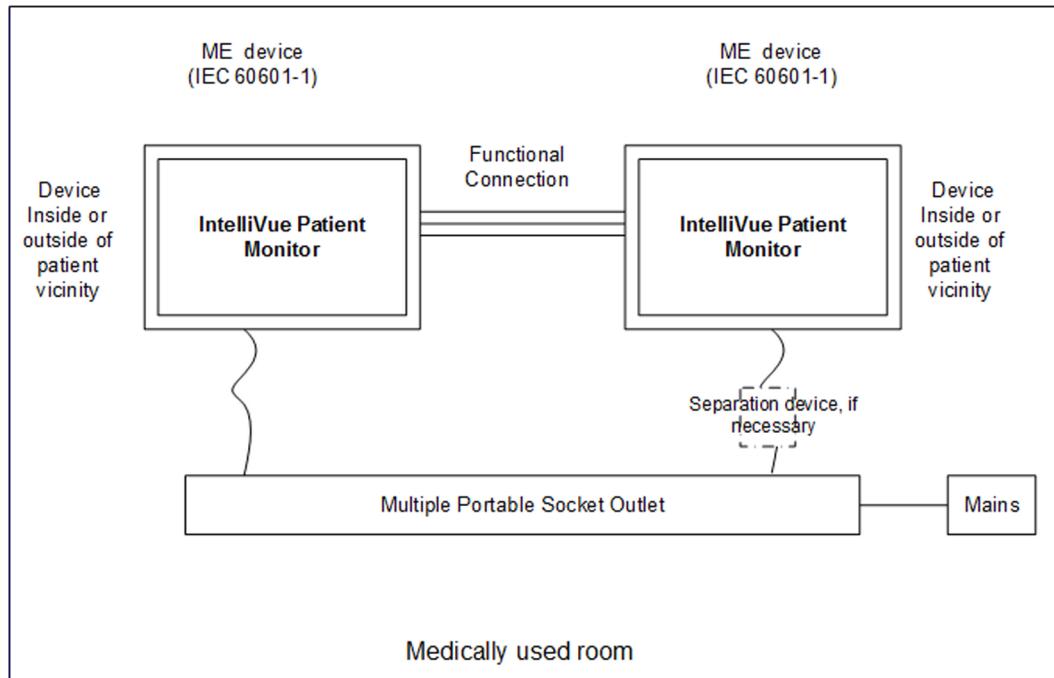
If you combine a medical device with another medical device (incl. Philips specified displays) to form a medical electrical system according to IEC/EN 60601-1 edition 3 clause 16, no additional protective measures are required. The medical electrical devices may be located in or outside the patient vicinity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



If the combined medical devices are connected to the same multiple socket outlet an enclosure leakage current test of the entire device combination on the multiple socket outlet is required to ensure that the resulting protective earth leakage current and equipment leakage current does not exceed the limits of IEC/

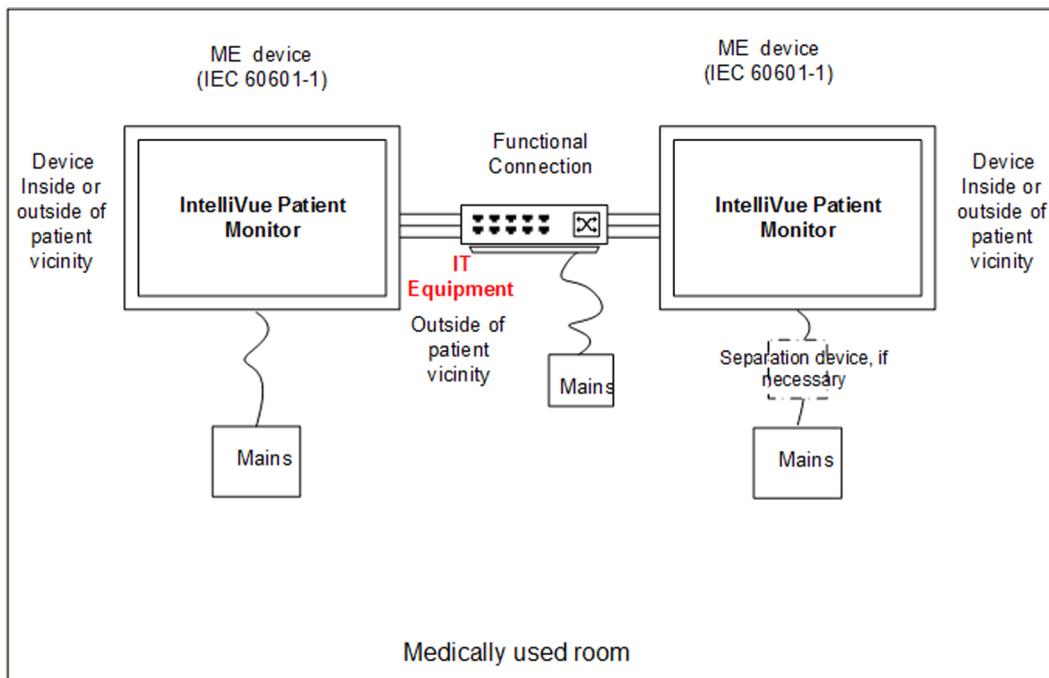
3 Testing and Maintenance

EN 60601-1 edition 3 clause 16. Avoid using multiple 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.



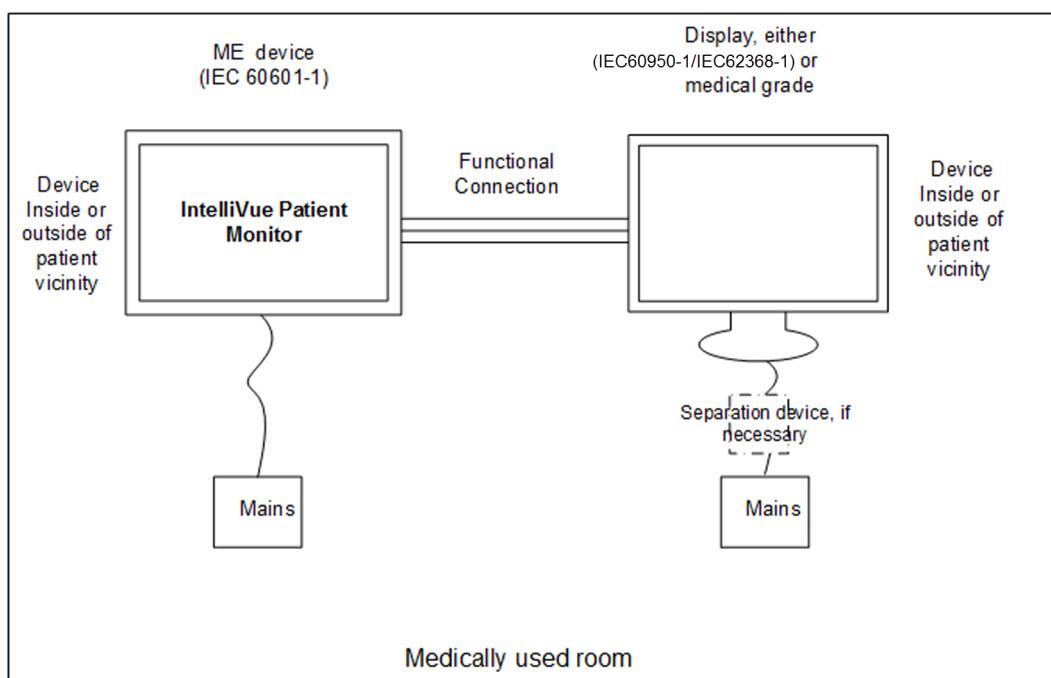
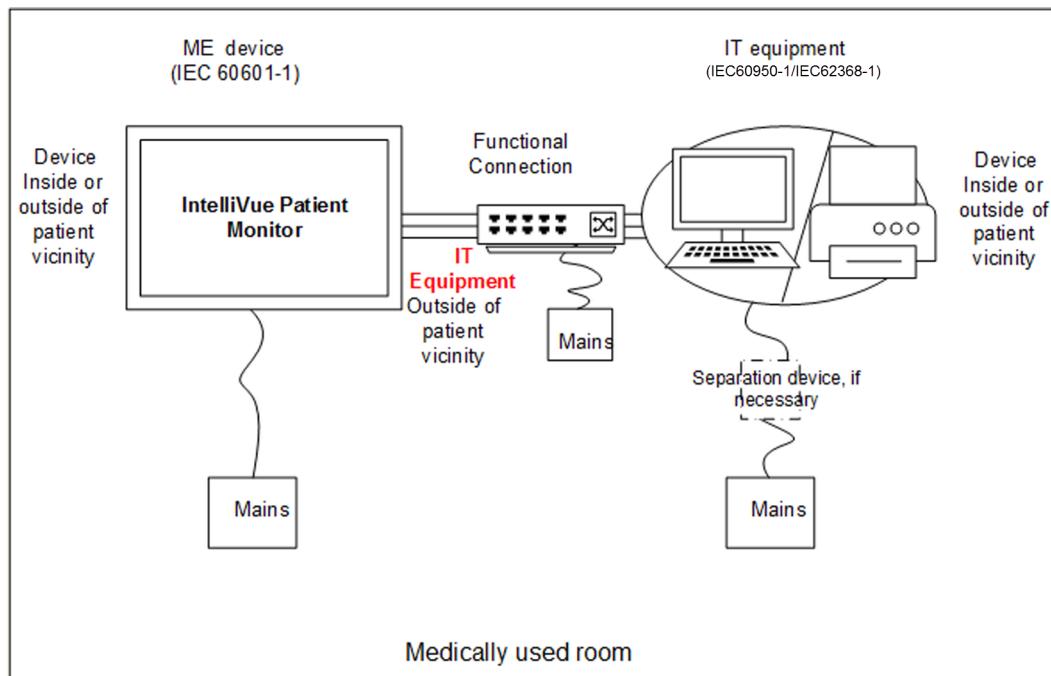
Case 2: Medical Device Combined with a Non-Medical Device

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

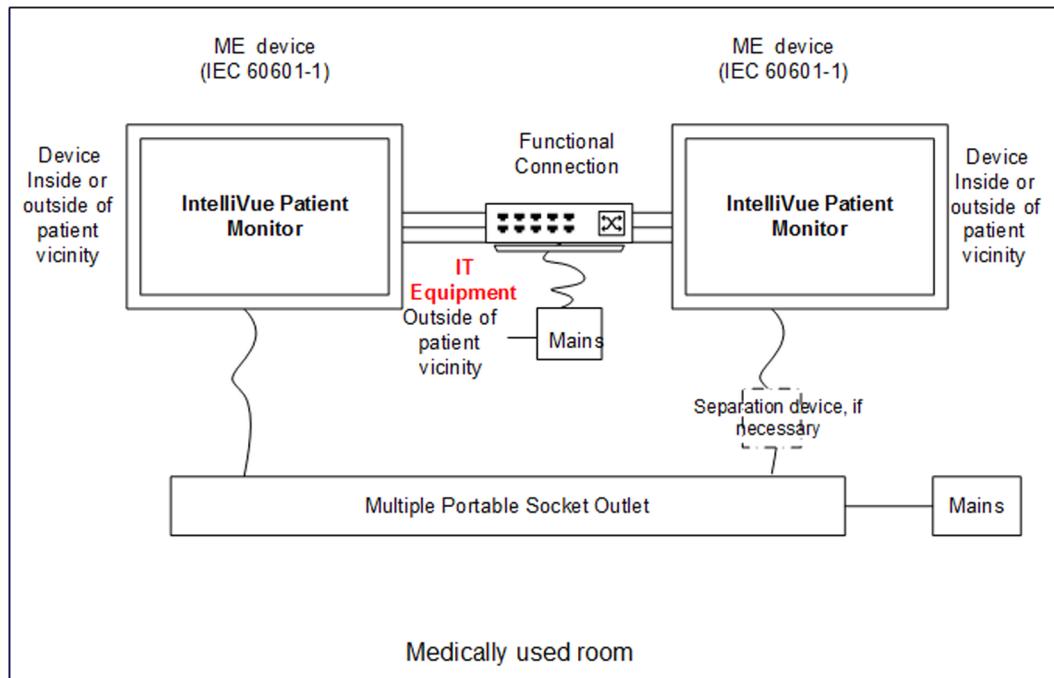


For any IT equipment (IEC60950-1/IEC62368-1) operated in patient vicinity ensure that the equipment leakage current does not exceed the limits described in IEC 60601-1 or IEC/EN 60601-1 edition 3 clause 16. Use a separation device to ensure compliance. After installation of IT equipment in patient vicinity,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

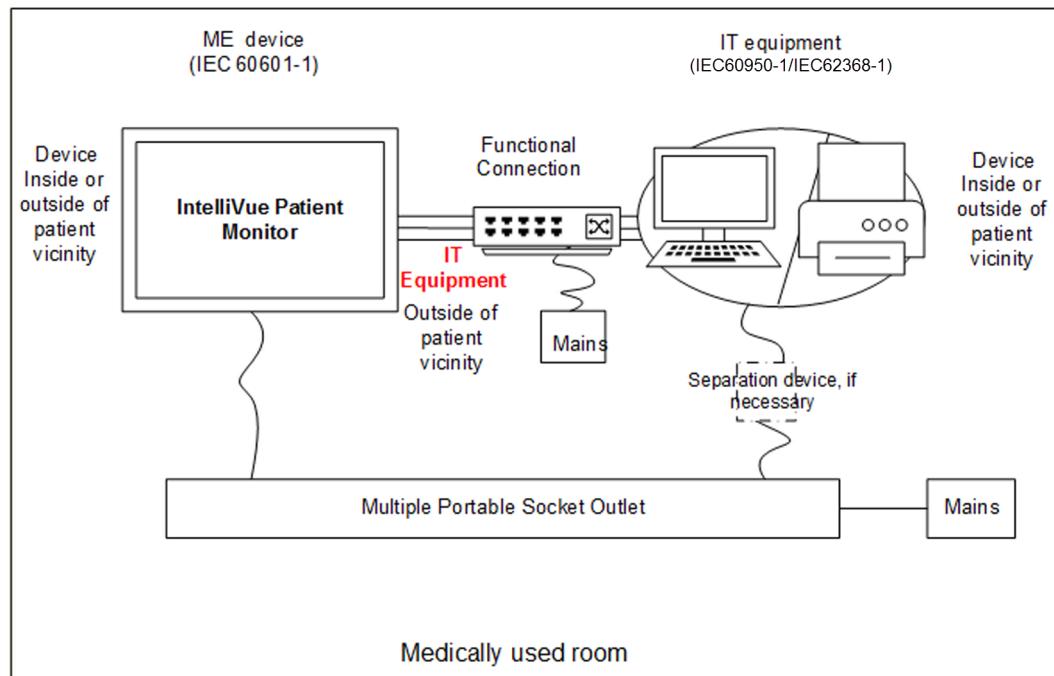
3 Testing and Maintenance



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

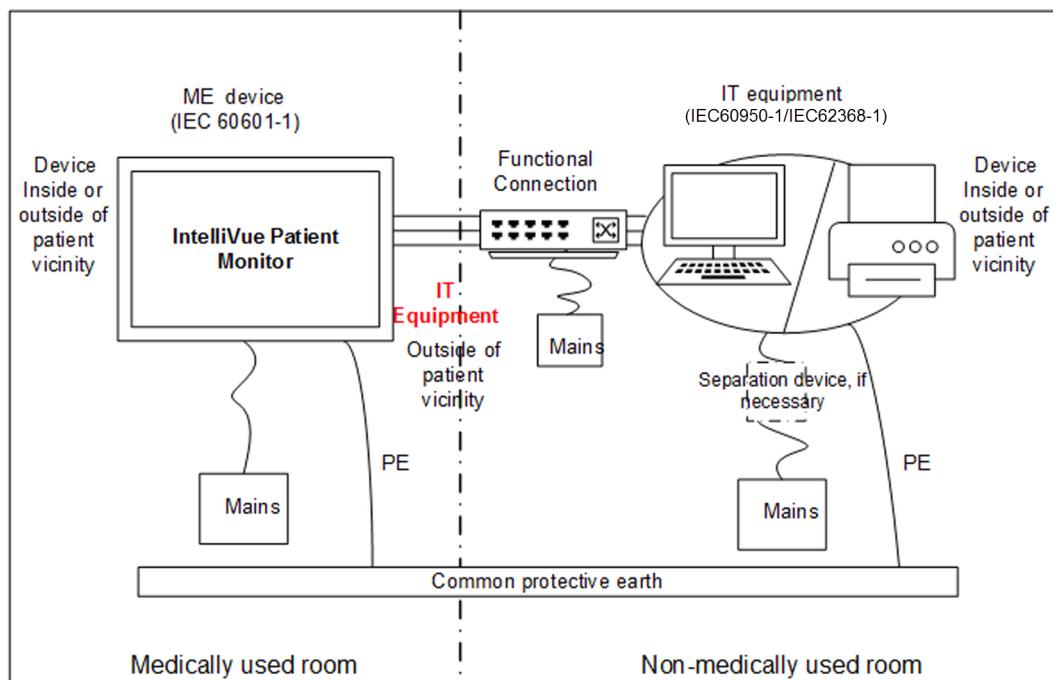
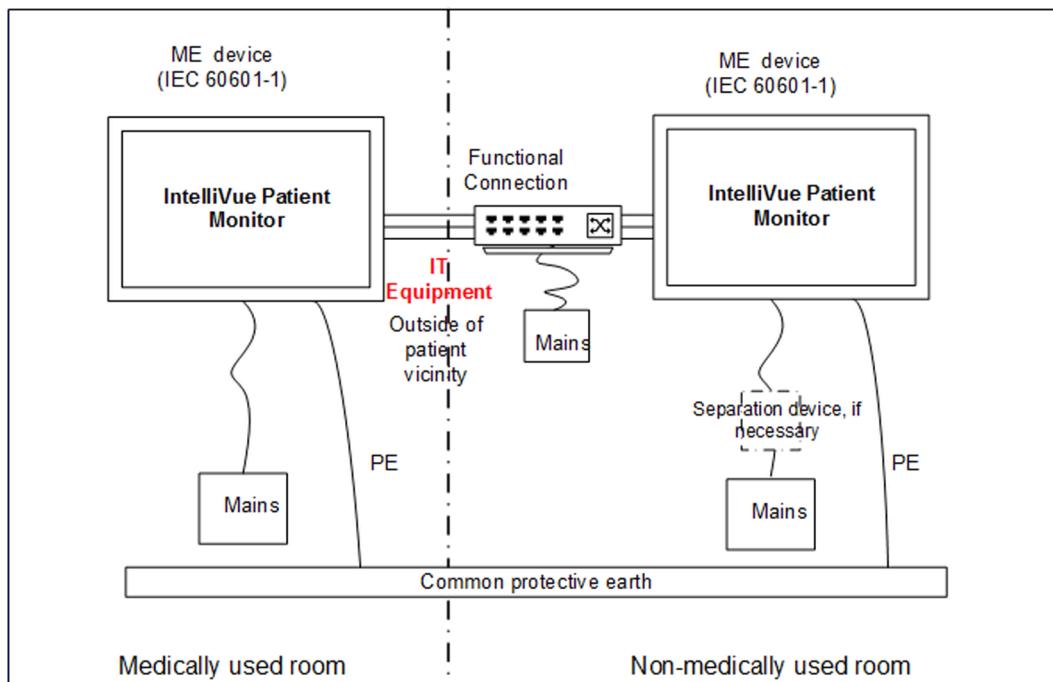


For any IT equipment (IEC60950-1/IEC62368-1) operated in patient vicinity ensure that the equipment leakage current does not exceed the limits described in IEC 60601-1 or IEC/EN 60601-1 edition 3 clause 16. Use a separation device to ensure compliance. After installation of IT equipment in patient vicinity,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

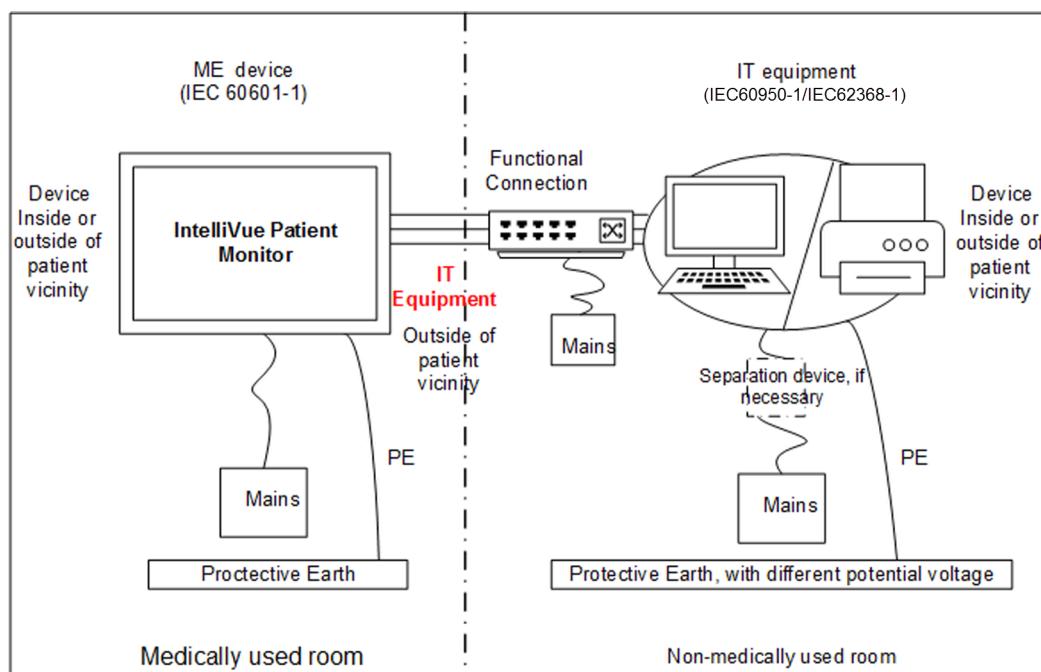
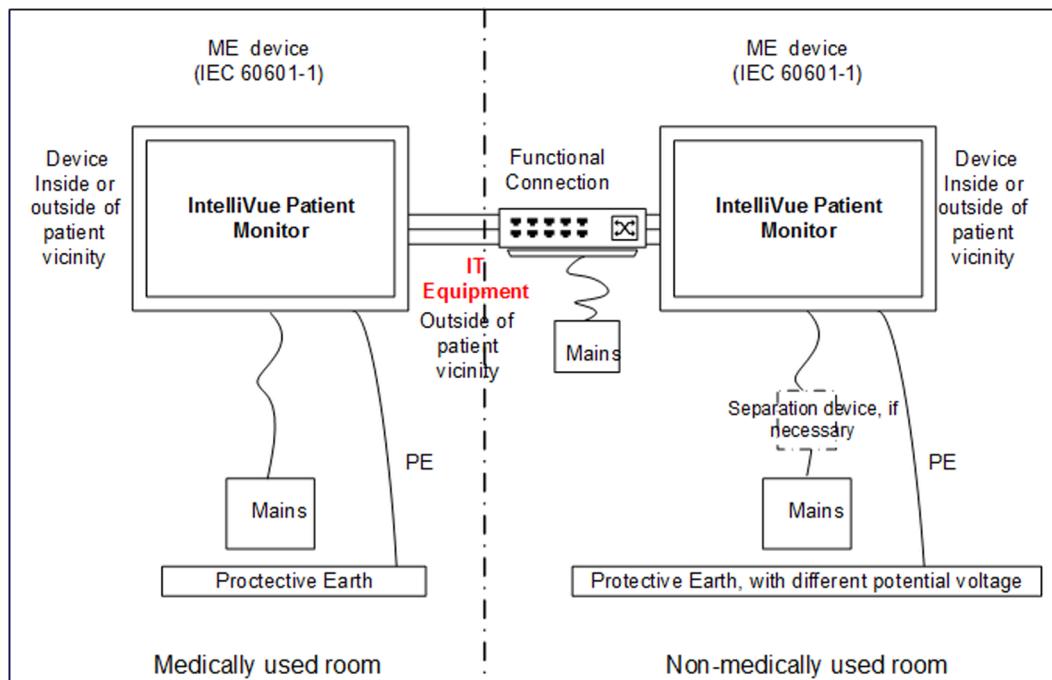


Case 3: Medical Device Combined with a Medical or Non-Medical Device with one Device in a Non-Medically-Used Room

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 edition 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 edition 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 edition 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 edition 3 clause 16.



System Test Procedure

ME SYSTEMS shall be visually inspected to determine whether the ME SYSTEM CONFIGURATION is still the same as at the time of the last INSPECTION, or whether any equipment making up the ME SYSTEM has been exchanged, added or removed. Such changes shall be documented, as well as any changes to the hardware CONFIGURATION of the ME SYSTEM.

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 individual equipment of the medical electrical system has not been tested as a standalone device, the devices have to be tested as of a standalone device (without connection to the system) and as part of the system (with connection to the system).

When equipment combined into an ME SYSTEM by FUNCTIONAL CONNECTION, cannot be tested separately for technical reasons, then the complete ME SYSTEM shall be tested.

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 socket outlet the resulting protective earth leakage current needs to be determined. All system components must be connected to the multiple socket outlet and be switched on during this measurement.

Test	Expected test results
Protective Earth Leakage Current of Multiple Socket Outlets	Sys3 <= 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 CO₂ 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 (also via extension) 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 IntelliVue MX100 or X3.
- 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.

3 Testing and Maintenance

Respiration Performance

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

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

SpO₂ Performance Test

This test checks the performance of the SpO₂ measurement.

Procedure for Philips FAST SpO₂ Technology:

Tools required: none

- 1 Connect an adult SpO₂ transducer to the SpO₂ connector.
- 2 Measure the SpO₂ value on your finger (this assumes that you are healthy).
- 3 The value should be between 95% and 100%.

Test	Expected test results
SpO ₂ Performance Test	95% and 100%

Procedure for Nellcor OxiMax SpO₂ Technology:

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

A possible performance assurance check requiring no tools would be:

- 1 Connect an adult SpO₂ transducer to the SpO₂ connector.
- 2 Measure the SpO₂ value on your finger (this assumes that you are healthy).
- 3 The value should be between 95% and 100%.

Test	Expected test results
SpO ₂ Performance Test	95% and 100%

Procedure for Masimo rainbow SET SpO₂ Technology:

Tools required: none

- 1 Connect an adult SpO₂ transducer to the SpO₂ connector.
- 2 Measure the SpO₂ value on your finger (this assumes that you are healthy).
- 3 The value should be between 95% and 100%.

Test	Expected test results
SpO ₂ Performance Test	95% and 100%

In addition to the SpO₂ Performance Test procedure described above, the following tests are recommended when using Masimo rainbow SET technology after a field repair or if the performance of the Masimo rainbow SET measurement is in question.

NOTE

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

SET Tester and RRa Simulator:

- 1 Connect a dual patient cable (Masimo part number 3503) to the board.
- 2 Connect a Masimo SET tester (Masimo part number 3776) to M15 side of the dual cable.
- 3 Connect one end of an RRa simulator cable (Masimo part number EQ-12070) to M6 side of the dual cable.
- 4 Connect the other end (3.5MM) of the RRa simulator cable (Masimo part number EQ-12070) to a laptop or PC which contains TR19673A_Appendix_A.wav wave file.
- 5 Play the wave file and set up the computer per instructions in R-EQ-12070 document.
- 6 Verify that all enabled parameters are within specified range.

Sensor Port Test Tool:

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

Shield Continuity:

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

Measurement Validation**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.

Philips FAST SpO₂ Technology

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

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

Nellcor OxiMax Technology

Accuracy specifications are based on controlled hypoxia studies with healthy non-smoking adult volunteers over the specified saturation SpO₂ range(s). Pulse oximeter SpO₂ readings were compared to SaO₂ values of drawn blood samples measured by hemoximetry. All accuracies are expressed as \pm "X" digits. Pulse oximeter equipment measurements are statistically distributed; about two-thirds of pulse oximeter measurements can be expected to fall in this accuracy (ARMS) range. Because scatter and bias of pulse oximeter SpO₂ and blood SaO₂ comparisons commonly increase as the saturation decreases, and accuracy specifications are calculated from data spanning the stated range, different accuracy values may result when describing partially overlapping ranges.

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Subjects used to validate SpO₂ measurement accuracies were healthy and recruited from the local population. Comprised of both men and women, subjects spanned a range of skin pigmentation and ranged in age from 18-50 years old.

Oxygen saturation accuracy can be affected by certain environmental, equipment, and patient physiologic conditions (as discussed in the Instructions for Use for the monitor) that influence readings of SpO₂, SaO₂, or both. Accordingly, observations of clinical accuracy may not achieve the same levels as those obtained under controlled laboratory conditions.

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

Masimo rainbow SET Technology:

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

SpO₂, SpCO, and SpMet accuracy was determined by testing on healthy adult volunteers in the range of 60-100% SpO₂, 0-40% SpCO, and 0-15% SpMet against a laboratory CO-Oximeter. SpO₂ and SpMet accuracy was determined on 16 neonatal NICU patients ranging in age from 7-135 days old and weighing between 0.5-4.25 kg. Seventy-nine (79) data samples were collected over a range of 70-100% SaO₂ and 0.5-2.5% MetHb with a resultant accuracy of 2.9% SpO₂ and 0.9% SpMet.

The Masimo sensors have been validated for motion and no motion accuracy in human blood studies on healthy adult male and female volunteers with light to dark skin pigmentation in induced hypoxia studies in the range of 70-100% SpO₂ against a laboratory CO-oximeter and ECG monitor. This variation equals plus or minus one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.

Masimo SET technology with LNOP, LNCS, and M-LNCS sensors has been validated for motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies while performing rubbing and tapping motions, at 2 to 4 Hz at an amplitude of 1 to 2 cm and a non-repetitive motion between 1 to 5 Hz at an amplitude of 2 to 3 cm in induced hypoxia studies in the range of 70-100% SpO₂ against a laboratory co-oximeter and ECG monitor. This variation equals plus or minus one standard deviation, which encompasses 68% of the population.

The Masimo SET Technology with LNOP Neo, LNCS Neo, and M-LNCS Neo sensors has also been validated for neonatal motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies while performing rubbing and tapping motions, at 2 to 4 Hz at an amplitude of 1 to 2 cm and a nonrepetitive motion between 1 to 5 Hz at an amplitude of 2 to 3 cm in induced hypoxia studies in the range of 70-100% SpO₂ against a laboratory CO-oximeter and ECG monitor.

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

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

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

For more details please refer to the sensor's directions for use (DfU).

NOTE

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

NBP Performance Test**NOTE**

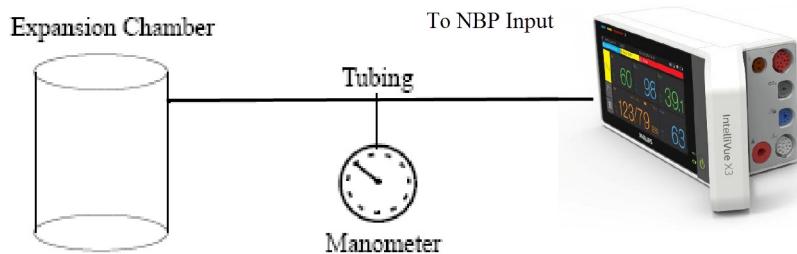
Wait at least 10 minutes after X3/MX100 has been switched on before performing the tests listed below.

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

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

NBP Accuracy Test and Calibration

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



Tools required:

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

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

- 1 Connect the manometer and the pump with tubing to the NBP connector on the MX100/X3 and to the expansion chamber.
- 2 In service mode, select the **Setup NBP** menu.
- 3 Select **Close Valves: On**.
- 4 Raise the pressure to 280 mmHg with the manometer pump.
- 5 Wait 10 seconds for the measurement to stabilize.
- 6 Compare the manometer values with the displayed values.
- 7 Document the value displayed by the monitor (**x1**).
- 8 If the difference between the manometer and displayed values is greater than 3 mmHg or if the NBP pump assembly has been exchanged, calibrate the MX100/X3. If not, proceed to the leakage test.

3 Testing and Maintenance

- 9 To calibrate the MX100/X3, 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 monitor or replace parts.

- 1 If you have calibrated, repeat steps 2 to 6 from the accuracy test procedure so that you have 280 mmHg pressure on the expansion chamber.
- 2 Watch the pressure value for 60 seconds.
- 3 Calculate and document the leakage test value (**x2**).
$$x2 = P1 - P2$$
where P1 is the pressure at the beginning of the leakage test and P2 is the pressure displayed after 60 seconds.
The leakage test value should be less than 6 mmHg.

NOTE

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

NBP Linearity Test

- 1 Reduce the manometer pressure to 150 mmHg.
- 2 Wait 10 seconds for the measurement to stabilize.
- 3 After these 10 seconds, compare the manometer value with the displayed value.
- 4 Document the value displayed by the monitor (**x3**)
- 5 If the difference is greater than 3 mmHg, calibrate the MX100/X3 (see steps 9 to 10 in the accuracy test procedure).

Valve Test

- 1 Raise the pressure again to 280 mmHg.
- 2 Select **Close valves: Off**.
- 3 Wait five seconds and then document the value displayed. The value should be less than 10 mmHg.
- 4 Document the value displayed by the monitor (x4).

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

Invasive Pressure Performance Test

This test checks the performance of the invasive pressure measurement.

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

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

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

Temperature Performance Test

This test checks the performance of the temperature measurement.

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

- 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 $40^\circ\text{C} \pm 0.2^\circ\text{C}$ or $100^\circ\text{F} \pm 0.4^\circ\text{F}$.

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

3 Testing and Maintenance

867040/M3014A Capnography Extension Performance Tests

The procedures below describe the mainstream and sidestream CO₂ performance tests for the 867040 and M3014A Capnography Extensions.

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 CO₂ 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 CO ₂ 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 CO ₂ 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 CO₂ extension pump draws. It should be 50 ml/min ± 10 ml/min. If the value is not within tolerance check your setup again and perform another flow check. If it fails again, the sensor must be replaced. The sensor cannot be calibrated.

Example for an expected test result:

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

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

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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 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
- Gas calibration equipment:
- Cal 1 gas 15210-64010 (5% CO₂)
- Cal 2 gas 15210-64020 (10% CO₂)
- 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*
- 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.

*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 mCO₂ 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 CO₂ 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 mCO₂ 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 mCO₂ outlet.
- 7 Open the Measurement Extension or MP5 and check the tubing connections at the pump outlet and the extension gas outlet. If the connections are good, then there is a leakage in the tubing and you must exchange the Measurement Extension or the mCO₂ 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 mCO₂ gas outlet.
- 2 Leave the calibration line connected to the M3015A inlet or the MP5 mCO₂ inlet..
- 3 Block the inlet of the calibration line using your fingertip and observe the flowmeter display. The value on the flowmeter (**x2**) should decrease to between 0 and 4 ml/min, accompanied by an audible increase in pump noise. The cell pressure shown in the status line on the display should decrease to between 300 and 500 mmHg. Do not block the inlet for longer than 25 seconds as this will lead to an "Occlusion" INOP. If the value is within the tolerance limits, there are no leakages and the leakage check is completed.
- 4 If the value is not within the tolerance limits, there is a leakage between the calibration line inlet and the pump inlet.
- 5 Check the calibration line connections and open the M3015A or MP5 to check the tubing connections at the pump inlet and the M3015A or MP5 mCO₂ 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 mCO₂ assembly of the MP5 must be exchanged.

