Passport 12m

Patient Monitor

Service Manual

Intellectual Property Statement

SHENZHEN MINDRAY BIO-MEDICAL ELECTRONICS CO., LTD. (hereinafter called Mindray) owns the intellectual property rights to this product and this manual. This manual may refer to information protected by copyrights or patents and does not convey any license under the patent rights of Mindray, nor the rights of others. Mindray does not assume any liability arising out of any infringements of patents or other rights of third parties.

Mindray intends to maintain the contents of this manual as confidential information. Disclosure of the information in this manual in any manner whatsoever without the written permission of Mindray is strictly forbidden. Release, amendment, reproduction, distribution, rent, adaption and translation of this manual in any manner whatsoever without the written permission of Mindray is strictly forbidden.

mindray, MINDRAY, and MINDRAY are the registered trademarks or trademarks owned by Mindray in China and other countries. All other trademarks that appear in this manual are used only for editorial purposes without the intention of improperly using them. They are the property of their respective owners.

Contents of this manual are subject to changes without prior notice.

For this manual, the issued Date is June2016 (Version3.0).

WARNING

- **Federal Law (USA) restricts this device to sale by or on the order of a physician or other practitioner licensed by U.S. state law to use or order the use of this device.**

NOTE

- **This manual describes all features and options. The equipment may not have all of them. Contact Mindray Technical Support department for any questions.**

Manufacturer's Responsibility

Contents of this manual are subject to changes without prior notice.

All information contained in this manual is believed to be correct. Mindray shall not be liable for errors contained herein nor for incidental or consequential damages in connection with the furnishing, performance, or use of this manual.

Mindray is responsible for safety, reliability and performance of this product only on the condition that:

- All installation operations, expansions, changes, modifications and repairs of this product are conducted by Mindray authorized personnel;
- The electrical installation of the relevant room complies with the applicable national and local requirements;
- This product is operated under strict observance of the operator's manual.

Warranty

Mindray warrants that components within its products will be free from defects in workmanship and materials for a period of one year from the date of purchase except that disposable or one-time use products are warranted to be free from defects in workmanship and materials up to a date one year from the date of purchase or the date of first use, whichever is sooner.

This warranty does not cover consumable items such as, but not limited to, batteries, external cables, and sensors.

Mindray shall not be liable for any incidental, special, or consequential loss, damage, or expense directly or indirectly arising from the use of its products. Liability under this warranty and the buyer's exclusive remedy under this warranty is limited to servicing or replacing the affected products, at Mindray's option, at the factory or at an authorized distributor, for any product which shall under normal use and service appear to Mindray to have been defective in material or workmanship. Recommended preventative maintenance, as prescribed in the service manual, is the responsibility of the user and is not covered by this warranty.

No agent, employee, or representative of Mindray has any authority to bind Mindray to any affirmation, representation, or warranty concerning its products, and any affirmation, representation or warranty made by any agent, employee, or representative shall not be enforceable by buyer or user.

THIS WARRANTY IS EXPRESSLY IN LIEU OF, AND MINDRAY EXPRESSLY DISCLAIMS, ANY OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY, NON-INFRINGEMENT, OR FITNESS FOR A PARTICULAR PURPOSE, AND OF ANY OTHER OBLIGATION ON THE PART OF MINDRAY.

Damage to any product or parts through misuse, neglect, accident, or by affixing any non-standard accessory attachments, or by any customer modification voids this warranty. Mindray makes no warranty whatsoever in regard to trade accessories, such being subject to the warranty of their respective manufacturers.

A condition of this warranty is that the equipment or accessories which are claimed to be defective be returned when authorized, freight prepaid to Mindray DS USA, Inc., 800 MacArthur Blvd, Mahwah, NJ 07430 or its authorized representative. Mindray shall not have any responsibility in the event of loss or damage in transit.

Exemptions

Mindray's obligation or liability under this warranty does not include any transportation or other charges or liability for direct, indirect or consequential damages or delay resulting from the improper use or application of the product or the use of parts or accessories not approved by Mindray or repairs by people other than Mindray authorized personnel.

This warranty does not extend to:

- Malfunction or damage caused by improper use or man-made failure.
- Malfunction or damage caused by unstable or out-of-range power input.
- Malfunction or damage caused by force majeure events, such as (i) flood, fire and earthquake or other similar elements of nature or acts of God; (ii) riots, war, civil disorders, rebellions, or revolutions in any country; or (iii) any other cause beyond the reasonable control of Mindray.
- Malfunction or damage caused by improper operation or repair by unqualified or unauthorized service people.
- Malfunction of the instrument or part whose serial number is not legible.
- Others not caused by instrument or part itself.

Return Policy

In the event that it becomes necessary to return a unit to Mindray, follow the instructions below.

1. Obtain a return authorization.

Contact the Mindray Service Department and obtain a Mindray Customer Service Authorization Number. The Mindray Customer Service Authorization Number must appear on the outside of the shipping container. Return shipments will not be accepted if the Mindray Customer Service Authorization Number is not clearly visible. Please provide the model number, serial number, and a brief description of the reason for return.

2. Freight policy

The customer is responsible for freight charges when this product is shipped to Mindray for service (including any relevant customs fees or other freight related charges).

3. Return address

Please send the part(s) or equipment to the address offered by Customer Service Department.

Contact Information

Manufacturer:	Shenzhen Mindray Bio-Medical Electronics Co., Ltd.
Address:	Mindray Building, Keji 12th Road South, Hi-tech Industrial Park, Nanshan, Shenzhen 518057 P.R. China
Tel:	+86 755 81888998
Fax:	+86 755 26582680
Website:	www.mindray.com

Distributor:	Mindray DS USA, Inc.
Address:	800 MacArthur Boulevard, Mahwah, New Jersey 07430 USA
Tel:	1.800.288.2121, 1.201.995.8000
Website:	www.mindray.com

Preface

Manual Purpose

This manual provides detailed information about the assembly, disassembly, testing and troubleshooting of the equipment to support effective troubleshooting and repair. It is not intended to be a comprehensive, in-depth explanation of the product architecture or technical implementation. Use of the manual is necessary for proper equipment maintenance and will help to eliminate equipment damage and personal injury.

This manual is based on the maximum configuration; therefore, some contents may not apply to your monitor. If you have any question, please contact our Customer Service Department.

Intended Audience

This manual is for biomedical engineers, authorized technicians or service representatives responsible for troubleshooting, repairing and maintaining the patient monitors.

Contact your local Mindray Service Organization for information on product courses which address service and support for this product.

Passwords

A password may be required to access different modes within the monitor. The passwords are listed below:

- User maintenance: 888888 (User adjustable)
- Configuration mode: 315666 (User adjustable)

It is recommended that the user should change the passwords for user maintenance and configuration mode once they take ownership of the equipment.

FOR YOUR NOTES

Contents

1 Safety

1.1 Safety Information

DANGER

- **Indicates an imminent hazard that, if not avoided, will result in death or serious injury.**

WARNING

- **Indicates a potential hazard or unsafe practice that, if not avoided, could result in death or serious injury.**

CAUTION

- **Indicates a potential hazard or unsafe practice that, if not avoided, could result in minor personal injury or product/property damage.**

NOTE

- **Provides application tips or other useful information.**

1.1.1 DANGER

There are no dangers that refer to the product in general. Specific "Danger" statements may be given in the respective sections of this manual.

1.1.2 Warnings

WARNING

- **All installation operations, expansions, changes, modifications and repairs of this product should be conducted by Mindray authorized personnel.**
- **There is high voltage inside the equipment. Never disassemble the equipment before it is disconnected from the AC power source.**
- **When you disassemble/reassemble a parameter module, a patient leakage current test must be performed before it is used again for monitoring.**
- **The equipment must be connected to a properly installed power outlet with protective earth contacts only. If the installation does not provide for a protective earth conductor, disconnect it from the power line and operate it on battery power, if possible.**
- **Dispose of the package material, observing the applicable waste control regulations and keeping it out of children's reach.**

1.1.3 Cautions

CAUTION

- **Make sure that no electromagnetic radiation interferes with the performance of the equipment when preparing to carry out performance tests. Mobile phone, X-ray equipment or MRI devices are a possible source of interference as they may emit higher levels of electromagnetic radiation.**
- **Before connecting the equipment to the power line, verify the voltage and frequency ratings of the power line are the same as those indicated on the equipment's label or in this manual.**
- **Protect the equipment from damage caused by drop, impact, strong vibration or other mechanical force during servicing.**

1.1.4 Notes

NOTE

- **Refer to Operation Manual for detailed operation and other information.**

1.2 Equipment Symbols

See the Passport 12m/Passport 17m Operator's Manual for information about the symbols used on this product and its packaging.

FOR YOUR NOTES

2 Theory of Operation

2.1 Introduction

This patient monitor is designed to monitor a fixed set of physiological parameters including ECG, heart rate (HR), respiration (Resp), temperature (Temp), pulse oxygen saturation (SpO_2), pulse rate (PR), non-invasive blood pressure (NIBP), invasive blood pressure (IBP), pulmonary artery wedge pressure (PAWP), cardiac output (C.O.), carbon dioxide (CO_2), oxygen (O_2), anesthetic gas (AG), impedance cardiograph (ICG), bispectral index (BIS), respiration mechanics (RM), and central venous oxygen saturation ($ScvO_2$).

The patient monitor also:

- Provides audible and visual alarm indications in case of patient or equipment problems.
- Enables displaying, reviewing, storing and transferring of real-time data.
- Incorporates multiple input devices such as buttons, knob, touchscreen, keyboard and mouse.
- Interfaces a clinical information system or central monitoring system.
- Enables program upgrade over the network.
- Integrates the information of other devices, which include but are not restricted to anesthesia machine and ventilator.

2.2 System Connections

2.2.1 Mounting the Patient Monitor

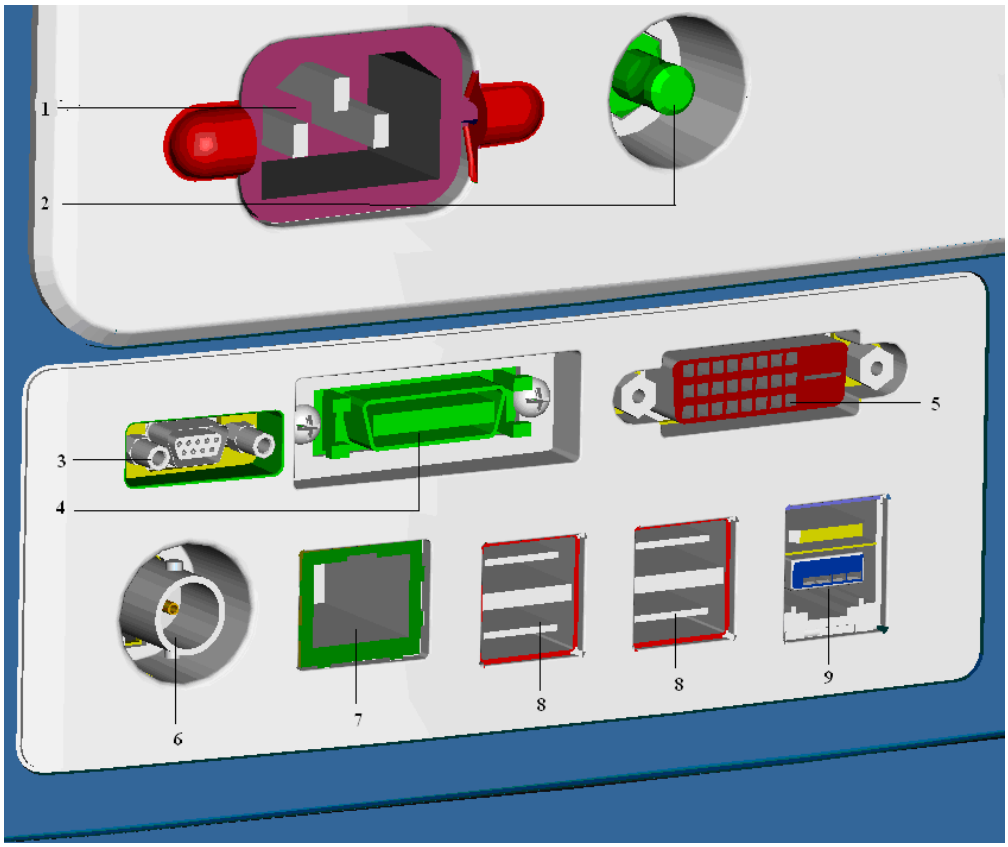
The patient monitor can be mounted on a wall bracket or on a trolley support. The wall bracket or trolley support can be ordered separately. Each mounting bracket is delivered with a complete set of mounting hardware and instructions.

CAUTION

- **Not using screw and bracket specified by Mindray may cause the screw to touch the internal battery and lead to monitor damage (the proper screw depth should be between 6.5mm and 7.5mm). Take out the rubber stoppers in the two screw holes of the base when installing the tray.**
- **The mounting bracket should be installed by our qualified service personnel, or qualified personnel having a full understanding of local building codes.**
- **If a non-validated mounting solution is used, the installation personnel and the customer should verify this mounting device can safely handle the load of the 12m monitor and peripheral equipment used with it such as modules, cables, SMR and hoses. Customer assumes all liability if installing mounting equipment other than that recommended by Mindray.**

2.2.2 Connectors for Peripheral Devices

On the back of the patient monitor you will find all connectors for peripheral devices.



1. AC Power Connector: used to connect an AC power source (100 to 240 VAC, 50/60Hz).
2. Equipotential Terminal: used to connect the equipotential terminal of other equipment, eliminating potential difference between different pieces of equipment.
3. Analog Output and Defibrillator Connector: It is a Micro-D connector used to output analog signals and defibrillator synchronization signals.
4. CIS Connector: It is used to connect a CIS.
5. Video Output: It is a DVI-D connector used to connect a secondary display.
6. Auxilliary Output Connector: It is a BNC connector used to output nurse call signals.
7. Network Connector: It is a RJ45 connector used to connect an ethernet network or a PC.
8. USB Connector: used to connect any USB-compatible peripheral device.
9. SMR Connector: Powered USB connector which is used with the special powered USB cable necessary to connect and operate the SMR.

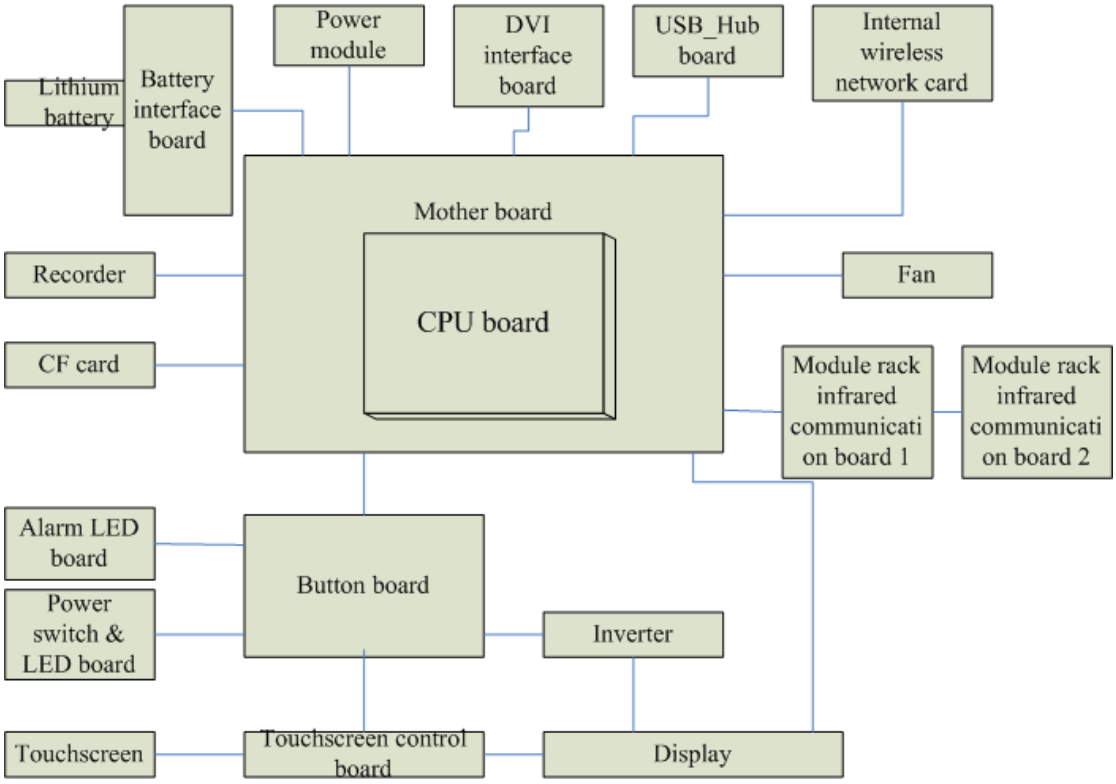
2.3 Main Unit

The patient monitor consists of:

- Input system: button board, knob, touchscreen, power switch and LED board
- Output system: LCD panel, alarm LED board, recorder and speaker
- Processing and communications system: main board and integral module rack assembly.
- Power management system: battery, battery interface board and power module
- Equipment interface system: USB_Hub interface board, DVI interface board CF card assembly and internal wireless network card.