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

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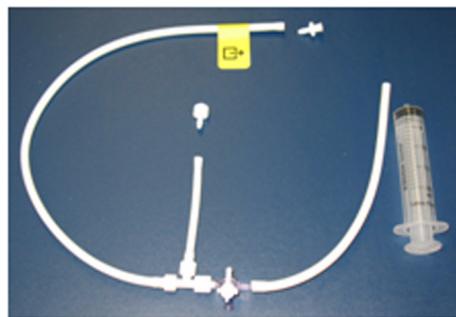
Leakage Check for 867041, M3015B and M3015A with HW Rev C or M3015A with HW Rev. A/B without M1026-60144 Flowmeter

Preparation of Leakage Test Kit:

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

NOTE

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



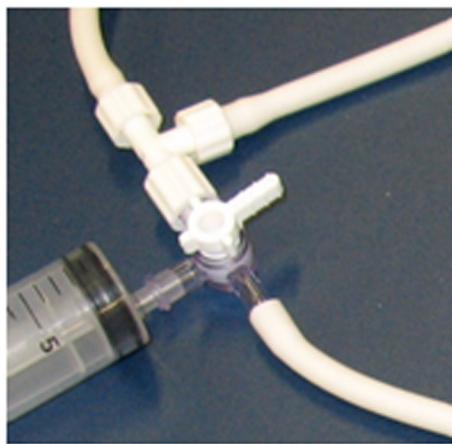
Test Setup:

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

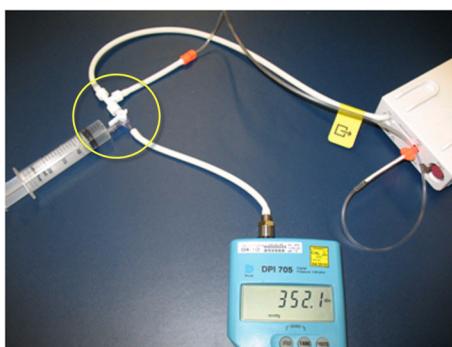


Test Procedure:

- 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.

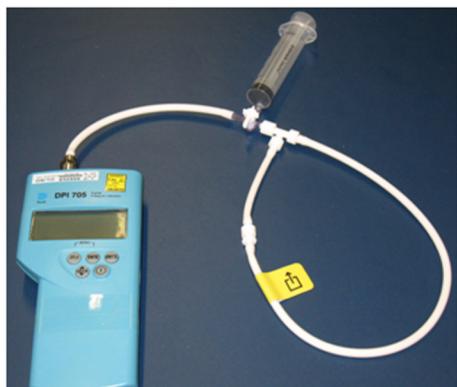
Test	Expected test results
Leakage Check	Reading on the digital barometer change is less than 20 mbar for 30 seconds (pass/fail)

NOTE

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

3 Testing and Maintenance

- 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 air 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.

Flow Rate Check and Calibration

Check the flow rate in the 867041 or M3015A/B Measurement Extension or the MP5 as follows:

- 1 Connect the calibration line to the mCO₂ inlet and the flowmeter outlet to the calibration line.
- 2 Check on the flowmeter the flow that the 867041 or M3015A/B Measurement 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 CO₂ Gas calibration check.

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

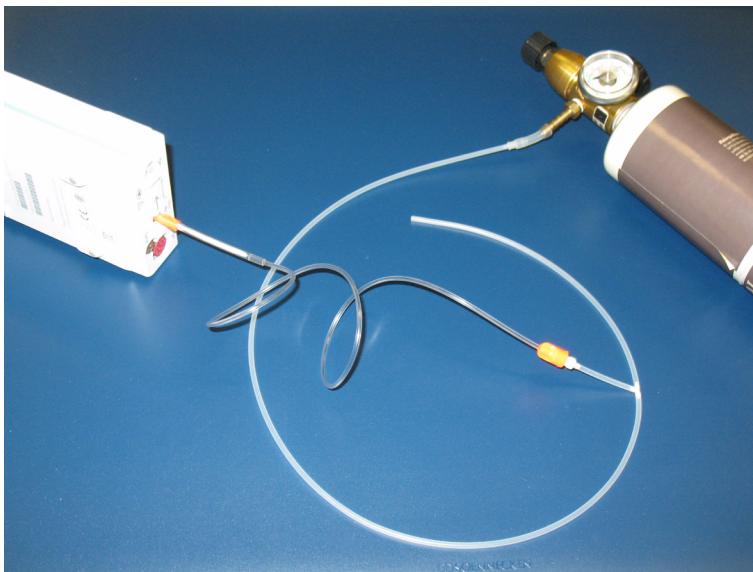
- a. Adjust the flow in the instrument by selecting **Increase Flow** or **Decrease Flow** until it is as close as possible to 50 ml per minute as indicated on the flowmeter gauge.
- b. When you are satisfied that the flow is set as close as possible to 50 ml per minute, select **Store Flow** and confirm 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. DE020xxxx)

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

Noise Check

- 1 With the monitor in service mode, select **Setup CO₂** menu.
- 2 Connect the calibration line, the cal tube, the flow regulator and the 5% calibration gas to the mCO₂ inlet.



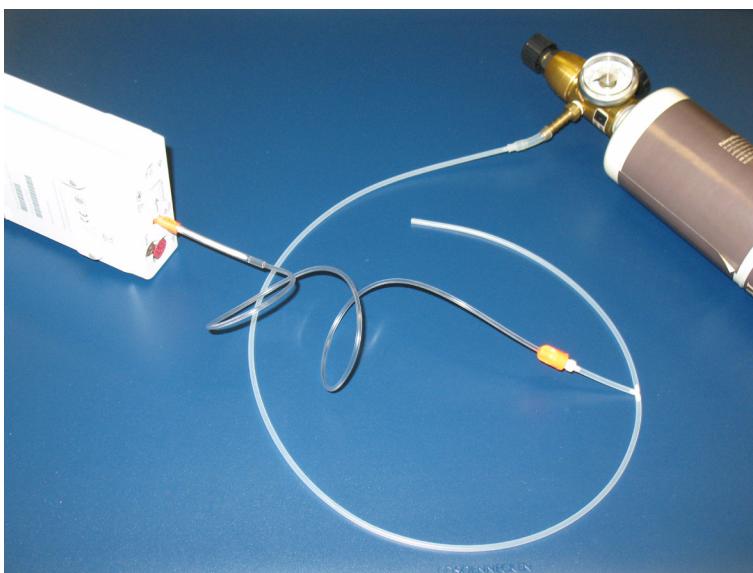
- 3 Open the valve to apply the 5% calibration gas and wait until the value is stable.
- 4 Check the noise index (**x6**) displayed next to the CO₂ value on the display (this indicates the level of noise on the CO₂ wave). If the value exceeds 3 mmHg, replace the measurement extension.

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 CO₂ gas measurement as follows:

- 1 Connect the calibration line, the cal tube, the flow regulator and the 5% calibration gas to the mCO₂ inlet.



- 2 Calculate the expected measurement value in mmHg as follows:
 $0.05 \times (\text{ambient pressure}) = \text{value mmHg}$
for example $0.05 \times 736 = 36.8 \text{ mmHg}$ (with an ambient pressure of 736 mmHg)
- 3 Open the valve on the flow regulator to allow 5% CO₂ gas to flow into the extension. Allow the value to stabilize.
- 4 Check that the value on the instrument (measurement value on the main screen, **x7**) matches the calculated mmHg value $\pm 2.6 \text{ mmHg}$.
If the value is outside the tolerance, calibrate as described in step 8a to 8e below.
- 5 Disconnect the 5% calibration gas and connect the 10% calibration gas.
- 6 Calculate the expected measurement value and tolerance in mmHg as follows:
 $0.1 \times (\text{ambient pressure}) = \text{value mmHg}$
 $\pm 0.07 \times (\text{value mmHg}) = \text{tolerance}$
for example $0.1 \times 737 \text{ mmHg} = 73.7 \text{ mmHg}$ (with an ambient pressure of 737 mmHg)
 $\pm 0.07 \times 73.7 \text{ mmHg} = \pm 5.16 \text{ mmHg}$ tolerance
- 7 Open the valve on the flow regulator to allow 10% CO₂ 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. CO₂**.
 - c. Select the value for the calibration gas. (The default value is 5.0%).
 - d. Open the valve on the calibration gas to allow CO₂ 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 x8 = calculated mmHg value within calculated tolerance

Calibration Verification

- 1 Keep the same setup as described in “CO2 Cal Check and Calibration” on page 70.
- 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 867041 or M3015A/B Measurement Extension or the MP5 mCO₂ 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) 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
Flow Check	x3 = difference between measured value and 50.0 ml/min (x3 = 50+15/-7.5 ml/min)
Noise Check	x4 = noise index displayed on monitor (x4 < 3.0)
CO ₂ Gas Calibration Check	x5 = difference between measured CO ₂ value and calculated value, based on 5% CO ₂ cal. gas. (x5 < 2.6 mmHg)
CO ₂ Cal Verification	x6 = difference between measured CO ₂ value and calculated value, based on 10% CO ₂ cal. gas. (x6 < $\pm \{0.07 \times \text{value calculated}\}$)

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

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 867039 and M3012A Measurement extensions with option C05.

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

$$T_{blood} = 37.0^{\circ}\text{C} +/- 0.1^{\circ}\text{C}$$

Test	Expected Test Results
Cardiac Output Service Tool Procedure Version 1	$T_{blood} = 37.0^{\circ}\text{C} +/- 0.1^{\circ}\text{C}$

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 867039 and M3012A Measurement 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
 - T_{blood}The expected results are:
 - Transpulmonary
 - 341
 - $T_{blood} = 37.0^{\circ}\text{C} +/- 0.1^{\circ}\text{C}$
- 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 T_{inj} value. The expected result is:
 $T_{inj} = 0.0^{\circ}\text{C} +/- 0.1^{\circ}\text{C}$

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

IntelliVue Dock Flexible Sync Out Performance Test

This test checks the performance of the ECG synchronization between the MX100/X3 connected to the IntelliVue Dock and another medical electrical device. It only needs to be performed when this feature is used at the customer site.

Tools required:

- other medical electrical device with ECG Input.

- patient simulator

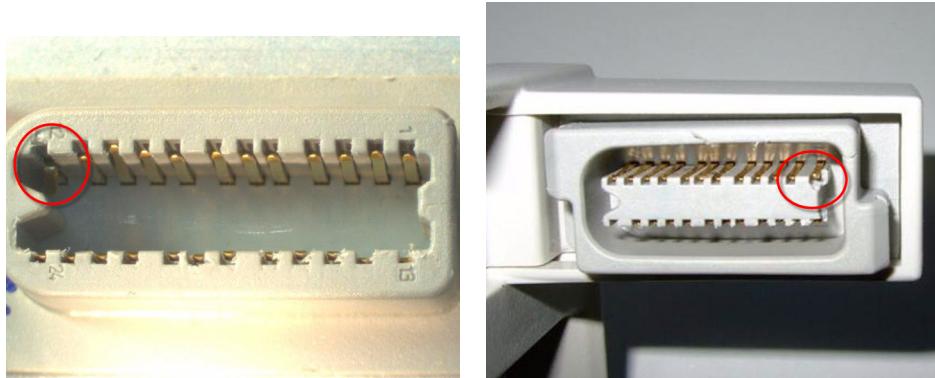
- 1 Connect the patient simulator to the ECG connector and the other medical electrical device to the flexible sync output.
- 2 Set the patient simulator to the following configuration:
 - HR = 100 bpm or 120 bpm (depending on your patient simulator).
 - ECG sinus rhythm.
- 3 Verify that the ECG signal is displayed.

Test	Expected test results
IntelliVue Dock Flexible Sync Out Performance Test	ECG signal is displayed (pass/fail)

MSL Assurance Test

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

- 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)

Battery Performance Test

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. One charge/discharge cycle is the equivalent of one full charge capacity.

In addition, experience indicates that the incidence of failure may increase with battery service life due to the accumulated stresses of daily use.

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:

1 Select the battery symbol on the patient monitor screen.

2 Select the appropriate Battery pop-up key.

3 If necessary, select the Battery pop-up key again to view the battery details.

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

Provide customer with details about age of battery and recommend replacement, if necessary.

Test	Expected test results
Battery Performance Test	Battery age less than 3 years or 500 charge/discharge cycles

WLAN Communication Test

1 Make sure the monitor does not have a LAN connection via IntelliVue Dock, External Power Supply or host monitor, then switch on the monitor.

2 Go into Service Mode and select **Keys ->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 match your installation.
- Enter the required keys/passwords.

3 Select **Keys -> Main Setup -> Network -> WLAN Diagnostic** to access the WLAN Diagnostic window.

4 Proper installation of the WLAN board is assured by connecting to an access point over the wireless link. Place the monitor with the WLAN board installed in close proximity to the access point (e.g. if the access point is mounted on the ceiling, place the monitor directly below). There should be no walls or other obstacles between the monitor and the access point. The following should apply:

- The wireless link should be active, i.e. the **Conn.Status** field should be *Connected*, and the other fields should contain values.

5 Verify that the **Network Type** under **Main Setup -> Network -> Network Status** is shown as **WLAN**.

6 If this test fails, retry in a different physical area with a different access point and/or check the credential settings in the monitor.

Test	Expected test results
WLAN Communication Test	Monitor connects to access point

IIT Communication Test

- 1 Make sure the monitor does not have a LAN connection via IntelliVue Dock, External Power Supply or host monitor, then switch on the monitor.
- 2 Go into Service mode and, select **Keys -> Main Setup -> Network -> Setup IIT**. In the Setup IIT menu, make sure that IIT is set to **Enabled** and set the **RF Access Code** in each profile to match your installation.
- 3 Go into Service Mode. Select **Keys -> Main Setup -> Network -> IIT Diagnostic** to access the Instrument Telemetry Diagnostic window.
- 4 Proper installation of the IIT board is assured by connecting to an access point over the wireless link. Place the monitor with the IIT board 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 the access point (should be vertical).
 - Remove the antenna at the access point. 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 from the IIT adapter to the antenna board 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 Verify that the **Network Type** under **Main Setup -> Network -> Network Status** is shown as **IIT**.
 - 7 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

LAN Communication Test

- 1 Make sure the MX100/X3 is connected to either the IntelliVue Dock or the External Power Supply and that a LAN cable is connected to the IntelliVue Dock or the External Power Supply.
- 2 Go into service mode and select **Main Setup-> Network -> Setup Network**. In the **Setup Network** menu, configure your monitor to match your local installation.
- 3 Verify that your monitor receives an IP address (shown under **Network Status**) or, if you are not using a DHCP or BOOTP server, configure an IP address manually and ping your monitor with its configured IP address via the network.
- 4 Verify that the **Network Type** under **Main Setup -> Network -> Network Status** is shown as **LAN**.
- 5 If this test fails, check the network settings in the monitor.

Test	Expected test results
LAN Communication Test	Monitor receives an IP address or can be pinged via the network

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

Table 3 Test Report

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

Table 4 Test and Inspection Matrix

Test Block	Test or Inspection to be Performed	Expected Test Results	Record the Results (mandatory for Philips Personnel only)	
			What to record	Actual Results
Visual Inspection	Perform Visual Inspection	Pass or Fail	V:P or V:F	
Power On	Power on the unit. Does the self-test complete successfully	If Yes, Power On test is passed	PO:P or PO:F	
Noninvasive Blood Pressure Performance Tests	Perform the Accuracy Test	X1 = value displayed by monitor Difference <= 3mmHg	PN:P/X1 or PN:F/X1	
	Performance Leakage Test	X2 = leakage test value X2 < 6 mmHg	PN:P/X2 or PN:F/X2	
	Performance Linearity Test	X3 = value displayed by monitor Difference <= 3mmHg	PN:P/X3 or PN:F/X3	
	Performance Valve Test	X4 = value < 10 mmHg	PN:P/X4 or PN:F/X4	
Temperature Performance Test	Perform the Temperature Performance Test	X1= 40°C ± 0.2°C or 100°F ± 0.4°F	PT: P/X1 or PT: F/X1	
All other performance tests	Perform the remaining parameter performance tests, if applicable	See expected results in test procedures	P: P or P: F	

3 Testing and Maintenance

Test Block	Test or Inspection to be Performed	Expected Test Results	Record the Results (mandatory for Philips Personnel only)	
			What to record	Actual Results
Safety (4)	Perform Safety Test (4): Patient Leakage Current - Single Fault Condition, mains on applied part.	Maximum leakage current (X1): <=50 µA	S(4): P/X1 or S(4): F/X1	*
System (Sys 1-2)	Perform the system test according to IEC/EN 60601-1 edition 3, clause 16, if applicable, after forming a system	Equipment Leakage Current: Sys1 <= 100 µA (Normal Condition) Sys2 <= 300µA (Single Fault Condition)	Sys: PSys1/PSys2 or Sys: FSys1/Fsys2	*
System (Sys 3)	Perform the system test according to IEC/EN 60601-1 edition 3, clause 16, if applicable, after forming a system	Protective Earth Leakage Current if medical electrical system components are connected to the same Multiple Socket Outlet: Sys3 <= 300 µA	Sys: PSys3 or Sys: FSys3	*

Key: P = Pass, F = Fail, X or Sys = test value to be recorded. * Record the worst-case results and the associated switch positions (e.g. normal/reverse polarity)

NOTE

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

Table 5 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.

Locking/Unlocking Touch Operation

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

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 battery.

NOTE

- In case the MX100/X3 is used in combination with the 865297 battery extension, the following instructions apply to the M4605A battery as well.

About the Battery

When monitoring a patient, **one** Philips (Part No. 989803196521) rechargeable Lithium Ion battery must **always** be inserted into the battery compartment on the bottom of the MX100/X3. This applies even when you are running the MX100/X3 on external power, either via the IntelliVue Dock or external power supply or when connected to a host monitor. A severe yellow INOP (**!!INSERT BATTERY**) will be issued if the monitor is connected to an external power source or host monitor without a battery fully inserted in the battery compartment. This INOP will persist until a battery is loaded.

To use the MX100/X3 with battery power, disconnect it from the host monitor, the IntelliVue Dock or the external power supply (M8023A).

The rechargeable Lithium-Ion battery used in the MX100/X3 is regarded as a *Smart* battery because it has built-in circuitry. (This circuitry communicates battery-status information to the Monitor.)

To get the most out of the battery, observe the following guidelines:

- Condition the battery only upon maintenance request prompt on display.
- **If a battery shows damage or signs of leakage, replace it immediately. Do not use a faulty battery in the MX100/X3.**
- The approximate charging time is 3 hours with the monitor switched off and up to 12 hours or more during monitor operation, depending on the monitor configuration.

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. Recharge the battery after 6 months of storage.

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 40% to 50%. 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.

A battery should not remain inside the monitor if it is not used for a longer period of time.

Stored batteries should be partially charged to 40% to 50% of their capacity every 6 months. They should be charged to full capacity prior to use.

NOTE

- The battery will discharge over time if it is stored inside the MX100/X3 when not connected to AC power via a host monitor, the IntelliVue Dock or the external power supply (M8023A). The reported values for “remaining capacity” and “runtime” will become less accurate when the battery is stored in this way for a longer period of time (that is, several weeks).
- Storing batteries at temperatures above 38°C (100°F) for extended periods of time could significantly reduce the batteries’ life expectancy.
- If the battery goes into deep discharge, it cannot be recharged anymore. Therefore, it is important to check that the battery is always at least partially charged.

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 full 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 full 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:

- 1 Select the battery symbol on the patient monitor screen.
- 2 Select the appropriate Battery pop-up key.
- 3 If necessary, select the Battery pop-up key again to view the battery details.

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

WARNING

The risk of battery failure increases with age, when a battery remains in use longer than 3 years or 500 full charge-discharge cycles. Such failures can result in overheating that in rare cases can cause the battery to ignite or explode.

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.

Checking the Battery Status

When the MX100/X3 is connected to the IntelliVue Dock (867043) or external power supply (M8023A), the battery charges automatically. The battery can be charged remotely from the MX100/X3 by using the battery charger. Use only the 865432 (LG 1480) Smart battery charger with the additional adapter.

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.
- LEDs on battery pack

The External Power LED is only on when the MSL cable is connected and external power is available to the monitor. In this case, the battery can be either charging or fully charged.

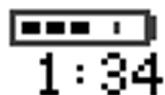
The battery LED can be green, yellow, or red depending on the following conditions:

Battery LED Colors	If the MX100/X3 is connected to a host monitor or IntelliVue Dock/external power supply , this means	If the monitor is running on battery power, this means
Green	battery fully charged (>90%)	
Yellow	battery charging (battery power ≤ 90%)	
Red, flashing		≤ 10 minutes power remaining
Red, flashes intermittently	battery or charger malfunction ^{1,2}	battery or charger malfunction ^{1,2}

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, with the battery power remaining and, when the battery is not charging, an estimate of the remaining monitoring time.

Battery power gauge:

This shows the remaining battery power. It is divided into sections, each representing 20% of the total power. If three sections are filled, as in this example, this indicates that 60% battery power remains. If no battery is detected, a blank battery gauge marked with a flashing red X is displayed. If no data is available from the battery, a question mark is shown in the gauge.

Battery status/malfunction indicator:

Normal battery function is indicated by the battery power gauge, together with the remaining operating time, on the Main Screen. You are informed of problems or changes in the status of the battery by the battery status/malfunction indicator. This consists of a blank battery gauge containing a symbol. If the symbol is red, this indicates a critical situation. You can check the specific cause of the problem by looking at the symbol(s) displayed in the **Battery Status** window.

Battery status indicator	Battery malfunction indicator
 <p>Alternates with the battery gauge on the Main Screen. Check in the Battery Status window to see which status symbol is displayed to identify the cause.</p>	 <p>The red ! flashes. Critical battery situation or malfunction. Check in the Battery Status window to see which malfunction indicator is displayed, or refer to the INOP, to identify the cause.</p>
	 <p>Indicator for missing battery (flashing red X). An INOP is issued when the battery compartment is empty, and the MX100/X3 is connected to external power (a host monitor or the optional IntelliVue Dock or external power supply). This !!!INSERT BATTERY INOP is suppressed for 15 seconds while the monitor is connected to AC mains power, allowing you sufficient time to insert a new battery. After silencing, the INOP reappears every 10 seconds until a battery is inserted.</p>

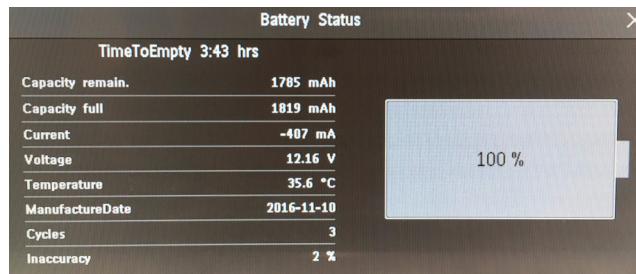
Monitoring Time Available:

While the MX100/X3 is running on battery power, a time is displayed below the battery power gauge. This is the estimated monitoring time available with the current battery power. Note that this time fluctuates depending on the system load (the display brightness and how many measurements you carry out), the age of the battery, and the remaining capacity of the battery. No time is displayed when the MX100/X3 is

running on external power via a host monitor or the IntelliVue Dock (867043) or the external power supply (M8023A).

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**.



Capacity, Remaining tells you how much power is left in the battery.

Capacity, Full Charge tells you how much power the battery can hold when fully charged.

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 (the display brightness and how many measurements and recordings you carry out), the age of the battery, and the remaining capacity of the battery.

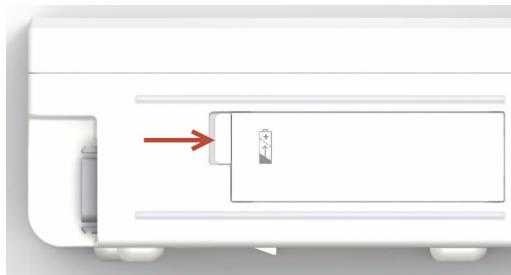
Time To Full is shown in place of **Time To Empty** if the MX100/X3 is connected to mains power via a host monitor or the IntelliVue Dock (867043) or the M8023A external power supply, and tells you how much time is left until the battery is charged to 90%. Please allow indication to stabilize for 3 to 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. You can use the M8043A Smart Battery Charger to charge the batteries externally.

Checking Battery Charge

- ◆ To check the charge status of a battery in a monitor, see the battery power gauge on the Screen or select **Main Setup -> Battery** to enter the **Battery Status** window.
- ◆ To check the charge status of a battery that is not connected to a monitor or battery charger, press the black dot marked "PUSH" on the top side of the battery. The remaining charge is indicated by four LEDs on the electronic fuel gauge directly above the dot. Each LED represents 25% of charge. If all LEDs are lit, the battery is fully charged, if only one LED is lit, 25% or less charge is left.

Replacing a Battery

- 1 Push the tab towards the cover of the battery compartment, then pull upwards to open it.



- 2 Remove the battery by pulling on the battery tab.



- 3 Slide in the new battery, with the contacts first. The battery tab is visible when the battery is correctly inserted.
- 4 Push the cover closed, with the outer tab latched into position.

WARNING

Do not insert your fingers or any objects into the open battery compartment.

Optimizing Battery Performance

The performance of rechargeable batteries may deteriorate over time. Battery maintenance as recommended here can help to slow down this process.

Display Brightness Setting

- ◆ In the **Main Setup** menu, select **User Interface -> Brightness - > Optimum**. This selects a level of brightness suitable for most monitoring locations that uses less battery power than brighter settings.
Please confirm that this level of brightness is suitable for your monitoring location.

Note that your monitor may be configured to dim or brighten the display brightness automatically when you disconnect from power, to suit the most common transport scenario (“**TransportBrightn**” setting).

Charging a Battery

A battery can be charged in a monitor during monitoring. You can also use the M8043A Smart Battery Charger to charge batteries.

- 1 Insert the battery into an MX100/X3 connected to a host monitor or the IntelliVue Dock or the external power supply (M8023A) that is connected to mains power.

- 2 Charge the battery until it is full, the battery LED turns green, and the battery power gauge is filled.

In certain situations, internal temperature conditions may mean that the battery will not charge. This is sometimes necessary to protect the battery from damage, and does not indicate a malfunction. In this case you must use the Smart Battery Conditioner (LG1480) (865432) to charge the battery. To charge the battery in the smart battery charger, insert the battery into the battery adapter and then insert the battery with adapter into the smart battery charger.



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

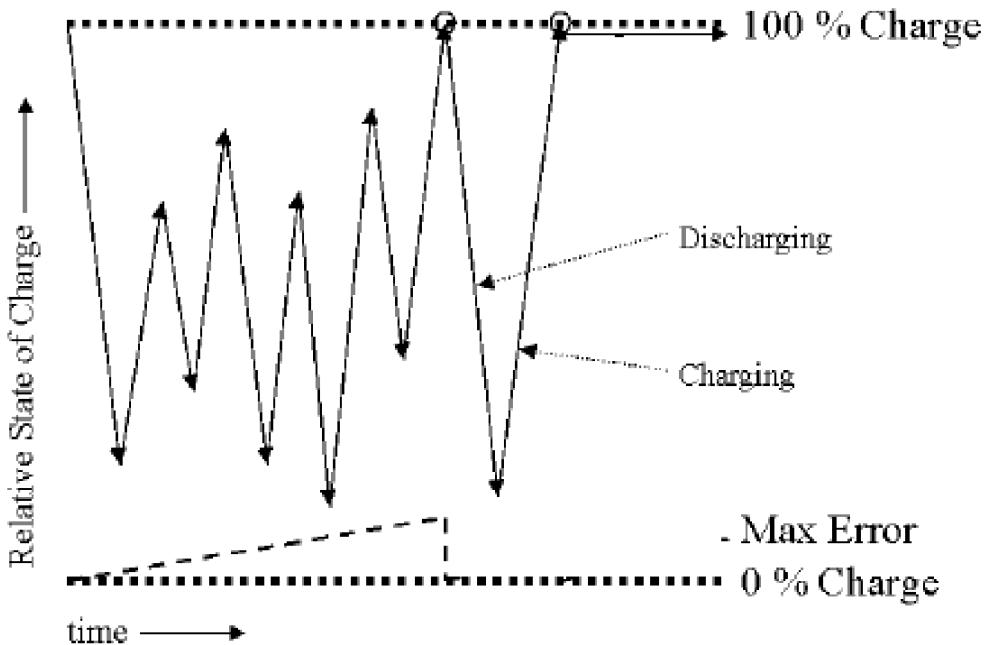
When the battery status signals a conditioning request, the displayed **Time to Full** or **Time to Empty** may not be reliable.

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 .



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.

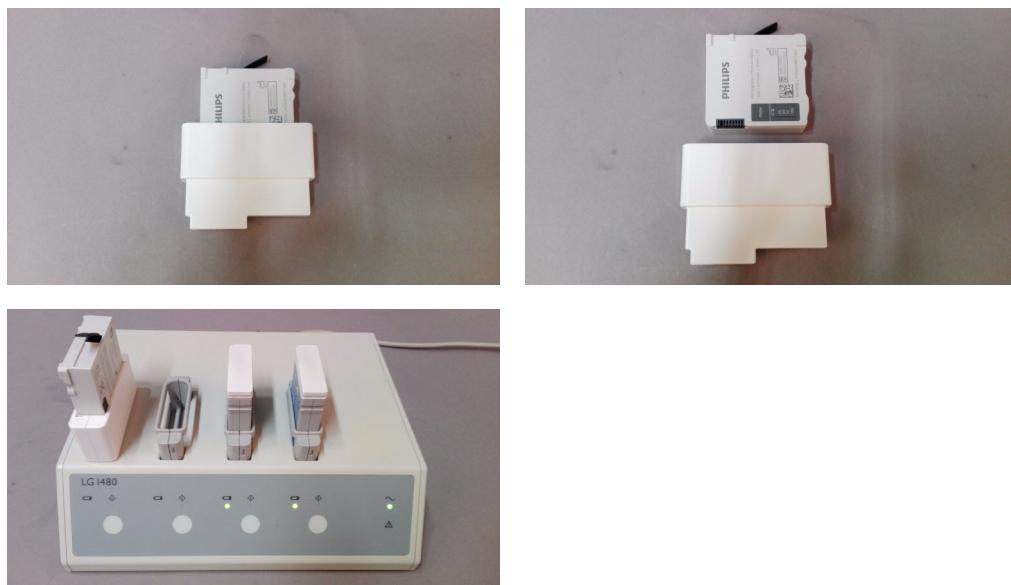
You should condition a battery when its “battery requires maintenance” symbol shows on the Screen. If conditioning is not performed immediately the monitor will still function according to specifications. However, the displayed time to empty and time to full will show increasing inaccuracy. Do not interrupt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

- 1 Insert the battery into an MX100/X3 connected to a host monitor or the IntelliVue Dock or the external power supply (M8023A) that is connected to mains power.
- 2 Charge the battery until it is completely full. Open the **Battery Status** window. Check that the **Battery fully charged** message is displayed.
- 3 Disconnect the MX100/X3 from the IntelliVue Dock or external power supply (M8023A) or host monitor, and let it run until the battery is empty and the MX100/X3 switches itself off.
- 4 Reconnect the monitor to mains power or a host monitor and charge the battery until it is full for use or charge to 40 - 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 UL labeled 865432 Smart Battery Conditioner. To

condition the battery in the smart battery conditioner, insert the battery into the battery adapter and then insert the battery with adapter into the smart battery conditioner.



Battery Safety Information

WARNING

Use only Philips batteries part number 989803196521. Use of a different battery may present a risk of fire or explosion.

Do not open batteries, or dispose of them in fire, or cause them to short circuit. They may ignite, explode, leak or heat up, causing personal injury.

Dispose of used batteries promptly and in an environmentally-responsible manner. Do not dispose of the battery in normal waste containers. Consult your hospital administrator to find out about local arrangements.

CAUTION

Do not disassemble, heat above 75°C (167°F) or incinerate the batteries, to avoid the risk of fire and burns. Keep batteries out of the reach of children and in their original package until you are ready to use them.

If battery leakage should occur, use caution in removing the battery. Avoid contact with skin. Refer to qualified service personnel.

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.

3 Testing and Maintenance

Troubleshooting

Introduction

This section explains how to troubleshoot the monitor if problems arise. Links to tables that list possible monitor difficulties are supplied, along with probable causes, and 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 *General Information* section offers information on how the monitor functions.

Who Should Perform Repairs

Only qualified service personnel (biomedical engineers or technicians) 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 or to a host monitor. Do not perform any disassembly procedures (other than server 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 the required tests listed in the *Testing and Maintenance* section. 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. **867030, 867033**)

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 serial number plate next to the MSL connector.

Software Compatibility Matrix

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

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

Obtaining Replacement Parts

See *Parts* section for details on part replacements.

Troubleshooting Guide

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

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 the Philips Response Center.

Checks for Obvious Problems

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

- 1 Is the battery adequately charged?
- 2 Is the AC power cord connected to the IntelliVue Dock (867043) or the external power supply (M8023A) and plugged into an AC outlet?
- 3 Is the device properly connected to the external power supply or the host monitor?

NOTE

If the instrument is connected to a host monitor, refer to the host monitor's service manual for further troubleshooting instructions.

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

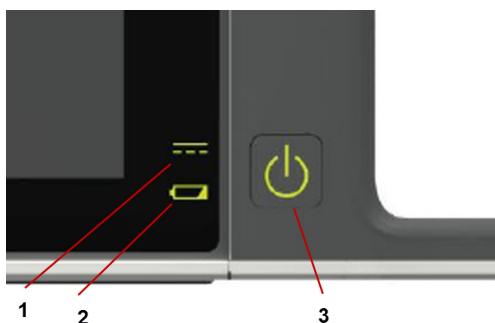
- external power connected, with battery:
 - External Power LED is on (green).
 - Battery LED is green if battery is fully charged, yellow if battery is being charged.
 - Battery LED red and blinking signals battery or charger malfunction. See *Battery-related problems*.
- No external power connected, with battery:
 - All LEDs are off.

Checks with the Instrument switched On, external power available, MSL cable connected

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

Checks with the Instrument switched On, external power not available, MSL not connected

When the monitor is not connected to external power, the external power LED is off and the Power On/Error LED lights up red and then switches to green and stays on.



No.	Description
1	External Power LED (Green)
2	Battery LED (Red/Yellow/Green)
3	Power On/Standby & Error LED (Green/Red)

Initial Instrument Boot Phase

The following tables describe the regular initial boot phase of the monitor and its components. If the boot phase does not proceed as described below go to [Troubleshooting](#) information.

Monitor Boot Phase:

For these steps it is assumed that the Monitor is powered correctly and the +3,3 V System Board supply voltage is okay. This is indicated by the green Power On LED.

Time (sec.) after Power On	Event
0	When the Power On/Off button is pressed, the combined Power On and Error LED switches on immediately and is red.
5	The combined Power On and Error LED switches to green.
9	Boot Screen with "Philips IntelliVue" appears on the display.
20	Boot Screen with "Philips IntelliVue" disappears. Test Sound is issued. Alarm LEDs are tested in the following sequence: Blue on-off (left LED only) Yellow on-off (all LEDs) Red on-off (all LEDs) Fixed screen elements (for example field separators and smart keys) appear on the screen.
25-30	First measurement information appears on the screen, touchscreen is functional

Troubleshooting Tables

The following tables list troubleshooting activities sorted according to symptoms.

NOTE

Be sure to check all cable connections within the monitor before proceeding to further troubleshooting.

How to use the Troubleshooting tables

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

Boot Phase Failures

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
External Power LED does not light up when connected to external power or host monitor	External Power Connection not ok	Check that the external power sources are powered and the power cord and the MSL cable are ok and connected
	MSL cable defective	Exchange MSL cable
	IntelliVue dock, external power supply or power cord defective	Exchange IntelliVue dock, external power supply or power cord
	MSL board defective	Exchange MSL board
	Connection between MSL board and main board	Check connection between MSL board and main board
	HIF board not connected correctly	Check if HIF board is connected correctly
	HIF board connector defective	Exchange HIF board or main board
	HIF board defective	Exchange HIF board
	Main board defective	Exchange main board
Combined Power On/Error LED remains off after pressing power on button:	Battery defective	Check battery and replace, if necessary
	HIF board not connected or not positioned correctly.	Check HIF board connection
	HIF board connector defective	Exchange HIF board or main board
	IIT board defective WLAN board defective integrated measurements defective NBP pump defective Front-End Adapter board defective	Disconnect cables and boards: - IIT board - WLAN board - Measurement Block - NBP pump - cable to Front-End Adapter board then try to switch on the monitor again and reconnect the cables and boards one at a time to isolate any defective component.
	Connection between MSL board and main board	Check connection between MSL board and main board
	MSL board defective	Exchange MSL board and try to switch the monitor on again.
	Main board defective	Exchange main board. Add boards in reverse order and try again with each board.