Additionally, the patient monitor can also support a satellite module rack (SMR), parameter modules, BeneLink module, mouse, keyboard, etc.

The following diagram illustrates the structure of the patient monitor



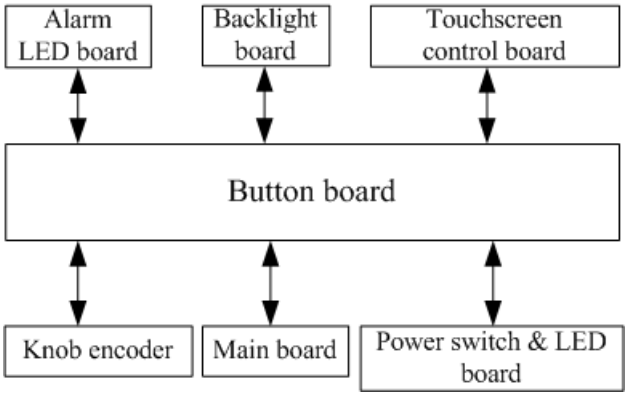
2.3.1 Input System

Button board

The button board, located at the lower part of the monitor's front panel, contains 6 keys and provides connections for the following components to the main board:

- Knob
- Power switch & LED board
- Touchscreen control board
- Alarm LED board
- Backlight board

The following diagram shows the button board connections.



Knob

The knob can be pressed, or rotated both clockwise and counter-clockwise. It is connected to the button board.

Touchscreen

The touchscreen enables touch operations and can be calibrated. It is connected to the touchscreen control board and main board.

Power switch & LED Board

The power switch & LED board controls the power supply for the main unit. It has three LEDs, which respectively indicate the AC power status, battery status and monitor power on/off status. It is connected to the button board.

2.3.2 Output System

LCD

The patient monitor utilizes a high-resolution LCD. The LCD is connected to the main board. The signals and power supply from the backlight board are transferred by the button board.

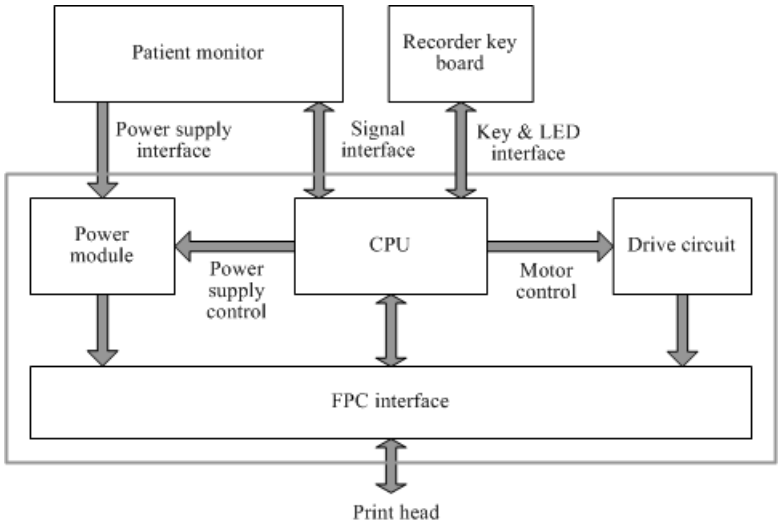
Alarm Lamp

The patient monitor has two alarm lamps integrated in the alarm lamp board.. Alarm lamps light either red or yellow. The alarm lamp signals are transferred by the button board and are directly controlled by the main board.

Recorder

The recorder receives data from the main board and transmits it to the thermal print head for printing. The recorder has a hardkey (start/stop recordings) and a green LED (It is ON during normal working) on its front panel. It is connected to the mother board.

The following diagram shows its operating principle.



Module	Description
Power interface	Introduces DC voltage from the main board.
Recorder power module	Converts the input A/C power into appropriate D/C voltages which power individual modules.
Recorder CPU	Controls the communications between modules.
Signal interface	Controls the communications between the main board and the recorder CPU.
Motor drive circuit	Receives the control signals from the CPU and then forwards them to the stepper motors
Button & LED board	The button and the LED board are directly controlled by the CPU.

Speaker

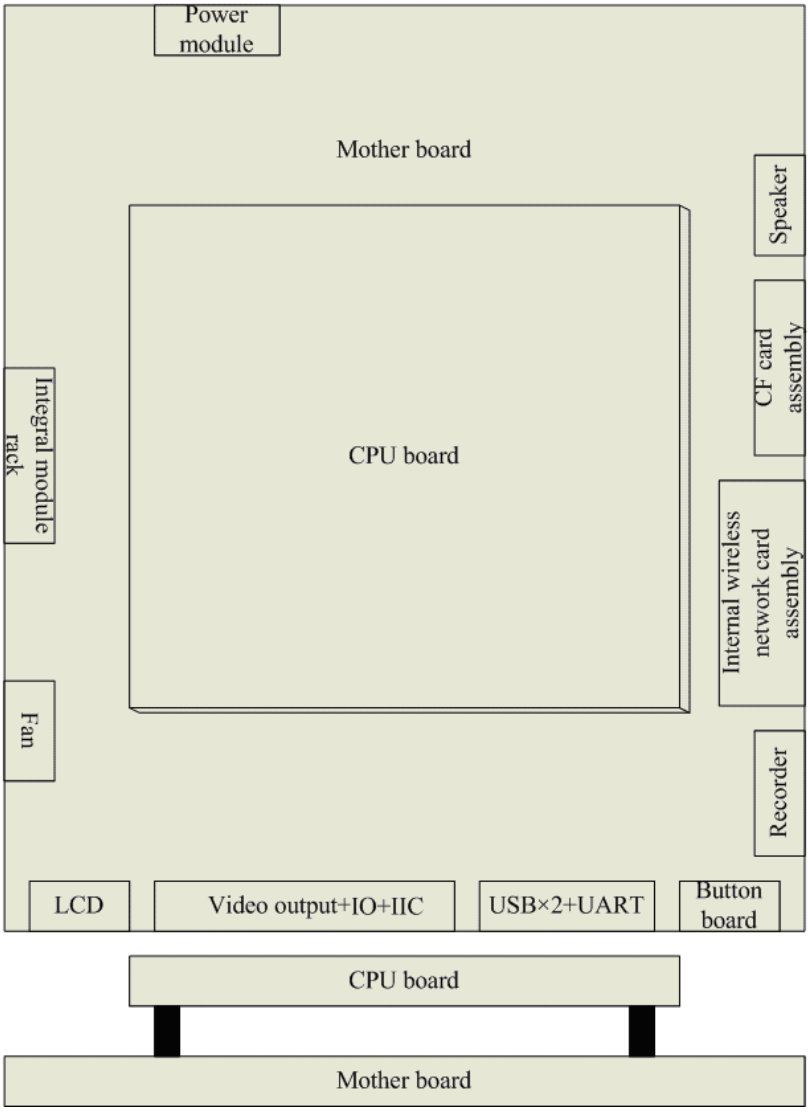
The speaker provides sound for alarms, key strokes, heart beats and pulse, and allows PITCH TONE and multi-level tone modulation. It is connected with the main board and is directly driven by the main board.

2.3.3 Processing and Communications System

Main Board

The main board is the heart of the patient monitor. It implements a series of tasks including input & output control, data storage and processing, display processing, system control, communication management, printing management and alarming, etc.

The main board is comprised of the CPU board and mother board. The following diagram shows interfaces to other components.



The CPU board consists of the CPU, FLASH, memory, real-time clock, EEPROM, etc. It interfaces to the mother board only, which then provides interfaces to all other external devices.

The mother board controls all connections and communications with other components and provides the following interfaces:

Name	Description
LCD connector	Connects the built-in display.
Video output +IO +IIC	Connects the digital video interface board.
USB×2+network+RS422 +GPIO port	Connects the USB_Hub board.
Button board connector	Connects the button board.
Recorder connector	Connects the recorder.
CF card connector	Connects the CF card assembly.
Speaker connector	Connects the speaker.
Power module connector	Connects the power module.
Integral module rack connector	Connects the 3-slot rack communication board in the integral module rack.
Fan connector	Connects the fan.
Internal wireless network card assembly	Connects the internal wireless network card.

Integral Module Rack

The patient monitor has two kinds of integral module racks: 2-slot and 5-slot. The control board includes a NIOS II FPGA. It implements protocol conversion and infrared communication between the main unit and the parameter modules

The module rack communication board can be a 2-slot type or a 3-slot type. The 3-slot communication board communicates with the main board directly. The 2-slot communication board is connected to and controlled by the 3-slot communication board. The 3-slot communication board has the function of communication control. The 2-slot communication board consists of the infrared circuit and module power circuit. The RS422 drive circuit is located on the 3-slot communication board.

2.3.4 Power Management System

Battery

The patient monitor uses two rechargeable lithium-ion batteries (11.1 V, 4500 mAh). The battery compartment is located at the bottom of the patient monitor. The battery power is supplied to the mother board via the battery interface board, and then to the power module.

Battery Interface Board

The Battery interface board connects the batteries to the DC input terminal of the power module via the mother board, implementing charging and discharging of the batteries and the power board.

Power Module

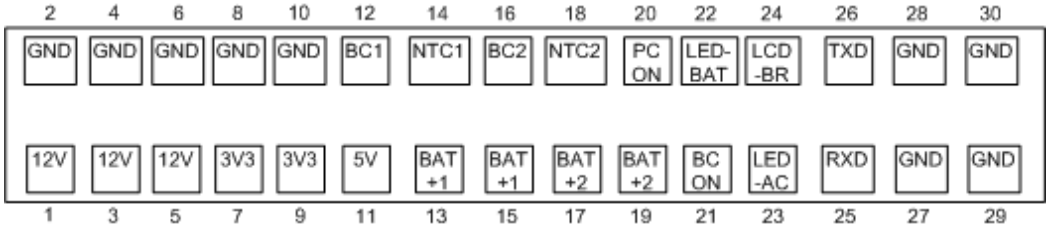
The power module is located at the back of the patient monitor. The main part of the power module is the power board, which contains charging & power management board, voltage drop DC transforming board and voltage rise and drop DC transforming board.

The power module converts the input power into DC and supplies each component of the patient monitor. The input power comes from either the batteries or an AC source. The patient monitor will run power from the AC source whenever an AC source is available. If the AC source is not available, the patient monitor will automatically switch to battery power. This does not affect the monitor's operating status.

The power module protects itself and the patient monitor by switching off AC input or DC output in case of overcurrent, short circuit and overvoltage. The power module provides 3 DC outputs:

Outputs	Description
＋3.3 VDC	Power supply of the LCD, mother board, CPU board, DVI interface board and integral module rack.
＋5.0 VDC	Power supply of the DVI interface board, recorder, CF storage card board and USB_Hub board.
＋12 VDC	Power supply of the recorder, LCD backlight board, integral module rack, parameter modules, USB_Hub board。

The following diagram shows the pins of the power socket connecting the power module and the mother board:



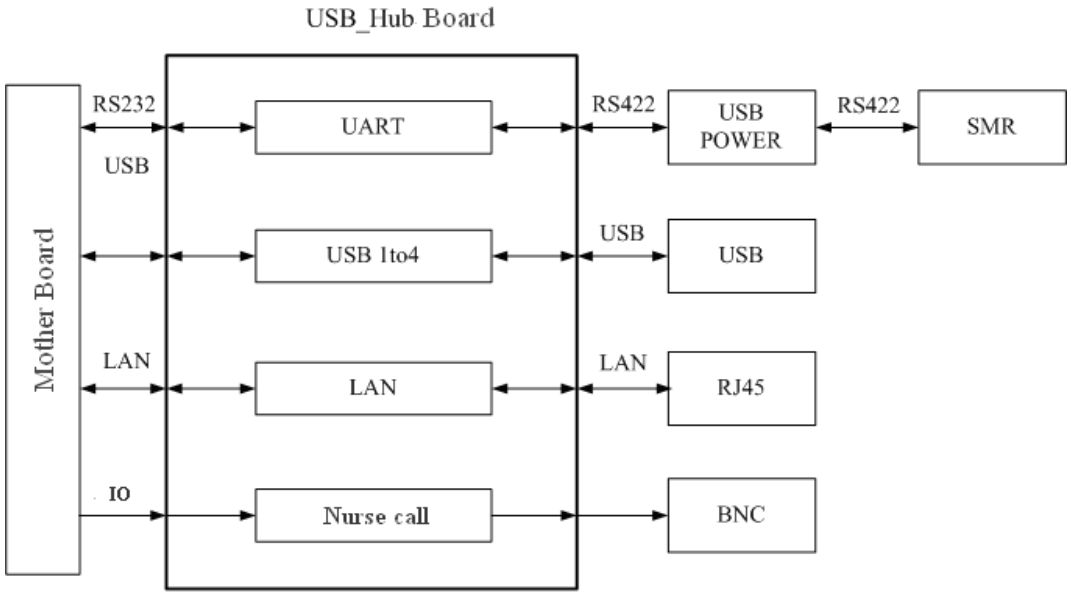
Pin ID	Marking	Description
1/3/5	12V	The positive output of the 12 VDC power
2/4/6/8/10/ 27/28/29/30	GND	The output grounding terminal of the power board.
7/9	3V3	The positive output of the 3.3 VDC power
11	5V	The positive output of the 5 VDC power
12	BC1	Signal indicating whether battery 1 is available. Low level indicates that battery 1 is available and high level indicates that battery 1 is not available.
13/15	BAT+1	Input of battery 1, connecting to the positive pole of the battery.
14	NTC1	Thermistor signal of battery 1.
16	BC2	Signal indicating whether battery 2 is available. Low level indicates that battery 2 is available and high level indicates that battery 2 is not available.
18	NTC2	Thermistor signal of battery 2.

Pin ID	Marking	Description
17/19	BAT+2	Input of battery 2, connecting to the positive pole of the battery.
20	PCON	Power on/off control signal. It is a TTL pulse signal inputted from the back board. Every time when the power on/off switch is pressed (pulse of falling edge), a switch between power "on" and "off" happens. The pulse duration is no less than 0.1 s for power on, 2 s for power off and 10 s for illegal power off.
21	BCON	Backlight on/off signal and switch output signal. The main board sends the LCD backlight on/off signals to the power board via a serial port, the power board processes the signals and output them. Low level is output when the backlight is off and high level is output when the backlight is on.
22	LED-BAT	Battery status indication driving output
23	LED-AC	AC power status indication signal
24	LCD-BR	Backlight brightness control voltage.

2.3.5 Equipment Interface System

USB_Hub board

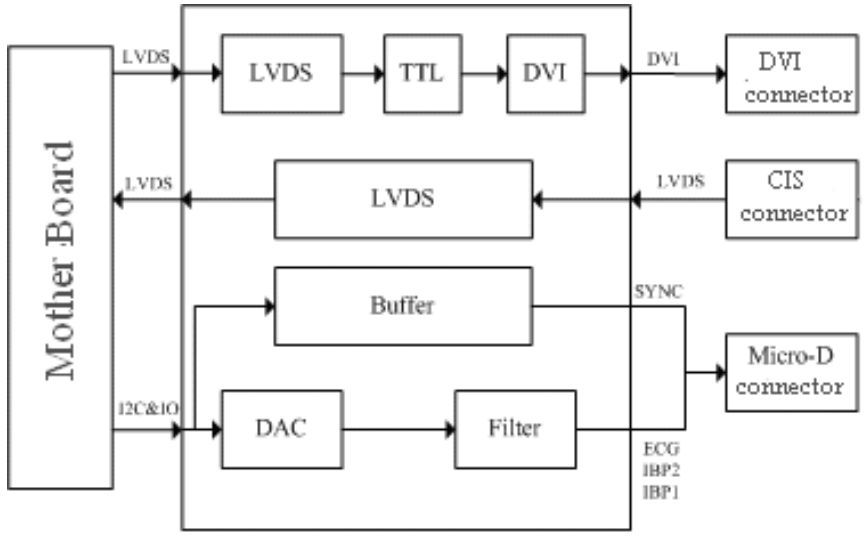
The USB_Hub board is connected with the mother board. It is compatible with USB1.1 connectors and supports equipment hot plug. The UART signal output by the main board is converted into RS422 signal by the USB_HUB board. It receives 5 VDC and 12 VDC inputs from the power module, of which the 5 VDC is supplied to the USB interface board and the 12 VDC is outputted to the SMR connector through a fuse.