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Red Power On/ Error LED stays on continuously	IIT board defective WLAN module defective integrated measurements defective NBP pump defective Front-End Adapter board defective	Disconnect cables and boards: - IIT board - WLAN board - Measurement Block - NBP pump - cable to Front-End Adapter board then try to switch on the monitor again and reconnect the cables and boards one at a time to isolate any defective component
	Main board defective	Exchange main board
Red Power On/ Error LED blinks (indicating cyclic reboots)	Software Failure	connect Support Tool directly to host monitor with crossover cable and start “scan for defective devices” 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 no device is detected by the Support Tool or if reloading the software does not fix the problem, proceed as described above in section “Red error LED stays on continuously”
	Main board defective	Exchange Main board
Alarm LEDs remain off:	Speaker not connected	check for INOPs and follow instructions check speaker connection
	Speaker defective	exchange speaker
	Main board defective	exchange main board

Display is blank

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Display is blank (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.)	Flex cable to touch or display not connected	Check flex cable connection to touch and display.
	Touch display assembly defective	Replace touch display assembly
	Main board defective	Replace main board

Touch Operation not functioning

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Touchscreen not functioning	Touchscreen functionality has been temporarily disabled	Check if touchscreen functionality has been temporarily disabled ("Touch disabled, press Main Screen" appears on the screen). If yes, press and hold the Screen key to re-enable touchscreen operation.
	Flex cable to touch defective or not positioned/connected correctly	Check flex cable connection to touch
	Main board defective	Exchange main board
	Touch display assembly defective	Exchange touch display assembly

General Monitor INOP Messages

INOP Message	Possible Causes of Failure	Failure Isolation and Remedy
Check Monitor Func	Problem with too low voltages in the monitor. Alarm lamps, display or interfaces may not function correctly.	Disconnect cables of: - Front-End Adapter board - IIT - WLAN and reconnect them one at a time to isolate any defective board
	Main board defective	Replace the main board
Check Monitor Temp	The temperature inside the monitor is too high	Check the environment for possible causes
	Battery temperature is too high	Check the battery.
	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
Check Passwords	Technical or network defect has led to the loss of the password settings block	Set up a new Admin password and then either manually enter new passwords for the operating modes or copy them onto the monitor in a configuration using the Support Tool Mark2.
<ul style="list-style-type: none"> • MON Msmt Malf (MX100 only) • X3 Msmt Malf (X3 only) 	Contact problem / defective cables	Check the connections between the Measurement boards, Front-End Adapter board and main board, or replace the cables
	Adapter board defective	Replace the Front-End Adapter board
	Main board defective	Replace the main board

Battery related problems

Symptoms	Causes of Failure	Failure Isolation and Remedy
Batt Empty INOP tone, battery LED flashes During this INOP, alarms cannot be paused or switched off.	The estimated remaining battery-powered operating time of the battery is ≤10 minutes.	Insert full battery or recharge the battery immediately. 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
	Communication problem between battery connection board and main board.	Check battery in a different monitor. If INOP persists replace battery.
		Check connection between battery connection board and main board.
		Check battery connection board using a known good battery. If INOP persist, replace battery connection board board.
		Replace main board.
Batt Low INOP tone	The estimated battery-powered operating time remaining is less than 20 minutes.	Insert full battery or recharge the battery
Batt Malf INOP tone, battery LED flashes 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 main board.	Replace the faulty battery. If the condition persists and the monitor is not connected to external power, this INOP is re-issued two minutes after you acknowledge it. Check the battery in a different monitor or in a battery charger. If the INOP persists the battery is faulty. Check the connection between battery connection board and main board. Check the battery connection board with known good battery. If the INOP persists, replace battery connection board. If the problem persists, replace main board.

4 Troubleshooting

Symptoms	Causes of Failure	Failure Isolation and Remedy
Charger Malfunc INOP tone, battery LED flashes	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, check the connection between battery connection board and main board, replace the battery connection board, if necessary. If the problem persists replace the main board.
Check Batt Temp INOP tone	The temperature of the battery is too high.	Check that the monitor is not exposed to heat.
!!!Insert Battery INOP tone	The monitor is connected to an external power source without a battery fully inserted.	Insert a battery into the battery compartment.

Alarm Lamps

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
INOP Message Check Alarm Lamps is issued	Main board defective	Replace main board
Alarm occurs, but no LED lights up	Environmental lighting too bright	Place monitor in a darker environment
	Main Board defective	Replace 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
	Speaker assembly defective	Replace speaker assembly
	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 sound too quiet	Speaker foil defective.	Exchange monitor housing.

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.

IntelliVue Dock Problems

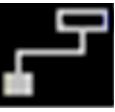
Symptoms	Cause of Failure	Failure Isolation and Remedy
MX100 or X3 not charging, power LED on IntelliVue Dock is off	Power cord defective IntelliVue dock defective	Exchange power cord Exchange IntelliVue dock
MX100 or X3 not charging, power LED on IntelliVue Dock is green	MSL connector defective IntelliVue Dock MSL board defective IntelliVue dock defective	Exchange MSL connector assembly in IntelliVue Dock Exchange MSL connector assembly in IntelliVue Dock Exchange IntelliVue dock
MX100/X3 has no LAN connection when docked	LAN connector or IntelliVue Dock MSL board defective	Exchange MSL connector assembly in IntelliVue Dock
No Flexible Sync Out Signal	Flexible sync out not configured correctly Wrong or defective cable No flexible sync out signal available IntelliVue dock defective	Check configuration of flexible sync out (see configuration guide) Make sure you are using the correct cable Measure signal with oscilloscope. Exchange IntelliVue dock
No ECG-OUT signal to the Defib		Disconnect the Defib cable. Connect Known good Defib and Defib cable. Check ECG OUT signal at defib again. If there is still no signal: Exchange IntelliVue dock

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)

4 Troubleshooting

Wireless Icon	Wired Icon	Inverse Video	Blinks	Icon Comments	INOP Message	What does it mean?
		No	No	Central - outline only	"No Central Monitoring"	MONITOR is connected to the LAN and has an IP address assignment, but the bed is not being monitored at the central 1. MONITOR is not assigned to a sector 2. There is another monitor on the network with the same "Equipment Label"
		No	No	Central - outline only, Client - filled *	"No Central Monitoring"	MONITOR is connected to the LAN and has an IP address assignment, but the bed is not being monitored at the central 1. MONITOR is not assigned to a sector 2. There is another monitor on the network with the same "Equipment Label" However, Management Association is available.
		No	No	Central - solid box, edge clipped	-	MONITOR assigned to a sector and is being monitored by a central, but no Time Service detected.
		No	No	Central - solid box	-	Normal Operation - MONITOR assigned to a sector and is being monitored by a central
		No	No	Central - solid box, network line extended	-	Normal Operation MONITOR assigned to a sector and is being monitored by a central. This monitor also has OVERVIEW functionality on other beds.
	-	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.

Wireless Icon	Wired Icon	Inverse Video	Blinks	Icon Comments	INOP Message	What does it mean?
		Yes	Yes	Central - outline only, line for broken connection to central	"No Central Monitoring"	Monitor lost connection to the Information Center: 1. LAN cable was disconnected 2. Information Center was disconnected 3. Network infrastructure failure (switch, etc.) 4. Out of range (wireless MONITOR)
		Yes	Yes	Central - outline only, Client - filled	"No Central Monitoring"	MONITOR assigned to a sector and is being monitored by a central, but Management Association is available

* Only for Software Release ≥ M.0

Network related problems

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Prompt Message “no central assigned to this bed” is issued	The monitor label is not set in the monitor (if the beds are “monitor labeled” in PIIC/PIC iX)	Set Monitor Label in Config Mode
	Problem with thePIIC/PIC iX to Switch communication (if the beds are “port mapped” in PIIC/PIC iX)	Check PIIC/PIC iX to Switch communication, Switch configuration and Firmware status
INOP “Unsupported LAN” is issued. One of the following icons is displayed.	Network failure	Check if network switches, PIIC/PIC iX 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 PIIC/PIC iX
	IIT installed, but no IIT infrastructure available	Move monitor back into IIT infrastructure or, disable IIT in Setup IIT menu if no infrastructure is available.

4 Troubleshooting

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
No connectivity to PIIC/ PIC iX, no prompt or error message on monitor	Hardware Defect	Check LAN cable connection of IntelliVue Dock or host monitor. Check MSL connection between MX100/X3 and IntelliVue Dock or host monitor
		Check main board in monitor and the external power supply.
		Check network switch
	Configuration problem	Check switch configuration and firmware revision

WLAN Problems

Symptoms	Cause of Failure	Failure Isolation and Remedy
No Network icon or Network icon flashes. No association to central station.	WLAN and IIT enabled at the same time	If both WLAN and IIT are installed, make sure that IIT is set to Disabled .
	Communication problem between the monitor and the WLAN board 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. Check the antenna cable connection between the WLAN board and the antenna. Check the cable connection between the WLAN board and the system interface board. Check that the indicator behind the RSSI value (Main Setup -> Network -> WLAN Diagnostic -> RSSI) is rotating. If it is not, check WLAN hardware. Replace antenna or WLAN board if necessary.
	WLAN 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. If problem persists, and MX100/X3 is connected to host monitor or IntelliVue Dock, check for an installed wired LAN cable and check MSL connection between MX100/ X3 and IntelliVue Dock or host monitor.
	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) 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
		<p>2. Check the connection status. If the device shows the state 'Authenticating', your SSID, Mode, Country and Security settings are correct.</p> <p>You already have a WLAN connection to your Access Point, but the device fails to authenticate, check your authentication server and WLAN controller error log.</p> <p>3. As an investigation step, disable the CertificateCheck. (Main Menu -> Network -> WLAN Setup -> CertificateCheck)</p> <p>If authentication is now possible, proceed with step 4.</p> <p>Otherwise double check your authentication server configuration, WLAN controller configuration and the user credentials (User Name, Password, Anonymous Identity).</p> <p>Note:</p> <p>If the previously used credential settings were wrong, the device is perhaps on the exclude list of your WLAN Controller. Resolve this issue on your WLAN controller.</p> <p>Note: Do not forget to re-enable the certificate check.</p>
		<p>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</p> <p>5. Check the installed CA certificate using the support tool. - Task -> Clone from Medical Device</p> <ul style="list-style-type: none"> - Open the cloned file using Configuration -> Configuration Editor - In Configuration Editor check Configuration -> Hardware -> Network -> Certificate 1 for validity(Valid from, Valid until) <p>6. Make sure that the installed CA certificate is the root certificate of your authentication server certificate chain.</p>

4 Troubleshooting

IIT-related Problems

Symptoms	Cause of Failure	Failure Isolation and Remedy
No Network icon or Network icon flashes. No association to central station. INOP “Unsupported LAN” is issued	WLAN and IIT enabled at the same time.	If both WLAN and IIT are installed, make sure that WLAN Mode is set to None .
	Incorrect RF Access Code. No IP Address.	Check that RF Access Code is set correctly. Make sure that network is set up correctly.
	Communication problem between the monitor and the IIT adapter. MAC Instr. Tele. field in Instrument Telemetry Service Window is 0000 0000 0000 0000	Check that RF Access Code is set correctly and the network is correctly set up. Check the connection between the main board and the IIT board. Check the antenna cable connection between the IIT board and the antenna. Replace antenna or IIT board if necessary.

Individual Parameter INOPs

If any of the following parameter INOP messages are issued check the connection from the measurement to the main board. If the INOP messages persist replace the respective measurement. If problem persists, replace the main board and/or the front end adapter board.

- **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**

Masimo rainbow SET SpO2-related Problems

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

Printer

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

Companion Mode Problems

NOTE

MX100 does not support companion mode

Symptoms	Cause of Failure	Failure Isolation and Remedy
X3 does not enter companion mode when connected to a host monitor	Incompatible software revision of host monitor	Make sure that the host monitor has software revision M.0 or higher.
	MSL connection not established correctly	Check MSL connection to host monitor
	MSL board defective	Exchange MSL board
	Connection between MSL board and main board	Check connection between MSL board and main board
	Main board defective	Exchange main board
	MSL interface on host monitor defective	See troubleshooting section in the host monitor's service guide

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 16 16:37
C	1721	21050	1	4 Apr 16 15:37

The Status Log window shows logged events which caused a reboot of the system component (monitor or measurement block).

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

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

Select **Status Log**.

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

Cold Start: A cold start erases patient data incl. ADT, trends and customer configuration settings.

Hot Start: A hot start is a system reset. No data is erased.

The following pop-up keys overlay the SmartKeys:

Clear StatLog		867033
---------------	--	--------

Clear StatLog

This key clears the currently displayed Status Log

867030/867033

This key switches to the Monitor Revision Window [867036?] PC123?]

NOTE

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

Troubleshooting with the Support Tool

Using the support tool you can:

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

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

Troubleshooting the Individual Measurements or Applications

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

If the instructions for use did not resolve an individual parameter problem, then another MX100 or X3 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.

The table below applies if you are receiving Equipment Malfunction (**Equip Malf**) or **NBP Measure Failed** INOPS.

Symptoms	Cause of Failure	Failure Isolation and Remedy
<parameter> Equip Malf INOP is issued	Connection to front end adapter board	Check the connection to the front end adapter board. Replace cable, if necessary
	Parameter board defective	Exchange the respective parameter board
	Front end adapter board defective	Exchange front end adapter board
	Main board defective	Exchange main board
NBP Measure Failed INOP is issued	NBP pump defective	Replace NBP pump

Respiration Measurement

In case of interference with other equipment, the internal frequency used for the respiration measurement can be changed. Never change the default setting unless specifically asked to do so.

Repair and Disassembly

The following section describes the disassembly and reassembly procedures for the monitor and its components.

To ensure the MX100/X3, Measurement Extensions and IntelliVue Dock are functioning correctly, you must perform safety tests and a performance check at the end of each repair activity. Please refer to the "Testing and Maintenance" chapter of this service guide for details.

WARNING

After disassembly/reassembly of an MX100/X3, Measurement Extension or IntelliVue Dock you must perform an applied part leakage current test before using the MX100/X3 for monitoring again.

Refer to "[When to Perform Tests](#)" on page 30 for more information.

Who Should Perform Repairs

Only qualified service personnel (biomedical engineers or technicians) 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 removal) with power applied to the instrument. Failure to adhere to this warning could cause serious injury or death.

Tools Required

- Torx screwdrivers (sizes 6, 8, 9, 20)
- Allen wrench (size 6)
- Small flat head screwdriver
- Needle Nose Pliers
- ESD mat and wrist strap
- mCO₂ Luer Remover for 867041 Microstream Extension

NOTE

If parts of the housing of your monitor or extension are exchanged, check the labeling on your existing housing and apply the respective labels to your new housing. Use the appropriate label from the label sheet that needs to be ordered separately with the exchange part (see "[Parts](#)" on page 179). Retain the serial number plate of the old housing and insert it into the new housing. See "[Removing the Serial Number Plate](#)" on page 128 for MX100/X3 and "[Removing the Serial Number Plate](#)" on page 141 for the Measurement Extensions.

MX100/X3 Disassembly

NOTE

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

WARNING

Always disconnect the monitor from power before performing any repair or disassembly procedures. Disconnect the MX100/X3 from any host monitors, IntelliVue Docks or external power supplies, disconnect any MSL cable and remove the battery.

Removing the Battery

Follow the instructions below to remove the battery:

- 1 Push the tab towards the cover of the battery compartment, then pull upwards to open it.



- 2 Remove the battery by pulling on the battery tab.



- 3 Slide in the new battery, with the contacts first. The battery tab is visible when the battery is correctly inserted.
- 4 Push the cover closed, with the outer tab latched into position.

WARNING

- Do not insert your fingers or any objects into the open battery compartment.
 - Always remove the battery before performing disassembly procedures.
-

Removing the Carrying Handle/Side Plate

Depending on the options purchased, your monitor may have either a carrying handle or a side plate.

Removing the Carrying Handle:

- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Loosen and remove the pin from the side of the handle using a Torx T20 screwdriver.



- 3 Remove the handle.



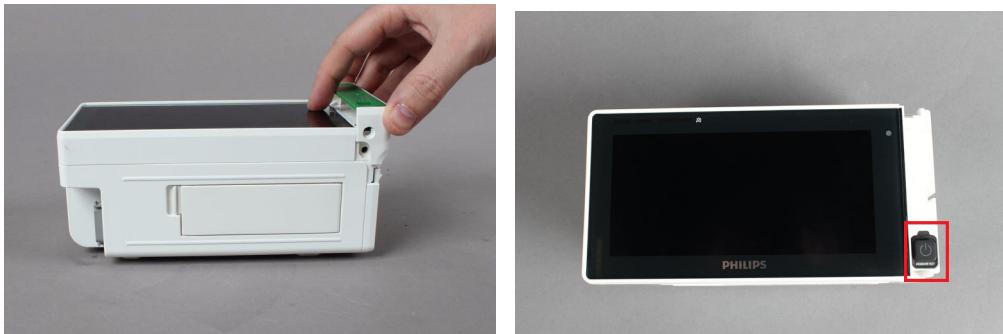
Removing the Side Plate:

- 1 Loosen and remove the pin from the top of the side cover using a Torx T20 screwdriver.



5 Repair and Disassembly

- 2 Remove the side plate, ensuring the Power Switch Cover on the lower left of the MX100 remains firmly in place.



Removing the Power Switch Cover

- 1 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on [page 111](#).
- 2 Pull off the Power Switch Cover.



Removing the Bezel

- 1 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on [page 111](#).
- 2 Position the thin-bladed screwdriver in the small slot provided for this purpose, and push off the bezel. A click signals that the cover has been removed from its position.



- 3 Check the labeling on the old bezel and apply the respective labels to the new one.

NOTE

The label sheet is not shipped with the bezel. It must be ordered separately.

Removing the NBP Inlet Connector

- 1 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on [page 111](#).
- 2 Remove the Power Switch Cover as described in “[Removing the Power Switch Cover](#)” on [page 112](#).
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on [page 112](#).
- 4 Slowly turn the connector counterclockwise with an Allen wrench until it is released.



NOTE

Ensure the connector's transparent cover is not removed when removing/releasing the connector as several metal balls may fall out.

- 5 Ensure the connector contains all four metal balls in the transparent cover. If a ball is missing, it may have fallen into the NBP connector chamber.



- 6 Insert the new connector using the same wrench. Turn it clockwise and tighten the connector carefully.



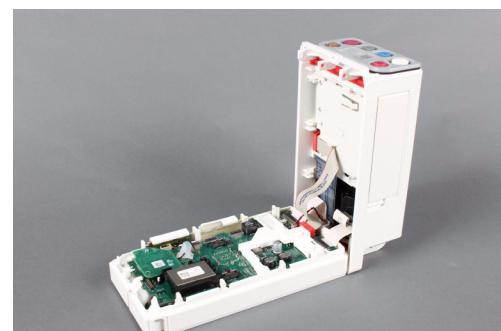
- 7 Perform a visual check of the new connector once it is assembled. Ensure the hole in the silicone cover is round and not oval or otherwise deformed as this can cause leakage. Perform the NBP performance test as described in “[NBP Performance Test](#)” on [page 59](#).

Separating the Front and Back of the Monitor

- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on [page 111](#).
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Position the MX100/X3 with the connectors facing towards you. Locate the heads of the two pins on the display side. Remove these by lifting them out gently with a thin-bladed screwdriver and then pulling them out manually.



- 5 Carefully pull apart the front and back of the monitor.



- 6 Lift up the latches and disconnect the two outer flex cables. Then disconnect the speaker cable and the flex cable in the middle.

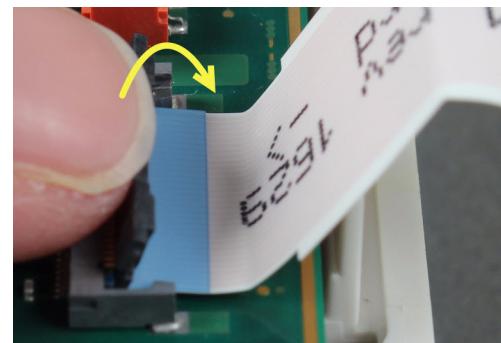
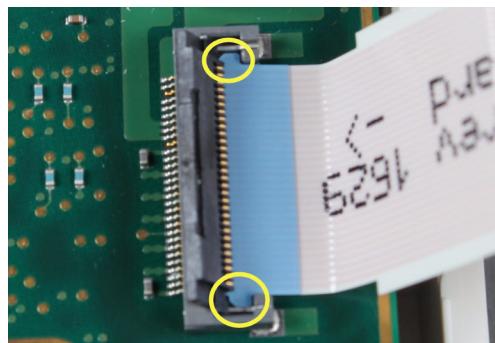
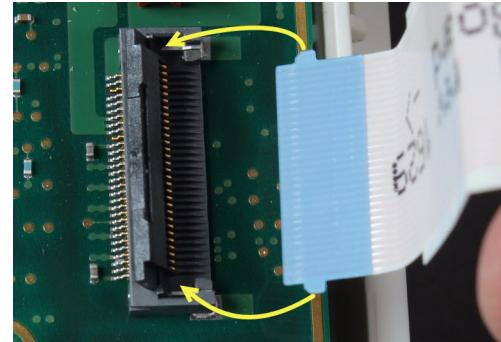
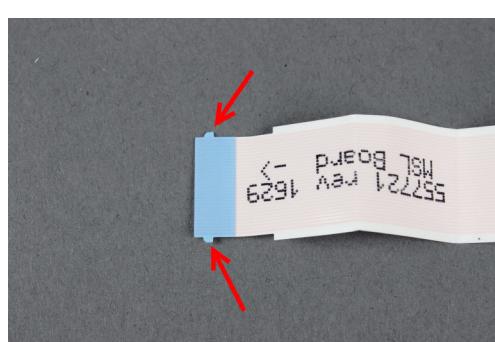


NOTE

To release the flex cables lift up the latches carefully to release the cable. Do not pull on the cable in an upward direction, as this could damage the connector.

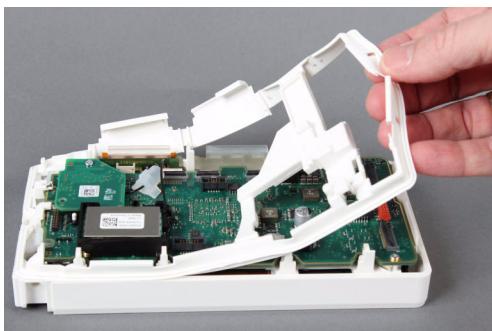


When reassembling the monitor, make sure that the tabs on the sides of the cables are properly inserted into the connector before closing the latch. Insert the cable with the blue side facing upwards straight into the connector opening, with the edge of the cable exactly in parallel to the connector. Inserting the cable at a skewed angle can damage the contacts.

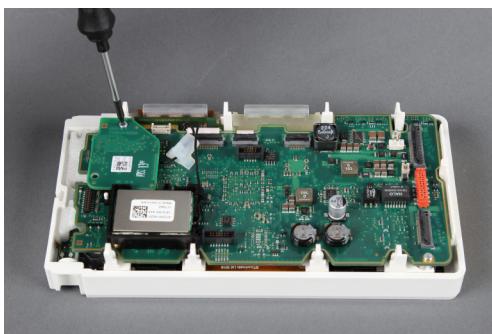


Removing the WLAN Board

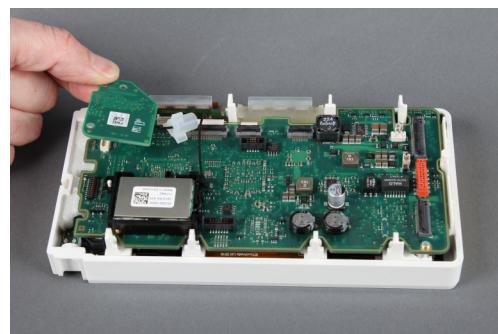
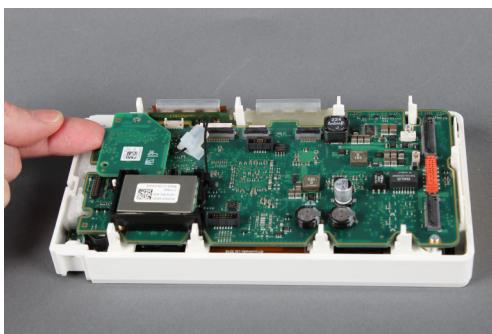
- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on [page 111](#).
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on [page 114](#).
- 5 Remove the Rubber Sealing from the housing.



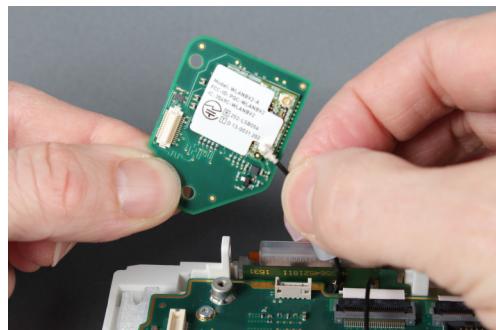
- 6 Remove the screw securing the WLAN board.



- 7 Disconnect and lift up the WLAN board.



- 8 Disconnect the antenna.



Reassembly Note: When reassembling the WLAN board, plug the antenna cable into the lower connector of the WLAN board as shown below.

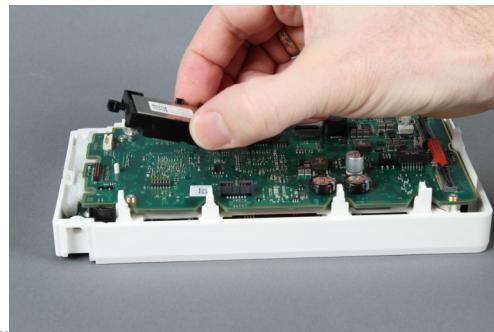


NOTE

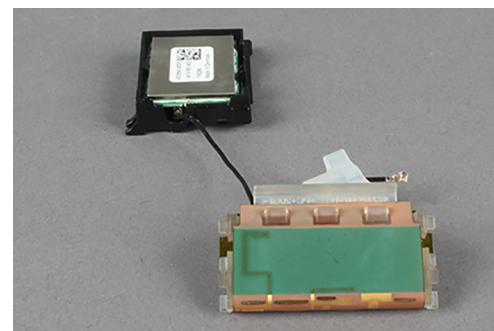
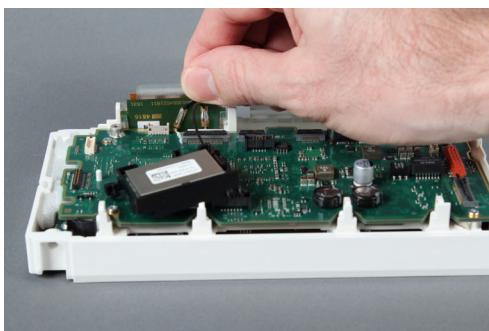
When replacing the WLAN board, the monitor must have the (hardware) serial number and product options reloaded. Support Tool Mark2 is required to perform this task. For details please refer to “[Setting Product Information](#)” on page 157 and the Support Tool Instructions for Use.

Removing the IIT Board

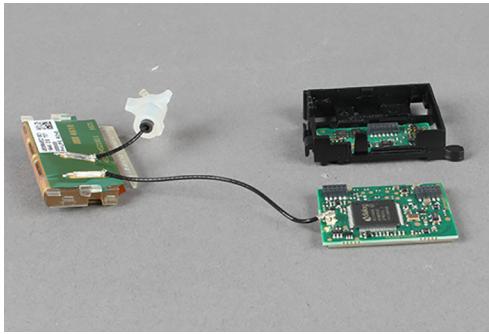
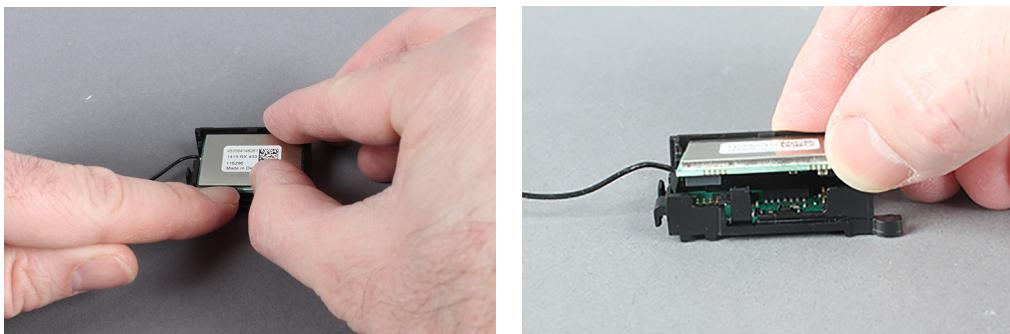
- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on [page 111](#).
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on [page 114](#).
- 5 Remove the WLAN board as described in “[Removing the WLAN Board](#)” on page 116.
- 6 Disconnect and lift up the IIT Assembly.



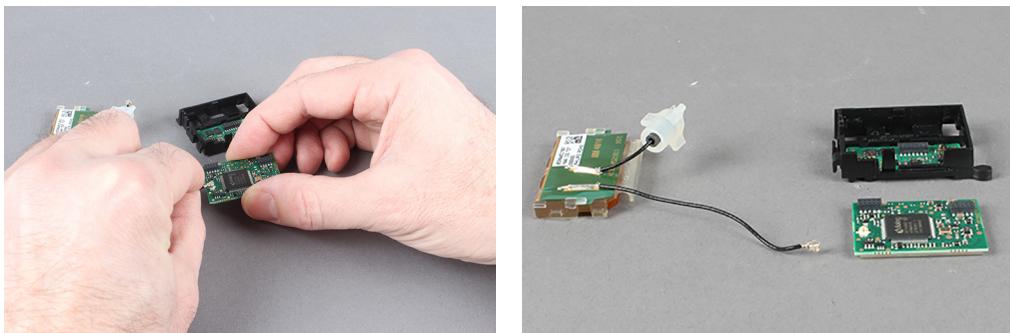
- 7 Pull the combined IIT/WLAN Antenna out of the housing.



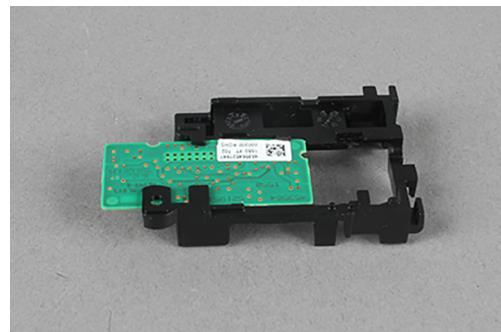
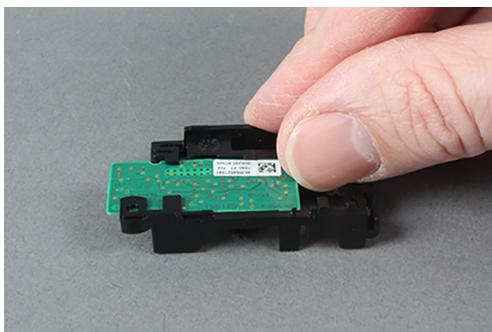
- 8 Gently pull the black plastic flap away from the Radio Board and lift and remove it from its casing.



- 9 Unsnap the antenna from the Radio Board.



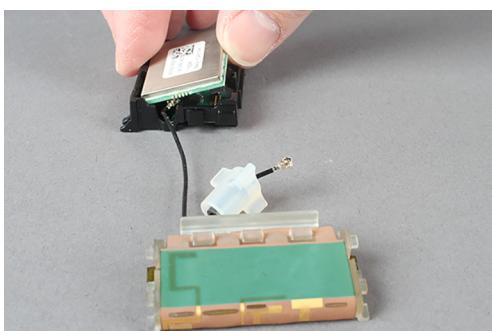
- 10 Gently push the Adapter Board from its casing.



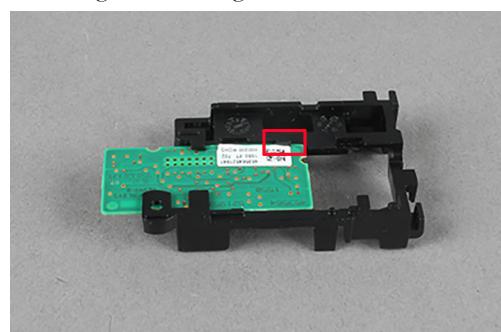
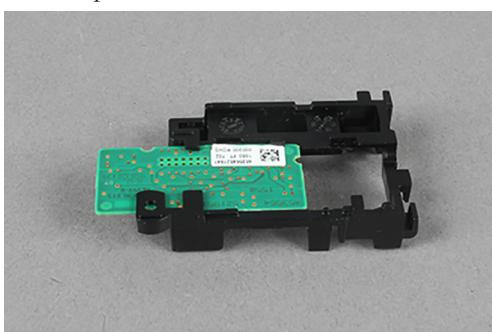
NOTE

When replacing the IIT assembly:

- The monitor must have the (hardware) serial number and product options reloaded. Support Tool Mark2 is required to perform this task. For details please refer to “[Setting Product Information](#)” on page 157 and the Support Tool Instructions for Use.
- The antenna must be sit in the hole when replacing the Radio Board.

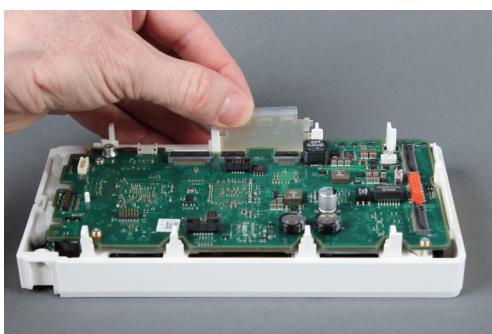


- The Adapter Board must sit beneath the notch on its casing when sliding it back in.

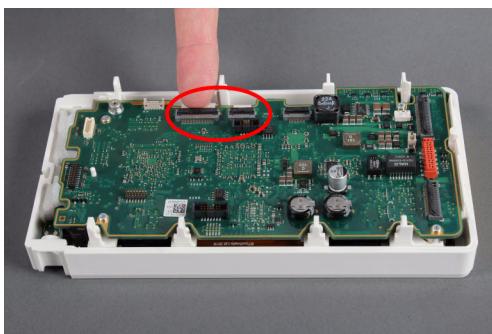


Removing the Main Board

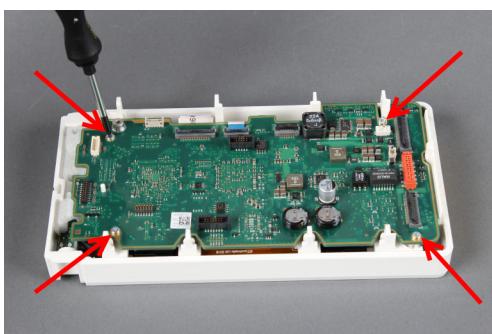
- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on [page 111](#).
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on [page 114](#).
- 5 If installed, remove the WLAN board as described in “[Removing the WLAN Board](#)” on page 116.
- 6 If installed, remove the IIT assembly as described in “[Removing the IIT Board](#)” on page 118.
- 7 Remove the antenna holder.



- 8 Disconnect the two flex cables from the main board.