BNC	A BNC connector used to output nurse call signals.
RJ 45 connector	A standard RJ45 connector, providing 10/100 BASE-TX Ethernet communications channels. It connects an Ethernet network or a PC.
USB connector	Connects devices with USB connector.
USB&POWER connector	Provides RS232 and RS422 interfaces for the communication between main board and SMR. It receives 5 VDC and 12 VDC inputs from the power module, of which the 5 VDC is supplied to the USB interface board and the 12 VDC is outputted to the SMR connector through a fuse.

DVI Interface Board

The DVI interface board is connected with the mother board. The following diagram shows its interfaces to other components.



Interface	Description
DVI connector	Connects the secondary display.
CIS Connector	Connects the CIS system.
Micro-D connector	Outputs analog signals and defibrillator synchronization signals.

CF Card Assembly

The CF assembly serves the non-volatile CF card which is used for data storage and transferring. It is connected with the mother board.

Internal wireless network card

The internal wireless network card connects with the mother board. User can set network type as LAN or WLAN through user interface and can set the internal wireless network card through PC.

2.4 Parameter Module

Each parameter module may consist of the module infrared communication board, module power board, module button board, parameter board, etc.

2.4.1 Module Infrared Communication Board

The module infrared communication board allows a short delay when powering up the module and adopts FPGA to enable infrared communications between the module and the module rack. An ID is integrated into the module infrared communication board. When a module is inserted in the module rack, the ID is automatically sent to the module rack.

2.4.2 Module Power Board

Some modules have no power board. There are two kinds of module power board:

1. Isolated power board: converts the 12 VDC into a 12 V isolated DC and a 5 V isolated DC.
2. Non-isolated power board: converts the 12 VDC into a 5 VDC

2.4.3 Module Button Board

There are keys and an LED on the module button board.

2.4.4 Parameter Board

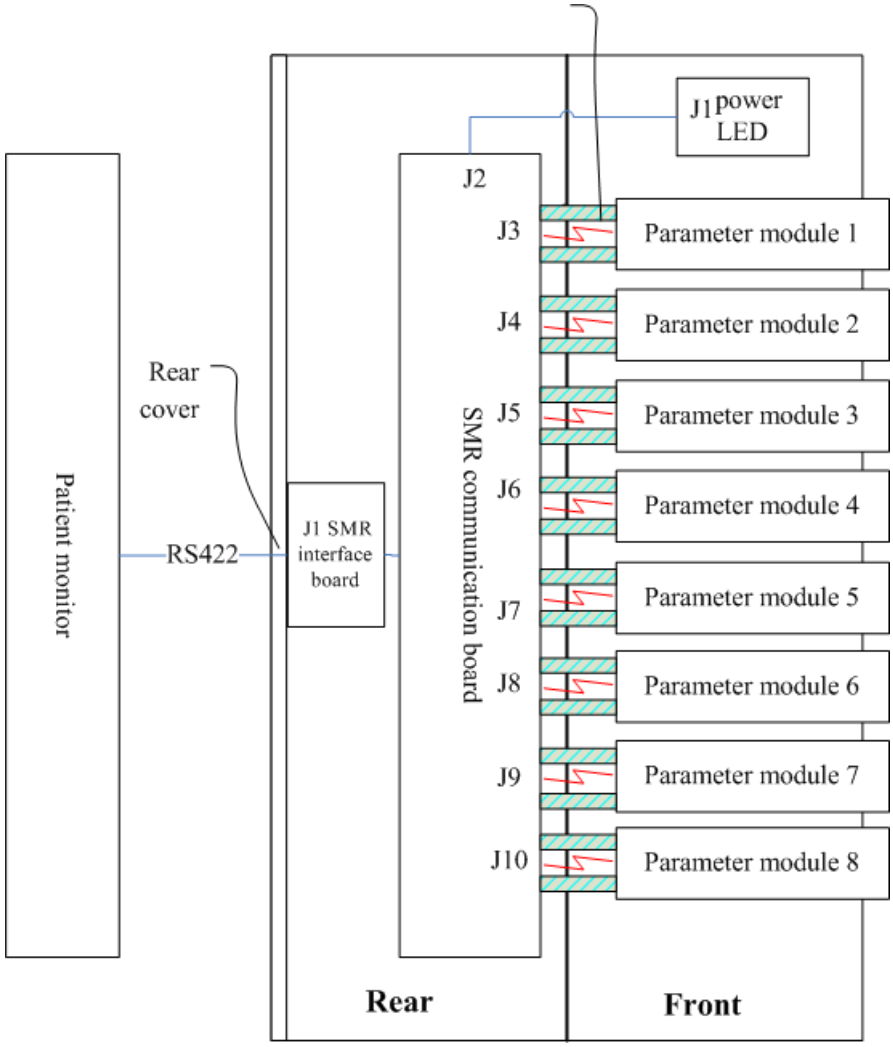
The parameter board is a parameter measurement component.

2.5 SMR

The satellite module rack (SMR) is independent of the patient monitor. It provides 8 slots for mounting parameter modules. It has the following features:

- It allows a parameter module to be plugged and unplugged with the patient monitor on. This allows function extension and patient transfer.
- The SMR receives 12 VDC through a powered USB cable coming from the 17m monitor. It then then supplies power to each parameter module via the contact screws.
- It implements communication protocol conversions between the patient monitor and each parameter module, provides infrared communications for parameter modules, and is responsible for detecting infrared communications malfunction for each parameter module.

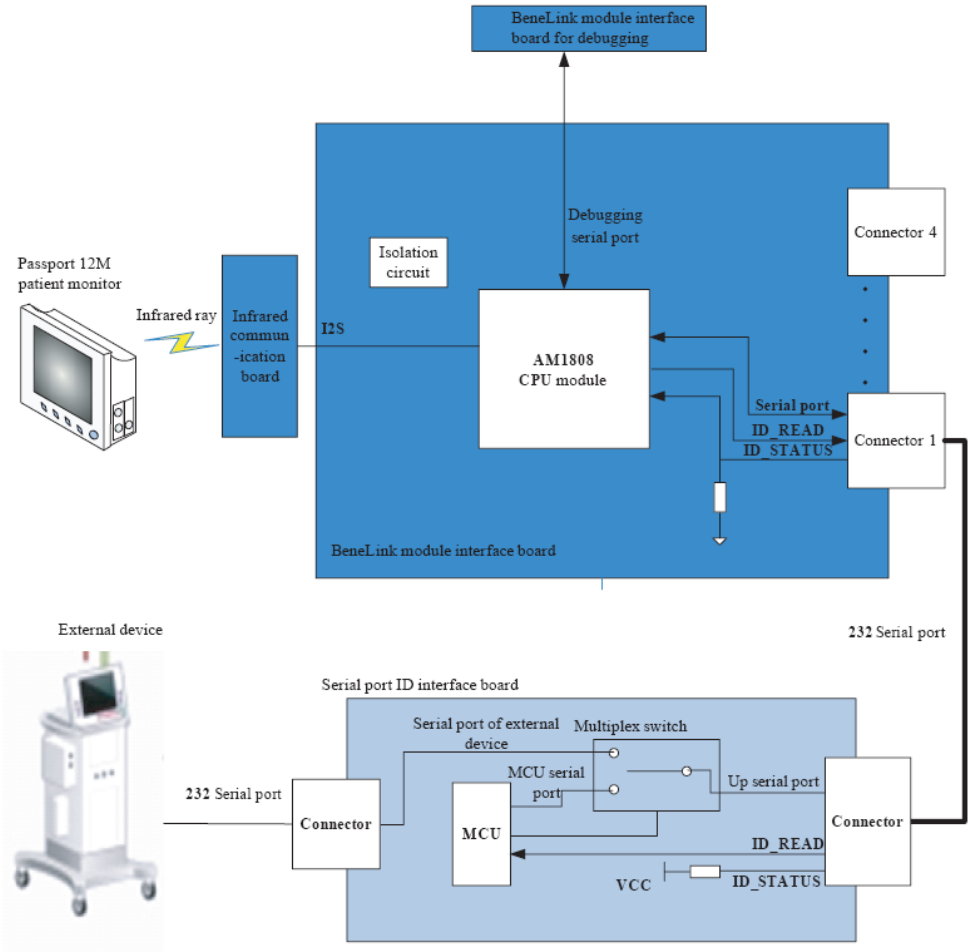
The following diagram shows the structure of the SMR.



2.6 BeneLink Module

The BeneLink module allows the information (patient data, alarms, etc.) from the external device to be displayed, saved, recorded, printed, or calculated through a Passport 12m patient monitor. If the patient monitor is connected with the CMS or gateway, information from the external device can also be transmitted to the CMS or gateway. The BeneLink module connects with the external device through an ID module, which enables the information transmission between the BeneLink module and the external device. The BeneLink module can be connected to many external devices such as anesthesia machines and ventilators.

The following diagram shows the structure of the BeneLink module:



FOR YOUR NOTES

3 Unpacking and Installation

This chapter provides information you need to install a patient monitor ready for use.

WARNING

- **The equipment shall be installed by personnel authorized by Mindray.**
- **The software copyright of the equipment is solely owned by Mindray. No organization or individual shall resort to altering, copying, or exchanging it or to any other infringement on it in any form or by any means without due permission.**
- **Devices connected to the equipment must meet the requirements of the applicable IEC standards (e.g. IEC 60950 safety standards for information technology equipment and IEC 60601-1 safety standards for medical electrical equipment). The system configuration must meet the requirements of the IEC 60601-1-1 medical electrical systems standard. Any personnel who connect devices to the equipment's signal input/output port is responsible for providing evidence that the safety certification of the devices has been performed in accordance to the IEC 60601-1-1. If you have any question, please contact Mindray.**
- **If it is not evident from the equipment specifications whether a particular combination with other devices is hazardous, for example, due to summation of leakage currents, please consult the manufacturers or an expert in the field. A determination must be made that the proposed combination will not negatively affect the devices themselves or the patient's safety.**

3.1 Unpacking and Checking

Before unpacking, examine the packing case carefully for signs of damage. If any damage is detected, contact the carrier or Mindray.

If the packing case is intact, open the package and remove the equipment and accessories carefully. Check all materials against the packing list and check for any mechanical damage. Contact Mindray in case of any problem.

WARNING

- **When disposing of the packaging material, be sure to observe the applicable waste control regulations and keep it out of children's reach.**
- **The equipment might be contaminated during storage and transport. Before use, please verify whether the packages are intact, especially the packages of single use accessories. In case of any damage, do not apply it to patients.**

NOTE

- **Save the packing case and packaging material as they can be used if the equipment must be reshipped.**

3.2 Preparation for Installation

3.2.1 Preparation for Installation Site

1. Ensure that the site meets all safety, environmental and power requirements
2. Check that required power sockets are available.
3. Check that a network connector is available if the monitor needs to be connected to the wired network.

3.2.2 Environmental Requirements

To avoid explosion hazard, do not use the equipment in the presence of flammable anaesthetics, vapors or liquids. The environment where the monitor will be used should be free from vibration, dust and corrosive substances. If these conditions are not met, the accuracy of the system may be affected and damage may occur.

Refer to ***Passport 12m/Passport 17m Patient Monitor Operator's Manual (PN: 046-005013-00)*** for the monitor's environmental specification

3.2.3 Electrical Requirements

The monitor can be connected to AC power source. Only power sockets with protective grounding can be used. Make sure that:

1. All cables and connectors are not damaged, and pins are not loose. Otherwise, remove it from use.
2. The insulation of patient cables and leadwires is not damaged, and connectors are not loose.

Before connecting the equipment to the power line, check that the voltage and frequency ratings of the power line are the same as those indicated on the equipment's label or in this manual.

3.2.4 Wireless Network Specification

Network standard	IEEE 802.11a/b/g/n
Modulation mode	DSSS and OFDM
Operating frequency	For 2.4G frequency bands (FCC): 2.4GHz to 2.483GHz (only use Channels 1 to 11) For 5G frequency bands (FCC): 5.15GHz to 5.35GHz, 5.725GHz to5.825GHz
QoS	QoS Supported. Real time monitoring data transmission priority can be configured with a higher priority than other data transmission.
Channel spacing	IEEE 802.11a: 20MHz IEEE 802.11b/g: 5MHz IEEE 802.11n at 2.4 GHz: 5MHz IEEE 802.11n at 5 GHz: 20MHz
Wireless baud rate	IEEE 802.11a: 6 to 54 Mbps IEEE 802.11b: 1to11 Mbps IEEE 802.11g: 6 to 54 Mbps IEEE 802.11n (at both 2.4GHz and 5GHz): 6.5 to 72.2 Mbps
Output power	< 30 dBm (FCC requirement: detection mode – peak power) < 20 dBm (CE requirement: detection mode – RMS)
Operating mode	Infrastructure
Data security	Security standards: WPA-PSK, WPA2-PSK, WPA-Enterprise/WPA2-Enterprise EAP methods: PEAP-MsCHAPv2, PEAP-GTC, PEAP-TLS, EAP-TTLS, EAP-TLS, EAP-FAST, and EAP-LEAP Encryption modes: TKIP and AES
Roaming	Supported
System capacity	Number of Passport 12m monitors supported by a single AP: ≤ 16. Each Passport 12m monitor can communicate with the central station and connect to two other monitors at the same time, and among them, at most two Passport12m monitors can transmit history data (the Panorama central station does not transfer the historical data.) when reconnection at the same time. The wireless functions of all Passport 12m monitors are normal at the same time.
Resistance to wireless interference	The wireless functions of the monitor are normal when the following conditions exist simultaneously: 1. The distance between interfering devices (including wireless devices at the frequency of 2.4GHz such as cellular communication devices, microwave ovens, intercoms, cordless phones and electro-surgical units, excluding Wi-Fi) and the monitor is greater than 20 cm. 2. Co-channel interference (CCI) on the Wi-Fi network should be no greater than -85dBm. 3. Adjacent–channel interference (ACI) on the Wi-Fi network should be no greater than -50dBm.
FCC approval	SQG-WB45NBT

3.2.5 Network Setup Overview

In the [**Network Setup**] menu, you can set IP address, subnet mask and gateway. You should not change the patient monitor's IP address randomly. If you want to know details about IP address setup, contact Mindray Technical Support Department..

NOTE

- **The design, installation, restruction and maintenance of the wireless network's distribution shall be performed by authorized service personnel of our company.**
- **The existence of obstacles (such as wall) will exert impact on data transferring or even cause network interruption.**
- **The Central Monitoring System is capable of connecting up to 32 bedside monitors via the wireless network.**

3.2.6 Setting the Network Type

The monitor supports both wired and wireless network.

To set the network type:

1. Select [**Main Menu**]→[**Maintenance>>**]→[**User Maintenance>>**]→enter the required password→select [**Ok**].
2. Select [**Network Setup** >>].
3. Select [**Monitor Network Setup** >>].
4. Set [**Network Type**] to [**LAN**] or [**WLAN**].

3.2.7 Setting the Wireless Network

The patient monitors can be connected to a wireless network via a wireless network card. The wireless network card used with the monitor is in compliance with IEEE 802.11a/b/g/n.

This wireless network will have the following capabilities:

- Support the 802.11a/b/g/n wireless protocol
- Have a channel bandwidth of 20 MHz
- Support WPA-PSK , WPA2-PSK , WPA-Enterprise, and WPA2-Enterprise
- Provide a signal strength at the monitor of no less than -65 dBm

To set up the wireless network:

1. Install the Firefox browser on your PC or laptop. You can use the Firefox browser only to set up the wireless network for the monitor.
2. After installing Firefox, connect one end of a network cable to your PC or laptop and connect the other end of the network cable to the network connector on the back of the monitor.
3. On the monitor, select [**Main Menu**]→[**Maintenance>>**]→[**Factory Maintenance>>**]→enter the required password→[**Network Setup >>**]→[**Network Setup >>**].
4. Select [**Configure Wireless AP**]. [**Wireless AP**] is checked by default. If it is not checked, check it.
5. Configure the IP address of your PC or laptop to an address such as 192.168.1. 245. Ensure that this IP address is within the same network segment with the monitor. Configure the subnet mask to 255.255.255.0.
6. Open Firefox and enter the network card IP address (https://192.168.1.220) into the address bar.
7. Enter the User Name (root) and Password (summit) and then click [**OK**]. Please note that all the characters are lower case letters. Then the Laird screen is displayed.
8. On the Laird screen, select the [**Wi-Fi**] tab and click the [**Edit**] button below the list box for Active Profile.
9. Edit the desired items on the right column of the screen. After editing, click [**Submit**].
10. Click the [**Activate**] button below the list box for Active Profile to activate the changes.
11. Select the [**Wi-Fi Globals**] tab and then set the desired items such as BG channels.
12. If you want to select an enterprise encryption mode that requires a certificate, you need to select the [**Advanced**] tab and upload the desired certificates.
13. After finishing the wireless network configuration, click the  button in the upper right corner of the monitor to exit the [**Network Setup]** menu.

3.2.8 Setting the Network Service Quality Level

To set the quality of service (QoS):

1. Select [**Main Menu**]→[**Maintenance**>>]→[**User Maintenance**>>]→enter the required password.→[**Network Setup** >>]→[**QoS Setup** >>].
2. Select the desired value for [**Realtime Monitoring**]. This sets the service quality of network connection for important realtime network transactions such as parameter measurements, waveforms, and alarms. The value ranges from 0 to 7. The greater the value, the higher priority the network transaction.
3. Select the desired value for [**Others**]. This sets the service quality of network connection for secondary non-realtime network transactions such as transferring history data from the monitor to the CMS. The value ranges from 0 to7. The greater the value, the higher priority the network transaction.

3.2.9 Setting the Multicast Parameters

Multicast parameters must be configured before use on a network.

To set the multicast parameters:

1 Select [**Main Menu**]→[**Maintenance**>>]→[**User Maintenance**>>]→enter the required password.→[**Network Setup >>**]→[**Multicast Setup** >>].

2. Set [**Multicast Addr**] and [**TTL**].

3. Select [**Ok**] to save the setting.

4 Testing and Maintenance

4.1 Introduction

To ensure the patient monitor always functions properly, qualified service personnel should perform regular inspections, maintenance and tests. This chapter provides a checklist of the testing procedures for the patient monitor with recommended test equipment and inspection schedule.

The testing procedures provided in this chapter are intended to verify that the patient monitor meets the performance specifications. If the patient monitor or a module fails to perform as specified in any test, repairs or replacement must be done to correct the problem. If the problem persists, contact Mindray Technical Support Department.

CAUTION

- **All tests should be performed by qualified service personnel only.**
- **Care should be taken when changing the settings in [User Maintenance>>] and [Factory Maintenance>>] menus to avoid loss of data.**
- **Service personnel should possess a working knowledge of the test equipment and make sure that test tools and cables are applicable.**

4.2 Preventative Maintenance

Preventative maintenance refers specifically to actions taken to prevent inaccurate results in the equipment. The following sections provide a list of recommended preventative maintenance procedures and their recommended frequencies.

4.2.1 Preventative Maintenance Frequency

Check/Maintenance Item		Frequency
NIBP test	Pressure check	1. If the user suspects that the measurement is incorrect. 2. Following any repairs or replacement of relevant module. 3. Once a year. 4. AG leak test should be performed before AG measurement.
	Leak test	
Sidestream and Microstream CO_2 tests and calibration	Leak test	
	Performance test	
	Calibration	
AG tests	Performance test	
	Calibration	

4.2.2 CO_2 Tests

4.2.2.1 CO_2 Leak test

Follow this procedure to perform the test:

1. Plug the module into the module rack.
2. Wait until CO_2 warmup is finished and then completely block the gas inlet of the module or watertrap (you may use a pneumatic plug or your finger to manually occlude the port). The sidestream and microstream CO_2 modules will behave as follows:
   - Sidestream: The alarm message [**CO2 FilterLine Err**] is displayed on the screen after 3 seconds. Block the gas inlet for another 60 s. Select [**Main Menu**] → [**Maintenance >>**] →[**User Maintenance >>**] → enter the required password → [**Maintain CO2 >>**] → [**Calibrate CO2 >>**], and verify the flow rate is less than. 10ml/min. The module does not leak if current flow rate is less than 10ml/min and the alarm message does not disappear.
   - Microstream: The alarm message [**CO2 Purging**] is displayed on the screen after a short time. Block the gas inlet for another 30s. If alarm message [**CO2 FilterLine Err**] is shown, it indicates that the module does not leak.

4.2.2.2 CO_2 Accuracy Test

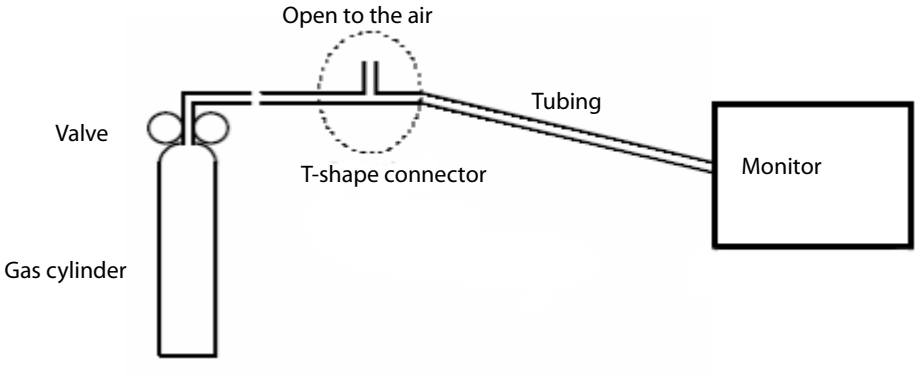
Tools required:

- A gas cylinder with 5±0.03% CO_2, 21.0% O_2 and balance gas N_2 (P/N 0075-00-0033-01), or a steel gas cylinder with:
  - CO_2 concentration 3% - 7%
  - a/c ≤ 0.01 (where a = absolute gas concentration accuracy, c = gas concentration)
  - balance gas N_2
- T-shape connector
- Tubing

Follow this procedure to perform the test:

1. Connect the CO_2 module.
2. Wait until the CO_2 module warmup is finished. Check the airway for leak.
3. Select [**Main Menu**] → [**Maintenance >>**] → [**User Maintenance>>**] → enter the required password→ [**Module Maintenance>>**] → [**Maintain CO2 >>**] → [**Calibrate CO2 >>**].

4. Connect the test system as follows:



5. Open the valve to flow CO_2 and make sure that there is flow sufficient to vent to atmosphere.
6. Verify the realtime CO_2 value is within 5.0±0.3% in the [**Calibrate CO_2**] menu.

4.2.2.3 CO_2 Calibration

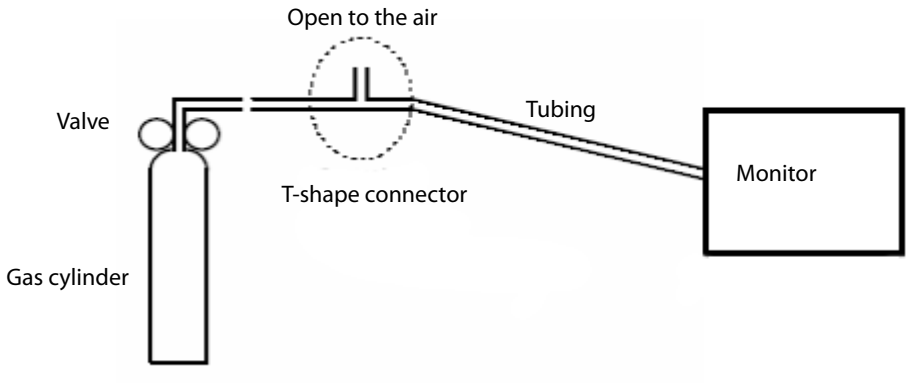
Tools required:

- A gas cylinder with 5±0.03% CO_2, 21.0% O_2 and balance gas N_2 (P/N 0075-00-0033-01), or a gas cylinder with:
  - CO_2 concentration 3% - 7%
  - a/c ≤ 0.01 (where a = absolute gas concentration accuracy, c = gas concentration)
  - balance gas N_2
- T-shape connector
- Tubing

Follow this procedure to perform a calibration:

1. Make sure that the sidestream or microstream CO_2 module has been warmed up.
2. Check the airway for leaks.
3. Select [**Main Menu**] → [**Maintenance >>**] → [**User Maintenance** >>] → enter the required password→ [**Module Maintenance>>**] → [**Maintain CO_2 >>**] → [**Calibrate CO_2 >>**].
4. In the [**Calibrate CO_2**] menu, select [**Zero**].

5. After the zero calibration is finished successfully, connect the equipment as follows:



6. Open the valve to flow CO_2 and make sure that there is flow sufficient to vent to atmosphere.
7. In the [**Calibrate CO_2**] menu, enter the CO_2 concentration in the [**CO_2**] field.
8. In the [**Calibrate CO_2**] menu, the measured CO_2 concentration is displayed. After the measured CO_2 concentration becomes stable, select [**Calibrate CO_2**] to calibrate the CO_2 module.

If the calibration is completed successfully, the message [**Calibration Completed!**] is displayed in the [**Calibrate CO_2**] menu. If the calibration failed, the message "Calibration Failed!" is displayed. If the initial calibration fails, perform a second calibration. If that attempt fails, contact Mindray Technical Support for assistance.

4.2.3 AG Tests

4.2.3.1 Leak Test

Follow this procedure to perform the test:

1. Plug the AG module into the module rack.
2. Wait until the AG module warmup is finished and then completely block the gas inlet of the AG module (you may use a pneumatic plug or your finger to manually occlude the port). An alarm message [**AG Airway Occluded**] will appear on the screen.
3. Block the gas inlet for another 30 s. Select [**Main menu**] → [**Maintenance >>**] → [**User Maintenance >>**] → enter the required password → [**Calibrate AG >>**], and verify the current flow rate is less than 10 ml/min.

If the alarm message does not disappear, it indicates that the module does not leak.

If the flow rate is less than 10ml/min and the alarm message [**AG Airway Occluded**] does not disappear, it indicates that the module does not leak. If the alarm message disappears, or the flow rate is greater than or equal to 10ml/min, it indicates that the module leaks. If the problem remains, contact your service personnel for assistance.

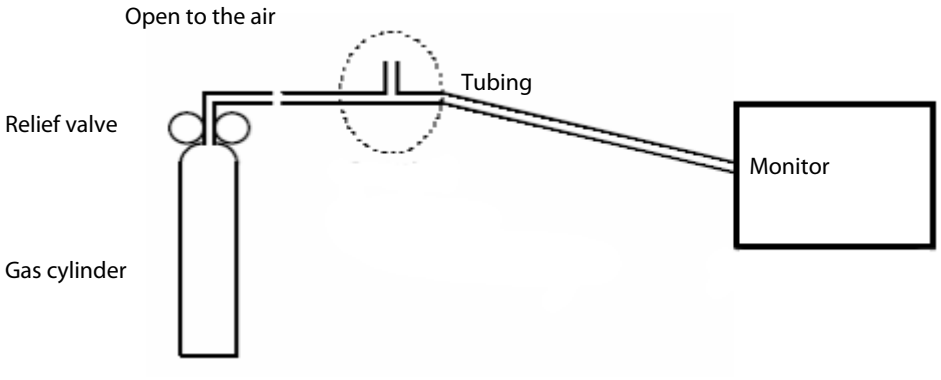
4.2.3.2 Accuracy Test

Tools required:

- A supply of medical grade 100% O_2 and an anesthetic calibration gas (4% Desflurane, 6% CO_2, 45% N_2O, Bal O_2, P/N: 0075-00-0048-01 and flow regulator P/N: 0119-00-0235). Gas concentration should meet the following requirements:
- AA≥1.5%, CO_2≥1.5%, N_2O≥40%, O_2≥40%, of which AA represents an anesthetic agent. a/c≤0.01 (a is the gas absolute concentration accuracy; c is the gas concentration)
- T-shape connector
- Tubing

Follow this procedure to perform the test:

1. Plug the AG module into the module rack.
2. Wait at least 10 min and then perform a leak test to make sure the airway has no leak.
3. Check if the fan inside the AG module works properly.
4. Connect the test system as follows:



5. Open the relief valve and vent a standard gas and make sure that there is an excess gas flow through the T-shape connector to air.
6. Verify the concentration of each composition meets the specification stated in the Operator's Manual.

WARNING

- **When performing AG accuracy test and AG calibration, be sure to dispose of exhaust gas properly.**

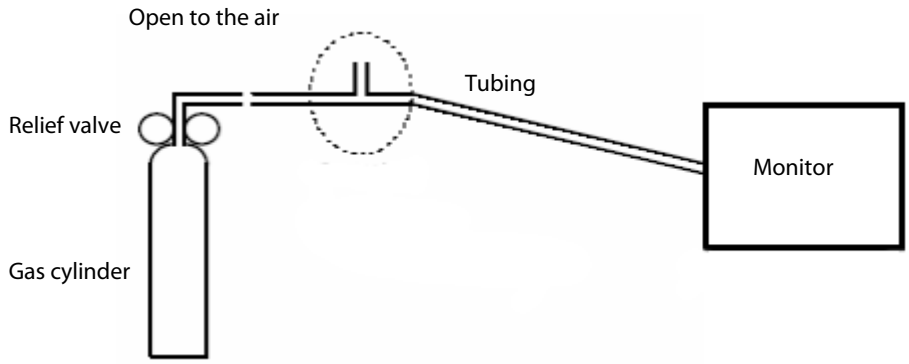
4.2.3.3 Calibration

Tools required:

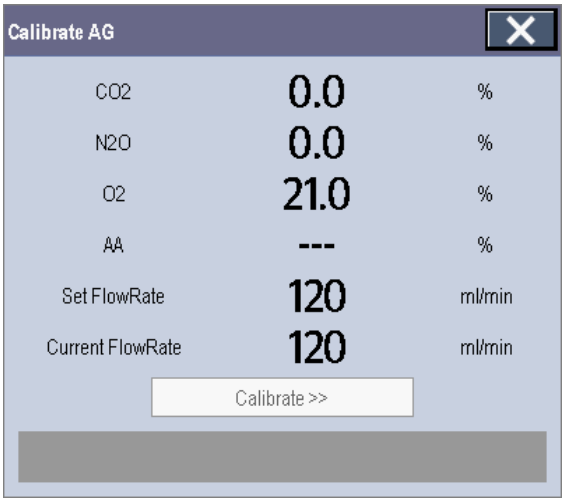
- Gas cylinder, Mindray P/N 0075-00-0048-01 and flow regulator P/N0119-00-0235 with an anesthetic calibration gas (4% Desflurane, 6% CO_2, 45% N_2O, Bal O_2, P/N: 0075-00-0048-01 and flow regulator P/N: 0119-00-0235). Gas concentration should meet the following requirements: AA≥1.5%, CO_2≥1.5%, N_2O≥40%, O_2≥40%, of which AA represents an anesthetic agent. a/c≤0.01 (a is the gas absolute concentration accuracy; c is the gas concentration）.For 100% O_2 calibration, a gas cylinder with 100% O_2 is used and the O_2 concentration is not less than 99%.
- T-shape connector
- Tubing

Follow this procedure to perform a calibration:

1. Select [**Main Menu**] → [**Maintenance >>**] → [**User Maintenance** >>] → enter the required password → [**Calibrate AG >>**].
2. Check the airway and make sure that there are no occlusions or leaks.
   - Vent the sampling tubing to the air and check if the [**Current FlowRate**] and [**Set FlowRate**] are approximately the same. If the deviation is great, it indicates that there is an occlusion in the tubing. Check the tubing for an occlusion.
   - Perform a leak test to make sure that the airway has no leak.
3. Connect the test system as follows:



4. Open the relief valve and vent an anesthetic calibration gas or gas mixture and make sure that there is an excess gas flow through the T-shape connector to air.
5. In the [**Calibrate AG**] menu, the concentration and flowrate of each measured gas are displayed.
   - If the difference between the measured gas concentration and the actual one is within tolerance, a calibration is not needed.
   - If the difference is not within tolerance, a calibration should be performed. Select [**Calibrate >>**] to enter the calibrate menu.



6. Enter the vented gas concentration. If you use only one gas for calibration, set other gases' concentration to 0.
7. Select [**Start**] to start a calibration.
8. If the calibration is finished successfully, the message [**Calibration Completed!**] is displayed. If the calibration failed, the message [**Calibration Failed!**] is displayed. Perform another calibration.

CAUTION

- **Calibrate the O_2 module, if it has been transported for long distance or if you suspect it does not work properly.**

4.3 Performance Tests

Performance test are designed to ensure that measurement results are accurate. The following sections provide a list of performance and accuracy tests and their recommended frequencies.