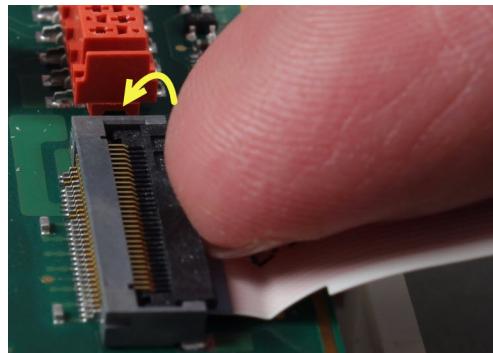


- 9 Remove the four screws from the main board.

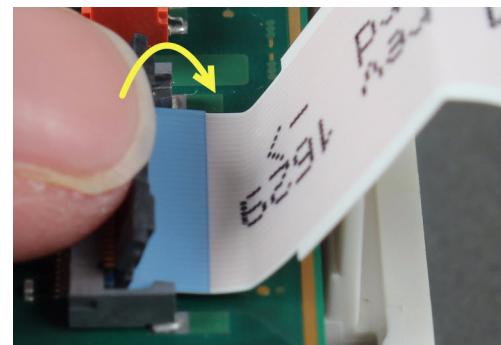
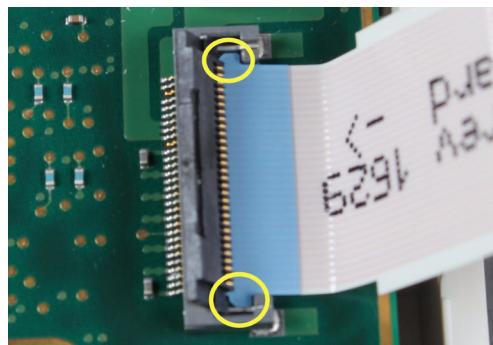
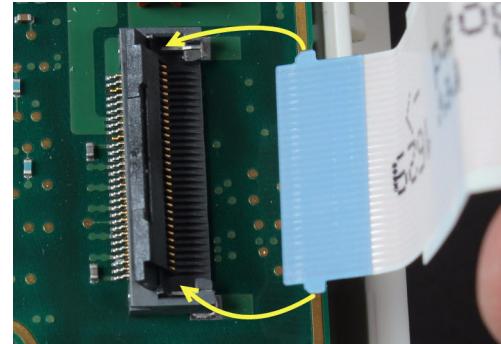
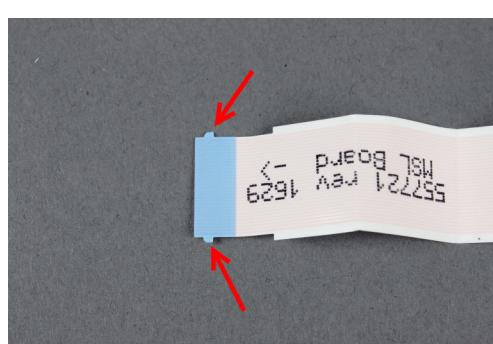


NOTE

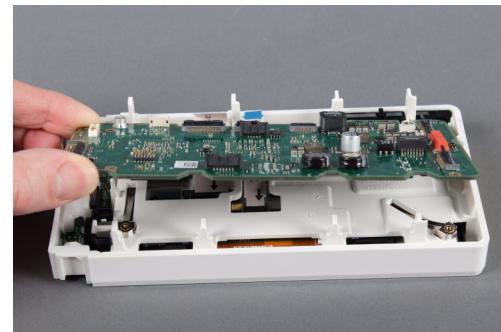
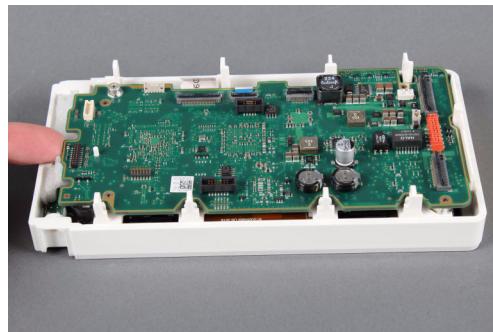
To release the flex cables lift up the latches carefully to release the cable. Do not pull on the cable in an upward direction, as this could damage the connector.



When reassembling the monitor, make sure that the tabs on the sides of the cables are properly inserted into the connector before closing the latch. Insert the cable with the blue side facing upwards straight into the connector opening, with the edge of the cable exactly in parallel to the connector. Inserting the cable at a skewed angle can damage the contacts.



- 10 Disconnect the main board from the HIF board by lifting it up on the side and then take out the main board.

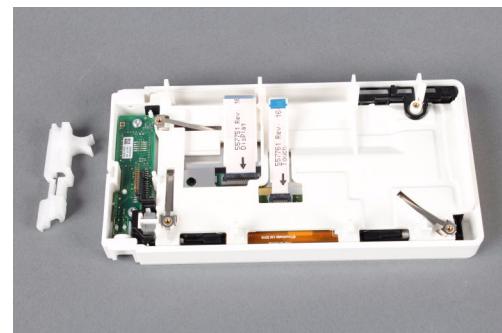
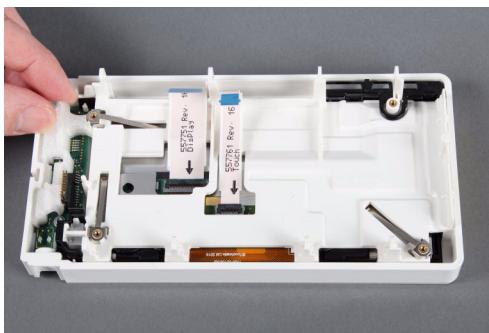


NOTE

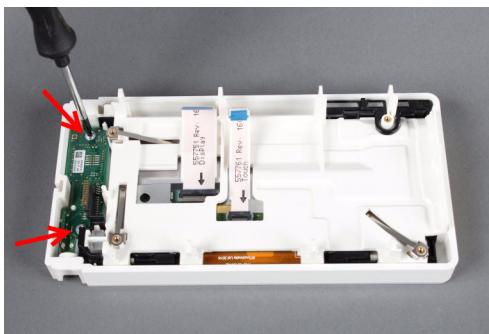
When replacing the main board, the monitor must have the (hardware) serial number and product options reloaded. Support Tool Mark2 is required to perform this task. For details please refer to “[Setting Product Information](#)” on page 157 and the Support Tool Instructions for Use.

Removing the HIF Board

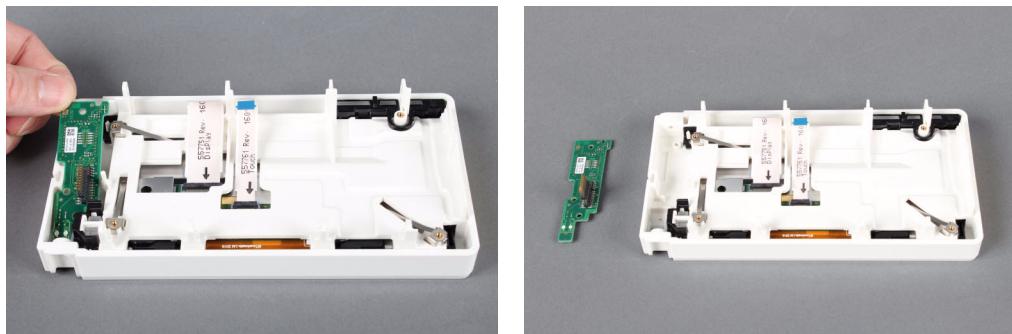
- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on page 111.
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on page 114.
- 5 If installed, remove the WLAN board as described in “[Removing the WLAN Board](#)” on page 116.
- 6 If installed, remove the IIT assembly as described in “[Removing the IIT Board](#)” on page 118.
- 7 Remove the main board as described in “[Removing the Main Board](#)” on page 121.
- 8 Remove the spacer between HIF board and main board.



- 9 Remove the two screws securing the HIF board.



- 10 Remove the HIF board.

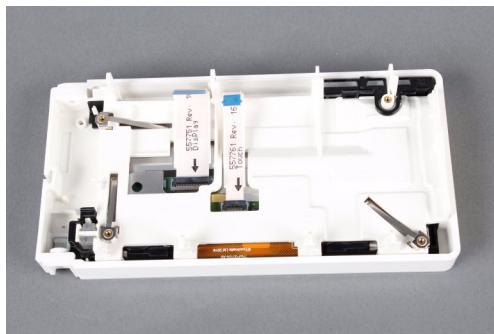


NOTE

When replacing the HIF board, the monitor must have the (hardware) serial number and product options reloaded. Support Tool Mark2 is required to perform this task. For details please refer to “[Setting Product Information](#)” on page 157 and the Support Tool Instructions for Use.

Removing the Display Assembly

- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on page 111.
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on page 114.
- 5 If installed, remove the WLAN board as described in “[Removing the WLAN Board](#)” on page 116.
- 6 If installed, remove the IIT assembly as described in “[Removing the IIT Board](#)” on page 118.
- 7 Remove the main board as described in “[Removing the Main Board](#)” on page 121.
- 8 Remove the HIF board as described in “[Removing the HIF Board](#)” on page 123.

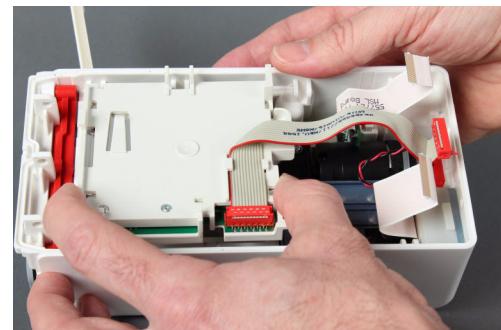
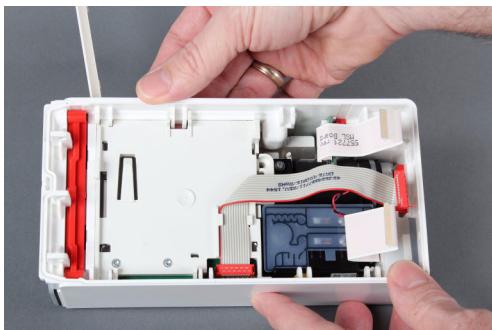


Removing the Measurement Block

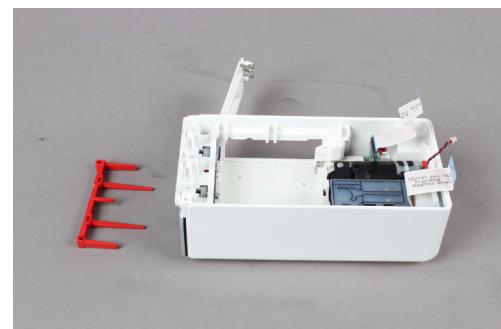
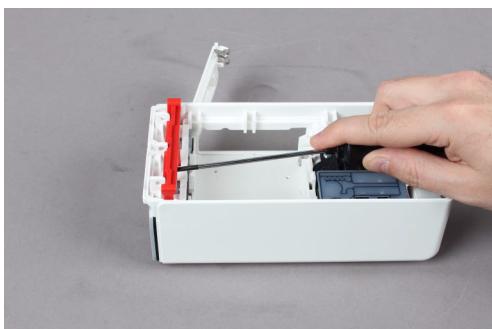
- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on [page 111](#).
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on [page 114](#).
- 5 Remove the screw from the chassis as shown below.



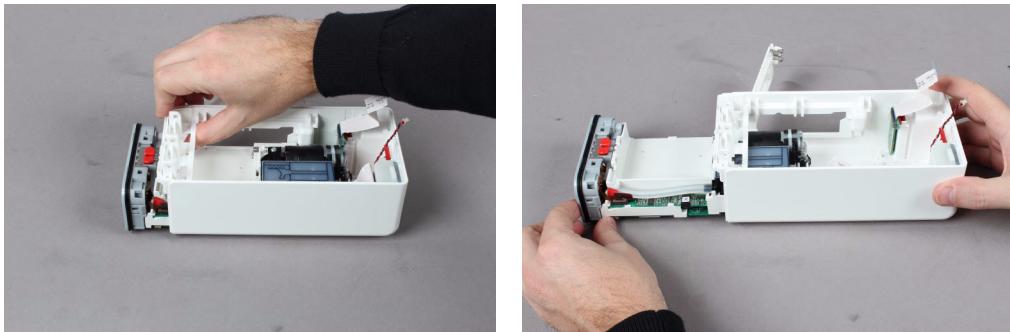
- 6 Release the battery housing, by pushing it out from the back and then lift it out.



- 7 Release the red fork that holds the connector block with a screwdriver and remove it.

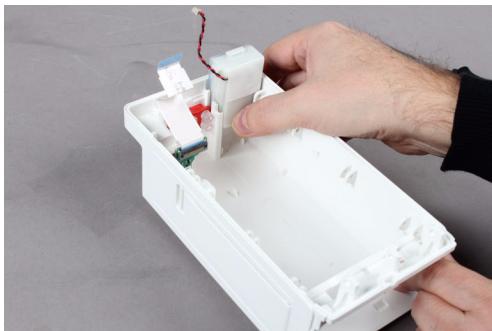


- 8 Push the measurement block out from the inside and then pull it out completely.



Removing the Speaker

- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on page 111.
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on page 114.
- 5 Remove the Measurement Block as described in “[Removing the Measurement Block](#)” on page 125.
- 6 Slide the speaker out of the housing

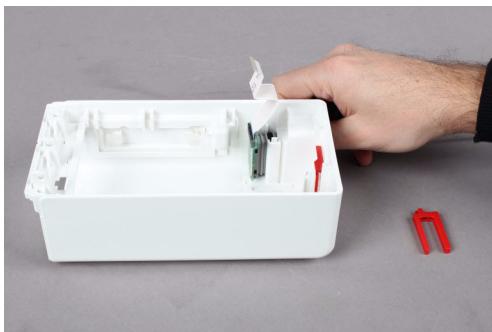


Removing the MSL Board

- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on [page 111](#).
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on [page 114](#).
- 5 Remove the Measurement Block as described in “[Removing the Measurement Block](#)” on page 125.
- 6 Remove the speaker as described in “[Removing the Speaker](#)” on page 126.
- 7 Release the red MSL board holder with a screwdriver and remove it.



- 8 Push the MSL connector from the outside into the housing to release the MSL board.



Removing the Serial Number Plate

- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on [page 111](#).
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on [page 114](#).
- 5 Remove the Measurement Block as described in “[Removing the Measurement Block](#)” on page 125.
- 6 Remove the speaker as described in “[Removing the Speaker](#)” on page 126.
- 7 Remove the MSL board as described in “[Removing the MSL Board](#)” on page 127.
- 8 Push together the serial number plate holder to release it and remove it.



- 9 Pull off the serial number plate.



NOTE

It is not necessary to remove the connector block before removing the serial number plate. For the pictures above, the connector block has only been removed to improve the visualization of the procedure.

Replacing the Housing

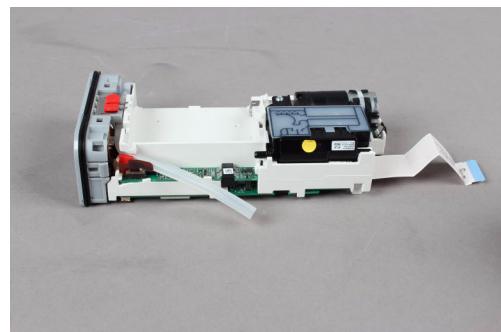
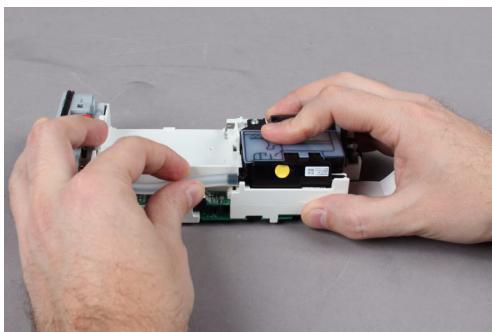
- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on [page 111](#).
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on [page 114](#).
- 5 Remove the Measurement Block as described in “[Removing the Measurement Block](#)” on page 125.
- 6 Remove the speaker as described in “[Removing the Speaker](#)” on page 126.
- 7 Remove the MSL board as described in “[Removing the MSL Board](#)” on page 127.
- 8 Remove the serial number plate as described in “[Removing the Serial Number Plate](#)” on page 128.
- 9 Reassemble the monitor by performing the above steps in reverse order.
- 10 Check the labeling on the old rear housing and apply the respective labels to the new rear housing.

NOTE

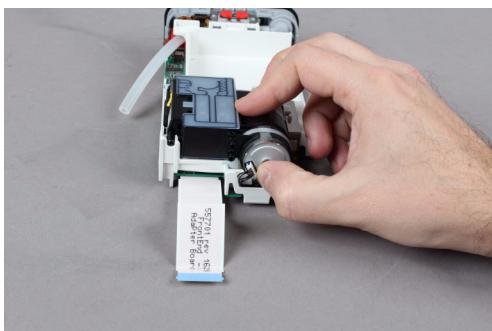
The label sheet is not shipped with the rear housing. It must be ordered separately.

Removing the NBP Pump Assembly

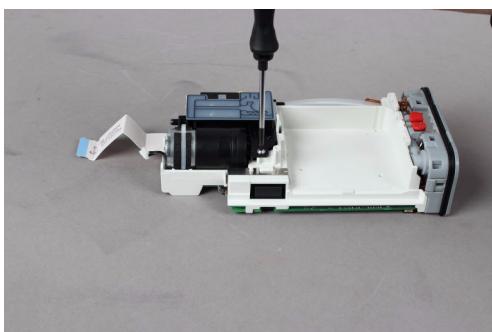
- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on [page 111](#).
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on [page 114](#).
- 5 Remove the Measurement Block as described in “[Removing the Measurement Block](#)” on page 125.
- 6 Disconnect the NBP pump tubing.



- 7 Unplug the cable from the NBP pump.



- 8 Remove the screw from the NBP pump assembly.



- 9 Lift out the NBP pump assembly and disconnect the flex cable.

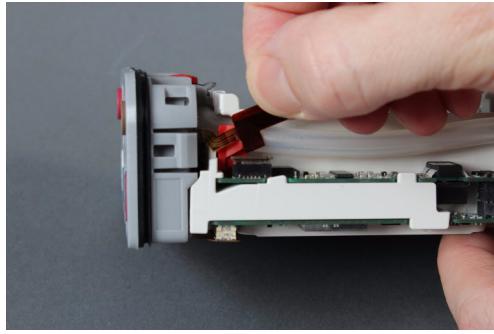
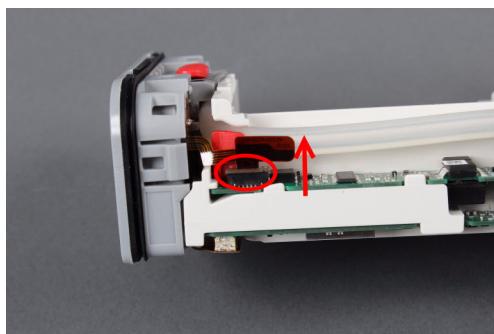


NOTE

After replacing the NBP pump, you must perform the NBP Performance Test and NBP Calibration. If an NBP pump is replaced in a device with SN prefix below DE647, set the option #YDN (Suppress iNBP functionality) via the IntelliVue Support Tool. The option #YDN does not need to be set if the iNBP functionality is already released in your country.

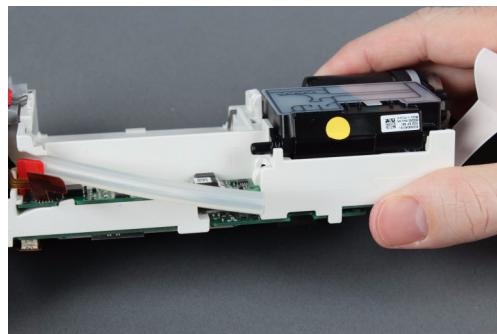
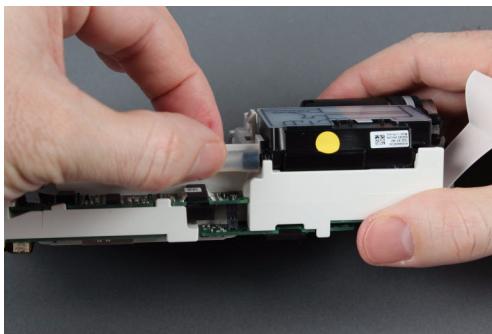
Removing the Temperature Board

- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on page 111.
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on page 114.
- 5 Remove the Measurement Block as described in “[Removing the Measurement Block](#)” on page 125.
- 6 Push the latch from below to unlock the flex cable from the temperature board and disconnect it.

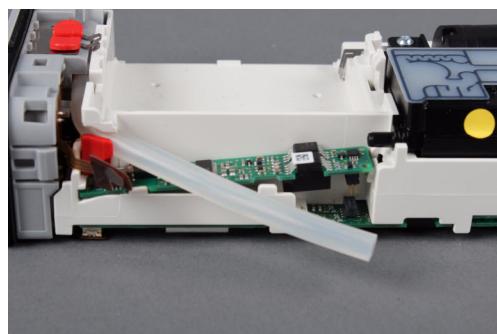


5 Repair and Disassembly

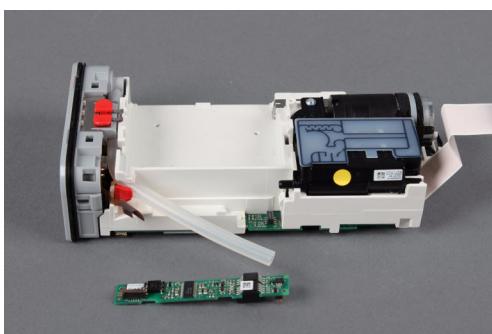
- 7 Disconnect the NBP Pump tubing.



- 8 Push the latch back to release the temperature board.



- 9 Remove the temperature board.

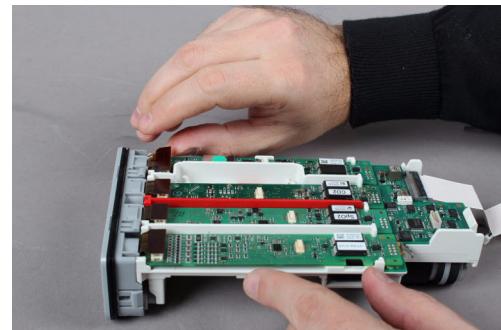
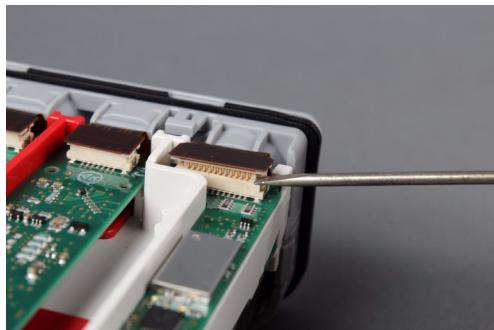


Removing the Connector Block

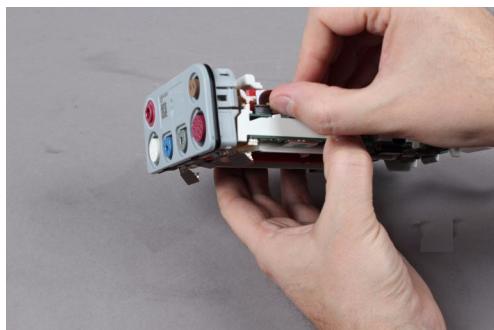
- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on [page 111](#).
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on [page 114](#).
- 5 Remove the Measurement Block as described in “[Removing the Measurement Block](#)” on page 125.
- 6 Release the flex cables from the measurement boards carefully with a screwdriver and disconnect them.

CAUTION

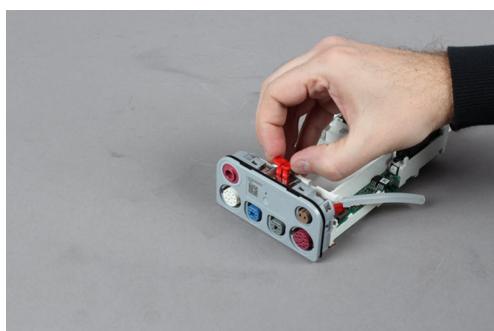
Handle these thin flex cable connectors with care, as they can easily be damaged. Do not pull on the cable itself.



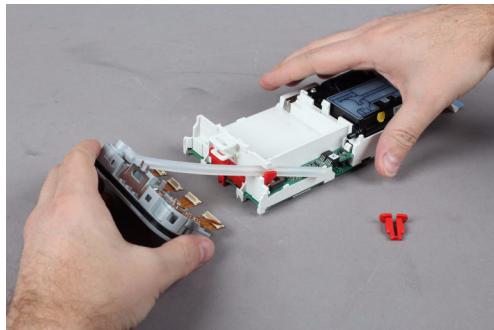
- 7 Push the latch from below to unlock the flex cable and disconnect it.



- 8 Push together the ends of the red connector block holder and remove it.



- 9 Pull off the connector block.

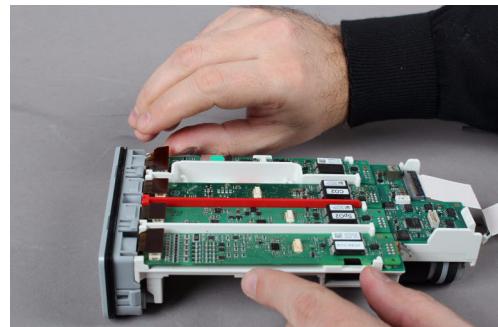
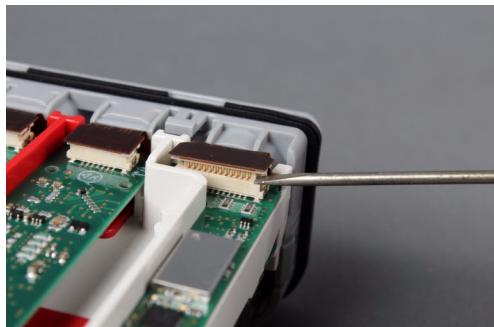


Removing the Measurement Boards

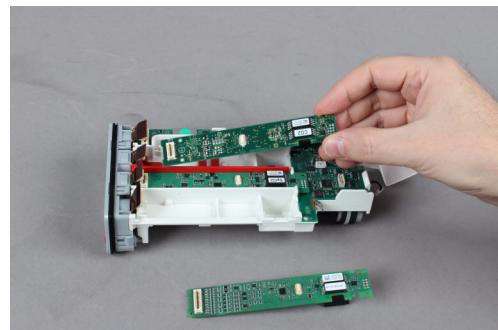
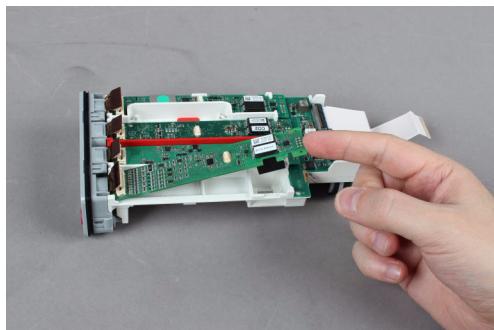
- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on page 111.
- 3 Remove the Side Cover as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on page 114.
- 5 Remove the Measurement Block as described in “[Removing the Measurement Block](#)” on page 125.
- 6 Release the flex cables from the measurement boards carefully with a screwdriver and disconnect them.

CAUTION

Handle these thin flex cable connectors with care, as they can easily be damaged. Do not pull on the cable itself.



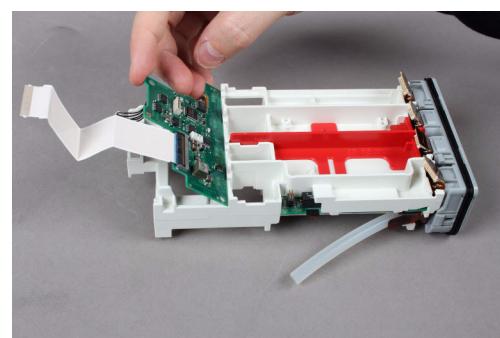
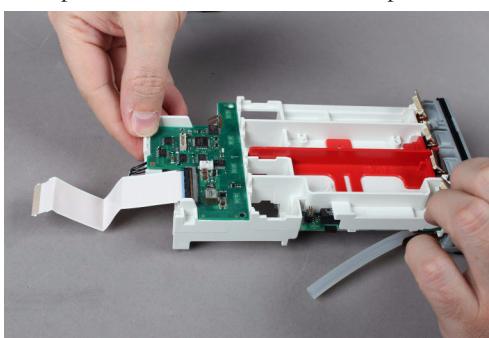
- 7 Lift up and remove the boards you wish to replace.



- 8 Reassemble the monitor by performing the above steps in reverse order. Make sure that each board is reinserted into its correct slot. The parameter label on each board must correspond with the parameter input connector. Be careful not to damage the connectors.

Removing the Front End Adapter Board

- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on page 111.
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on page 114.
- 5 Remove the Measurement Block as described in “[Removing the Measurement Block](#)” on page 125.
- 6 Remove all other measurement boards as described in “[Removing the Measurement Boards](#)” on page 134.
- 7 Lift up and remove the front end adapter board.

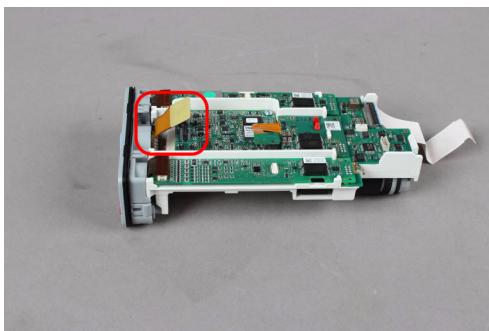


NOTE

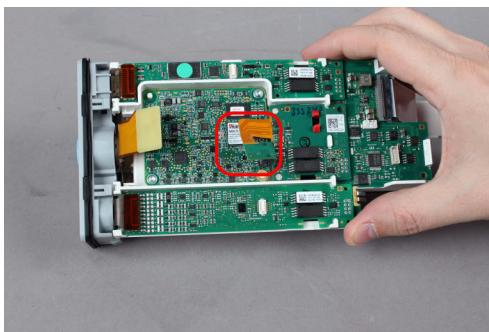
When replacing the front end adapter board, the monitor must have the (hardware) serial number and product options reloaded. Support Tool Mark2 is required to perform this task. For details please refer to “[Setting Product Information](#)” on page 157 and the Support Tool Instructions for Use.

Removing the Masimo rainbow SpO₂/Nellcor OxiMax SpO₂ Board

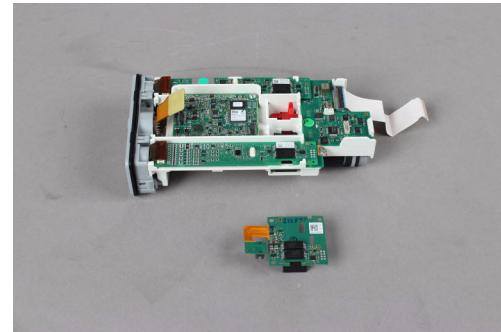
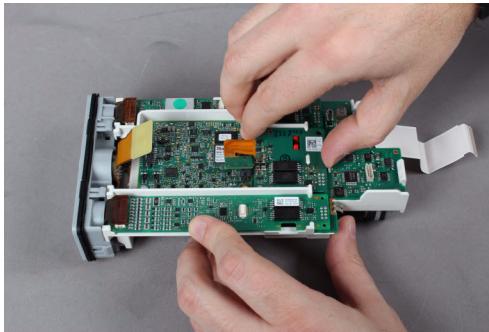
- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on page 111.
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on page 114.
- 5 Remove the Measurement Block as described in “[Removing the Measurement Block](#)” on page 125.
- 6 Remove the flex connector from the connector block to the Masimo rainbow SpO₂/Nellcor OxiMax SpO₂ board.



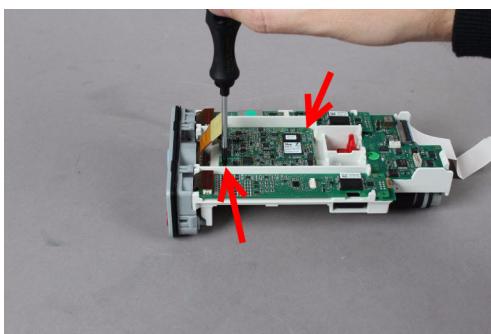
- 7 Remove the other flex connector from the Masimo rainbow SpO₂/Nellcor OxiMax SpO₂ board



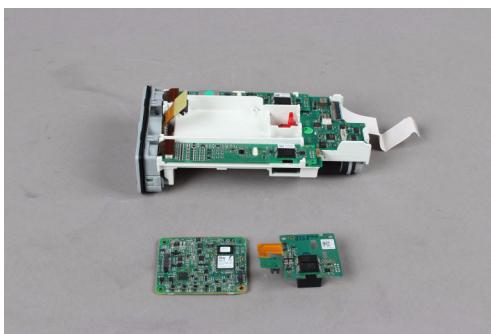
- 8 Remove the adapter board.



- 9 Remove the two screws from the Masimo rainbow SpO₂/Nellcor OxiMax SpO₂ board.

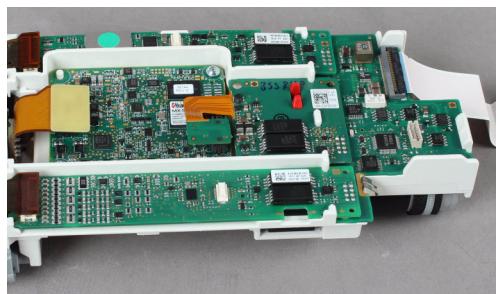


- 10 Remove the Masimo rainbow SpO₂/Nellcor OxiMax SpO₂ board.

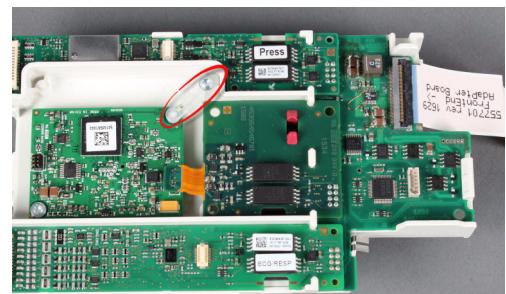


NOTE

The Masimo rainbow SpO₂/Nellcor OxiMax SpO₂ boards look slightly different. The procedure above shows the rainbow SpO₂ board but it is identical for both.



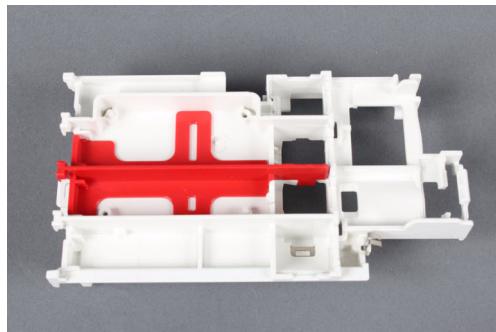
Masimo rainbow SpO₂ board incl. adapter board



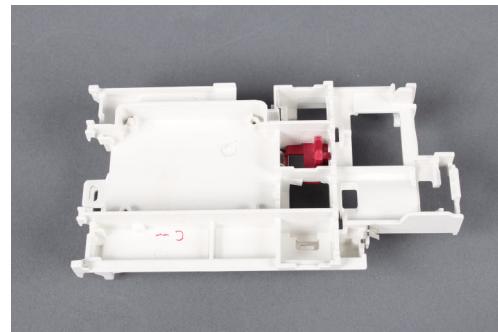
Nellcor OxiMax SpO₂ board incl. adapter board, and Nellcor OxiMax SpO₂ board holder (circled in red)

Removing the Measurement Board Chassis

- 1 Remove the battery as described in “[Removing the Battery](#)” on page 110.
- 2 Remove the handle or side plate as described in “[Removing the Carrying Handle/Side Plate](#)” on [page 111](#).
- 3 Remove the bezel as described in “[Removing the Bezel](#)” on page 112.
- 4 Separate the front and back of the monitor as described in “[Separating the Front and Back of the Monitor](#)” on [page 114](#).
- 5 Remove the Measurement Block as described in “[Removing the Measurement Block](#)” on page 125.
- 6 Remove the NBP Pump assembly as described in “[Removing the NBP Pump Assembly](#)” on page 130.
- 7 Remove the temperature board as described in “[Removing the Temperature Board](#)” on page 131.
- 8 Remove the Measurement boards as described in “[Removing the Measurement Boards](#)” on page 134.
- 9 If installed, remove the Masimo rainbow SpO₂/Nellcor OxiMax SpO₂ board as described in “[Removing the Masimo rainbow SpO₂/Nellcor OxiMax SpO₂ Board](#)” on page 136.