4.3.1 Performance Test Frequencies

Check/Maintenance Item		Frequency
Visual inspection		1. When first installed or reinstalled.
ECG test	Performance test	1. If the user suspects that the measurement is incorrect. 2. Following any repairs or replacement of relevant module. 3. At least once every two years. At least once a year is recommended for NIBP, CO_2 and AG. 4. AG leak test should be performed before AG measurement.
	Verification	
Resp performance test		
SpO_2 test		
NIBP test	Pressure check	
	Leak test	
Temp test		

Check/Maintenance Item		Frequency
IBP test	Performance test	
	Pressure calibration	
C.O. test		
CO_2 tests and calibration	Leak test	
	Performance test	
	Calibration	
AG tests	Leak test	
	Performance test	
	Calibration	
BIS test		
RM test		
CCO/SvO_2 test	Interconnecting function	
	Output calibration	
$ScvO_2$ test		
Nurse call relay performance test		If the user suspects that the nurse call or analog output does not work correctly.
Analog output performance test		
Device integration check		1. When first installed. 2. Following any repair or replacement of the external device.

4.3.2 Visual Inspection

Inspect the equipment for obvious signs of damage. Follow these guidelines when inspecting the equipment:

- Carefully inspect the case, display screen, buttons and knob for obvious signs of damage.
- Inspect the SMR and parameter modules for obvious signs of damage.
- Inspect the power cord, wall-mount bracket and module accessories for obvious signs of damage.
- Inspect all external connections for loose connectors, bent pins or frayed cables.
- Inspect all connectors on the equipment for loose connectors or bent pins.
- Make sure that safety labels and data plates on the equipment are clearly legible.

After visual inspection, replace any damaged equipment parts or accessories.

4.3.3 ECG Tests

4.3.3.1 ECG Performance Test

Tool required:

- Fluke Medsim 300B patient simulator or equivalent equipment

Follow this procedure to perform the test:

1. Connect the patient simulator with the ECG module using an ECG cable.
2. Set the patient simulator as follows: ECG sinus rhythm, HR=80 bpm with the amplitude as 1mV.
3. Check the ECG waves are displayed correctly without noise and the displayed HR value is within 80 ± 1 bpm. If the value is not within 80 +/-1 then contact Mindray Technical Support
4. Disconnect each of the leads in turn and observe the corresponding lead off message displayed on the screen.
5. Set the output of the simulator to deliver a paced signal and set [**Paced**] to [**Yes**] on the monitor. Check the pace pulse marks on the monitor screen.

4.3.3.2 ECG Verification

Tool required:

- Vernier caliper

Follow this procedure to perform verification:

1. Select the ECG parameter window or waveform area → [**Filter**] → [**Diagnostic**].
2. Select [**Main Menu**] → [**Maintenance >>**] → [**User Maintenance** >>] → enter the required password→ [**Module Maintenance>>**].
3. Select [**Calibrate ECG**]. A square wave appears on the screen and the message [**ECG Calibrating**] is displayed.
4. Compare the amplitude of the square wave with the wave scale. The difference should be within 5%. If the difference is not within 5% contact Mindray Technical Support.
5. After completing the verification, select [**Stop Calibrating ECG**].

4.3.4 Resp Performance Test

Tool required:

- Fluke Medsim 300B patient simulator or equivalent equipment

Follow this procedure to perform the test:

1. Connect the patient simulator to the module using a non ESU-proof cable and set lead II as the respiration lead.
2. Configure the simulator as follows: lead II as the respiration lead, base impedance line as 1500 Ω; delta impedance as 0.5 Ω, respiration rate as 40 rpm.
3. Verify the Resp wave is displayed without any distortion and the displayed Resp value is within 40 ± 2 rpm.

4.3.5 SpO_2 Test

Tool Required:

- None.

Follow this procedure to perform the test:

1. Connect SpO_2 sensor to the SpO_2 connector of the monitor. Set [**Patient Cat.**] to [**Adu**] and [**PR Source**] to SpO_2 on the monitor.
2. Apply the SpO_2 sensor to the ring finger of a healthy person.
3. Check the Pleth wave and PR reading on the screen and make sure that the displayed SpO_2 is within 95% and 100%. If you are unable to get the SPO_2 between 95% and 100%, contact Mindray Technical Support.
4. Remove the SpO_2 sensor from the finger and make sure that an alarm of SpO_2 Sensor Off is triggered.

NOTE

- **A functional tester cannot be used to assess the accuracy of a pulse oximeter monitor. 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.**

4.3.6 NIBP Tests

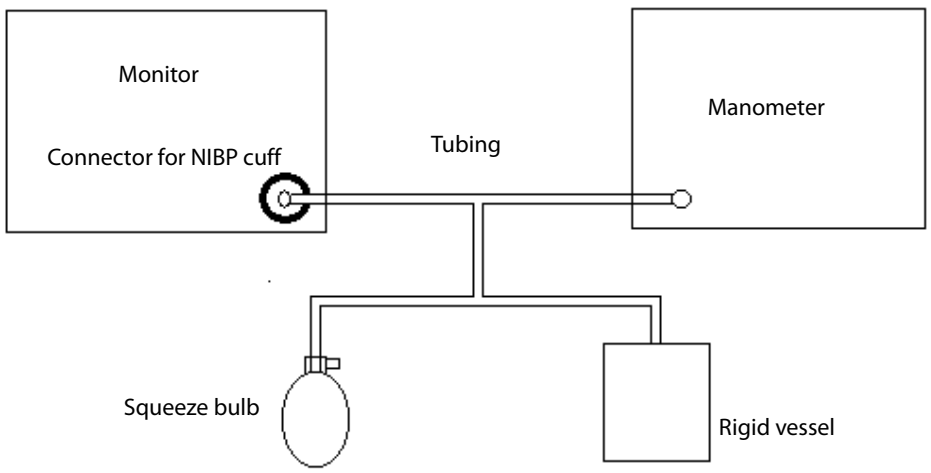
4.3.6.1 NIBP Accuracy Test

Tools required:

- T-shape connector
- Appropriate tubing
- Squeeze bulb
- Rigid Vessel with volume 500 ± 25 ml
- Reference manometer (calibrated with accuracy equal to or better than 0.75 mmHg)

Follow this procedure to perform the test:

1. Connect the equipment as shown below.



2. Before inflation, the reading on the manometer should be zero. If not, disconnect the squeeze bulb to release any pressure. Reconnect the squeeze bulb and verify that the pressure reading is zero.
3. Select [**Main Menu**] → [**Maintenance >>**] → [**User Maintenance** >>]→ enter the required password→ [**Module Maintenance>>**] →[**NIBP Accuracy Test**].
4. Check the manometer values and the monitor values. Both should be 0 mmHg.
5. Raise the pressure in the rigid vessel to 50 mmHg with the squeeze bulb. Then, wait for 10 seconds until the measured values become stable.
6. Compare the manometer values with the monitor values. The difference should be within ±3 mmHg.
7. Raise the pressure in the rigid vessel to 200 mmHg with the squeeze bulb. Then, wait for 10 seconds until the measured values become stable and repeat step 6.

NOTE

- **You can use an NIBP simulator to replace the squeeze bulb and the reference manometer to perform the test.**
- **You can use an appropriate cylinder and a cuff instead of the rigid vessel.**

4.3.6.2 NIBP Leakage Test

NOTE

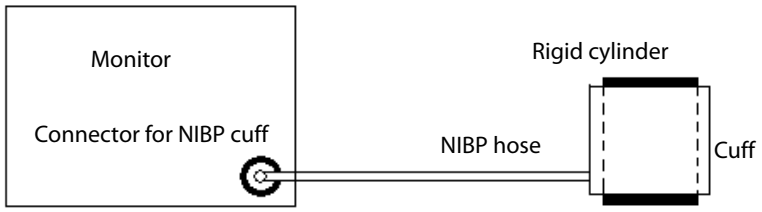
- **You should perform the NIBP leakage test before any other NIBP test.**

Tools required:

- NIBP cuff for adult patient
- Appropriate tubing
- Rigid cylinder

Follow this procedure to perform the test:

1. Set [**Patient Cat.**] to [**Adu**].
2. Connect the NIBP cuff to the NIBP connector on the monitor.
3. Wrap the cuff around the cylinder as shown below.



4. Select [**Main Menu**] → [**Maintenance >>**] → [**User Maintenance** >>] → enter the required password→ [**Module Maintenance>>**] → [**NIBP Leakage Test**]. The message [**Leakage Testing**…] is displayed in the NIBP parameter area.

5. The cuff automatically deflates after 20s, which means NIBP leakage test is completed.

   If no message is displayed in the NIBP parameter area, it indicates that the system does not leak. If the message [**NIBP Pneumatic Leak**] is displayed, it indicates that the system may have a leak. In this case, check to make sure the NIBP cuff, hose and connectors are not leaking and perform the test again.

You can also perform a manual leak test:

1. Perform procedures steps 1 to 4 in the ***NIBP Accuracy Test***.
2. Raise the pressure in the rigid vessel to 250 mmHg with the squeeze bulb. Then, wait for 5 seconds to let the measured values becoming stable.
3. Record the current pressure value, and then, record the pressure value after 60s.
4. Compare the two pressure values and make sure the difference is not greater than 6 mmHg.

4.3.7 Temp Test

Tool required:

- Resistance box (with accuracy above 0.1Ω) or equivalent in Patient Simulator

Follow this procedure to perform the test:

1. Connect the two pins of any Temp connector of a module to the two ends of the resistance box using 2 wires.
2. Set the resistance box to 1354.9Ω (corresponding temperature is 37ºC).
3. Verify that the displayed value is within 37 ± 0.1ºC. If the temperature is not within 37 ± 0.1ºC, contact Mindray Technical Support.
4. Repeat steps 1 to 3 and verify another temperature channel.

4.3.8 IBP Tests

4.3.8.1 IBP Performance Test

Tools required:

- Medsim300B patient simulator, or MPS450, or equivalent equipment
- IBP adapter cable for test (P/N 009-002199-00 for Medsim 300B, P/N 009-002198-00, for MPS450)

Follow this procedure to perform the test:

1. Connect the patient simulator to the monitor's IBP connector.
2. Verify the patient simulator output to the IBP channel is zero.
3. Select IBP Zero in the IBP setup menu to make a zero calibration.
4. Configure the patient simulator as P (static) = 200 mmHg.
5. The displayed value should be within 200 ± 4 mmHg. If the error is beyond ±4 mmHg, return the IBP module to the factory for repair.
6. Set the patient simulator output to 120/80 mmHg ART signal and 120/0 mmHg LV signal to the IBP channel and check that the IBP wave is displayed correctly.
7. Repeat the steps above for all the IBP channels.

4.3.8.2 IBP Pressure Calibration

Method 1:

Tools required:

- Medsim300B Patient simulator, MPS450, or other equivalent device
- Dedicated IBP adapter cable (300B, P/N 00-002199-00) (use P/N 00-002198-00, if the simulator is MPS450)

Follow this procedure to perform the test:

1. Connect the patient simulator to the pressure connector on the module.
2. Set the patient simulator to 0 pressure for the desired IBP channel.
3. Press the Zero Key on the module to perform a zero calibration.
4. Configure the patient simulator as P (static) = 200 mmHg.
5. Select [**Main Menu**] → [**Maintenance >>**] → [**User Maintenance >>**] → [**Cal. IBP Press. >>**]. In the [**Cal. IBP Press**.] menu, set the calibration value to 200 mmHg.
6. Select the [**Calibrate**] button next to the desired IBP channel to start a calibration.
7. If the calibration is completed successfully, the message [**Calibration Completed!**] will be displayed. Otherwise, a corresponding message will be displayed.

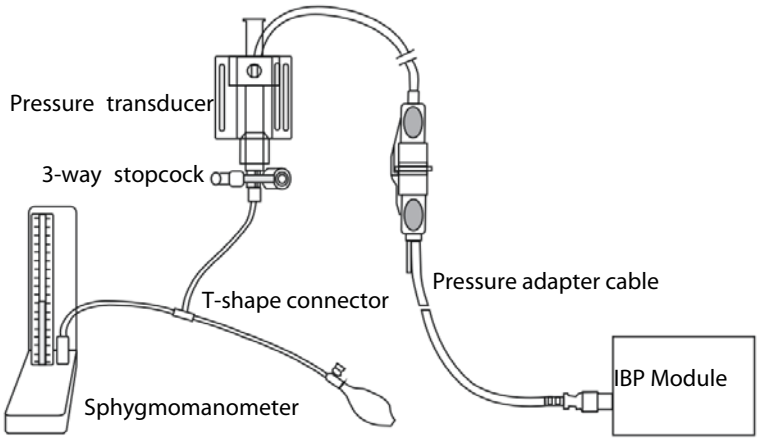
Method 2:

Tools required:

- Standard sphygmomanometer
- Squeeze bulb
- Tubing
- T-shape connector

To perform a calibration:

1. Connect the 3-way stopcock, the sphygmomanometer and the squeeze bulb through a T-shape connector, as shown below.
2. Zero the transducer. Then open the stopcock to the sphygmomanometer.
3. Press the Main menu button on the equipment's front panel. Select [**Maintenance>>**] → [**User Maintenance >>**] → enter the required password → [**Cal. IBP Press. >>**]. Then configure IBP calibration value.
4. Inflate using the squeeze bulb until the reading of sphygmomanometer approximates the preset calibration value.



5. Adjust the calibration value in the [**Cal. IBP Press**.] menu until it is equal to the reading on the sphygmomanometer.
6. Select the [**Calibrate**] button to start a calibration
7. The message [**Calibration Completed!**] is displayed after a successful calibration. If the calibration failed, the prompt [**Calibration Failed!**] will be displayed.

4.3.9 C.O. Test

Tools required:

- Medsim300B Patient simulator
- C.O. adapter box

Follow this procedure to perform the test:

1. Connect the patient simulator to the C.O. module using a C.O. main cable.
2. Set the blood temperature (BT) to 37ºC on the patient simulator and check the temperature value is 37 ± 0.1ºC.
3. Set [**Auto IT**] to [**Off**] and adjust [**IT**] to 24ºC. Select [**C.O. Measure**] to enter the C.O. measurement window and set [**Comp. Const.**] to 0.595.
4. Set the injectate temperature to 24ºC and the C.O. to 5L/min on the C.O. simulator. Select [**Start**] in the C.O. measurement window to start C.O. measurements and after 3-10 seconds press the run key on the simulator.
5. Check the C.O. value is 5±0.25L/min.

4.3.10 CO_2 Tests

See section 4.2.2 CO2 Tests.

4.3.11 AG Tests

See section ***4.2.3AG Tests***.

4.3.12 BIS Test

Tools required:

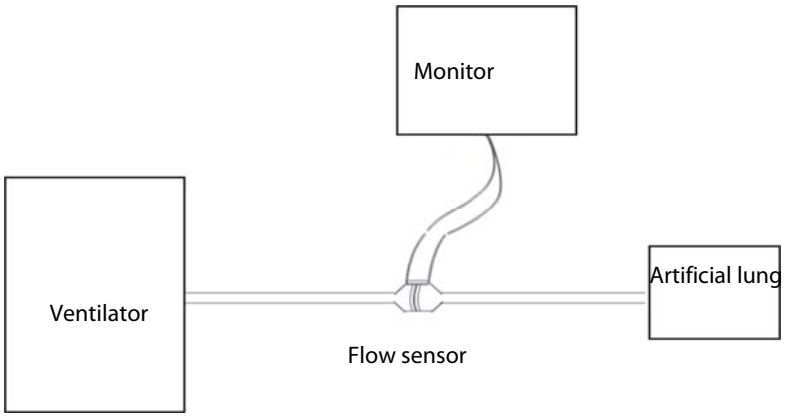
- None.

1. Connect the BIS sensor to a healthy, wide-awake adult as directed in the Operator's Manual.
2. Check the EEG wave and BIS numerics displayed on the screen and make sure the BIS value is within 80-100.

4.3.13 RM Test

Tool required:

- Gas source
- Ventilator (calibrated)
- Artificial lung
- Pediatric/neonate flow sensor



Follow this procedure to perform the test:

1. Connect the equipment as shown above. Make sure that the blue sensing tube on the flow sensor is connected with the artificial lung.
2. Set [**Patient Cat**.] to [**Adu**]. In the [**RM Setup**] menu, select [**Sensor Type**] according to the used sensor and set [**Ventilation Mode**] to [**Mechanical**].
3. Enter the [**RM Setup**] menu and select [**Calibrate >>**]. Input the constant marked on the sensor and calibrate the flow sensor.
4. Configure the ventilator as follows: Vt=500 ml, RR =20 rpm, I:E=1:2.
5. Select [**Respiratory Loop**] in the [**RM Setup**] menu. Verify that the displayed TV is within 500±50ml and RR is within 20±1rpm.

4.3.14 CCO/SvO_2 Tests

4.3.14.1 Interconnecting Function

Tools required:

- None.