*Measurement Board Chassis
(Philips FAST SpO₂)*

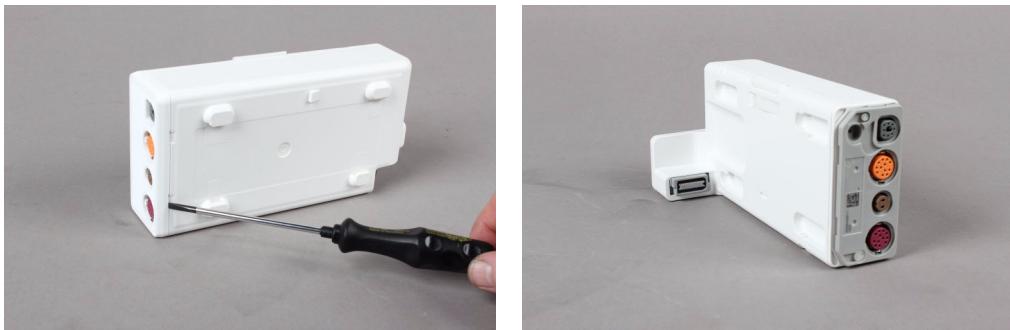


*Measurement Board Chassis
(Masimo rainbow SpO₂/Nellcor OxiMax SpO₂)*

Measurement Extensions (Current Generation - 867039, 867040, 867041) Disassembly Procedures

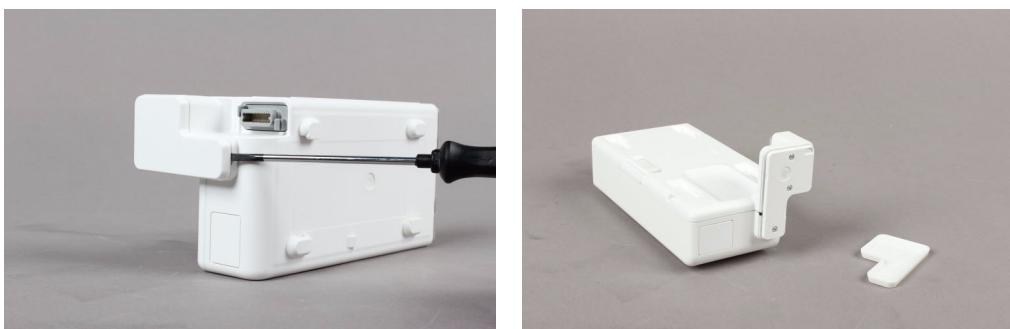
Removing the Front Bezel

- 1 Position the thin-bladed screwdriver in the small slot provided for this purpose. The front bezel then clicks away from the extension. Remove the bezel.



Removing the Housing Top Cover

- 1 Remove the front bezel as described in "Removing the Front Bezel" on page 139.
- 2 Use a thin-bladed screwdriver to pry off the MSL Link bar back cover.



- 3 Remove the three screws securing the MSL Link Bar back plate.



5 Repair and Disassembly

- 4 Remove the MSL Link Bar back plate.



- 5 Locate the two plastic pins on the connector side and pull them out.



NOTE

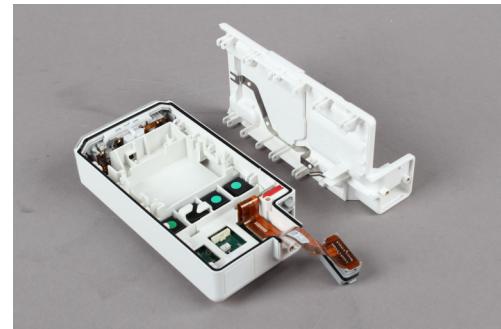
The pins have two different lengths and must be reinserted in their designated slots when reassembling the monitor.



- 6 Push the MSL connector out of the MSL Link Bar housing to release it.



- 7 Carefully remove the housing top cover from the Extension by pulling the housing top cover off with a slight rotating movement.



- 8 **Reassemble** the extension by performing the above steps in reverse order. Be careful not to damage the flex connector and remember that the pins have two different lengths and need to be inserted into the correct slot.



Removing the Serial Number Plate

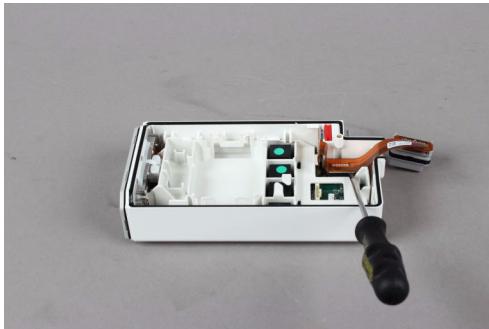
- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 139.
- 2 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 139.
- 3 Lift up and remove the plastic serial number plate holder and then push out the serial number plate.



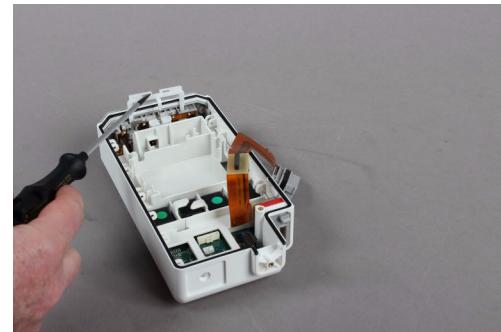
- 4 **Reassemble** the extension by performing the above steps in reverse order.

Removing the Chassis Sled

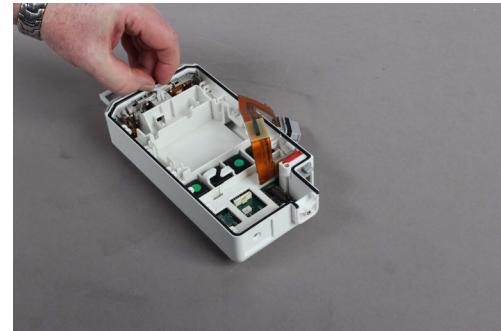
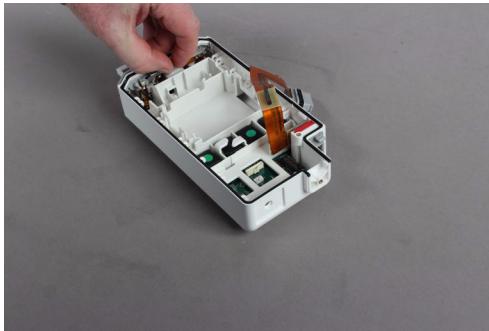
- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 139.
- 2 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 139.
- 3 Disconnect the MSL Flex Connector from the Power Board.



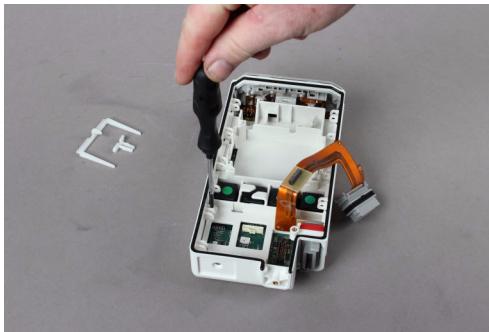
- 4 Remove the Connector Block holder by positioning a thin-bladed screwdriver in the small slot provided for this purpose and then lifting the holder upwards.



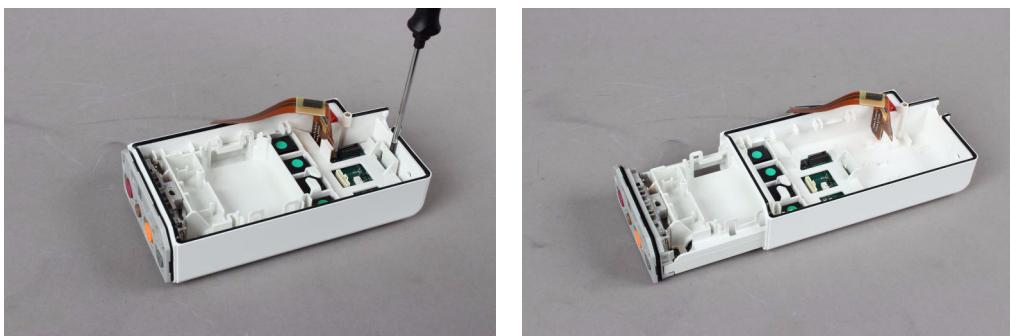
- 5 Press the ends of the plastic holder clamp together and pull out the clamp.



- 6 Remove the screw securing the Chassis Sled to the housing.



- 7 Release the Chassis Sled with a screwdriver and pull it out.



- 8 **Reassemble** the extension by performing the above steps in reverse order. Ensure the Connector Block holder, the holder clamp and the screw are reinserted into the correct positions.

Removing the MSL Board Assembly

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 139.
- 2 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 139.
- 3 Remove the Chassis Sled as described in “[Removing the Chassis Sled](#)” on page 142.
- 4 Lift up and remove the red MSL Board Holder.



- 5 Push the MSL connector inwards and remove the MSL Board Assembly.



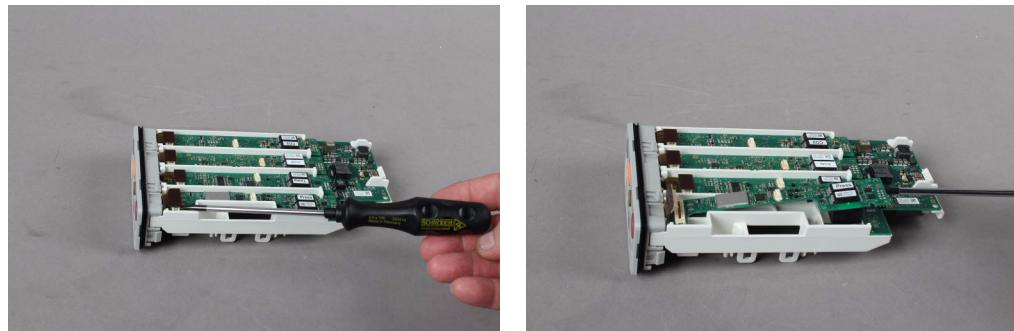
- 6 **Reassemble** the extension by performing the above steps in reverse order. Ensure the red MSL Board Holder is reinserted into the correct position. Note that it only fits when it is correctly oriented.

Removing the Measurement Boards

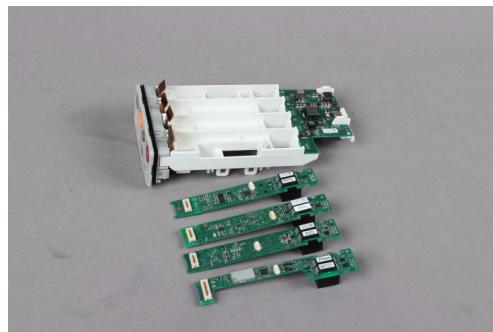
- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 139.
- 2 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 139.
- 3 Remove the Chassis Sled as described in “[Removing the Chassis Sled](#)” on page 142.
- 4 Release the flex cables from the measurement board you wish to replace carefully with a screwdriver and disconnect it.

CAUTION

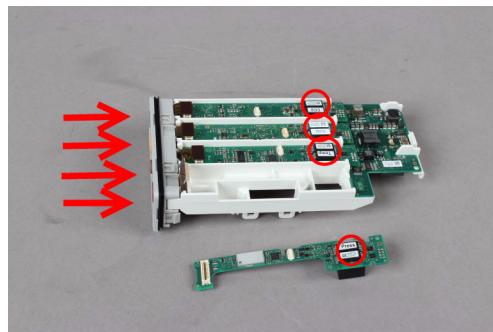
Handle these thin flex cable connectors with care, as they can easily be damaged. Do not pull on the cable itself.



- 5 Apply the same procedure to all or any other measurement board you wish to replace.

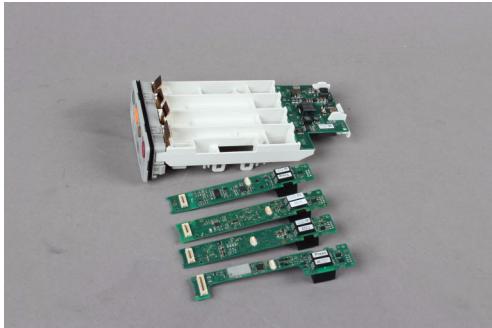


- 6 **Reassemble** the extension by performing the above steps in reverse order. Ensure each board is reinserted into its correct slot. The parameter label on each board must correspond with the parameter input connector. Be careful not to damage the connectors.

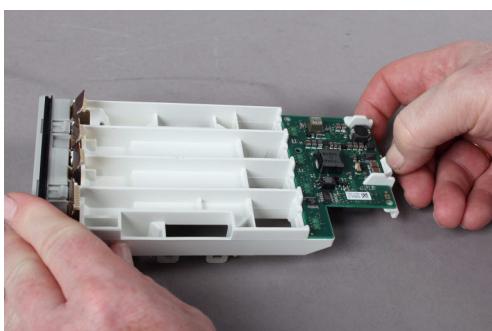


Removing the Power Board

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 139.
- 2 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 139.
- 3 Remove the Chassis Sled as described in “[Removing the Chassis Sled](#)” on page 142.
- 4 Remove all Measurement Boards as described in “[Removing the Measurement Boards](#)” on page 144.



- 5 If Microstream CO₂ is installed, remove the connector to the Microstream CO₂ measurement unit as described in “[Removing the Microstream CO₂ Measurement Unit](#)” on page 148.
- 6 Push the white lever outwards to release the Power Board.

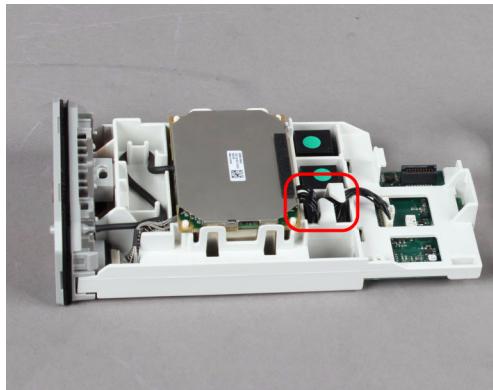


- 7 Remove the Power Board.



5 Repair and Disassembly

- 8 **Reassemble** the extension by performing the above steps in reverse order. When connecting the cable from the Microstream measurement unit to the power board, ensure the cable is correctly inserted into the guiding latches.

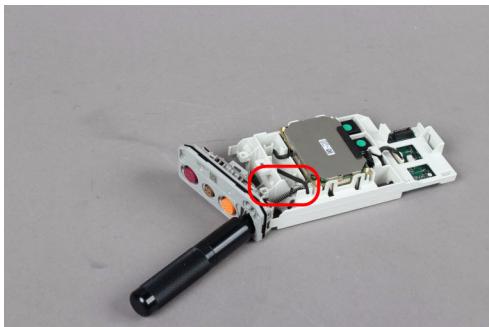


NOTE

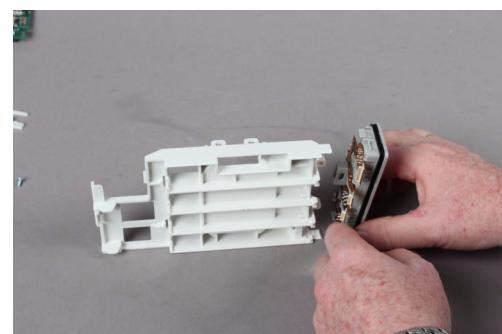
When replacing the power board, the monitor must have the (hardware) serial number and product options reloaded. Support Tool Mark2 is required to perform this task. For details please refer to “[Setting Product Information](#)” on page 157 and the Support Tool Instructions for Use.

Removing the Connector Block

- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 139.
- 2 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 139.
- 3 Remove the Chassis Sled as described in “[Removing the Chassis Sled](#)” on page 142.
- 4 Remove all Measurement Boards as described in “[Removing the Measurement Boards](#)” on page 144.
- 5 If Microstream CO₂ is installed, Use the mCO₂ Luer Remover to release the Microstream CO₂ connector from the housing and remove the exhaust tubing from the connector block.



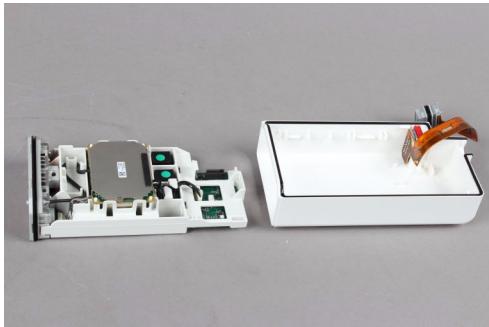
- 6 Carefully pull off the connector block.



- 7 **Reassemble** the extension by performing the above steps in reverse order. For reassembly of the Microstream connector and exhaust tubing, see “[Removing the Microstream CO₂ Measurement Unit](#)” on page 148.

Removing the Microstream CO2 Measurement Unit

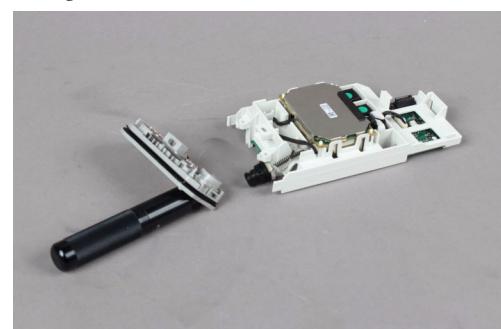
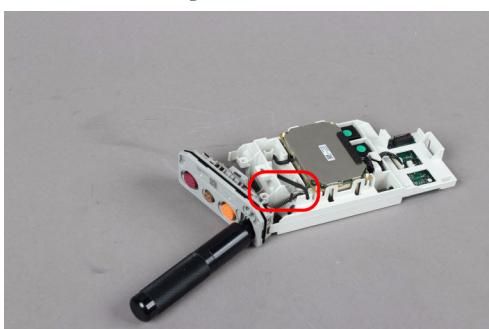
- 1 Remove the front bezel as described in “[Removing the Front Bezel](#)” on page 139.
- 2 Remove the housing top cover as described in “[Removing the Housing Top Cover](#)” on page 139.
- 3 Remove the Chassis Sled as described in “[Removing the Chassis Sled](#)” on page 142.



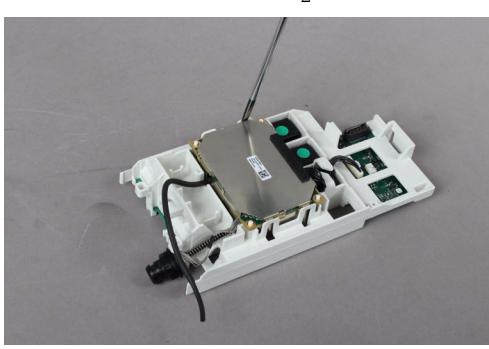
- 4 Use the Luer Remover to release the Microstream CO2 connector from the housing.



- 5 Remove the tubing from the connector block and then pull off the connector block.



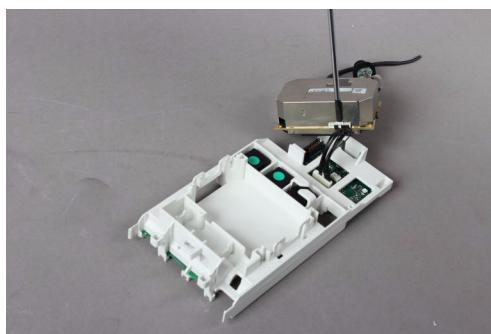
- 6 Release the Microstream CO2 measurement unit by pushing out the latches.



- 7 Lift out the Microstream CO₂ measurement unit.

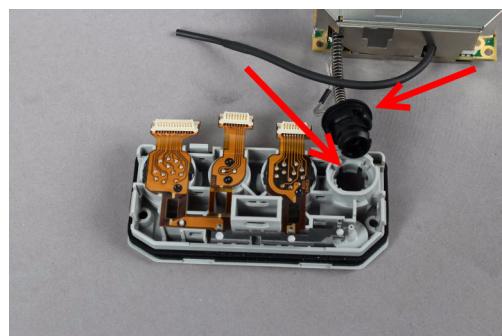


- 8 Remove the connector to the power board.



- 9 **Reassemble** the extension by performing the above steps in reverse order while noting the following considerations:

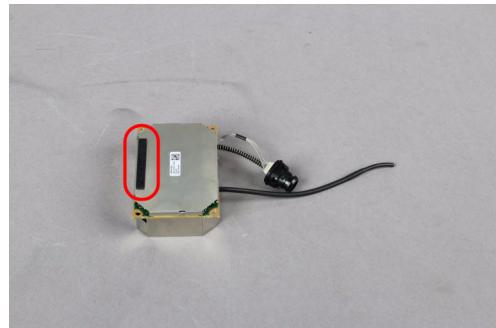
- The Luer connector of the Microstream unit is inserted into a crown-like gasket. Keep this gasket for the reassembly procedure as it is not shipped with the exchange Microstream measurement unit. When reassembling the Luer connector with the gasket, ensure the cut-outs of the gasket fit correctly into the connector block



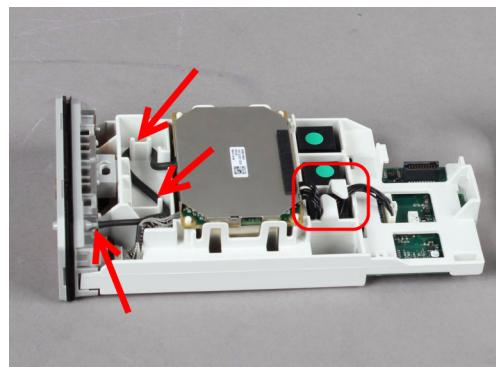
- The Microstream measurement unit requires the placement of an adhesive foam pad on one side. This is not included with the exchange part. Before reassembling the unit, place the adhesive pad

5 Repair and Disassembly

on the exchange unit, using either the foam pad from the defective part or a new one, which is set up as a support part.



- Ensure:
 - the cable from the Microstream unit to the Power Board and the exhaust tube are correctly inserted into the fixation latches.
 - the cable is not pinched or kinked.
 - the exhaust tube is tightly connected to the outlet of the connector block and is not twisted or kinked.



IntelliVue Dock Disassembly Procedures

Removing the Cable Management Hooks

- 1 Slide the cable management cover downwards.



- 2 Remove the screw from the cable management hook.



- 3 Slide the cable management hook downwards and remove it.



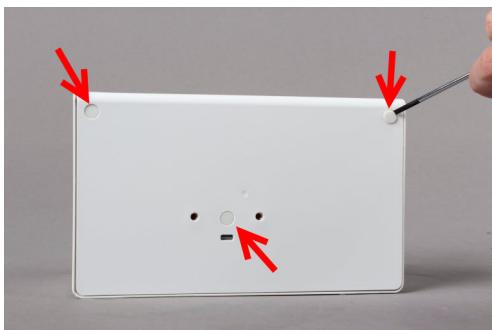
Removing the Release Button

- 1 Push the release mechanism into the housing and pull the release button upwards to remove it.

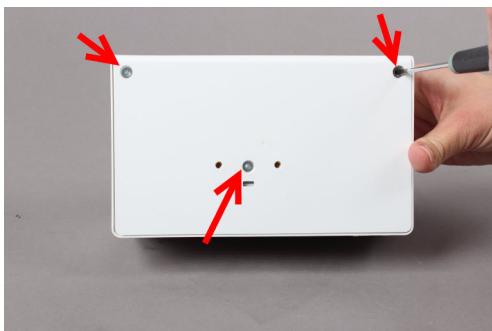


Separating the Front and Back of the Dock

- 1 Remove the covers from the three screws on the back of the dock, using a screwdriver.



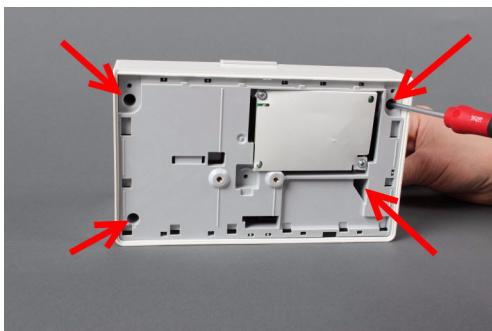
- 2 Remove the three screws from the back of the dock.



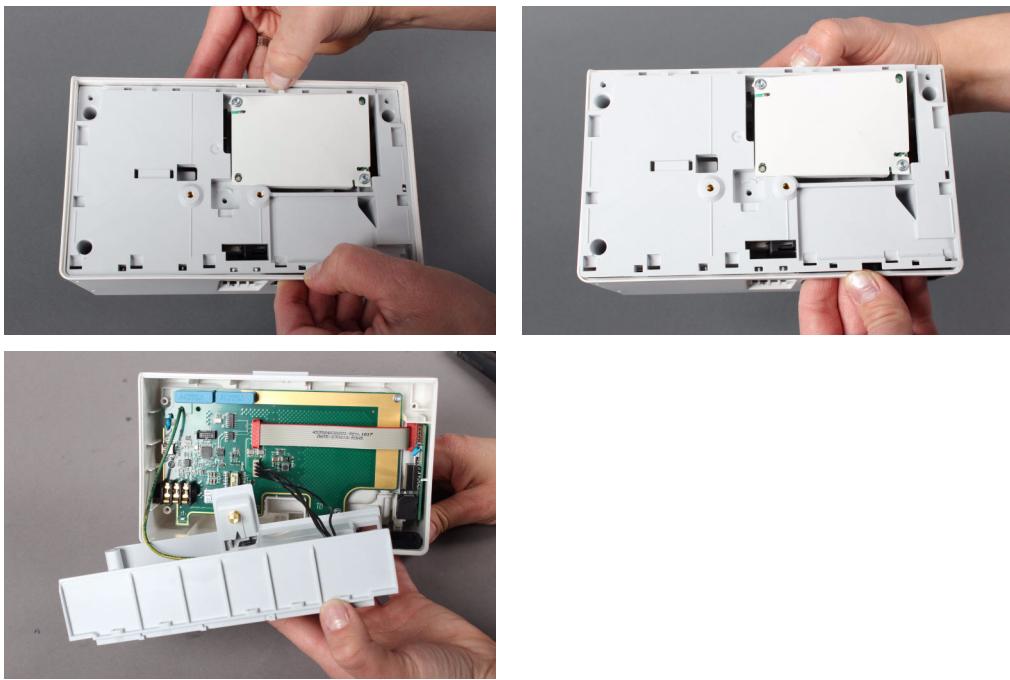
- 3 Insert a screwdriver into the slot below the middle screw of the back cover and release the cover with slight pressure and a rotating movement of the screwdriver. Remove the cover.



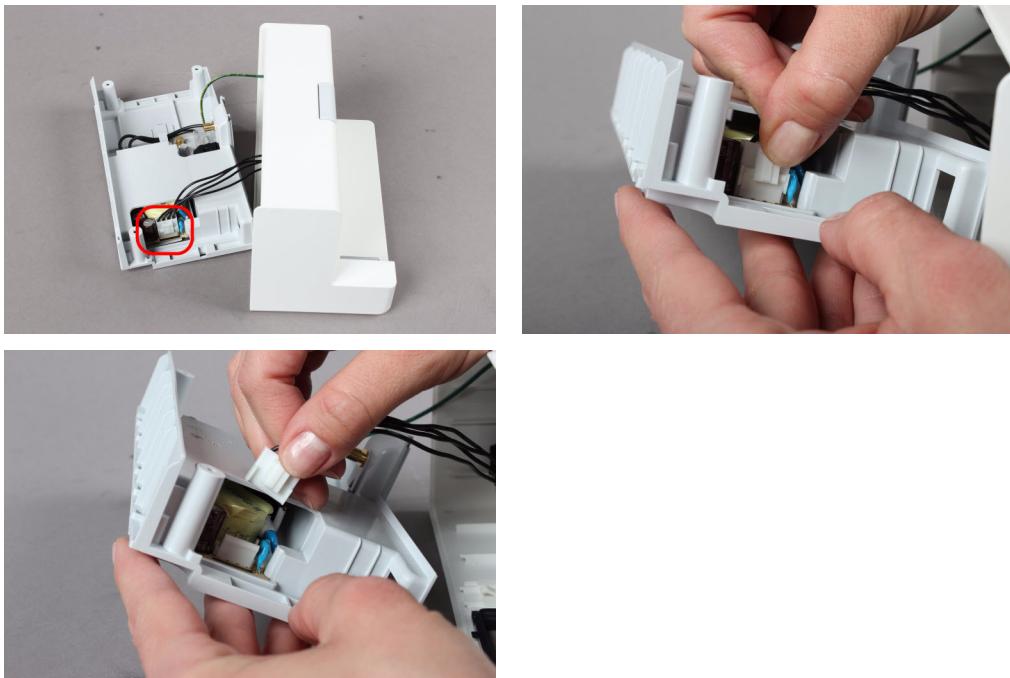
- 4 Remove the four screws from the chassis.



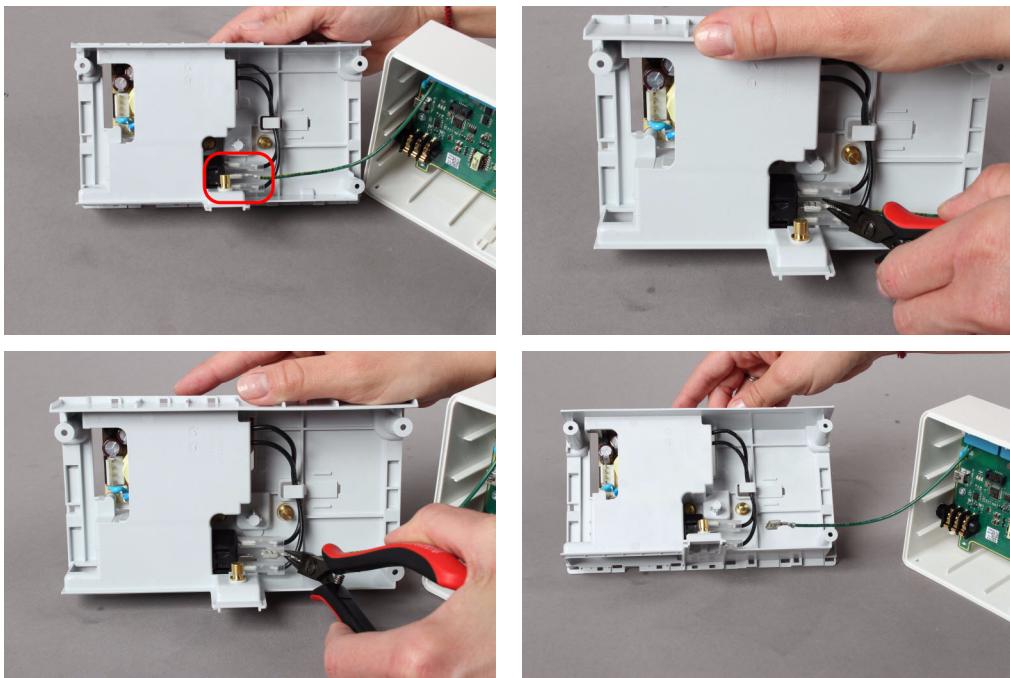
- 5 Release and pull out the chassis from the front housing.



- 6 Disconnect the white cable connector.



- 7 Disconnect the grounding cable.



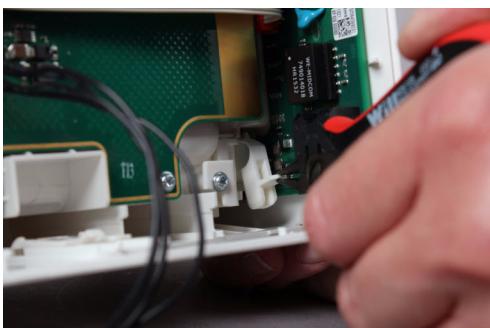
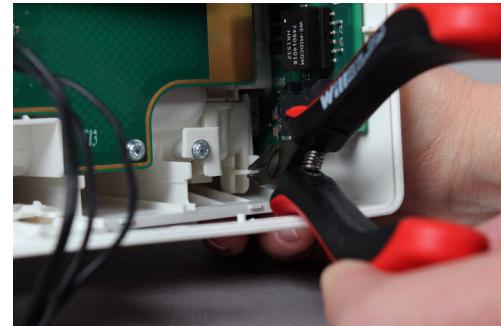
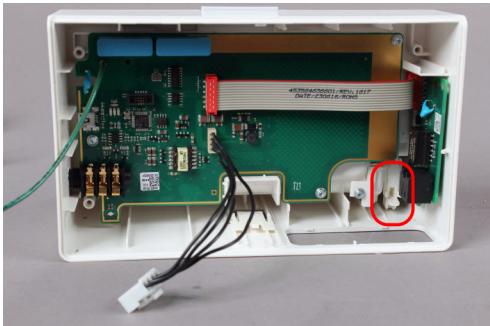
Removing the Power Connector Frame

- 1 Separate the front and back of the dock as described in “[Separating the Front and Back of the Dock](#)” on page 152.
- 2 Press the power connector frame inwards to remove it.



Removing the MSL Board

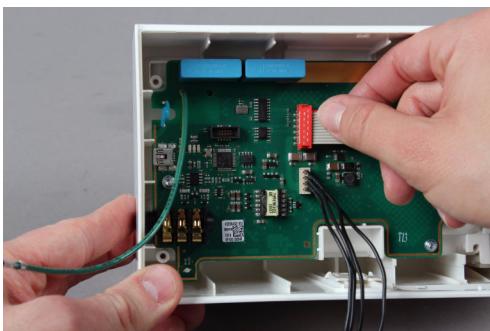
- 1 Separate the front and back of the dock as described in “[Separating the Front and Back of the Dock](#)” on page 152.
- 2 Pull the latch with pliers to release the MSL board connector.



- 3 Remove the screw from the latch.

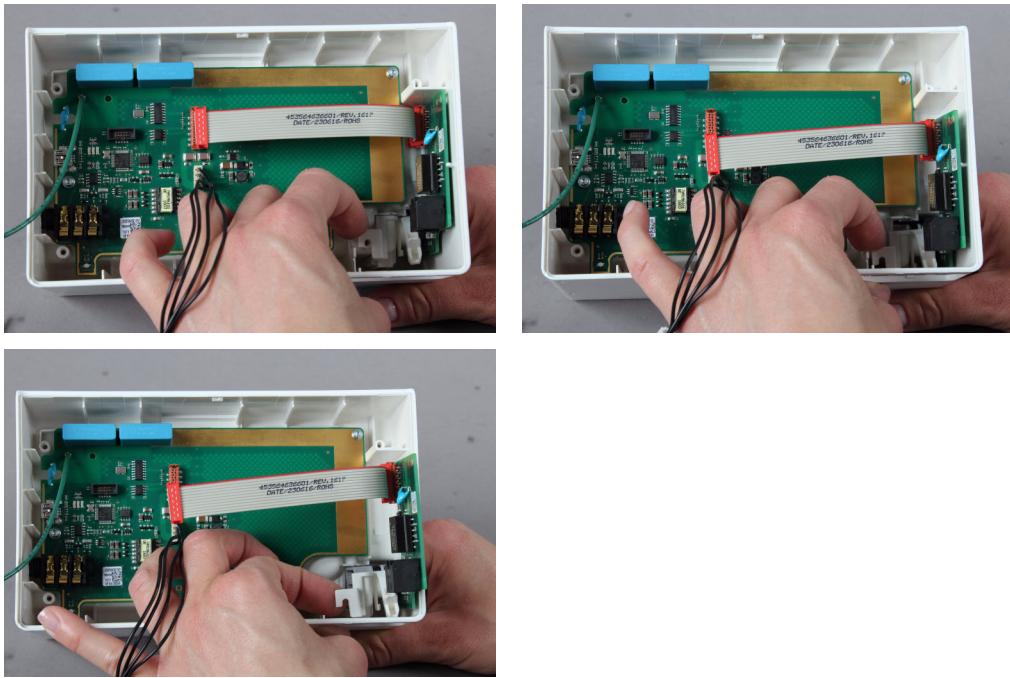


- 4 Disconnect the cable connecting the MSL board to the main board.



5 Repair and Disassembly

- 5 Push the latch forward and then pull it upwards to remove the MSL board.



Setting Product Information

If any of the following boards are replaced you must set the product information (hardware serial number and product options) after the repair procedure. The Support Tool Mark2 is required to perform this task. Please refer to the Support Tool Mark2 Instructions for Use for a description of the exact procedure.

MX100/X3 board replacements which require setting product information:

- Main Board
- Front End Adapter Board
- Display Assembly
- HIF Board
- IIT Assembly
- WLAN Board

Current Generation Measurement Extensions board replacements which require setting product information:

- Power Board

Available Options:

The following combinations of options are available for X3:

- SP1
- SP1 B02 B06
- SP1 B03 B06
- SP1 B06
- SP5
- SP5 B06
- SP6
- SP6 B06

The following combinations of options are available fro MX100:

- SP1 B20
- SP1 B26
- SP1 B27
- SP5 B20
- SP6 B20

5 Repair and Disassembly

Table 6 MX100/X3

HW Option	Description	Available with X3	Available with MX100
SP1	FAST SpO2	X	X
SP5	Masimo® rainbow SET SpO2	X	X
SP6	Nellcor OxiMax SpO2	X	X
B02	Dual SpO2 (FAST only)	X	
B03	Respironics CO2 ready	X	
B06	Dual Press and Temp	X	
B20	ECG, NBP, any SpO2		X
B26	ECG, NBP, FAST SpO2, Dual Press, Temp		X
B27	ECG, NBP, FAST SpO2, Dual Press, Temp, CO2		X

Table 7 Current Generation Measurement Extensions

HW Option	Description
867039	Hemodynamic Extension
B05	Dual Press, Temp, C.O
B06	Dual Press, Temp
B10	Dual Press, Temp, C.O./PiCCO
867040	Capnography Extension
-	CO2 only
B05	CO2, Dual Press, Temp, C.O.
B06	CO2, Dual Press, Temp
B10	CO2, Dual Press, Temp, C.O./PiCCO
867041	Microstream Extension
-	Microstream CO2 only
B05	Microstream CO2, Dual Press, Temp, C.O.
B06	Microstream CO2, Dual Press, Temp
B10	Microstream CO2, Dual Press, Temp, C.O./PiCCO

Measurement Extensions - (Previous Generation - M3012A, M3014A, M3015A/B)

This section describes the exchange procedures for:

- The Top Cover with new release mechanism
- The Dual Link Bar incl. the MSL Board Assembly.

for all Measurement Extension (MSE) types (M3012A, M3014A, M3015A/B).



Exchange Procedures

NOTE

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 Bezel

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



NOTE

There may be a slight resistance when you remove the front bezel.

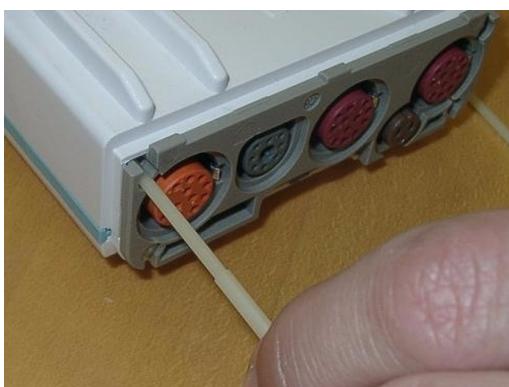


Removing the Housing Pin

- 1 Position the MSE on the dual link bar with the measurement connector hardware facing upwards and the arm of the dual link bar away from you. There are four long housing pins threaded into the MSE in each of the four corners under the cover. Locate the heads of the two long housing pins on the top housing and only remove these.
- 2 Use the thin-bladed screwdriver to lift the pins gently out far enough so they can be removed manually.



- 3 Remove the two pins and set them aside for refitting.

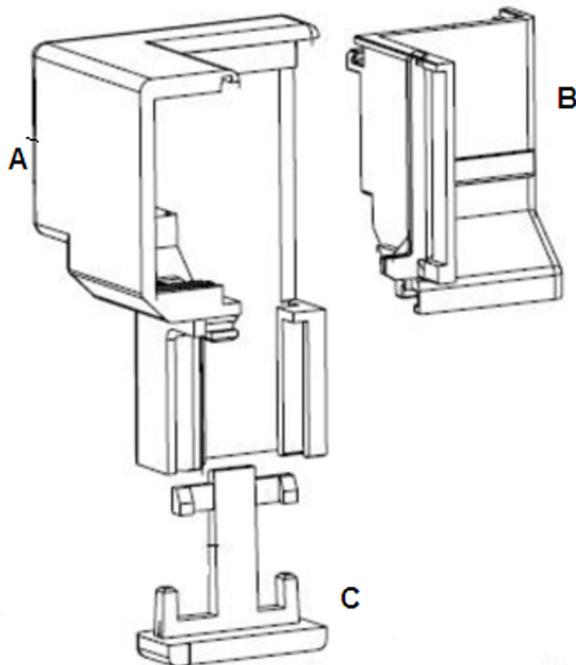


NOTE

Without these long housing pins the MSE will not function properly.

Removing the Dual Link Bar

The Dual Link Bar consists of three parts as shown below. Follow the specific steps carefully to remove the Link Bar.



CAUTION

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



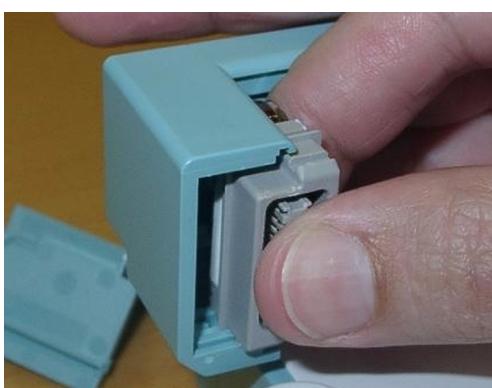
- 3 Repeat Step 2 at the bottom.



- 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.

5 Repair and Disassembly

- 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.

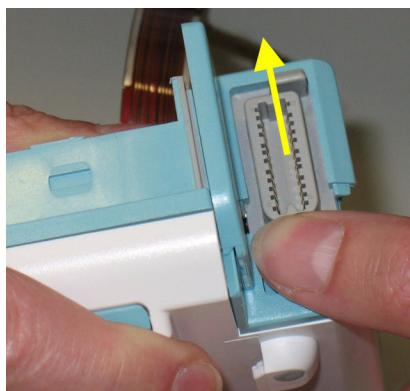


Replacing the Flex Cable Assembly

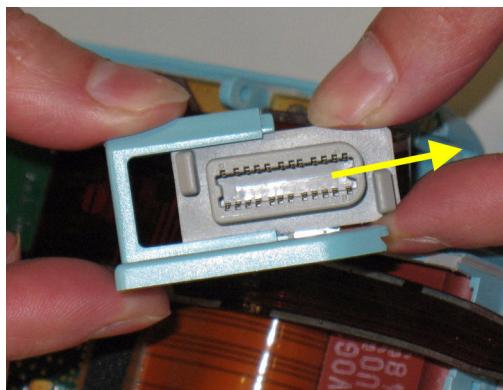
- 1 Hold the Extension firmly and push upwards against the connector. Then slide connector (together with the connector holder) out of the dovetail connection.

NOTE

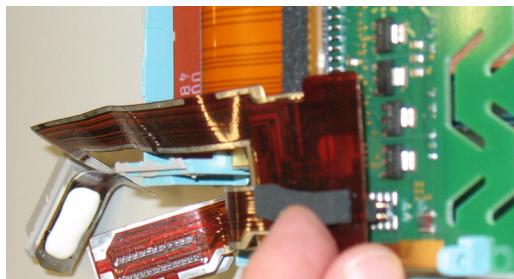
You will probably need to apply some more force at first until the holder slides out of its mechanical lock.



- 2 Slide the connector out of its holder.

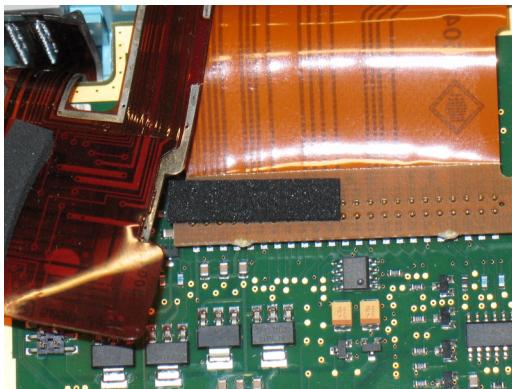


- 3 Remove the flex cable connector on the MSE board. Be careful not to bend any pins on the female part of the MSE connector.

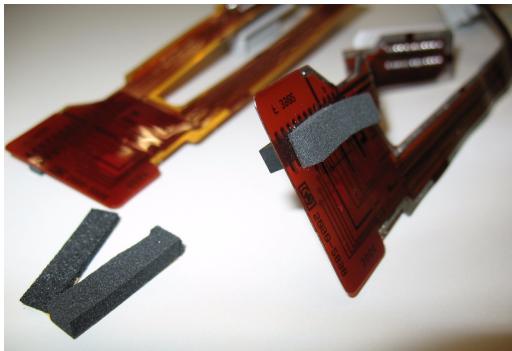


NOTE

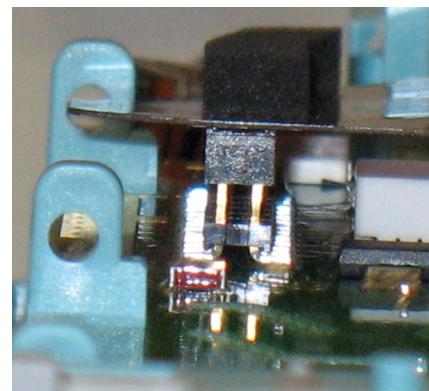
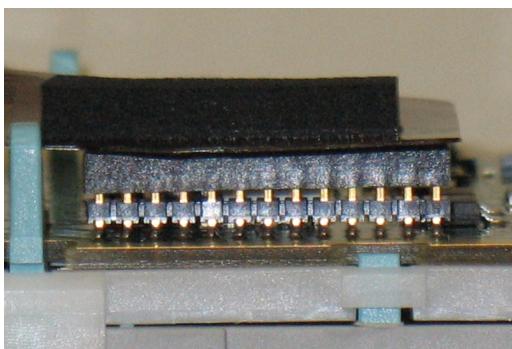
Some units may have a foam pad on the connector of the inner flex cable of the MSEs (as shown below) and some units may not. This has no impact on the functionality of these units.



- 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/B. You can also check the old flex cable for the correct pad.



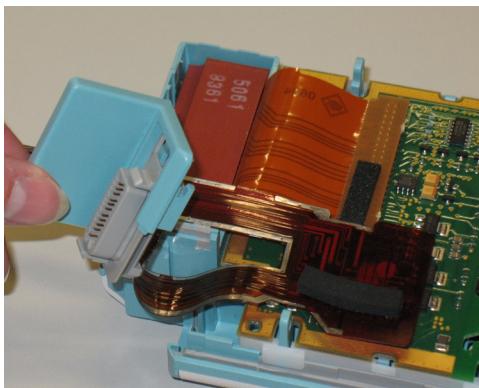
- 5 Insert the flex cable connector into the female receptacle on the MSE board. **Check from the side and the front that the connector is inserted correctly (there is no mechanical guidance)** and that no pins are bent, otherwise you may damage the MSE when powering it on.



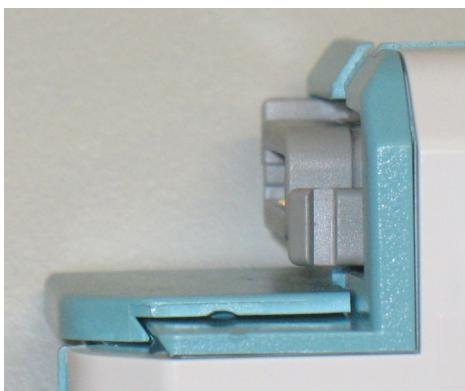
WARNING

A misplaced connector might damage the MSE or the monitor.

- 6 Slide the connector into the holder as shown below. Arrange the flex cable in the space beside and underneath the board (be careful not to bend the cable) while positioning the holder for insertion.



- 7 Insert the holder with the connector into the dovetail connection and slide it down until you hear a click.

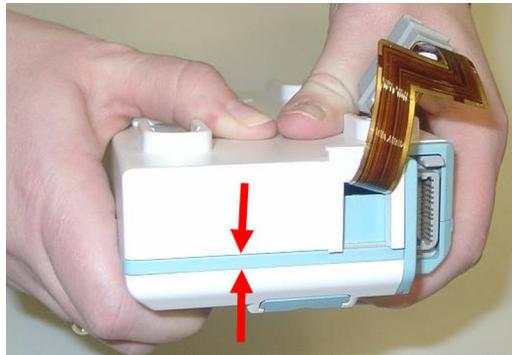


Refitting the Top Cover

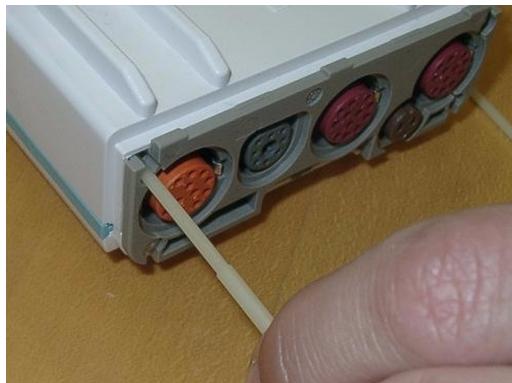
NOTE

Be careful with the MSL Board Assembly. 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 housing pins completely back into the MSE.



Assembling the dual Link Bar

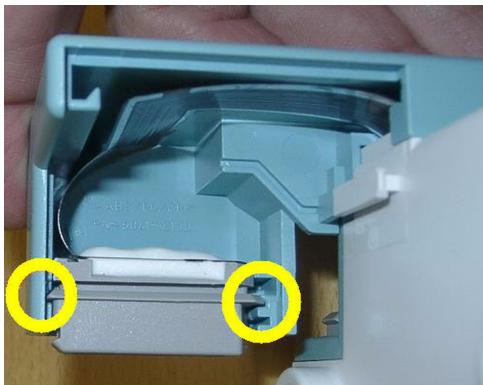
CAUTION

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

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



- 2 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 Board Assembly lies flat in part A of the assembly, place part B into the dovetail and close the open link bar.



5 Repair and Disassembly

- 4 Turn the MSE around and insert part C into the bottom part of the link bar. When you hear a click, part C is correctly inserted.



Refitting the Front Bezel

To refit the front bezel, press it back into place over the measurement connector hardware until you hear a click.



Final Inspection

Perform a final inspection to ensure that:

- The link bar is positioned correctly
- There are no gaps between the link bar parts
- There is no gap between the top and bottom cover



Testing

To ensure that the MSE is functioning correctly, you must perform a performance check on it. Please refer to the "Testing and Maintenance" chapter of this service guide.

WARNING

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

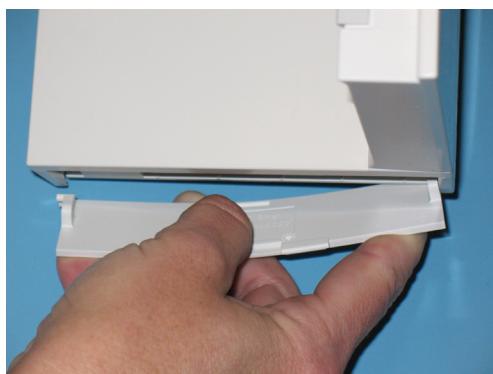
Battery Extension (865297) Repair and Disassembly

CAUTION

Always remove the battery and the SRL cable before performing any disassembly procedures on the battery extension.

Replacing the Battery Door

- 1 Open the battery door, hold it as shown below and bend it slightly until one hinge slides out. Then remove the door.



- 2 Insert the new battery door on one side, bending the door slightly until the hinge on the other side slides in.

Replacing Housing Parts and the Main Board

To replace parts of the battery extension housing, follow the procedure below until the respective part you wish to replace is accessible. Replace the part and reassemble the battery extension by following the performed steps in reverse order. If you need to replace the main board you will need to follow the procedure below until the end and disassemble the battery extension completely.

- 1 Unscrew two screws on the rear housing using a Torx T20 screwdriver.



- 2 Lift up the front cover of the rear housing as shown below and slide it out. Be careful not to damage the flex cable.



The front cover of the rear housing and the metal plate are now accessible.



- 3 Unscrew the two screws on the bottom of the housing using a Torx T10 screwdriver.



The back part of the rear housing is now accessible. If you need to replace this part, make sure you transfer the serial number tag to the new housing part. Be sure not to lose the pins holding the housing together, as you will need them for reassembly.



- 4 To disassemble the bottom housing, open the battery door and pull out the plastic pin as shown below.



5 Repair and Disassembly

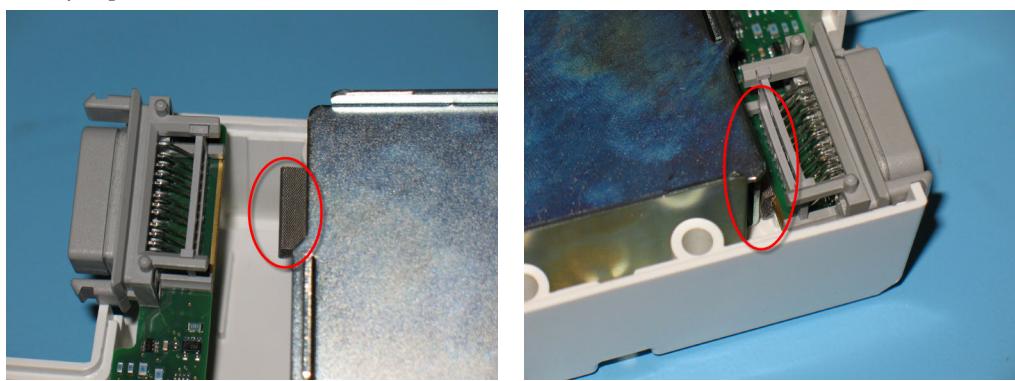
- 5 Separate the two bottom housing parts. Be careful not to damage the flex cable.



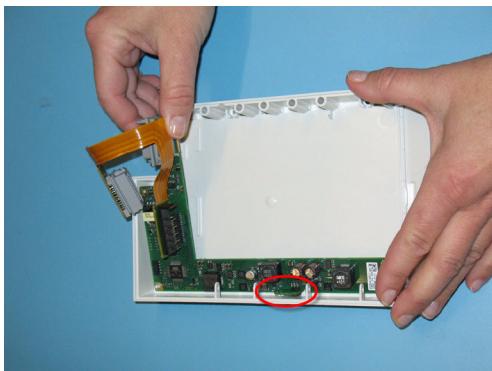
Now the battery cage can be lifted out of the housing.

NOTE

When reinserting the battery cage, make sure that the EMC shield is correctly positioned between the battery cage and the main board.



- 6 To remove the main board, lift it up as shown below and then pull it out. When replacing the main board, make sure that the small LED board (circled in red below) is positioned correctly.



All bottom parts of the housing as well as the main board are now accessible.



- 7 To reassemble the battery extension, perform the above steps in reverse order. Always make sure that you do not damage the flex cable.

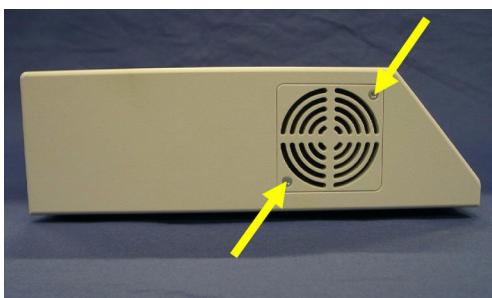
Smart Battery Conditioner LG1480 (865432)

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.



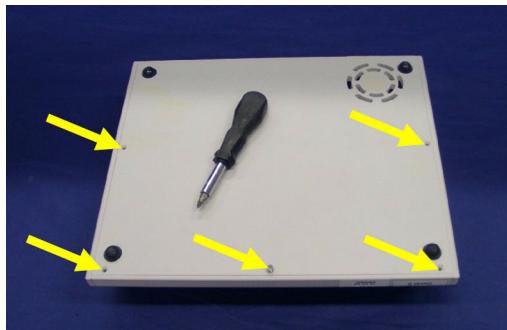
- 2 Remove the filter mat and clean the dust out by shaking.



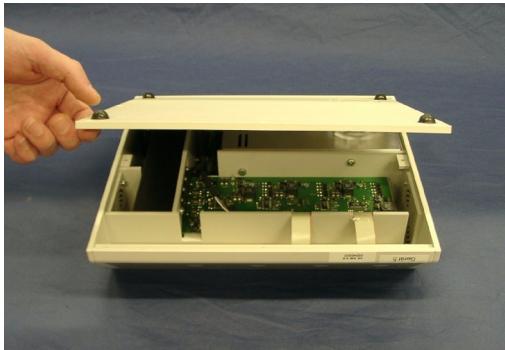
- 3 Re-insert the mat and refit the cover and screws.

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.

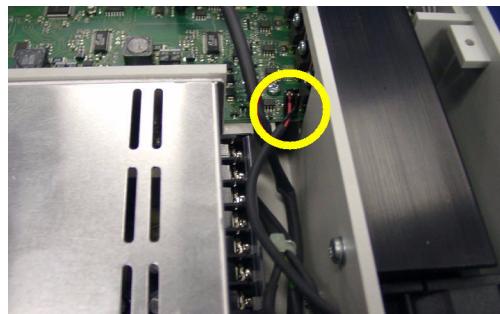


- 4 Lift the fan out of the battery conditioner housing.



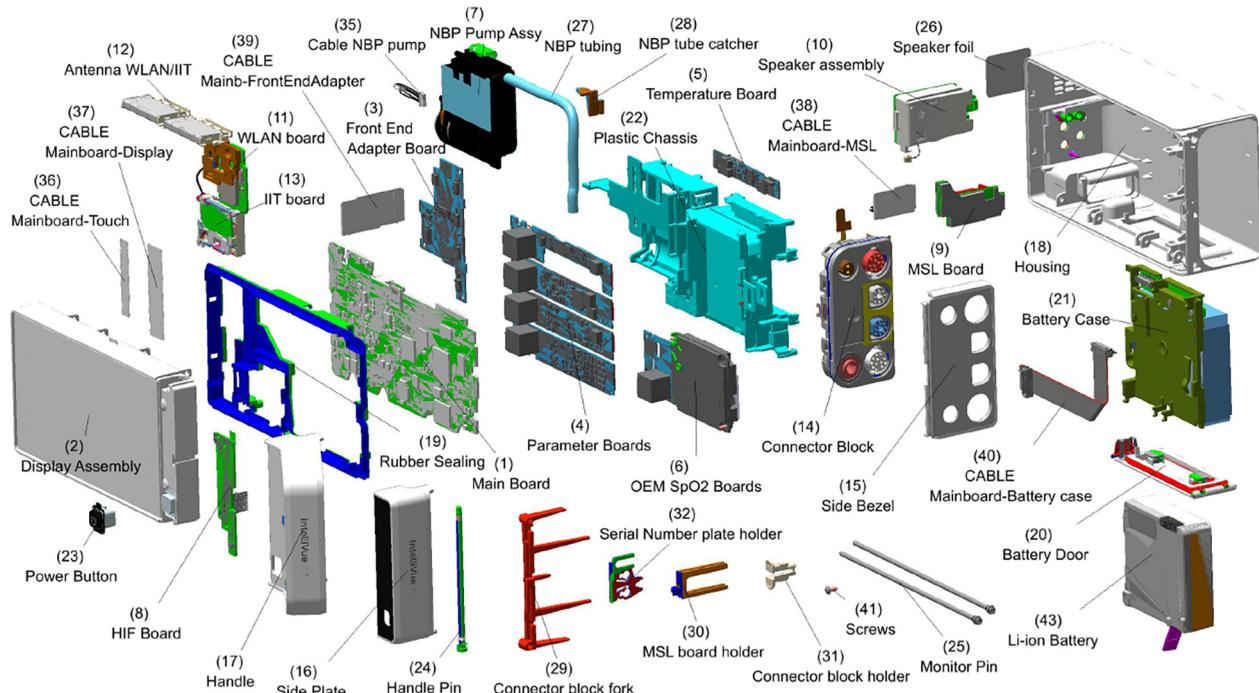
5 Repair and Disassembly

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



Parts

MX100/X3 Exchange and Replacement Parts



Exchange Parts

Part Number	Description	Number in Diagram
453564660181	MX_100/X3 Main Board	1

Replacement Parts

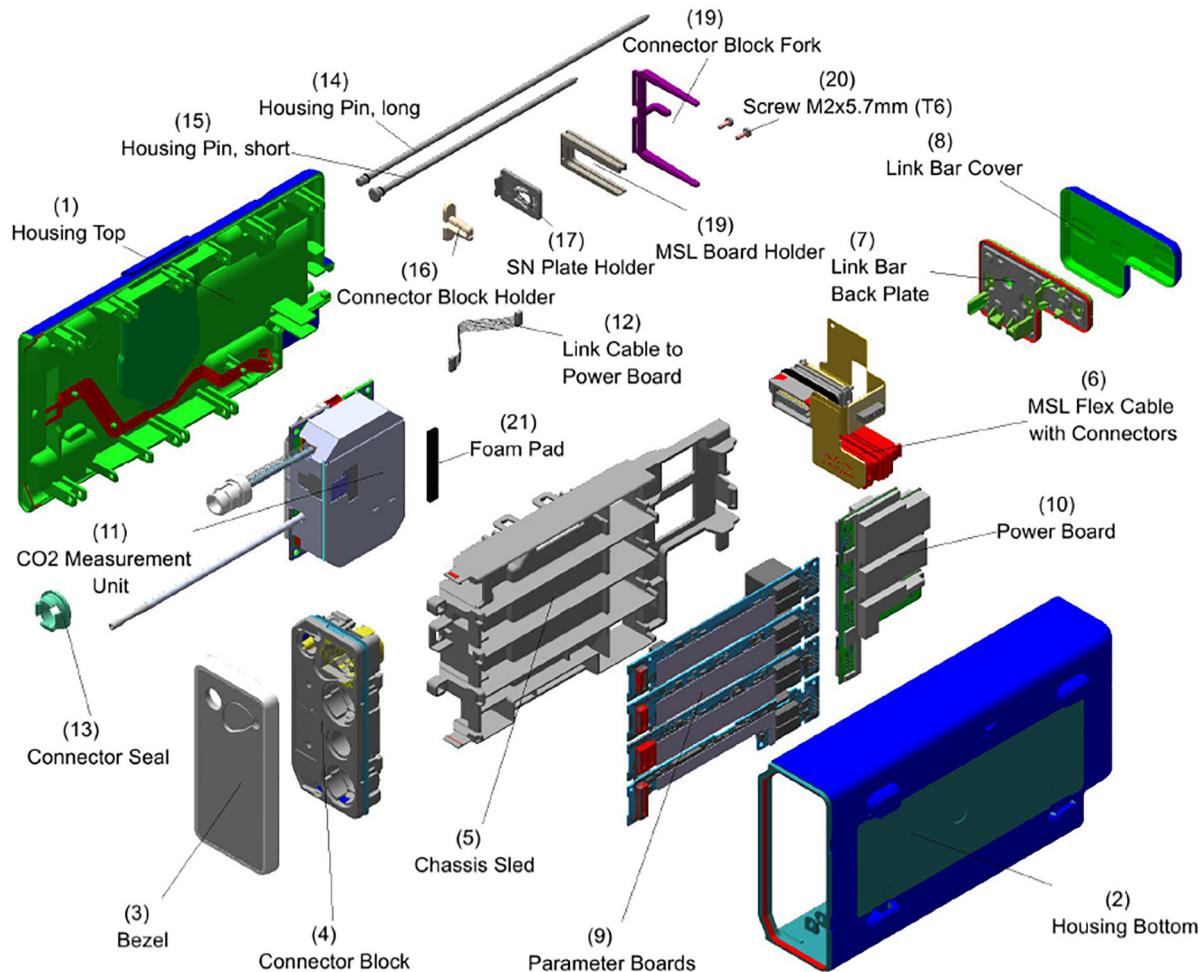
Part Number	Description	Number in Diagram
453564673851	MX_100/X3 Display Assembly	2
453564673681	MX_100/X3 Front End Adapter Board	3
453564673691	MX_100/X3 ECG Measurement Board	4
453564673731	MX_100/X3 FAST SpO2 Board	4
453564673701	MX_100/X3 Pressure Board	4

6 Parts

Part Number	Description	Number in Diagram
453564685561	MX_EXT RCO2 CO2 Board	4
453564673711	MX_100/X3 Temperature Board	5
453564673741	MX_100/X3 OxiMax SpO2 Board	6
453564673751	MX_100/X3 OxiMax SpO2 Adapter	6
453564673761	MX_100/X3 Rainbow SpO2 Board	6
453564673771	MX_100/X3 Rainbow SpO2 Adapter	6
453564673781	MX_100/X3 NBP Pump Assembly	7
453564673801	MX_100/X3 HIF Board	8
453564673811	MX_100/X3 MSL Board	9
453564673831	MX_100/X3 Speaker Assembly	10
453564408321	IV2-FLEX WLAN Board (MX400-550/100/X3)	11
453564698421	MX_100/X3 Antenna WLAN	12
453564698401	MX_100/X3 Antenna WLAN + IIT	12
453564698411	MX_100/X3 Antenna IIT	12
453564778041	MX_100/X3 IIT Radio Board	13
453564778021	MX_100/X3 IIT Adapter Board	13
453564778031	MX_100/X3 IIT Holder	13
453564673611	MX_100/X3 ConnectorBlock FAST	14
453564673621	MX_100/X3 ConnectorBlock OxiMax	14
453564673631	MX_100/X3 ConnectorBlock rainbow	14
453564673641	MX_100/X3 ConnectorBlock FAST, P, T	14
453564673651	MX_100/X3 ConnectorBlock OxiMax, P, T	14
453564673661	MX_100/X3 ConnectorBlock rainbow, P, T	14
453564673671	MX_100/X3 ConnectorBlock FAST,CO2, P, T	14
453564705411	MX_100/X3 ConnectorBlock 2xFAST,P,T	14
453564705241	MX_100/X3 Bezel FAST SYM (3ea)	15 (Requires 42)
453564705251	MX_100/X3 Bezel FAST TXT (3ea)	15 (Requires 42)
453564705261	MX_100/X3 Bezel 2xFAST,P,T SYM (3ea)	15 (Requires 42)
453564705271	MX_100/X3 Bezel 2xFAST,P,T TXT (3ea)	15 (Requires 42)
453564705281	MX_100/X3 Bezel FAST,CO2,P,T SYM (3ea)	15 (Requires 42)
453564705291	MX_100/X3 Bezel FAST,CO2,P,T TXT (3ea)	15 (Requires 42)
453564705301	MX_100/X3 Bezel FAST,P,T SYM (3ea)	15 (Requires 42)
453564705311	MX_100/X3 Bezel FAST,P,T TXT (3ea)	15 (Requires 42)
453564705321	MX_100/X3 Bezel rainbow SYM (3ea)	15 (Requires 42)
453564705331	MX_100/X3 Bezel rainbow TXT (3ea)	15 (Requires 42)
453564705341	MX_100/X3 Bezel rainbow,P,T SYM (3ea)	15 (Requires 42)
453564705351	MX_100/X3 Bezel rainbow,P,T TXT (3ea)	15 (Requires 42)
453564705361	MX_100/X3 Bezel OxiMax SYM (3ea)	15 (Requires 42)
453564705371	MX_100/X3 Bezel OxiMax TXT (3ea)	15 (Requires 42)

Part Number	Description	Number in Diagram
453564705381	MX_100/X3 Bezel OxiMax,P,T SYM (3ea)	15 (Requires 42)
453564705391	MX_100/X3 Bezel OxiMax,P,T TXT (3ea)	15 (Requires 42)
453564673881	MX_100/X3 Side Plate X3 (3ea)	16
453564673931	MX_100/X3 Handle X3	17
453564673941	MX_100/X3 Handle MX100	17
453564673981	MX_100/X3 Rear Housing	18 (Requires 42)
453564673821	MX_100/X3 Rubber Sealing	19
453564673841	MX_100/X3 Battery Door (3ea)	20
453564673861	MX_100/X3 Battery Case	21
453564673791	MX_100/X3 Plastic Chassis (FAST SpO2)	22
453564673971	MX_100/X3 Plastic Chassis (OxiMax/Rnbow)	22
453564673871	MX_100/X3 Power Button X3 Black (3ea)	23
453564694971	MX_100/X3 Power Button MX100 Gray (3ea)	23
453564765801	MX_100/X3 Handle Pin (3ea)	24
453564765811	MX_100/X3 Monitor Pin (2ea)	25
453564673901	MX_100/X3 Speaker Foil (5ea)	26
453564765741	MX_100/X3 NBP Tubing (3ea)	27
453564765761	MX_100/X3 NBP Tube Catcher (3ea)	28
453564765771	MX_100/X3 Connector Block Fork (3ea)	29
453564765791	MX_100/X3 MSL Board Holder (3ea)	30
453564765821	MX_100/X3 Connector Block Holder (3ea)	31
453564765861	MX_100/X3 SN Plate Holder (3ea)	32
453564765851	MX_100/X3 Spacer (3ea)	33 (Not Shown)
453564765781	MX_100/X3 OxiMax SpO2 Board Holder (3ea)	34 (Not Shown)
453564765751	MX_100/X3 CABLE NBP Pump	35
453564765691	MX_100/X3 CABLE Mainboard-Touch	36
453564765701	MX_100/X3 CABLE Mainboard-Display	37
453564765711	MX_100/X3 CABLE Mainboard-MSL	38
453564765721	MX_100/X3 CABLE Mainb-FrontEndAdapter	39
453564765731	MX_100/X3 CABLE Mainboard-Battery Case	40
453564765831	MX_100/X3 SCREW PT 25x6mm (T8) (5ea)	41
453564765841	MX_100/X3 SCREW M2x5.7mm (T6) (5ea)	41
453564768991	MX_100/X3 Label Sheet (3ea)	42 (Not Shown)
989803196521	MX_100/X3 Lithium Ion Battery	43
989803202201	X3/MX100 Battery Charger Adapter	(Not Shown)
453564787091	IV2 CONN NBP Inlet X3/MX100/MMX (5ea)	(Not Shown)

Current Generation Measurement Extension Parts (867036, 867039, 867040*, 867041**)



Exchange Parts

Part Number	Description	Number in Diagram
453564685711	MX_EXT MCO2 CO2 Measurement Unit	11