1. Connect and set the patient monitor and Vigilance monitor per the procedures in the Operator's Manual.
2. Set the Vigilance monitor to Demo mode.
3. Verify the CCO/SvO_2 numerics displayed on the patient monitor and Vigilance monitor are consistent.

4.3.14.2 Output Performance

Tools required:

- Oscilloscope

1. Connect the signal output end of the connecting cables of the CCO/SvO_2 module to the oscilloscope.
2. Perform an ECG calibration on the monitor. Verify the ECG waves displayed on the oscilloscope are consistent with the ECG calibration waves displayed on the monitor screen.
3. Select [**CCO Setup**] → [**Signal Output Setup >>**] and then select [**Simulated High Value**] from the pop-up menu. Verify the amplitude of the electrical level at the signal output port of MAP, CVP and SpO_2 are 5±0.25V, 5±0.25V and 10±0.5V respectively.

4.3.15 $ScvO_2$ Tests

Tools required:

- None.

1. Connect the $ScvO_2$ sensor to the patient monitor. Verify the front end of the $ScvO_2$ sensor illuminates normally.
2. Pinch the front end of the $ScvO_2$ sensor with two fingers.
3. Verify the patient monitor displays the $ScvO_2$ measurement normally.

4.3.16 Nurse Call Relay Performance Test

Tools required:

- Multimeter

1. Connect the nurse call cable to the Nurse Call Connector of the patient monitor.
2. Enter Demo mode. Then, select [**Main Menu**] → [**Maintenance >>**] → [**User Maintenance >>**] → enter the required password → [**Others >>**] → [**Auxiliary Output**] → [**Nurse Call**].
3. In the [**Others >>**] menu, select [**Nurse Call Setup >>**] and then select all options of [**Alm Lev**] and [**Alarm Cat**.] and set [**Contact Type**] to [**Normally Open**]
4. In [**Nurse Call Setup >>**] setup menu, set [**Signal Type**] to [**Pulse**]. Cause the monitor to generate an alarm and verify the output are pulses of 1s width and the relay contacts are closed (can be measured with a multimeter) when there is an alarm.
5. In [**Nurse Call Setup >>**] setup menu, set [**Signal Type**] to [**Continuous**]. Cause the monitor to generate an alarm and verify the output is continuous high level and the relay contacts are closed (can be measured with a multimeter) when there is an alarm.

4.3.17 Analog Output Performance Test

Tools required:

- Patient simulator
- Oscilloscope

1. Connect the patient simulator to the monitor using an ECG or IBP cable and connect the oscilloscope to the Auxiliary Output Connector of the patient monitor.
2. Select [**Main Menu**] → [**Analog Output Setup**]. Switch Analog Output [**On**].
3. Verify that the waves displayed on the oscilloscope are identical with those displayed on the monitor.

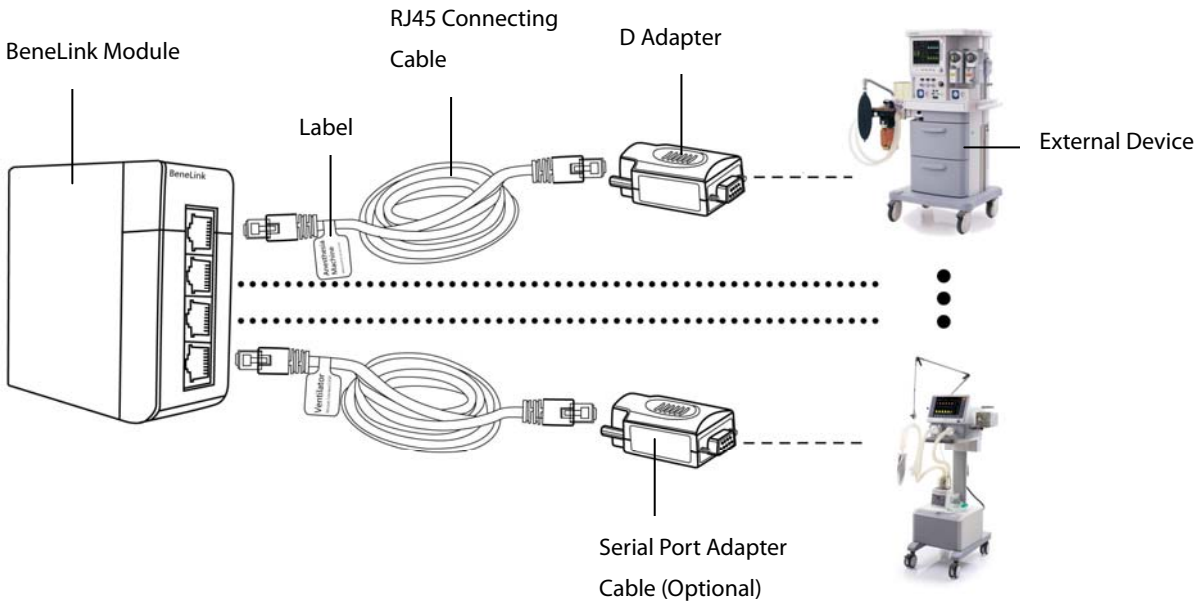
4.3.18 BeneLink Module Check

4.3.18.1 Device Connection and Setup

Tools required:

- External device (anesthesia machine, ventilator)
- ID adapter that maches the external device
- RJ45 connecting cable
- Serial port adapter cable that maches the external device

Please refer to the following procedure to connect an external device:



1. Insert the BeneLink module into the module slot on the patient monitor.
2. Connect the ID adapter that matches the external device to the BeneLink module with a RJ45 connecting cable.
3. Plug the ID adapter into the RS232 port on the external device. Some external devices may have ports incompatible with the ID adapter. In this case, a serial port adapter cable is required. Please be sure that you have selected the proper cable before connection. For the detailed information of the serial port adapter cable, see below table of this section.
4. Attach a label indicating device name to the RJ45 connecting cable at the end closer to the BeneLink module. When the BeneLink module is connected to several external devices, you can tell the devices apart easily with these labels.
5. Switch the external device on.

NOTE

- **Devices in the same category can not be connected to the BeneLink module simultaneously.**
- **Use the serial port adapter cable only with its matching external device. Please see the following table to select the correct adapter cable.**
- **Use the ID adapter only with the matching external device. Please see the following table for correct ID setup in [Factory Maintenance] menu.**

Category	External Device	ID for ID adapter	Type of serial port adapting cable
Anesthesia machine	Draeger Fabius GS/Fabius Tiro	4446BBBA	Fabius GS: No need to use the adapting cable.The ID adapter can be plugged into the serial port of the external device directly. Fabius Tiro: Type C
	Draeger Primus	4450BBB0	Type C
	GE Datex-Ohmeda Avance/Aisys	4F41B0BF	Type D
	GE Datex-Ohmeda Aestiva 7100/7900	4F37B0C9	Type D
	Maquet Flow-i	4D46B2BA	Type B
	Mindray A3/A5/A7	4D52B2AE	No need to use the adapting cable: the ID adapter can be plugged into the serial port of the external device directly.
Ventilator	Carefusion Vela	564ca9b4	Type E
	Draeger Babylog 8000 plus/Babylog 8000	4442bbbe	Type B
	Draeger Evita 2/Evita 2 dura/Evita 4/Evita XL	4434BBCC	Type B
	Draeger Infinity V500	4456bbaa	No need to use the adapting cable. The ID adapter can be plugged into the serial port of the external device directly.
	Draeger Savina 300	4441bbbf	Type B
	GE CARESCAPE R860	4F52B0AE	Type B
	GE Engstrom Carestation	4F45B0BB	Type B
	Hamilton C2	3270CD90	Type B
	Hamilton Galileo	4750B8B0	Type B
	Hamilton G5 (protocol Block)	3542CABE	Type B
	Hamilton G5 (protocol Polling)	3550CAB0	Type B
	Maquet SERVO-I/SERVO-S	4D53B2AD	Type B
	Maquet SERVO-U	4d55B2AB	Type B
	Newport E360	4E50B1B0	Type B

Category	External Device	ID for ID adapter	Type of serial port adapting cable
Ventilator	Philips Respironics V60	VPRT： 5637A9C9 SDNA:5636A9CA	Type B
	Puritan Bennett 840	SNDF: 5042AFBE(recommended) SNDA: 5031AFCF(supports fewer parameters than protocol SNDF)	No need to use the adapting cable. The ID adapter can be plugged into the serial port of the external device directly.
	ResMed VSIII	5653a9ad	Type C
Neuromuscular transmission monitor	Organon TOF-Watch® SX	5457ABA9	Type C
Transcutaneous monitor	TCM CombiM/TCM TOSCA	5443ABBD	Type C
	SenTec SDMS tcPCO2	5354ACAC	Type C

Serial port adapting cable	PN	Remark
Type A	009-001767-00	Male to female
Type B	009-001768-00	Male to male
Type C	009-001769-00	Male to male
Type D	009-002943-00	9-pin to 15-pin
Type E	009-004613-00	9-pin to RJ45 connector

4.3.18.2 Device Integration Function Test

Preparation

Prepare the tools and/or equipment necessary for function testing according to the type of external device you install. Please see the Instructions for Use of the corresponding external device for guidance. For the function testing of ventilator and anesthesia machine, the following tools are required:

- Passport 12M patient monitor with BeneLink module properly installed
- External device under test (anesthesia machine or ventilator) under test
- Gas source(tube or gas cylinder), including medical air or oxygen . Other anethetic gases such as N_2O are optional.
- Test lung and a matching Y-tubing, or other accessories

Procedure and Items to Be Checked

Follow the steps below:

1. Connect the BeneLink module to the ventilator or the anesthesia machine. See Device Connection and Setup for more details.
2. Connect the gas supply and test lungs to the ventilator or anesthesia machine, turn on the device, and configure as follows:
   - Set up the serial port of the external device by refering to ***Serial Port Configuraion List***.
   - Set up the pressure control mode and verify the ventilator or anesthesia machine works properly.
3. Make sure the ID adapter is properly configured and the green indicator of corresponding port on the BeneLink module illuminates constantly.
4. Access the [**Devices Integrated**] screen on the patient monitor. Verify the device type (ventilator or anesthesia machine) and ventilation mode are properly displayed.
5. Select parameters PEEP, Pmean, VTe, MV, I:E, and f (RR) and verify the parameter values displayed on the patient monitor are consistent with those displayed on the ventilator or anesthesia machine.
6. Re-configure the above parameters on the ventilator or the anesthesia machine and verify the parameter values displayed on the patient monitor change accordingly.
7. Trigger alarms [**MV Too Low**], [**Airway Pressure Too High**], [**PAW Too High**], [**Peak Too High**], and [**No Gas Supply**] (no Air or O2) on the ventilator or the anesthesia machine. Verify these alarm messages are properly recorded in the alarm list of the patient monitor.
8. Switch the ventilator or anesthesia machine to volume control ventilation mode. Verify the ventilation mode displayed on the patient monitor changes accordingly, and that the parameter values for PEEP, Pmean, VTe, MV, I:E, and f (RR) are displayed properly.

Serial Port Configuration List

Category	External Device	Setup	Remark
Anesthesia machine	Drager Fabius GS/Plus/Tiro	Protocol: Medibus Baud Rate: 9600 Word Length: 7 bits Parity: even Stop Bits: 1	/
	Drager Primus	Protocol: Medibus Baud Rate::9600 Word Length: 8 bits Parity: even Stop Bits: 1	/
	GE Datex-Ohmeda Aestiva 7100/7900	Not required.	The following information is for further reference: Baud Rate: 19200 bps Word Length: 7 bits Parity: odd Stop Bits: 1
	GE Datex-Ohmeda Avance/Aisys	Not required.	The following information is for further reference: Baud Rate: 19200 bps Word Length: 7 bits Parity: odd Stop Bits: 1
	Maquet Flow-i	Not required.	/
	Mindray A3/A5/A7	Not required.	/
Ventilator	Carefusion Vela	Baud Rate: 115200 bps Word Length: 8 bits Parity: None Stop Bits: 1	/
	Draeger Babylog 8000 plus/Babylog 8000	Not required.	/
	Draeger Evita 2	Channel A: Not required; Channel B: Protocol: Medibus Baud rate: 19200 Parity: even Stop Bits: 1	/
	Draeger Evita 2 dura/ Evita 4/ Evita XL	Protocol: Medibus Baud Rate: 19200 Parity: even Stop Bits: 1 Interval: ---(Evita 2 dura)	/

Category	External Device	Setup	Remark
Ventilator	Draeger Infinity V500	Not required.	The following information is for further reference: Baud Rate: 19200 bps Parity: even Stop Bits: 1
	Draeger Savina 300	Baud Rate: 19200 bps Parity: even Word Length: 1 bit Stop Bits: 1	/
	GE CARESCAPE R860	Baud Rate: 19200 bps Parity: odd Word Length: 7 bits Stop Bits: 1	/
	GE Engstrom Carestation	Baud Rate: 19200 bps Parity: odd Word Length: 7 bits Stop Bits: 1	/
	Hamilton C2（protocol Polling）	Protocol: Polling.	The following information is for further reference: Baud Rate: 9600 bps Word Length: 7 bits Parity: even Stop Bits: 2
	Hamilton Galileo （protocol Polling）	Not required.	The following information is for further reference: Baud Rate: 9600 bps Word Length: 7 bits Parity: even Stop Bits: 2
	Hamilton G5（protocol Block）	Protocol: Block.	The following information is for further reference: Baud Rate: 38400 bps Word Length: 8 bits Parity: none Stop Bits: 1
	Hamilton G5（protocol Polling）	Protocol: Polling.	The following information is for further reference: Baud Rate: 9600 bps Word Length: 7 bits Parity: even Stop Bits: 2

Category	External Device	Setup	Remark
Ventilator	Maquet SERVO-I/SERVO-S	Not required.	The following information is for further reference: Baud Rate: 9600 bps Word Length: 8 bits Parity: even Stop Bits: 1
	Maquet SERVO-U	Baud Rate: 38400 bps Parity: even Word Length: 8 bits Stop Bits: 1	/
	Newport E360	Protocol: Newport	The following information is for further reference: Baud Rate: 38400 bps Word Length: 8 bits Parity: NONE Stop Bits: 1
	Philips Respironics V60	Baud Rate: 19200 bps Word Length: 8 bits Parity: NONE Stop Bits: 1	/
	Puritan Bennett 840	Baud Rate: 38400 Word Length: 8 bits Parity: NONE	/
	ResMed VSIII	Baud Rate: 9600 bps Word Length: 8 bits Stop Bits: 1	/
Neuromuscular transmission monitor	Organon TOF-Watch® SX	Baud Rate: 19200 bps Word Length: 8 bits Parity: None Stop Bits: 1	/
Transcutaneous monitor	TCM CombiM/TCM TOSCA	Protocol: Monlink.	The following information is for further reference: Baud Rate: 9600 bps Word Length: 8 bits Parity: even Stop Bits: 1
	SenTec SDMS tcPCO2	Baud Rate: 115200 bps Word Length: 8 bits Parity: None Stop Bits: 1	/

4.4 Electrical Safety and Other Tests

4.4.1 Electrical Safety and Other Test Frequencies

Check/Maintenance Item		Frequency
Electrical safety tests		Refer to ***Appendix A Electrical Safety Inspection***.
Power on test		1. When first installed or reinstalled. 2. Following any maintenance or the replacement of any main unit parts.
Touchscreen calibration		1. When the touchscreen accuracy diminishes. 2. After the touchscreen is replaced.
Recorder check		Following any repair or replacement of the recorder.
Network print test		1. When first installed. 2. Whenever the printer is serviced or replaced.
Battery check	Function test	1. When first installed. 2. Whenever a battery is replaced.
	Performance test	Once a year or if the battery run time is significantly reduced.

4.4.2 Electrical Safety Test

See Appendix A Electrical Safety Inspection for electrical safety tests.

4.4.3 Power On Test

This test is to verify that the patient monitor can power up correctly. The test is passed if the patient monitor starts up by following this procedure:

1. Insert two batteries in the battery chamber and connect the patient monitor to the AC mains, the AC mains LED and battery LED light.
2. Press the power on/off switch to switch on the patient monitor. The operating status LED lights up, and the technical and physiological alarm lamps light blue and red respectively.
3. After the start-up screens are displayed, the system sounds a beep indicating the self test on alarm sounds is passed. At the same time, the alarm lamp turns from yellow to red, and then turns off together with the technical alarm lamp. This indicates that the self test on alarm lamps is passed.
4. The patient monitor enters the main screen and start-up is finished.

4.4.4 Touchscreen Calibration

Tools required:

- None.

1. Select [**Main Menu**] → [**Maintenance >>**]→ [**Cal. Touchscreen**]. The symbol will appear at different positions on the screen.
2. Touch, in turn, the central point of the symbol. After the calibration is completed, the message [**Screen Calibration Completed!**] is displayed.
3. Select [**Ok**] to confirm.

4.4.5 Recorder Check

Tools required:

- None.

1. Print ECG waveforms. The recorder should print correctly and the printout should be clear.
2. Remove the paper roll to generate an out of paper error. The patient monitor should display the proper message for the condition created. After the problem is removed, the recorder should work properly.
3. Switch on automatic alarm recording for each parameter and then set each parameter's limit outside set alarm limits. Corresponding alarm recordings should be triggered when parameter alarms occur.

4.4.6 Network Print Test

Note

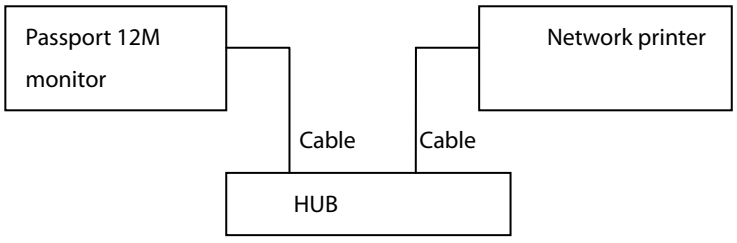
- **Use the recommended printers specified in the operator's manual (PN: 046-005013-00).**

Tools required:

- Hub and network cable

4.4.6.1 Equipment Connection and Setup

1. Connect the patient monitor and network printer to a HUB using common network cables as follows:



2 Set IP address as follows: Select [**Main Menu**] → [**Maintenance >>**] → [**User Maintenance >>**] → enter the required password → [**Network Setup >>**] → [**Monitor Network Setup >>**], set the IP address of the patient monitor in the same network segment with that of the network printer. (See the instructions for use accompanying the printer)

3 Search for printer by selecting [**Main Menu**] → [**Print Setup >>**] → [**Printer Setup >>**] → [**Search Printer**]. After a while, the printer's model and IP address will appear in the box beside [**Printer**].

4.4.6.2 Print Function Test

1 Enter the Demo mode of the patient monitor.

2 Select [**Main Menu**] → [**Print Setup >>**] → [**Realtime Reports >>**] → [**Normal Report**] and then select [**Print**]. The network printer should print out the report correctly.

4.4.7 Battery Check

Tools required:

- None.

4.4.7.1 Function Test

1. Remove any batteries that are installed in the patient monitor.
2. Verify that the patient monitor works properly when running on AC power.
3. Insert two fully charged batteries per the procedures provided in the Operator's Manual.
4. Remove the AC power cord and verify that the patient monitor still works properly.
5. Remove one battery and verify that the patient monitor continues to work correctly. Verify that the patient monitor can also work independently from the other battery.

4.4.7.2 Performance Test

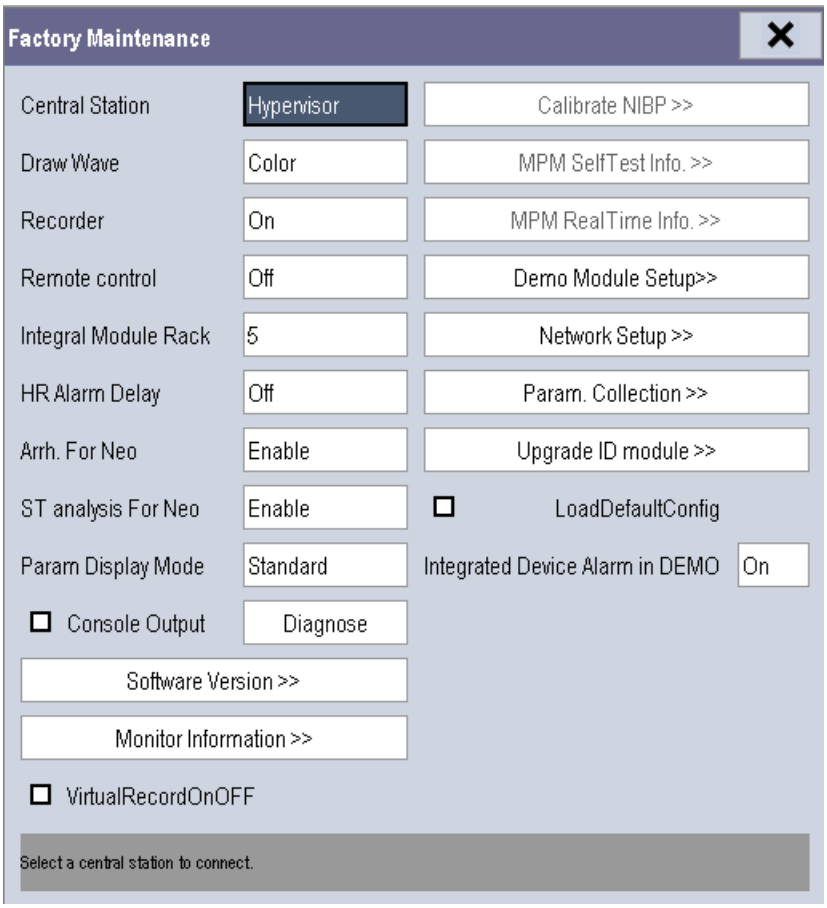
Perform the test procedure in the ***Battery*** chapter in the Operator's Manual and verify the operating time of the battery meets the product specification.

4.5 Factory Maintenance

4.5.1 Accessing Factory Maintenance Menu

To access the factory maintenance menu, select [**Main Menu**] → [**Maintenance >>**] → [**Factory Maintenance**] and then enter the required password.

The [**Factory Maintenance**] menu is shown below.



4.5.2 Drawing Waves

In the [**Factory Maintenance>>**] menu, select [**Draw Wave**] to define the method to draw waves. There are two methods to draw waves:

- Color: selecting Color will have smoother waveforms.
- Mono: selecting Mono will have a wider viewing angle.

4.5.3 Enabling/Disabling the Recorder

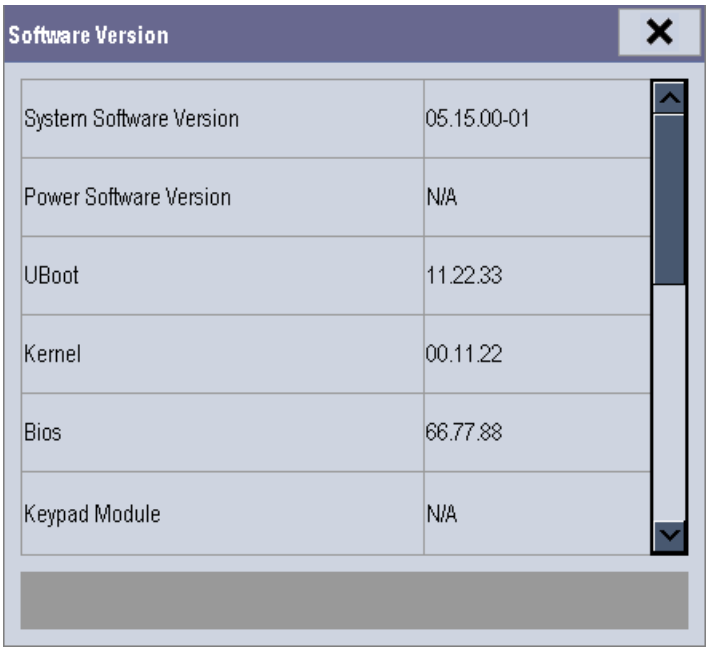
To enable/disable the recorder, select [**Recorder**] and toggle between [**On**] and [**Off**].

CAUTION

- **The recorder is disabled if [Recorder] is switched off in the [Factory Maintenance>>] menu.**

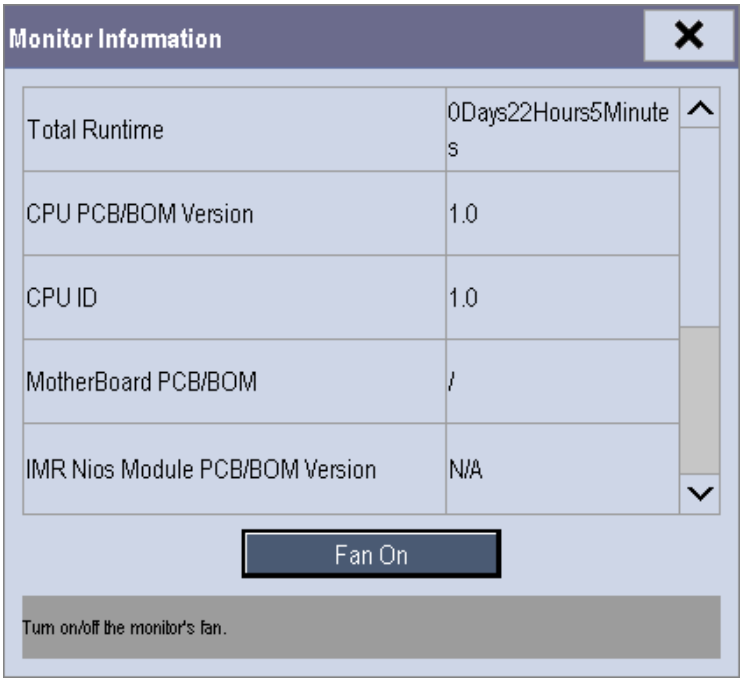
4.5.4 Checking Software Version

In the [**Factory Maintenance**] menu, select [**Software Version**] to show software version information. The [**Software Version**] menu is as follows:



4.5.5 Checking Monitor Information

In the [**Factory Maintenance**] menu, select [**Monitor Information**] to show the status of the patient monitor.



FOR YOUR NOTES

5 Troubleshooting

5.1 Introduction

In this chapter, patient monitor problems are listed along with possible causes and recommended corrective actions. Refer to the tables to check the patient monitor, identify and eliminate these problems.

For more information on troubleshooting, contact our Mindray Technical Support Department.

5.2 Part Replacement

Printed circuit boards (PCBs), major parts and components in patient monitors are replaceable. Once you isolate a PCB you suspect defective, follow the instructions in ***Repair and Disassembly*** to replace the PCB with a known good one. Verify proper operation and that the patient monitor passes all performance tests.
To obtain information on replacement parts, refer to ***Parts.***

5.3 Patient Monitor Status Check

Some troubleshooting tasks may require you to identify the hardware version and status of your patient monitor.

1. To view the information on system start time, self check, etc., select [**Main Menu**] → [**Maintenance >>**] → [**Monitor Information >>**].
2. You can also view the information on the monitor's current status by selecting [**Main Menu**] →[**Maintenance>>**] → [**Factory Maintenance>>**] → enter the required password → [**Monitor Information >>**].

5.4 Software Version Check

Some troubleshooting tasks may require you to identify the configuration and software version of your patient monitor.

1. To view information on the system configuration and system software version, Select [**Main Menu**] → [**Maintenance>>**] → [**Software Version>>**].
2. You can also view the information on system software version and module software version by selecting [**Main Menu**] → [**Maintenance>>**] → [**Factory Maintenance>>**] → enter the required password →[**Software Version>>**].

5.5 Technical Alarm Check

Before troubleshooting the patient monitor, check for technical alarm message. If an alarm message is presented, eliminate the technical alarm first. For detailed information on technical alarm messages, possible causes and corrective actions, refer to the 12M's Operation Manual.

5.6 Troubleshooting Guide

5.6.1 Power On/Off Failures

Symptoms	Possible Cause	Corrective Action
The patient monitor fails to start. AC LED or battery LED does not light	AC mains not connected or battery too low	Verify the AC mains is properly connected or battery capacity is sufficient.
	Power supply protection	Refer to ***5.6.9 Power Supply Failures*** .
	Cables defective or poorly connected	1. Verify the cables from power switch & LED board to button board, button board to main board, and power module to main board are correctly connected. 2. Verify the cables and connectors are not damaged.
	Power switch & LED board defective	Replace the power switch & LED board.
	Power module defective	Replace the power module.
	Mother board Defective	Replace the mother board.

5.6.2 Display Failures

Symptoms	Possible Cause	Corrective Action
Integrated display is blank.	Cables defective or poorly connected.	1. Verify the cable from the display to the mother board and the cables from the backlight board respectively to the button board and the display are correctly connected. 2. Verify the cables and connectors are not damaged.
	Backlight board defective	Replace the backlight board.
	Power module defective	Replace the power module.
	Display defective	Replace the display.
Secondary display does not function.	Cables defective or poorly connected.	1. Verify the cable between the secondary display and the patient monitor is correctly connected. 2. Verify the cables and connectors are not damaged.
	DVI interface board defective	Replace the DVI interface board.
Secondary display shows snows or flashing specks	Cables defective or poorly connected.	1. Verify the cable between the display and the patient monitor is correctly connected. 2. Verify the cables and connectors are not damaged.
	DVI interface board defective	Replace the DVI interface board.

	The mother board is defective.	Replace the mother board.
Images overlapped or distorted	FPGA error.	Update or upgrade FPGA.
	Cables defective or poorly connected.	1. Verify the cable between the display and mother board is correctly connected. 2. Verify the cables and connectors are not damaged.
Touchscreen does not respond	Touchscreen disabled	Check if there is a symbol  shown above the [**Main Menu**] QuickKey. If yes, press the [**Main Menu**] QuickKey for more than 3s to enable the touchscreen.
	Cables defective or poorly connected.	1. Verify the cables from the touchscreen to the touchscreen control board, the touchscreen control board to the button board, and the button board to the mother board are correctly connected. 2. Verify the cables and connectors are properly connected.
	Touchscreen control board defective	Replace the touchscreen control board.
	Button board defective.	Replace the button board.
	Touchscreen defective.	Replace the touchscreen.
	Mother board defective	Replace the mother board.
Touchscreen accuracy is off	Touchscreen needs to be calibrated	Calibrate the touchscreen.

5.6.3 Module Rack Failures

Symptoms	Possible Cause	Corrective Action
SMR		
SMR cannot identify parameter modules	Extension Cable defective or improperly connected	1. Verify the powered USB cable between SMR and main unit is connected to the SMR connector on the monitor. 2. Verify the connecting cables and connectors are not damaged. 3. Check that contact screws on SMR are tight.
	Defective parameter module	Replace the malfunctioning parameter module with a known good module. If the patient monitor identifies the replacement module, the original module is faulty.
	Wrong communication board software revision	Upgrade the module and/or the SMR software to a compatible level.
	Module is not recognized in all slots, only certain slots.	Replace the Nios II module. Replace the 8-slot module rack communication board.
	Power supply failure	1. Verify there is 12VDC potential as measured across two contact points for a module slot. If yes and the parameter module functions properly then the PCB assembly in SRM might be faulty. 2. If there is no 12 VDC power sent to the SMR, check whether the power voltage output to the USB_Hub board by the power module reaches 12VDC. If yes, the fuse of the USB interface board might be open. Replace the USB_Hub board.

Symptoms	Possible Cause	Corrective Action
	Cable defective or improperly connected	1. Verify the cable between the SMR interface board and the communication board is properly connected. 2. Verify the connecting cables and connectors are not damaged.
	Nios II module loose or not working	1. Verify the Nios II module is correctly connected. 2. If the symptom persists, replace the Nios II module.
	SMR interface board failure	Replace the SMR interface board.
	SMR communication board failure	Replace the SMR communication board.
	USB_Hub board failure	Replace the USB_Hub board.
	Mother board failure	Replace the mother board.
Integral module rack		
Integral module rack cannot identify parameter modules	Module failure	Replace parameter module. If a new module is identified, the original one is defective.
	Cable defective or improperly connected	1. Verify the cables from the 3-slot module rack communication board to the MPM module rack communication board, and the module rack to the mother board are properly connected. 2. Verify the connecting cables and connectors are not damaged.
	Wrong communication board software revision	Upgrade the module or the integral module rack software to a compatible version.
	Module is not recognized in all slots, only certain slots.	Replace the corresponding module rack communication board.
	Power supply to integral module rack is not correct	1. Verify there is 12VDC potential as measured across two contact points for a module slot. If yes and the parameter module functions, PCB assembly in the SMR might be faulty. 2. If there is no 12VDC sent to the integrated module rack, verify the power module output voltage to the mother board reaches 12VDC. If yes, the mother board might be faulty.
	3-slot or MPM module rack communication board failure	Replace the 3-slot or MPM module rack communication board.
	Nios II module failure	Replace the Nios II module.
	Mother board failure	Replace the mother board.