Replacement Parts

Part Number	Description	Number in Diagram
453564685391	MX_EXT Housing Top	1
453564685381	MX_EXT Housing Bottom	2
453564685501	MX_EXT HMS Bezel P, T, C.O Eng.Text (3ea)	3
453564685511	MX_EXT HMS Bezel P, T, C.O Symbols (3ea)	3
453564685521	MX_EXT HMS Bezel P, T, C.O/CCO Eng. Text (3ea)	3
453564685531	MX_EXT HMS Bezel P, T, C.O/CCO Symbols (3ea)	3
453564685541	MX_EXT HMS Bezel P, T Eng. Text (3ea)	3
453564685551	MX_EXT HMS Bezel P, T Symbols (3ea)	3
453564685601	MX_EXT RCO2 Bezel CO2 Eng. Text/Symb (3ea)	3
453564685621	MX_EXT RCO2 Bezel P, T, CO2 Eng. Text (3ea)	3
453564685631	MX_EXT RCO2 Bezel P, T, CO2 Symbols (3ea)	3
453564685641	MX_EXT RCO2 Bezel P,T,C.O,CO2 Eng. Text (3ea)	3
453564685651	MX_EXT RCO2 Bezel P,T,C.O,CO2 Symbols (3ea)	3
453564685691	MX_EXT RCO2BezelP,T,C.O/CCO,CO2 Eng (3ea)	3
453564685701	MX_EXT RCO2BezelP,T,C.O/CCO,CO2Symb (3ea)	3
453564685751	MX_EXT MCO2 Bezel CO2 Eng. Text/Symbol (3ea)	3
453564685761	MX_EXT MCO2 Bezel P,T,CO2 Eng. Text (3ea)	3
453564685771	MX_EXT MCO2 Bezel P,T,CO2 Symbols (3ea)	3
453564685781	MX_EXT MCO2 Bezel P,T,C.O, CO2 Eng. Text (3ea)	3
453564685791	MX_EXT MCO2 Bezel P,T,C.O,CO2 Symbols (3ea)	3
453564685801	MX_EXT MCO2 Bezel P,T,C.O/CCO,CO2 Eng. (3ea)	3
453564685811	MX_EXT MCO2 Bezel P,T,C.O/CCO,CO2 Symb. (3ea)	3
453564685481	MX_EXT HMS Conn Block P, T, C.O/ CCO	4
453564685491	MX_EXT HMS Conn Block P, T	4
453564685571	MX_EXT RCO2 Conn Block CO2 only	4
453564685581	MX_EXT RCO2 Conn Block P, T , CO2	4
453564685591	MX_EXT RCO2 C- Block P, T, C.O/CCO, CO2	4
453564685721	MX_EXT MCO2 Conn Block CO2 only	4
453564685731	MX_EXT MCO2 Conn Block P, T, CO2	4
453564685741	MX_EXT MCO2 Conn Block P,T,C.O/CCO,CO2	4
453564685401	MX_EXT Chassis Sled	5
453564685441	MX_EXT MSL Board Assembly	6
453564685411	MX_EXT Link Bar Back Plate	7

6 Parts

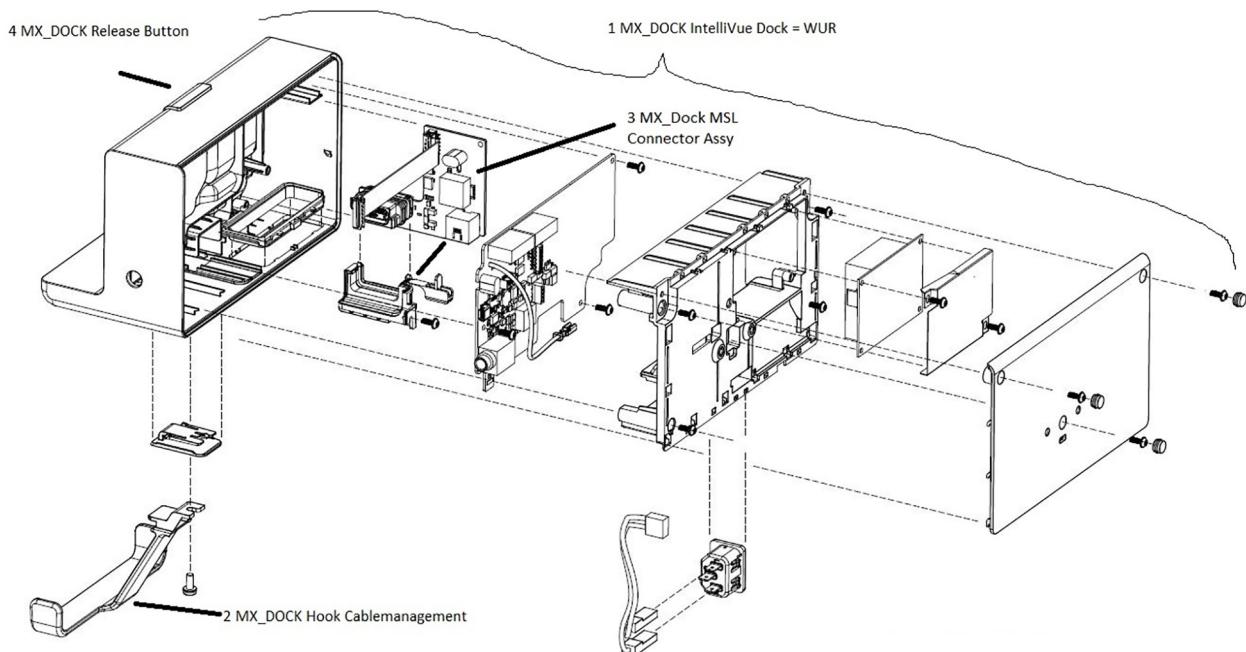
Part Number	Description	Number in Diagram
453564685421	MX_EXT Link Bar Cover	8
453564685461	MX_EXT C.O Board	9
453564769121	MX_EXT COO Board	9
453564685471	MX_EXT Temp Board	9
453564685561	MX_EXT RCO2 CO2 Board	9
453564673701	MX_100/X3 Pressure Board	9
453564685451	MX_EXT Power Board	10
453564686571	MX_EXT MCO2 Link Cable to Power Board	12
453564770651	MX_EXT MCO2 Connector Seal (3ea)	13
453564770381	MX_EXT Housing Pin, Long (3ea)	14
453564770391	MX_EXT Housing Pin, Short (3ea)	15
453564770361	MX_EXT Connector Block Holder (3ea)	16
453564770371	MX_EXT SN Plate Holder (3ea)	17
453564770351	MX_EXT MSL Board Holder (3ea)	18
453564770341	MX_EXT Connector Block Fork (3ea)	19
453564765841	MX_100/X3 SCREW M2x5.7mm (T6) (5ea)	20
453564686561	MX_EXT MCO2 Foam Pad (3ea)	21
453564770411	MX_EXT Locking Pins (4ea)	(Not Shown)
453564770421	MX_EXT Cover Plugs (4ea)	(Not Shown)

* PiCCO is not available for the 867040 Capnography extension in the USA and territories relying on FDA market clearance.

** PiCCO is not available for the 867041 Microstream CO2 extension in the USA and territories relying on FDA market clearance.

*** Only required for mounting purposes. See Installation Chapter

IntelliVue Dock Parts (867043)



Part Number	Description	Number in Diagram
453564681011	MX_DOCK IntelliVue Dock	1
453564681041	MX_DOCK Hook Cablemanagement	2
453564681031	MX_Dock MSL Connector Assy	3
453564681051	MX_DOCK Release Button	4

Previous Generation Measurement Extension Parts (M3012A, M3014A, M3015A/B)

Exchange Measurement Extensions are shipped with English front bezels only. If you require a bezel in another language (compare the part numbers of your language to the English ones to check this) the front bezel has to be ordered additionally. Attach the appropriate bezel before putting the Measurement extension into operation.

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

Measurement Extension General Support Parts

Part Number	12NC	Description	Comments
M3014-64200	451261012731	MS_RCO2 Measurement Ext Clips+Springs, 10ea	Old top housing
M3012-64600	451261012721	MS_HMS Measurement Ext. Lever Locks (5ea)	Grey lever release mechanism
M3012-64620	451261016601	MS_HMS MSE Top Cover Assy	
M3012-64621	451261016611	MS_HMS MSE Link Bar Assy	Without Flex, must be ordered separately
453564088851	453564088851	MS_MCO2 Flex Cable/Connector Assy	
5041-8114	453563100081	MS_X1 Housing Pin	



Measurement Extensions Exchange Units

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.

Part number	12NC	Description
M3012A Non-RoHS SN Prefix <>DE452 & DOM <2014-07		
M3012A	862111	Hemodynamic Measurement Extension
M3012-6801A	451261000201	MS_HMS OEM EXCH.UNIT ENGLISH (#C00) nRoHS
M3012-6831A	451261000341	MS_HMS OEM EXCH.UNIT ENGLISH (#C05) nRoHS
M3012-6861A	451261000491	MS_HMS OEM EXCH.UNIT ENGLISH (#C10) nRoHS
M3012A RoHS SN Prefix =DE452 & DOM >2014-07		
M3012A	862111	Hemodynamic Measurement Extension
M3012-6901A	453564453601	MS_HMS OEM UNIT ENGLISH (#C00)
M3012-6931A	453564453611	MS_HMS OEM UNIT ENGLISH (#C05)
M3012-6961A	453564453621	MS_HMS OEM UNIT ENGLISH (#C10)
M3014A Non-RoHS SN Prefix <>DE454 & DOM <2014-07		
M3014A	862187	Capnography Extension
M3014-6801A	451261009281	MS_RCO2 OEM EXCH.UNIT ENGLISH (#C00) nRoHS
M3014-6831A	451261009311	MS_RCO2 OEM EXCH.UNIT ENGLISH (#C05) nRoHS
M3014-6861A	451261009601	MS_RCO2 OEM EXCH.UNIT ENGLISH (#C10) nRoHS
M3014-6891A	451261009461	MS_RCO2 OEM EXCH.UNIT ENGLISH (#C07) nRoHS
M3014A RoHS SN Prefix =DE454 & DOM >=2014-07		
M3014A	862187	Capnography Extension
M3014-6901A	453564453631	MS_RCO2 OEM UNIT ENGLISH (#C00)
M3014-6931A	453564453641	MS_RCO2 OEM UNIT ENGLISH (#C05)
M3014-6961A	453564453651	MS_RCO2 OEM UNIT ENGLISH (#C10)
M3014-6991A	453564453661	MS_RCO2 OEM UNIT ENGLISH (#C07)
M3015A Non-RoHS SN Prefix <>DE455 & DOM <2014-07		
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) nRoHS
453564293891	453564293891	MS_SCO2 Exch. Unit without P/T (HW Rev. C) nRoHS
M3015A RoHS SN Prefix =DE455 & DOM >=2014-07		
M3015A	862393	Microstream CO2 Extension
453564435491	453564435491	MS_SCO2 M3015A with P/T (HW C)
453564435511	453564435511	MS_SCO2 M3015A without P/T (HW C)

6 Parts

Part number	12NC	Description
Spare Parts		
453564312801	453564312801	MS_SCO2 Housing Bottom HW Rev A,B
453564312871	453564312871	MS_SCO2 Top Cover Assy HW Rev C
M3015B Non-RoHS SN Prefix <>DE456 & DOM <=2014-07		
M3015B	865377	Microstream CO2 Extension
453564270041	453564270041	MS_SCO2 M3015B with CO2,P, P and T
M3015B RoHS SN Prefix =DE455 & DOM >=2014-07		
M3015B	865377	Microstream CO2 Extension
453564435461	453564435461	MS_SCO2 M3015B with CO2,P,P, and T
Spare Parts		
453564312871	453564312871	MS_SCO2 Top Cover Assy HW Rev C

Measurement 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,PP/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,PP/T Text
451261024591	451261024591	MS_RCO2 Bezel C.O.,CCO, CO2, P, P/T Sym
Capnography Sensors RoHS with SN Prefix US401		
M2741-68100	453564453731	MS_MCO2 Sidestream Sensor
M2501-68100	453564453721	MS_MCO2 Mainstream Sensor
Capnography Sensors Non RoHS with SN Prefix other than US401		

Part number	12NC	Description
M2741-68000	451261011291	SNSR M2741A Sidestream Sensor
M2501-68000	451261006391	MS_MCO2 M2501A MainstreamSensor
Spare Parts		
M2741-60000	451261011731	Mounting Bracket Replacement
M3015A Bezel		
451261024601	451261024601	MS_SCO2 Bezel CO2 w P/T Eng. Text
451261024611	451261024611	MS_SCO2 Bezel CO2 w P/T Symbols
451261024621	451261024621	MS_SCO2 Bezel CO2 w/o P/T Eng. Text
451261024631	451261024631	MS_SCO2 Bezel CO2 w/o P/T Symbols
M3015B Bezel		
453564270051	453564270051	MS_SCO2 Bezel Symbols M3015B CO2. P, P, T
453564270061	453564270061	MS_SCO2 Bezel Text M3015B CO2. P, P, T

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

Battery Extension Part Numbers

Part number	12NC	Description
453564246121	453564246121	MS_X2 ASSY Main Board Battery Extension
453564246131	453564246131	MS_X2 PLAST Housing Kit Battery Ext
453564246141	453564246141	MS_X2 PLAST Batt Door (5x) Battery Ext

Test and Service Tools

Table 8 Network Service Adapter

Part Number	12NC	Description
453564738941	453564738941	IV2 X3/MX100 Network Service Adapter

Table 9 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 10 Test Cables

Part Number	12NC	Description
451261026081	451261026081	CBL Safety Test ECG
451261026141	451261026141	CBL Safety Test IBP
451261026041	451261026041	CBL Safety Test SpO2 (MMS/M1020B)
453564427181	453564427181	IV CBL Safety Test SpO2 Rainbow
451261026171	451261026171	CBL Safety Test C.O.
451261026131	451261026131	CBL Safety Test Temp
451261026031	451261026031	CBL Safety Test CO2 (M3014A)
M1012-61601	453563227731	M_CO CONN Test Adapter Cardiac Output

Table 11 Capnography - Resironics Mainstream

Part Number	12NC	Description
M2506A		GAS Verification Gas
M2505A		GAS CYLINDER REGULATOR

Table 12 Capnography - Resironics Sidestream

Part Number	12NC	Description
M2267A	989803106081	Calibration Regulator
13907A	989803100361	Calibration Tube Assembly
M2506A		GAS Verification Gas
M2776A		Straight Sample Line

Table 13 Capnography Microstream Oridion

Part Number	12NC	Description
453564117411	453564117411	mCO ₂ Luer remover
M1013-64002	451261014851	M_G1 IV Leakage Test Kit
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

Part Number	12NC	Description
13907A	989803100361	Calibration Tube Assembly
453564178121	453564178121	M_AGM Flowmeter TSI

Installation Instructions

Installation should be carried out by qualified service personnel, either by the hospital's biomedical department, or by Philips Support.

If you have purchased a “customer-installable bundle”, it is assumed that your own hospital personnel will install and, if necessary, configure the monitor. You can contact Philips Support for assistance if required; any assistance will be associated with additional costs.

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.

WARNING

- Monitor configuration settings must be specified by authorized hospital personnel.
 - As the first step in preparing the monitor for use, follow the installation instructions given in this chapter.
-

Installation Checklist

Use this checklist to document your installation.

Step	Task	Check Box when Task Done
1	Perform initial inspection of delivery, unpack and check the shipment	<input type="checkbox"/>
2	Mount the monitor as appropriate for your installation	<input type="checkbox"/>
3	Connect the monitor to AC mains via the IntelliVue Dock or external power supply using the supplied power cord or connect the MX100/X3 to a host monitor	<input type="checkbox"/>
4	Perform Visual, Power On and Functional test blocks	<input type="checkbox"/>
5	Perform Safety Tests, if required by local laws and regulations	<input type="checkbox"/>
6	Check/set the time and date	<input type="checkbox"/>
7	Check that the country-specific default settings are appropriate	<input type="checkbox"/>
8	Perform System Test as necessary	<input type="checkbox"/>

Unpacking and Checking the Shipment

The monitor and any supporting options ordered are supplied packed in protective shipping cartons.

Initial Inspection

Before unpacking, check the packaging and ensure that there are no signs of mishandling or damage.

Open the package carefully and remove the monitor and accessories.

Check that the contents are complete and that the correct options and accessories have been delivered.

System Components, Accessories and Supplies	Comments
Monitor with options as ordered	1
ECG accessories	optional
NBP accessories	optional
SpO ₂ accessories	optional
Pressure accessories	optional
Temperature accessories	optional
CO ₂ Accessories	optional
IntelliVue Dock including AC power cord (MX100)	1
IntelliVue Dock including AC power cord (X3)	optional
Rechargeable battery	1
Instructions for Use	1
Quick Guide	1
Documentation CD-ROM (includes Service Guide and Instructions for Use)	1

Claims for Damage

If the shipping cartons are damaged, contact the carrier.

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

Repacking

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

Mounting the Monitor

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.

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.

Mounting Instructions

You can mount the monitor using either the bedhanger mount or the rotatable quick claw mount.

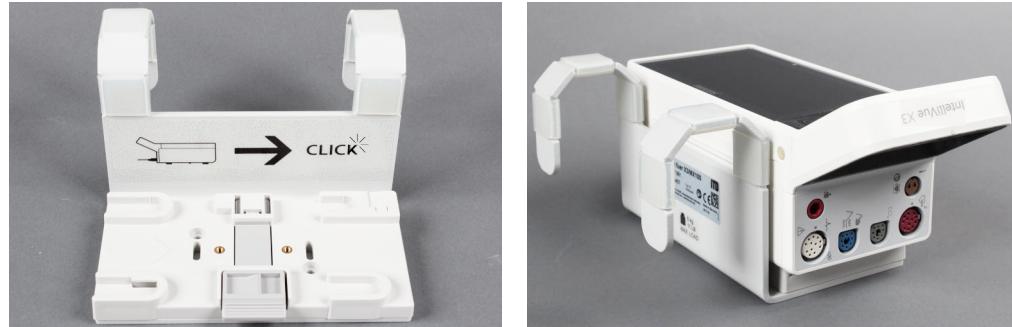
To mount the monitor,

- 1 Slide it onto the mounting plate, aligning the monitor feet with the four recesses in the plate. The arrows on the mounting plate show you the correct direction.
- 2 Push the monitor across the plate until you hear it click into place.

CAUTION

If the monitor does not click into place, it is not fixed securely on the mounting plate and can fall off the mount.

Bedhanger Mount:



7 Installation Instructions

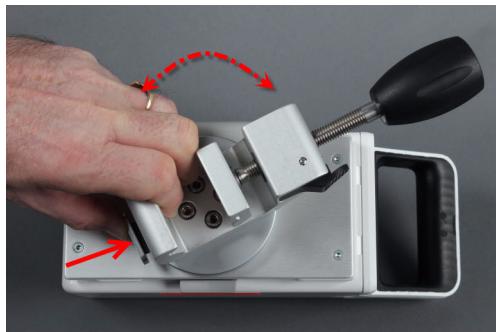
Rotatable Quick Claw Mount:



To adjust the clamp, push the black lever and bring the clamp into the desired position.



To rotate the quick claw mount, push the silver lever and rotate the mount into the desired position.



WARNING

Ensure that the monitor is mounted in the horizontal position, to avoid liquid entering the connectors and causing damage to the monitor.

Mounting

Part Number	Description
989803200021	IntelliVue X3/MX100 Bed Hanger Mount (Only Commercially Available)
989803200031	IntelliVue X3/MX100 Rot. Claw Mount (Only Commercially Available)

Connecting the Monitor to AC Mains

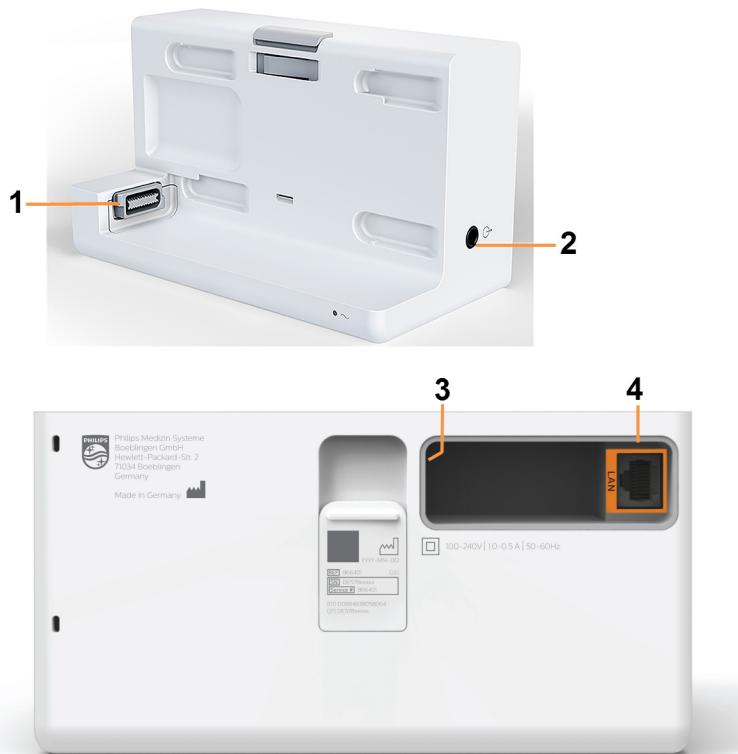
The MX100/X3 itself has no direct connection to AC Mains. It requires either the IntelliVue Dock or the M8023A External Power Supply to obtain external power. The IntelliVue Dock is an electrical Class II device in which the protection against electric shock does not rely on basic insulation and a protective earth conductor but on double and/or reinforced insulation.

Host Monitor as Power Source (only available for X3)

When connected to a host monitor, via the Measurement Link (MSL) cable or when directly attached to the host, the X3 obtains its power from the host, including that needed for battery charging. Note that the X3 will operate and charge its battery even when attached to a host monitor running on battery power.

IntelliVue Dock (Standard with MX100, Optional with X3)

The monitor has a wide-range external power supply in the IntelliVue Dock (867043) that allows you to operate the monitor from an AC (alternating current) power source of 100 V to 240 V ($\pm 10\%$) and 50 to 60 Hz ($\pm 5\%$). The IntelliVue Dock also charges the monitor's battery.





Item	Description
1	Measurement Link (MSL) connector. Supplies DC input power to the monitor for AC operation and for battery charging. The MSL connection is also used to communicate with a PC or Information Center.
2	Flexible Sync Out Connector
3	AC power connector. Connect to AC mains socket.
4	Connect LAN cable here. For connection to a PC or Information Center.
5	Power-on LED. The green light is on when the external power supply is connected to AC mains.

WARNING

- Always use the supplied power cord with the earthed mains plug to connect the IntelliVue Dock (867043) to an earthed AC mains socket. Never adapt the mains plug from the power supply to fit an unearthing AC mains socket.
- Do not use AC mains extension cords or multiple socket-outlets. If a multiple socket-outlet without an approved isolation transformer is used, the interruption of its protective earthing may result in enclosure leakage currents equal to the sum of the individual earth leakage currents, so exceeding allowable limits.
- Do not connect any devices that are not supported as part of a system.
- Any non-medical device placed and operated in the patient's vicinity must be powered via an approved isolation transformer that ensures mechanical fixing of the power cords and covering of any unused power outlets.
- The grub screws at the bottom of the external power supply are not internally connected to ground.
- The On/Standby switch does not disconnect the monitor from the AC power source. To disconnect, unplug the power cable.
- Always ensure that the monitor is positioned so that the AC power plug is easily accessible, to allow disconnection of the monitor from the AC power source.

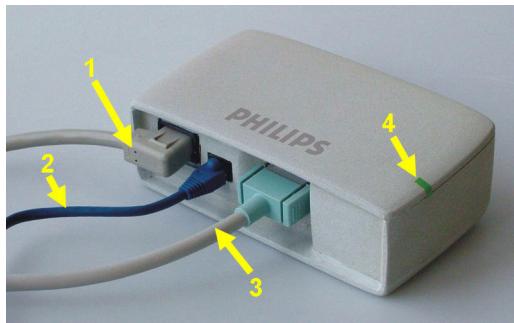
Docking the Monitor



- 1 Set the monitor onto the base of IntelliVue Dock, flush to the vertical surface
- 2 Push the monitor sideways so that the connectors engage and continue until you hear the monitor click into place.

External Power Supply M8023A (Standard with MP2, Optional with X2)

The monitor can also be connected to the M8023A external power supply. It allows you to operate the monitor from an AC (alternating current) power source of 100 V to 240 V ($\pm 10\%$) and 50 to 60 Hz ($\pm 5\%$). The external power supply also charges the monitor's battery.



Item	Description
1	AC power cord. Connect to AC mains socket.
2	Connect LAN cable here. For connection to a PC or Central Station.
3	Measurement Link (MSL) cable. Supplies DC input power to the monitor for AC operation and for battery charging. The MSL cable is also used to communicate with a PC or Information Center.
4	Power-on LED. The green light is on when the external power supply is connected to AC mains.

WARNING

- Always use the supplied power cord with the earthed mains plug to connect the external power supply (M8023A) 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 socket-outlets. If a multiple socket-outlet without an approved isolation transformer is used, the interruption of its protective earthing may result in enclosure leakage currents equal to the sum of the individual earth leakage currents, so exceeding allowable limits.
- Do not connect any devices that are not supported as part of a system.
- Any non-medical device placed and operated in the patient's vicinity must be powered via an approved isolation transformer that ensures mechanical fixing of the power cords and covering of any unused power outlets.
- The grub screws at the bottom of the external power supply are not internally connected to ground.
- The On/Standby switch does not disconnect the monitor from the AC power source. To disconnect, unplug the power cable.
- Always ensure that the monitor is positioned so that the AC power plug is easily accessible, to allow disconnection of the monitor from the AC power source.

Fixing the Current Generation Extensions to the Monitor

If you wish to secure a current generation measurement extension to an MX100/X3 monitor to avoid accidental removal, follow the procedure below.

NOTE

If you secure an extension to the MX100/X3, you will no longer be able to remove the extension quickly by simply sliding it out.

- 1 Before you can fix the extension to the monitor with the two locking pins, you need to remove the white cover plugs from the two slots on each side of the extension using a screwdriver.



7 Installation Instructions

- 2 Attach the extension to the monitor and insert the grey locking pins into both slots.



- 3 To remove the extension from the monitor again, remove the locking pins using a screwdriver.



Configuration Tasks

You must configure these settings during installation in configuration mode.

- Line Frequency
- Altitude
- Equipment Label (depending on selected workflow - see configuration guide)
- ECG cable colors
- Height and Weight units
- Setup Network (**service mode**)
- Setup WLAN (**service mode**)
- Setup IIT (**service mode**)

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.

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.

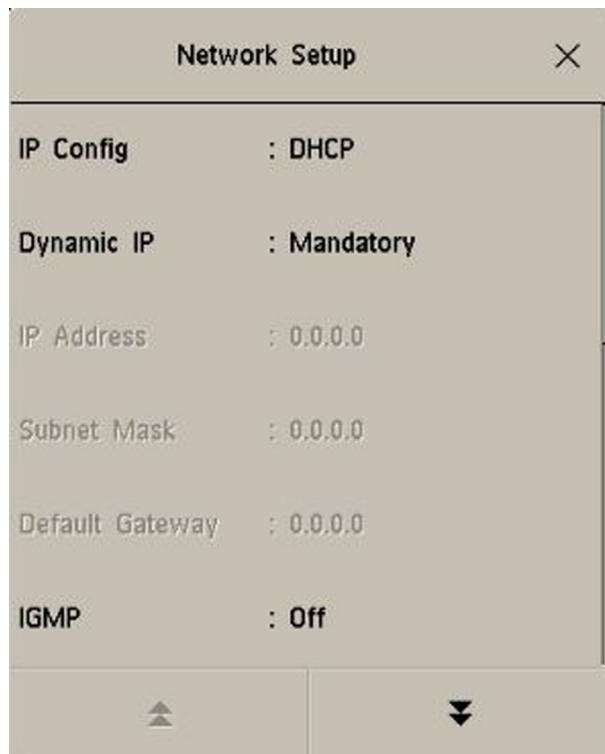
- 1 Select **Main Setup -> Bed Information** to call up the **Bed Information** menu.
- 2 Select **Equipment Label** to call up the onscreen keyboard.
- 3 Enter the system identifier. This needs to be set up in either the monitor or the Information Center. If the Information Center is in flexible monitoring mode, the monitor must be setup to match the Information Center's monitor label.

Network Configuration Tasks

Setup Network

Network Setup Window

Main Setup -> Network -> Setup Network



IP Config Allows you to change the mode to acquire the IP address. Choices are **BOOTP**, **DHCP**, **DHCP restricted** and **Manual**. In **DHCP restricted** mode, any true BOOTP responses are ignored.

Dynamic IP Can be either **Mandatory** (default) or **Optional**. If **Mandatory** is set, the bedside will issue an INOP if an IPv4 address could not be acquired.

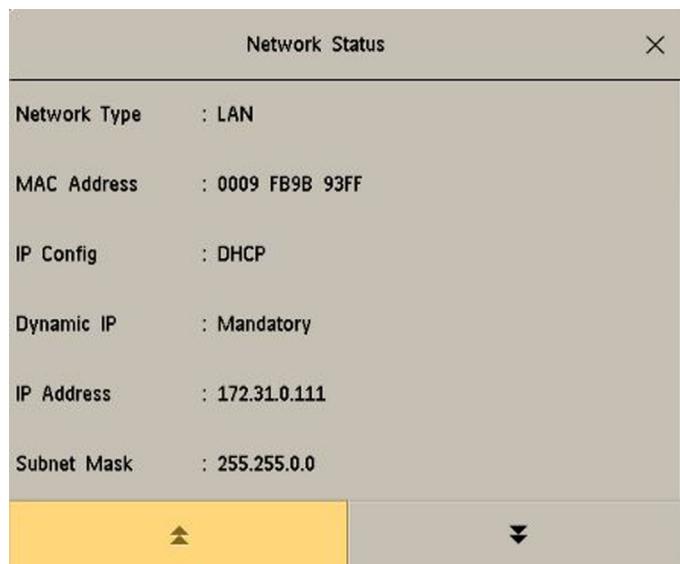
IP Address If IP Config is set to Manual, the IP address should be a valid IP address, e.g. not 0.0.0.0. The configured value is ignored when IP Config is not set to Manual.

Subnet Mask	The Subnet Mask must be provided for manual IP addresses. The Subnet Mask must consist of a single consecutive series of "1" bits; e.g. 255.255.248.0. The configured value is ignored when IP Config is not set to Manual.
Default Gateway	The IP address of the Default Gateway can be optionally configured. The configured value must be within the range of the Subnet Mask. The configured value is ignored when IP config is not set to Manual.
Authentication	The Authentication setting is for encrypted communication between the IntelliVue monitor and the PIC ix or XDS. It can be set to either Required or Optional . If set to:
	<ul style="list-style-type: none"> • Required: The monitor will only allow encrypted communication with authenticated devices. • Optional: The monitor will allow encrypted communication with authenticated devices AND unencrypted communication with unauthenticated devices.
	The default setting is Optional . For further details on setting up encrypted communication, please see the PIC iX or XDS documentation.
IGMP	Enables or disables IGMP support (On/Off)
CI Mode	The mode in which CI messages (Connect Indication messages) are sent (Broadcast, Multicast, Manual)
CI Address	Multicast address for Device Connect Indication (only used if CI Mode is set to Manual). If CI Mode is set to Broadcast , the CI address is implicitly the subnet broadcast address. If CI Mode is set to Multicast , the CI address is implicitly 224.0.23.63
CI TTL	Sets the TTL (Time to Live) of the CI message. Defaults to 1 .
QoS State	QoS (Quality of Service) can be switched On or Off .
QoS Level	The QoS Level (DSCP CoS value) can be entered between 0 and 7
Directory Mode	The mode in which Directory Service requests are received (Broadcast, Multicast).
Directory Addr	Multicast address for Directory Service requests (if Directory Mode is set to Multicast).
LLDP	LLDP (Link Layer Discovery Protocol) enables information exchange with other devices. Can be switched On or Off .
Store	The entered values are verified when the Store softkey is pressed. A valid configuration is immediately activated and the window closed. If any field is invalid (e.g. invalid subnet mask or gateway not in subnet), an error popup window is shown and the configuration is not applied.

Network Status Window

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

Main Setup => Network => Network Status



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

MAC Address MAC Address of LAN adapter

MAC IIT MAC Address of IntelliVue Instrument Telemetry adapter (only when IIT is enabled)

RF Access Code IntelliVue Instrument Telemetry specific partitioning of the radio domain (only when IIT is enabled)

LLDP System Name Advertised System Name of the link partner. This is normally a switch or router.

LLDP Chassis ID Advertised Chassis ID of the link partner. Chassis ID is an administratively assigned name that identifies the particular chassis.

LLDP Port ID Advertised Port ID of the link partner. Port ID is a string that identifies the port component of the link partner.

LLDP Port Status Shows the current ethernet duplex mode and the speed of the link partner.

The **MAC Address**, current IP address configuration (**IP Address, Subnet Mask, Default Gateway, Server IP address and CI mode/ CI Address/ CI TTL**) and **BOOTP/ DHCP Server** is displayed. The IP address configuration can be changed in Service Mode only. Manually entered IP addresses are marked by the suffix "Manual", invalid fields are marked by the suffix "Invalid".

If the Instrument Telemetry interface is available, its **MAC Address** and **RF Access Code** are displayed. In addition, the bedside monitor's IPv6 link local address is shown.

Network Configuration Check

If LLDP is configured "on" while a network connection is established, the network is checked for specific LLDP related issues or incompatibilities.

If issues are found during this check, the status message „Check LLDP Configuration" will be shown in the status prompt area of the monitor's resting display.

The status message is shown when one of the following issues is found:

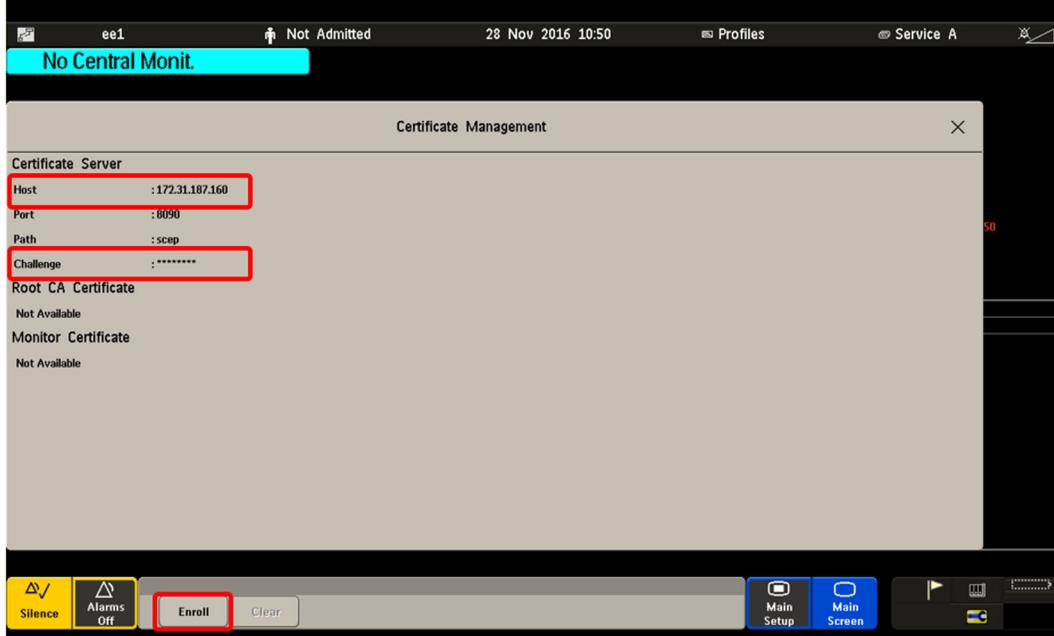
Cause of Failure	Failure Isolation and Remedy
LLDP is configured "on" and a static IP is configured and LLDP answers are received via the network	do not configure a manual IP address when using LLDP
LLDP is configured "on" and the received Chassis ID and Port ID of the link partner changed	Check LLDP settings of switch
LLDP is configured "on" and more than one link partner is sending LLDP answers (e.g. if monitor is connected to hub or non- LLDP/multicast capable switch)	connect monitor to LLDP/multicast capable devices

The prompt will be cleared after a power cycle or after reconnecting the network cable, but will be shown again if the issue persists.

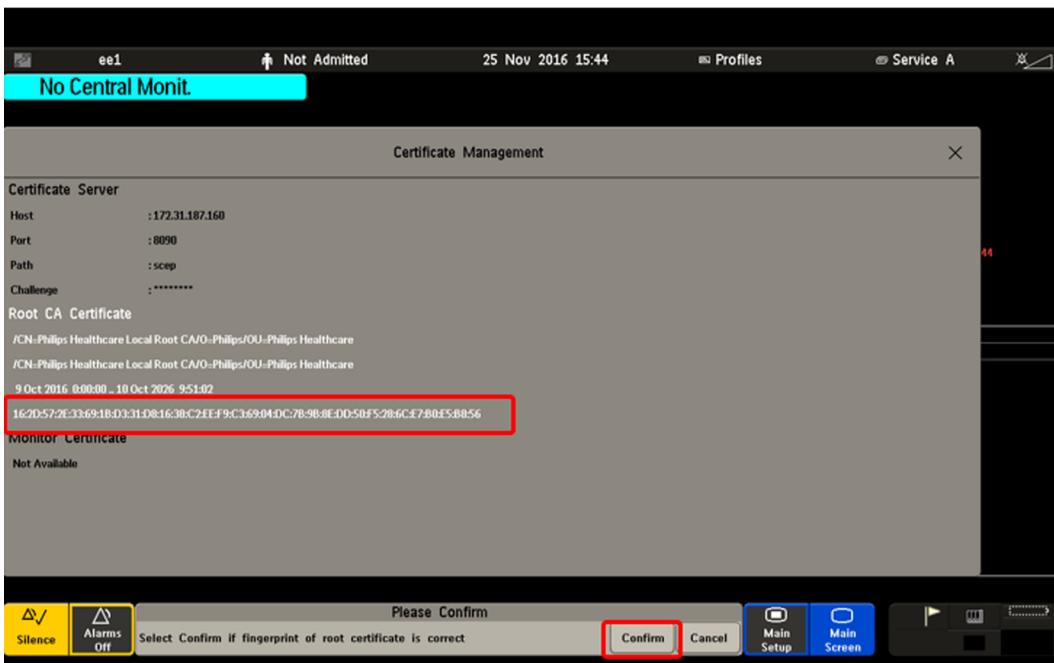
Certificate Enrollment for Encrypted Communication

To set up encrypted communication for an IntelliVue monitor, you need to enter the IP address of the host PIC iX and the challenge password which was set on the PIC iX.

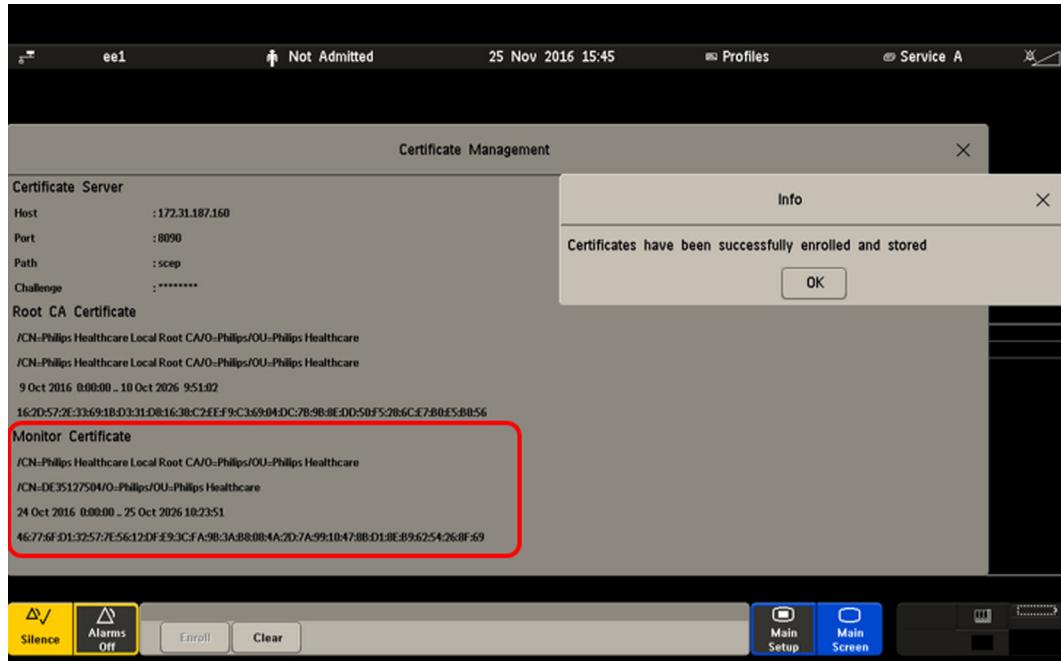
- 1 Go to **Main Setup -> Network -> Certificates**.
- 2 Enter the IP address and the challenge password.



- 3 Click on the **Enroll** button.
- 4 The Root CA Certificate information is shown. Check the CA thumbprint and make sure it corresponds with the one listed in PIC iX during the configuration of the SCEP server.
- 5 Click on **Confirm** if the CA thumbprint is correct.



- 6** Monitor Certificate Information is shown after a successful enrollment. Note that the SCEP server settings (host IP) are only stored in the settings if the enrollment succeeds. These settings can then be copied with the Support Tool Mark2.



For the full setup procedure for encrypted communication, please refer to the PIC iX or XDS documentation.

Setup WLAN

Main Setup => Network => Setup WLAN

Setup Wireless LAN	
Country	1000
IP Address	172.31.10.04
WMM Mode	disabled
Mode	802.11bg
SSID	Philips
Security Mode	WPA2Enterpr.
WEP Key Size	40 bit
WEP Key	*
WEP Key Index	2
WPA Password	*
Authentication	PEAP
Inner Authentication	MSCHAPv2
PEAP Version	Default
PEAP Label	Default
User Name	username
Password	secret
Anonymous Ident.	anonymous
CertificateCheck	Enabled
CA Certificate	Installed

The Setup Wireless LAN Menu allows you to configure the following items:

- Country** Country setting for the WLAN card to adapt to the local frequency and transmit power regulations. The default value 1000 should be left to support adapting to country provided by the AP.
- IP Address** IP Address of the WLAN card. Typically the automatic configuration via the BOOTP/ DHCP Server of the central station is used. In this case the field is set to 0.0.0.0. For special requirements, it is possible to switch to a manual/fix IP address configuration.
Manually entered IP addresses are marked by the suffix "Manual"

NOTE

- The subnet mask and the gateway address of the WLAN card will be taken from the corresponding fields in the **Bed Information** or **Setup Network** menu.
- Only limited checks of the manual values are possible. Therefore it is mandatory that a manual configuration is only performed by experienced service personnel to prevent problems such as duplicate IP addresses, non matching subnet mask, etc.

WMM Mode Changes to WMM (Wireless Multimedia Mode) mode for the WLAN adapter supporting this feature.

Mode Defines the WLAN operating mode/ IEEE 802.11 Standard. Valid values are either 802.11ah, 802.11bg (not recommended), 802.11g, Auto (not recommended) or None. None indicates that no wireless connection should be established although a wireless adapter is available and operational.

NOTE

If both WLAN and IIT are installed, one of the two must be disabled in order for the other to function. If IIT is used, set WLAN Mode to **None**.

SSID Set Identifier: Logical WLAN Network Name.

Security Mode **WEP, WPA(PSK)** or **WPA2(PSK)**, **WPA-Enterprise** and **WPA2-Enterprise** with either Protected EAP (PEAP) or Tunneled TLS (TTLS) as authentication methods.

WEP Key Size 40 bit or 104 bit.

WEP Key The number of hex chars for the WEP key depends on the WEP key size chosen. For a 40 bit WEP key size the WEP key must be 10 hex chars long, for a 104 bit key the WEP key must be 26 hex chars long. Will be shown as “**” after the user entered the key.

WEP Key Index Defines the transmit WEP Key Index. This entry must match the WEP Key Index configured at the infrastructure device, i.e. on a WLAN Access Point, and ranges from 1 to 4.

WPA Password In WPA(PSK) or WPA2(PSK) mode this entry defines the Pre-Shared-Secret or Password with 8 to 63 alpha-numeric characters. Will be shown as “**” after the password is entered.

In WPA-Enterprise or WPA2-Enterprise mode the following read only fields are available. The configuration can only be performed via the IntelliVue Support Tool:

Authentication Authentication method can be either Protected EAP (PEAP) or Tunneled TLS (TTLS).

Inner Authentication PEAP and TTLS can be used with several different Inner Authentication methods. PEAP with MSCHAPv2 and TTLS with PAP, CHAP, MSCHAP or MSCHAPv2

PEAP Version This setting describes the PEAP protocol version to be used while authenticating against the authentication server. Valid values are either Default, Version 0 and Version 1. If set to Default the decision is up to the wireless adapter. Version 0 or 1 forces the wireless adapter to use the protocol version required for a certain authentication server. This setting is intended for experts only.

PEAP Label The PEAP label setting defines the string to be used to signal EAP-PEAP encryption to the authentication server. Valid values are Default, EAP or PEAP. Default lets the decision up to wireless adapter. Both EAP and PEAP forces the wireless adapter to use this setting. This setting is intended for experts only.

Username The username used in the encrypted tunnel with 1-63 alpha-numeric characters. It is also used as outer identity as long as the Anonymous Identity is not set.

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.

7 Installation Instructions

- Anonymous Identity** The identity used for the outer PEAP or TTLS authentication, which may be “unprotected”. Thus, the identity should be different to the Username for enhanced security. The Anonymous Identity contains 1-63 characters. It can be set to NotConfigured by clearing it.
- CA Certificate** Indicates that the certificate of the Certification Authority (CA) has been installed on the device. The CA certificate is the root certificate of the server delivered certificate chain. The certificate chain ends with the server certificate, which contains the key material used to build up the encrypted tunnel for PEAP or TTLS. Values are either Installed or NotInstalled. This field is not user configurable. The CA certificate can only be installed with the IntelliVue Support Tool.
- Certificate Check** As long the Certificate Check is set to Enabled, the CA Certificate is used to verify the authenticity of the certificate chain delivered by the authentication server. The verification involves also the system time to check the validity period of every certificate in the chain. This item can only be set to Enabled, if an CA Certificate has been installed. Valid values are Disabled or Enabled.

WLAN Diagnostic Window

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

Main Setup => Network => WLAN Diagnostic

WLAN Diagnostic	
Wireless LAN	On
Check WLAN	Security Mode
MAC WLAN	0097 3498 87EC
IP Address WLAN	172.31.11.15
IP Address	172.31.10.03
Server IP	172.31.10.165
Subnet Mask	255.255.0.0
Country	1000 / 1276
WMM Mode	Disabled
Mode	802.11bg
Security Mode	WPA2Enterpr.
Authentication	PEAP
Inner Athentic.	MSCHAPv2
PEAP Version	Default
PEAP Label	Default
User Name	username
Anonymous Ident.	anonymous
CertificateCheck	Enabled
CA Certificate	Installed
SSID	Philips
Rate	54,0 Mb/s
Active Channel	9
RSSI	65 -
Conn. Status	Connected
MAC AP WLAN	00A0 F8CE D231

7 Installation Instructions

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.
Mode	Defines the WLAN operating mode/IEEE 802.11 Standard. Valid values are either 802.11ah, 802.11bg, 802.11g, Auto (not recommended) or None. None indicates that no wireless connection should be established although a wireless adapter is available and operational.
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.

RF Design Requirements for Philips Devices

Philips medical devices require a robust and high capacity WLAN. The WLAN deployed should meet specific RF requirements in all areas of coverage where Philips devices will operate. One of these requirements is the minimum RF signal (RSSI) level of -67 dBm.

To achieve the required minimum signal strength of -67dBm, the RSSI must ≥ 22 .

WLAN Configuration Check

Before a wireless connection is established, the configuration is checked for basic issues or incompatibilities. If issues are found during this check, a status message will be shown in the status prompt area of the monitor's resting display. Additionally, the Check WLAN line of the WLAN Diagnostic window will display the status message. In Service Mode, a detailed status message is shown, while a simplified message is shown in all other operating modes.

The table below lists the status messages displayed in service mode, depending on the issue found.

Issue	Status Message
Security Mode	Check WLAN Security Mode
Country Setting	Check WLAN Country Setting
IEEE Wireless Mode	Check WLAN IEEE Mode
WMM Mode	Check WLAN WMM Mode
WEP Encryption	Check WLAN WEP Settings
WPA Encryption	Check WLAN WPA/WPA2 Key
Authentication	Check WLAN Authentication Mode
Inner Authentication	Check WLAN Inner Authentication Mode
PEAP settings	Check WLAN PEAP Properties
Certificate Check	Check WLAN Certificate Check Setting
User Name, Password	Check WLAN EAP Credentials

The simplified message in all other operating modes is "Check WLAN Settings"

Setup IIT

Main Setup => Network => Setup IIT

IIT Setup	
IIT	Enabled
RF Access Code	1

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

- IIT** 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.

NOTE

If both WLAN and IIT are installed, one of the two must be disabled in order for the other to function. If WLAN is used, set IIT to **Disabled**.

- 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.

Setting the Date and Time

To set the date and time:

- 1 Select the **Main Setup** SmartKey to enter the Main Setup menu.
- 2 Select the **Date, Time** screen element from the monitor’s info line to enter the **Date, Time** menu.
- 3 Select, in turn, the **Year, Month, Day, Hour** (in 24 hour format, only) and **Minute** as necessary. Select the correct values from the pop-up list.
- 4 Select **Store Date, Time** to change the date and time.

If your monitor is connected to an Information Center, the date and time are automatically taken from this.

If the X3 is connected to a host monitor, the date and time are automatically synchronized with the host monitor. When connected to a host monitor, you cannot set the date and time on the X3.

Once it is set, the internal clock retains the setting even when you switch off the monitor.

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 documentation delivered with the monitor:

- Training Guide - for self-training on the monitor before use
- Quick Guide - for quick reminders during use
- Instructions for Use- for full operating instructions

WARNING

All users must complete the training program 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 the MX100/X3 monitor.

NOTE

The battery must be charged prior to first use of the monitor.

Clinical Network (Wired and Wireless)

Creating a network solution to support patient monitoring system data is a significant undertaking. The network must be designed to support real-time transmission of patient waveforms, data, and alarms on an uninterrupted and continuous basis.

Philips can deploy a patient monitoring system in one of two ways:

- 1 Some customers prefer to purchase a patient monitoring system that includes a Philips-provided network switching infrastructure. These systems are known as a Philips-Supplied Clinical Network (PSCN).
- 2 Other customers prefer to run their patient monitoring system on the hospital's existing network infrastructure. These types of systems are known as a Customer-Supplied Clinical Network (CSCN).

Please refer to the appropriate PSCN/CSCN documentation when connecting bedside devices to an IntelliVue Information Center via PSCN or CSCN infrastructure.

For creating network solutions which connect to other systems than an IntelliVue Information Center please refer to the documentation of the respective systems.

WARNING

In order to maintain the galvanic isolation of the IntelliVue monitor, it is essential that UTP (Unshielded Twisted Pair) LAN cables is used to connect the IntelliVue monitor to other devices.

Philips IntelliVue Information Center

Please refer to the installation instructions and Instructions for Use of the IntelliVue Information Center Rev. System N.01 or higher or PIC iX Rev. A or higher.

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 M8102A/M3002A #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**; 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, 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 Patient Monitor Instrument Telemetry adapter devices combined.
- The Effective Radiating Power: 6.3 mW.
- The Equipment Manufacturer: Philips Medical Systems.
- The Model numbers: 867033/867030 #J45 IntelliVue Instrument Telemetry adapter used with 867033/867030 (MX100/X3)
- 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.

IntelliVue Dock Flexible Sync Out

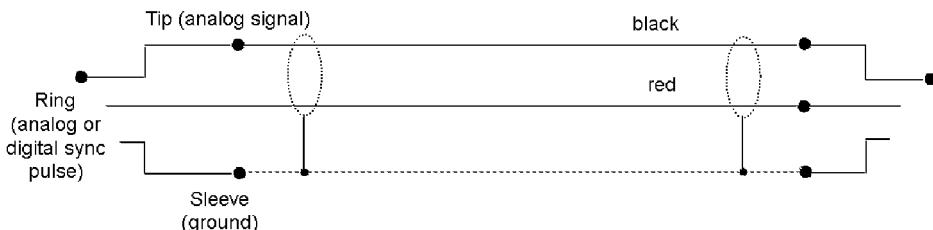
The configurable Flexible Sync Out interface allows you to output medical parameter waves (e.g. ECG, invasive blood pressure) as an analog signal to interface and to trigger other medical devices e.g. intraaortic balloon pumps, defibrillators or imaging systems. The connection is made via a 1/4" stereo phone jack with tip, ring and sleeve.



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.

MSL Cable Termination

The following installation procedure describes how to install the wall installation cable kit when the X3 and the host monitor are not located at the same site. The kit consists of two connector boxes and a cable (15m or 25m).

For this procedure you need the insertion tool (M3086-43801) and a small screwdriver.

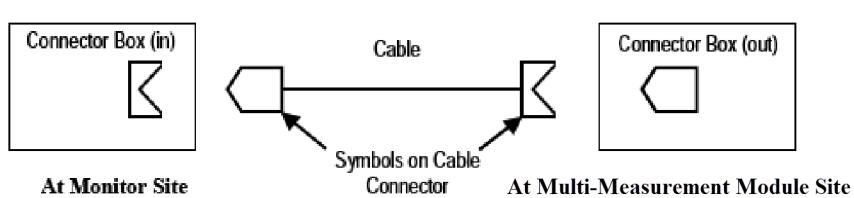
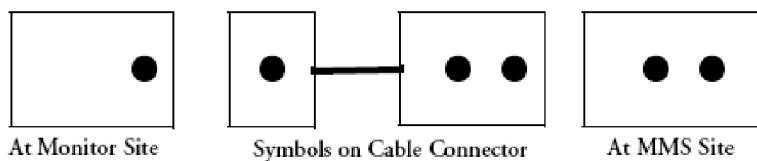
- 1 Draw the MSL cable through the wall from the site of the monitor to the site of the Multi-Measurement Module.

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

NOTE

The installation procedure is the same for both connector boxes. This means you must perform steps 3 to 8 of this procedure twice.

The connectors on each box are different, so you must ensure that the correct box is placed at the correct location. The dots on the plastic angled cover indicates at which site you should install the box:



If there are no dots on the cover, symbols are used:

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

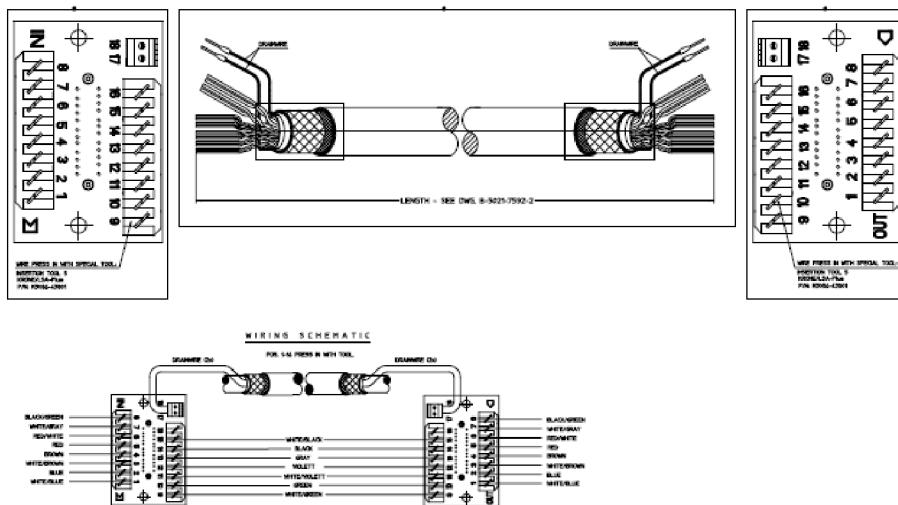
Symbol:  is connector box (out) and must be placed at the Multi-Measurement Module site.

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

- 2 Detach the PCB assembly (in/out) from the metallic mounting flange.
- 3 Use the Insertion Tool (M3086-43801) to position each wire on the PCB according the wiring schematic in , 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.
- 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 Multi-Measurement Module 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
 - IntelliVue Dock Flexible Sync Out Performance Test

7 Installation Instructions

Site Preparation

Introduction

This section describes the procedures you should follow to plan and prepare a site for an MX100/X3 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 MX100/X3 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 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.

Alternatively, the following procedures can be performed by 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.

- 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).
- 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.

- Hand over the monitor to the end-users as described in *Handing Over the Monitor* in the Installation section

WARNING

Incorrect installation, mounting and use of inappropriate mounting material may lead to serious injury. It is the customer's responsibility to ensure that the mounting procedures have been performed correctly, the appropriate mounting devices have been used and the monitor has been installed and configured correctly.

Procedures for Philips Personnel

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

- Install the MX100/X3 monitor using the appropriate mounting solution and perform the installation procedures as described in the Installation section.
- Hand over the monitor to the end-users as described in "[Handing Over the Monitor](#)" on page 217.

Monitor 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.

Size (W x H x D)	Weight
193.6mm x 97.1mm x 85mm ¹ (7.6" x 3.8" x 3.3")	<2kg (4.4lb)*

* With standard measurement and battery.

NOTE

For detailed specifications, see "[Specifications](#)" on page 229.

Environmental Requirements

The environment where the MX100/X3 monitor will be used should be reasonably free from vibration, dust and corrosive or explosive gases. The ambient operating and storage conditions for the MX100/X3 monitor must be observed. If these conditions are not met, the accuracy of the system will be affected and damage can occur.

NOTE

For detailed environmental specifications, see see "[Specifications](#)" on page 229.

Electrical and Safety Requirements (Customer or Philips)

Safety Requirements

Grounding

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

WARNING

The functional earth conductor of the IntelliVue Dock is required for EMC purposes. It has no protective function against electric shock! The protection against electric shock in this device is provided by double and/or reinforced insulation.

Do not use additional AC mains extension cords or multiple socket-outlets. If a multiple socket-outlet without an approved separating transformer is used, the interruption of its protective earthing may result in equipment leakage currents equal to the sum of the individual earth leakage currents, so exceeding allowable limits.

Electrical Requirements

- **Line Voltage Connection:** The IntelliVue Dock uses < 30W (1.3 to 0.7 A).
- **Line Voltage:** The IntelliVue Dock may be operated on ac line voltage ranges of 100 to 240V (50/60 Hz).

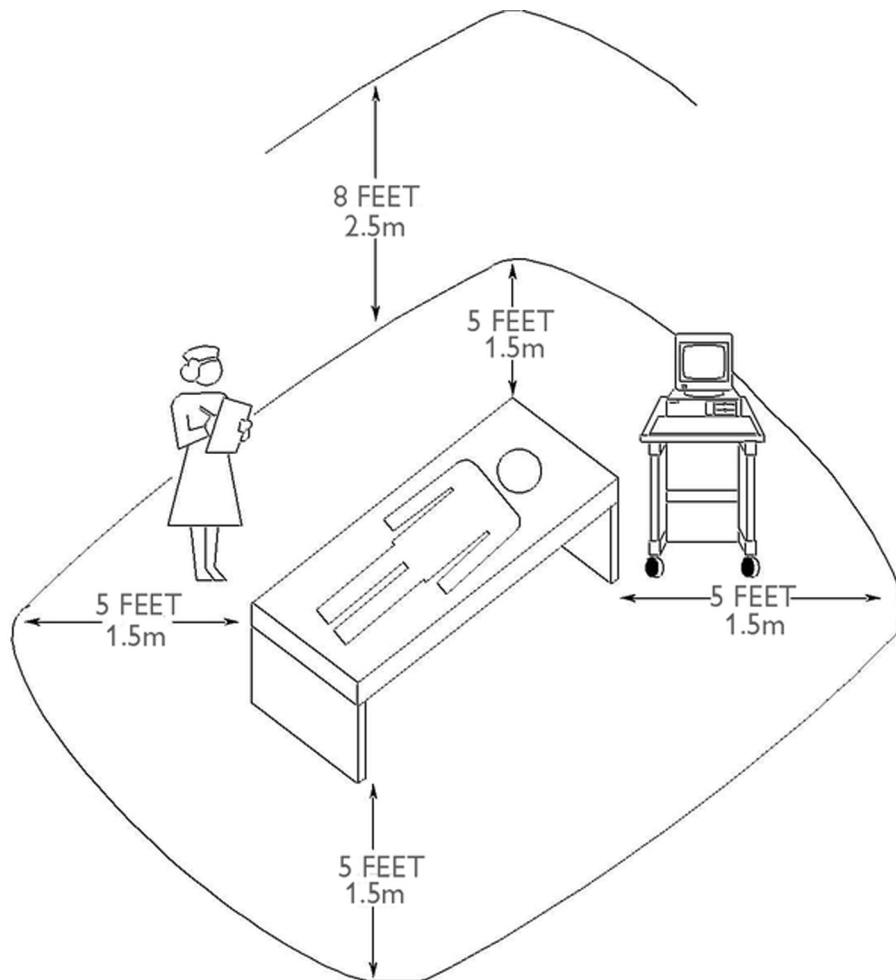
Connecting Non-Medical Devices

The standard IEC 60601-1 edition 3 clause 16 applies to any combination of medical and non-medical electrical devices, where at least one is a medical electrical device. Therefore IEC 60601-1 edition 3 clause 16 must still be met after all devices are connected.

For further details refer to the *Testing and Maintenance* section.

WARNING

Do not use a device in the patient environment if it does not comply with IEC 60601-1 edition 3 clause 16. The whole installation, including devices outside of the patient environment, must comply with IEC 60601-1 edition 3 clause 16; one reasonable solution may be the use of a separating transformer.



Equipment Location in the Patient Environment

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.

Connecting to the Philips IntelliVue Information Center

For information refer to the IntelliVue Information Center documentation.

8 Site Preparation

Specifications

This section contains selected specifications for the IntelliVue MX100/X3 Patient Monitors. For a complete and detailed list of specifications, see the Instructions for Use.

Essential Performance Characteristics

This section defines the Essential Performance for IntelliVue patient monitors, in combination with Measurement Extensions.

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).
C.O./C.C.O	Measurement of blood temperature within the specified accuracy/error limits. Alarming on blood temperature limit violations.
ECG	Measurement of heart rate within $\pm 10\%$ or ± 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.
Invasive Pressure	Measurement of systolic, diastolic and mean blood pressure within $\pm 4\%$ or ± 4 mmHg, whichever is greater, and pulse rate within $\pm 10\%$ 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.
Respiration	Measurement of respiration rate within specified accuracy/error limits. Alarming on apnea and on respiration rate limit violations.
CO ₂	Measurement of CO ₂ within the following measurement accuracy ranges: $\pm (0.43\% \text{ absolute} + 8\% \text{ of reading})$ Measurement of airway respiration rate within specified accuracy/error limits. Alarming on apnea, airway respiration rate and CO ₂ limit violations.
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 violations.
Temperature	Measurement of temperature within specified accuracy/error limits. Alarming on temperature limit violation.

9 Specifications

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 defibrillation and the following 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 parameters	After electrostatic discharge, fast transients/bursts, surges, electrosurgery interference and defibrillation the equipment returns to previous operation mode within 30 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.

* Some particular standards (e.g. IEC 60601-2-49, IEC 60601-2-27, etc.) may specify shorter recovery times.

MDD Classification

According to the Council Directive 93/42/EEC (Medical Devices Directive) the device classification is IIb, according to Rule 10.

Classification According to IEC 60601-1

Classification (according to IEC 60601-1): Class II, Type CF Applied Parts, Continuous Operation.

Safety and Regulatory Information

For details about safety and regulatory information, refer to the Instructions for Use.

Use Environment

Hospital Environment

The monitor is suitable for use in all medically used rooms which fulfill the requirements regarding electrical installation according to IEC 60364-7-710 "Requirements for special installations or locations - Medical locations", or corresponding local regulations.

EMC Environment

All measurements (except the sidestream CO₂ measurement with M2741A sensor) and system interfaces (except short range radio and wireless LAN) are, in addition, suitable for use in establishments directly connected to the public low-voltage supply network that supplies buildings used for domestic purposes (see table in *Electromagnetic Emissions*).

WARNING

The monitor is not intended for use in an MRI environment or in an oxygen-enriched environment (for example, hyperbaric chambers).

Disconnecting from AC Mains Power

To disconnect the monitor from AC mains power, depending on your setup:

- Unplug the power cord for the external power supply (M8023A) from the mains socket or disconnect the MSL cable.
- Unplug the power cord for IntelliVue Dock (867043) from the mains socket or remove the monitor from IntelliVue Dock.
- Detach the X3 from the host monitor (if directly connected) or disconnect the MSL cable.

Symbols

These symbols can appear on the monitor and its associated equipment and packaging (depending on options).

Symbols			
	Caution is necessary when operating the device		On/Off/Standby
	Follow instructions for use	Rx only	Prescription use only
	Alternating current		Rechargeable battery symbol
	DC power source		Connection direction indicator
	Zero the invasive pressure transducer		Connection direction indicator
	Pressure connector		Temperature connector

9 Specifications

Symbols			
	Dual pressure connector		Applied part has special protection against electric shocks and is defibrillator proof (Type CF according to IEC 60601-1)
	NBP connector		SpO ₂ connector
	Uses FAST SpO ₂ algorithm		ECG connector
	Not made with natural rubber latex		Nellcor OxiMax compatible
	Masimo rainbow SET Technology		Alarms Switched Off
	Identifies date of manufacture		LAN connection indicator for connection to a wired network
	Indicates location of loudspeaker		IntelliVue Instrument Telemetry wireless network
	Always use separate collection for waste electrical and electronic equipment (WEEE)		Monitor supports 12-lead ECG
	Indicates location of the date of manufacture and/or name and address of manufacturer		Built-in short range radio interface
	Built-in wireless network		Non-ionizing radiation symbol
	Indicates location of catalog number		Followed by two alphanumeric characters, indicates ingress protection grade
	Indicates location of serial number		Indicates location of service number
	Gas input indicator		Gas output indicator
	Electrical output indicator (In some cases gas output indicator)		Electrical input indicator (In some cases gas input indicator)
	Indicates location of batch number		Mass in kilogram (kg)
	Atmospheric pressure limitations for storage		Indicates the location of the "use by" date

Symbols			
	Humidity limitations for storage		Contents of the packaging are not sterile
	Temperature limitations for storage		For successful mounting, the monitor must audibly click into place.

Physical Specifications

Product	Maximum Weight	Size (W x H x D)	Comments
MX100/X3 Monitor	1.4 kg (3.1 lbs)	249 x 97 x 111 mm (9.8 x 3.8 x 4.4 in)	including battery and options, with handle
		194 x 97 x 85 mm (7.6 x 3.8 x 3.3 in)	including battery and options, without handle
867043 IntelliVue Dock	0.79 kg (1.7 lbs)	190 x 112 x 100 mm (7.5 x 4.4 x 3.9 in)	without cable management
		190 x 172 x 100 mm (7.5 x 6.8 x 3.9 in)	with cable management
M8023A External Power Supply	0.6 kg (1.4 lb)	208 x 105 x 135 mm (8.2 x 4.1 x 5.3 in)	
865297 Battery Extension	1.3 kg (2.9 lbs)	193 x 140 x 132 mm (7.6 x 5.5 x 5.2 in)	
867039 Hemodynamic Extension	0.5 kg (1.1 lbs)	200 x 97 x 90 mm (7.9 x 3.8 x 3.5 in)	
867040 Capnography Extension	0.5 kg (1.1 lbs)	200 x 97 x 90 mm (7.9 x 3.8 x 3.5 in)	
867041 Microstream Extension	0.6 kg (1.4 lbs)	200 x 97 x 90 mm (7.9 x 3.8 x 3.5 in)	
M3012A Hemodynamic Extension	0.6 kg (1.4 lbs)	200 x 98 x 89 mm (7.9 x 3.9 x 3.5 in)	
M3014A Capnography Extension	0.6 kg (1.4 lbs)	200 x 98 x 89 mm (7.9 x 3.9 x 3.5 in)	
M3015A/B Microstream Extension	0.6 kg (1.4 lbs)	202 x 98 x 89 mm (8 x 3.9 x 3.5 in)	

Environmental Specifications

The monitor may not meet the performance specifications given here if stored or used outside the specified temperature and humidity ranges.

The monitor is protected against ingress of objects and fluids according to IEC 60529 IP32 (see specifications below). Do not expose the monitor or other system components listed below directly to heavy rain.

When the monitor and related products have differing environmental specifications, the effective range for the combined products is that range which is common to the specifications for all products.

MX100, X3, and all Measurement Extensions		
Item	Condition	Range
Temperature Range	Operating	0 to 40°C (32 to 104°F)
	Operating when charging the battery, when equipped with wireless LAN or IntelliVue Instrument Telemetry Wireless network, or when X3 is mounted directly on a host monitor	0 to 35°C (32 to 95°F)
	Storage including transportation	-20 to 60°C (-4 to 140°F)
Humidity Range	Operating	15% to 95% Relative Humidity (RH)
	Storage including transportation	5% to 90% Relative Humidity (RH)
Altitude Range	Operating	-500 m to 3000 m (-1640 ft to 9842 ft)
	Storage including transportation	-500 m to 4600 m (-1640 ft to 15091 ft) ¹
Ingress Protection	Monitor	IP32 when mounted horizontally
	867039 Hemodynamic Extension	IP32 when mounted horizontally
	867040 Capnography Extension	IP32 when mounted horizontally
	867041 Microstream Extension	IP32 when mounted horizontally
	867043 IntelliVue Dock	IP32
	External Power Supply (M8023A)	IP31 when rested on its rubber feet on a flat, level surface. IP32 when mounted as described in the Service Guide.
	Battery Extension (865297)	IP32
Definition of IP codes used:		
IP31	Protected against ingress of water when the water is dripping vertically, and ingress of solid foreign objects 2.5 mm in diameter or larger.	
IP32	Protected against ingress of water when the water is dripping vertically and the monitor is tilted up to 15°, and ingress of solid foreign objects 2.5 mm in diameter or larger.	

¹ Sufficient for flight altitudes up to 12,000 m with pressurized cabins

Masimo rainbow SET Measurement (additional specifications)	
Incandescent Light Intensity	≤ 100 kilolux
Fluorescent Light Intensity	≤ 10 kilolux
Fluorescent Light Frequency	50, 60 Hz ± 1.0 Hz (LNOP, LNCS Sensors) 50, 60 Hz ± 0.5 Hz (rainbow Sensors)
Ambient Noise Level (Sound Pressure Level) (applies to acoustic respiration measurement only)	≤ 65 dB Alarm tolerant

Measurement-Related Specifications

Mainstream and Sidestream CO₂

CO₂ sample rate: 100 samples/second

Calculation of end tidal CO₂ (etCO₂):

Peak of the expired CO₂ waveform. 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:

Respiration Rate accuracy was verified by using a solenoid test setup to deliver a square wave of known CO₂ concentration to the device. 5% and 10% CO₂ concentrations were used and respiration rate was varied over the range of the device.

Microstream CO₂

CO₂ sample rate: 20 samples/second

Calculation of end tidal CO₂ (etCO₂):

The 867041 and M3015A/B Measurement 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.

Note: PiCCO is not available for the 867041 Microstream CO₂ extension in the USA and territories relying on FDA market clearance.

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.



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