5.6.4 Alarm Problems

Symptoms	Possible Cause	Corrective Action
No visual alarm indicator when the audible alarm is sounding.	Cable defective or improperly connected	1. Verify the cables from the alarm LED board to the button board and button board to the mother board are properly connected. 2. Verify the connecting cables and connectors are not damaged.
	Alarm LED board failure	Replace the alarm LED board.
	Button board failure	Replace the button board.
	Mother board failure	Replace the mother board.
No audible alarm sounds emitted when visual alarm is activated.	Audible alarm is disabled	Select [**Main Menu**] → [**Maintenance >>**] → [**User Maintenance >>**] → enter the required password → [**Alarm Setup >>**], and then in the popup menu, set [**Minimum Alarm VolumeAlm Sound**] to appropriate setting [**On**]. In the [**Others**] window of the [**Alarm Setup**] menu, set [**Alm Volume**] to appropriate setting.
	Cable defective or poorly connected	1. Verify the cable between speaker and mother board is properly connected. 2. Verify the connecting cables and connectors are not damaged.
	FPGA audio logic error	Upgrade the audio logic part of the FPGA program.
	Speaker failure	Replace the speaker.
	Mother board failure	Replace the mother board.

5.6.5 Button and Knob Failures

Symptoms	Possible Cause	Corrective Action
Buttons do not work	Cable defective or poorly connected	1. Verify the cable between the button board and mother board is properly connected. 2. Verify the connecting cables and connectors are not damaged.
	Button board failure	Replace the button board.
Rotary encoder does not work	Cable defective or improperly connected	1. Verify the cables from the knob to the button board, and the button board to the mother board are properly connected 2. Verify the connecting cables and connectors are undamaged.
	Encoder failure	Replace the encoder.
	Button board failure	Replace the button board.

5.6.6 Recorder Failures

Symptoms	Possible Cause	Corrective Action
No printout	Recorder module disabled	1. Verify the recorder status LED is lit. 2. If yes, enable the module in the [**Factory Maintenance**] menu. If it is not lit, check for other possible causes.
	Paper is installed upside down	Remove and reinstall the paper roll properly.
	Cable defective or improperly connected	1. Verify the cable between the recorder and the mother board is properly connected. 2. Check that the connecting cables and connectors are not damaged.
	Recorder power supply failure	Verify the power module's 5 VDC and 12VDC outputs are present.
	Recorder failure	Replace the recorder.
Poor print quality or paper not feeding properly	Paper roll not properly installed	Stop the recorder and re-install the paper roll.
	Print head dirty	1. Verify the thermal print head and the paper roller for foreign matter. 2. Clean the thermal print head with an appropriate cleaning solution.
	Print head failure	Replace the recorder.
	Recorder failure	Replace the recorder.

5.6.7 Output Interface Failures

Symptoms	Possible Cause	Corrective Action
No analog signals or nurse call signals are generated	Respective output disabled	1. Select [**Main Menu**] → [**Analog Output Setup**] → set [**Analog Output**] to [**On**].
	USB_Hub board cable is loose	1. Verify the cable between the USB_Hub board and the mother board is properly connected. 2. Verify the connecting cables and connectors are not damaged.
	USB_Hub board failure	Replace the USB_Hub board.
	Mother board failure	Replace the mother board.
Connected USB devices not working. (It is assumed these devices are working properly when connected elsewhere).	Cable defective or not connected properly	1. Verify the cable between the USB_Hub board and mother board is properly connected. 2. Verify the connecting cables and connectors are not damaged.
	USB_Hub board failure	Replace the USB_Hub board.
	Mother board failure	Replace the mother board.

5.6.8 CF Card Problems

Symptoms	Possible Cause	Corrective Action
CF card malfunctions	Wrong CF card or insufficient storage capacity size	Use the storage card specified by Mindray. Those with 4GB memory space are recommended.
	Data error; CF card error	Format CF card on PC.
	CF card failure	Replace the CF card.
	Cable defective or poorly connected	1. Verify the cable between the CF card board and the mother board is correctly connected. 2. Check that the connecting cables and connectors not damaged.
	CF card pcb failure	Replace the CF card pcb.
	Mother board failure	Replace the mother board.

5.6.9 Power Supply Failures

Symptoms	Possible Cause	Corrective Action
Battery voltage is too low	Battery failure	Replace battery.
	Cable defective or improperly connected	1. Verify the cable is properly connected. 2. Verify the connecting cables and connectors are not damaged.
	Power board failure	Replace the power board.
Battery cannot be recharged	Battery failure	Replace the battery and charge fully. If this is successful, the original battery is faulty.
	Cable defective or improperly connected	1. Verify the cable between the battery interface board and power module is correctly connected. 2. Verify the cables and connectors are not damaged.
	Power board failure	Replace power board
No +3.3 VDC output	1. Power supply protected 2. Power board failure	1. Turn off the patient monitor then restart it. 2. If the problem remains, disconnect the AC mains for 5 s and reconnect it, then restart the patient monitor. 3. If the problem still remains, replace the power board.
No +5.0 VDC output		
No +12 VDC output		

NOTE

- **When the power module fails, it may cause damage to other components, e.g. the monitor suddenly fails during start-up, due to supply protection. In this case, troubleshoot the power module per the procedure described in the table above.**
- **Components of the main unit, SMR and parameter modules are powered by the power module. In the event that a component malfunctions, verify the operating voltage is correct. Refer to *2 Theory of Operation* for the operating voltage and measurement points for each component.**

5.6.10 Wi-Fi Related Problems

Symptoms	Possible Cause	Corrective Action
The monitor is frequently off line or disconnects from the Wi-Fi network. The transmission delay is too long.	The Wi-Fi signal is unstable in the operating area.	1. Check if the Mindray recommended wireless AP is used. If not, verify the AP effective transmission rate meets the throughput requirements of the connected devices. 2. Verify the AP channel bandwidth is 20 MHz. 3. Verify where the monitor is located, the wireless AP signal strength is no less than -65 dBm. 4. Verify where the monitor is located, the signal strength of other Wi-Fi devices at the same channel is no greater than -85 dBm. 5. Verify where the monitor is located, the signal strength of other Wi-Fi devices of adjacent channels is no greater than -50 dBm. 6. Verify that the recommended distance between the monitor and other non-Wi-Fi wireless devices, including wireless devices at the frequency of 2.4GHz, cellular mobile communication networks, microwave ovens, intercoms, cordless phones and electro-surgical units, is no less than 20 cm. 7. Verify that no unauthorized devices are connected to the wireless AP.
	The monitor's Wi-Fi antenna is detached from or not properly connected with the Wi-Fi module.	Disassemble the monitor and properly attach the Wi-Fi antenna.
	Wi-Fi antenna defective	Replace the Wi-Fi antenna.
	Wi-Fi module defective	Replace the Wi-Fi module.

Symptoms	Possible Cause	Corrective Action
Unable to connect to the Wi-Fi network.	The Wi-Fi signal is unstable in the operating area.	1. Verify that the network is available. 2. Check if the network type is correctly set. For example, if LAN is used, set network type to LAN and connect the patient monitor to the network; if WLAN is used, set the network type to WLAN and connect the patient monitor to the network. 3. Check that the SSID and password of the monitor are consistent with those of the wireless AP. 4. Check for IP address conflicts. If any, set the IP addresses correctly. 5. Check if Mindray recommended wireless AP is used. If not, verify the AP effective transmission rate meets the throughput requirements of the connected devices. 6. Verify the AP channel bandwidth is 20 MHz. 7. Verify where the monitor is located, the wireless AP signal strength is no less than -65 dBm. 8. Verify where the monitor is located, the signal strength of other Wi-Fi devices at the same channel is no greater than -85 dBm. 9. Verify where the monitor is located, the signal strength of other Wi-Fi devices of adjacent channels is no greater than -50 dBm. 10. Verify that the recommended distance between the monitor and other non-Wi-Fi wireless devices, including wireless devices at the frequency of 2.4GHz, cellular mobile communication networks, microwave ovens, intercoms, cordless phones and electro-surgical units, is no less than 20 cm.
	The monitor's Wi-Fi antenna is detached from or not connected to the Wi-Fi module.	Properly attach the Wi-Fi antenna.
	Wi-Fi antenna defective	Replace the Wi-Fi antenna.
	Wi-Fi module defective	Replace the Wi-Fi module.
	Main board defective	Replace the main board.

5.6.11 Wired Network Related Problems

Symptoms	Possible Cause	Corrective Action
Frequent dropouts and network disconnects	Improper LAN cable connection	Check LAN cable connection. LAN cable should not be longer than 50 m.
	Improper IP address configuration	Check for IP address conflict. Reconfigure IP address.
The patient monitor is connected to a LAN but cannot view other patients in the View Others mode	Improper LAN cable connection	Check LAN cable connection. LAN cable should not be longer than 50m.
	More than 4 simultaneous requests for viewing the patient monitor	A patient monitor can only be viewed by 4 other patient monitors simultaneously under the View Others mode. Requests in excess of that number will be ignored.
	Incorrect IP configuration	Check for IP address conflict. Reconfigure IP address.
	USB_Hub board failure	Replace the USB_Hub board.

5.6.12 Software Upgrade Problems

Symptoms	Possible Cause	Corrective Action
Bootstrap upgrade fails	Power failure or unintended power off during bootstrap upgrade	Replace the CPU board.
Program upgrade fails	Incorrect network connection	1. Verify the network connector, NOT the CIS connector, on the patient monitor is being used. 2. Verify the hub or switch operates properly. Verify the network cables are the correct type and have been connected properly.
	Wrong upgrade package has been downloaded	Upgrade package should be .pkg files. Select package according to system requirement.
	Incorrect IP address configuration	Configure the IP address to '77.77.1.xx' (xx can be any number between 1 and 253). We recommend not to upgrade a program when the patient monitor is connected to a network with multiple PCs.

5.6.13 Technical Alarm Messages

Please refer to the Operator's manual.

5.6.14 M51A Self Test Information

MPM module uses the integrative parameter board (ECG ASIC).

MPM Selftest Item	Test Value	Corrective Action
DSP selftest information	Not FF	Replace the module
7024 selftest information		
2131 selftest information		
ECG module selftest information		

5.6.15 Device Integration Failures

Symptoms	Possible Cause	Corrective Action
The [**Devices Integrated**] window displays nothing after connection.	The ID adapter is not compatible with the external device.	1. Replace the ID adapter. 2. Upgrade the ID adapter in [**Factory Maintenance**] menu to make the ID adapter match the corresponding external device. See ***4.3.18.1 Device Connection and Setup*** for more about the setup of the ID.
	The serial port adapter cable is not compatible with the external device.	Replace the serial port adapter cable.
	Wrong software version or wrong protocol version of the external device.	Make sure the protocol version and software version are supported by the BeneLink module.
Generate the alarm: [**BeneLink Comm Stop**].	The BeneLink module application software is corrupted.	Update or upgrade the software application of the BeneLink module with the network upgrading tool.
The patient monitor has no response when loading the ID adapter.	The BeneLink module application software is corrupted.	Update or upgrade the software application of the BeneLink module with the network upgrading tool.
	The kernel or the document system of the BeneLink module is damaged.	Return the BeneLink module to Mindray for repair.

FOR YOUR NOTES

6 Repair and Disassembly

6.1 Tools

During disassembly and repair, the following tools may be required:

- Phillips screwdrivers
- Small flat-bladed screwdrivers
- Tweezers
- Needle-nose pliers
- Hex nut driver or socket wrench

6.2 Preparations for Disassembly

Before disassembling the monitor:

- Stop monitoring the patient, turn off the monitor and disconnect all the accessories and peripheral devices.
- Disconnect the AC power source and take out both of the batteries.
- Remove all the modules in the integral module rack. If the SMR is connected, disconnect the SMR from the monitor and then remove all the modules in it.

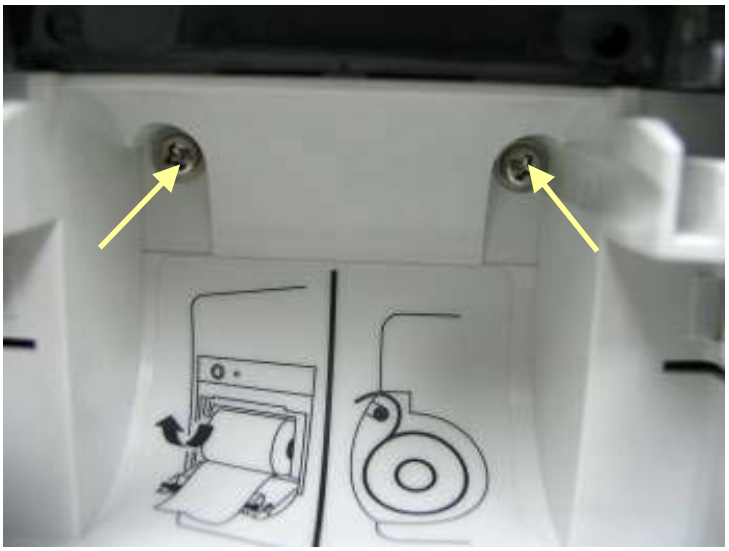
WARNING

- **Before disassembling the monitor, be sure to eliminate any static electricity charges. When disassembling the parts labeled with static-sensitive symbols, make sure you are wearing electrostatic discharge protection such as an antistatic wristband or gloves to avoid damaging the equipment.**
- **Carefully position cables and wires to avoid short circuits and/or pinched tubing when reassembling the monitor.**
- **When assembling the monitor, be sure to use the specified screws. If an incorrect screw is tightened by force, the monitor may be damaged and the screw or the part may fall off during use and cause unpredictable damage or human injury.**
- **Be sure to follow the correct sequence when disassembling the monitor.**
- **Be sure to disconnect all the cables before disassembling any parts. Take care not to damage any cables or connectors.**
- **Be sure to place the monitor face up when disassembling it. Otherwise, the screen or the knob may be scratched or damaged.**

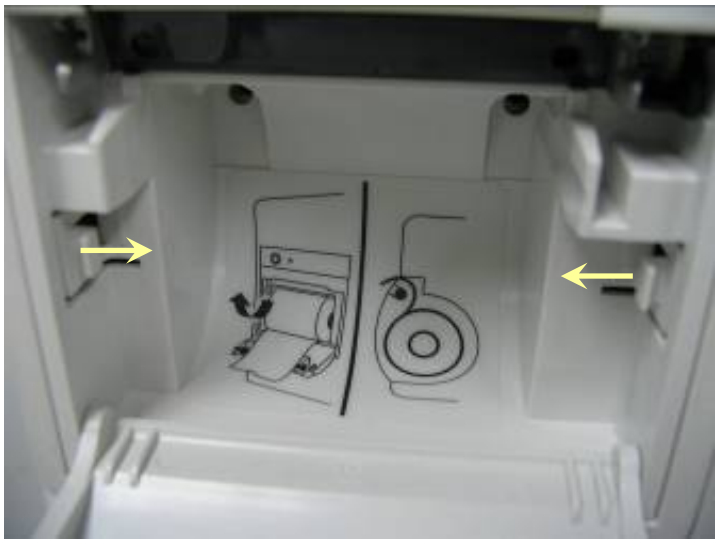
6.3 Disassembling Procedure

6.3.1 Removing the Recorder

1. Open the recorder door and unscrew the two M3×6 screws.



2. Pull the two clips in the directions as indicated and pull out the recorder.



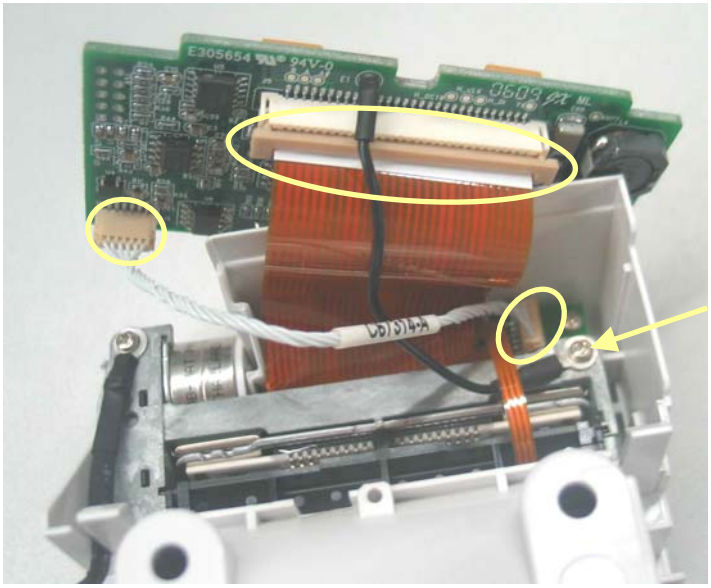
NOTE

- **Take care not to damage the connecting cables or connectors when pulling out the recorder.**

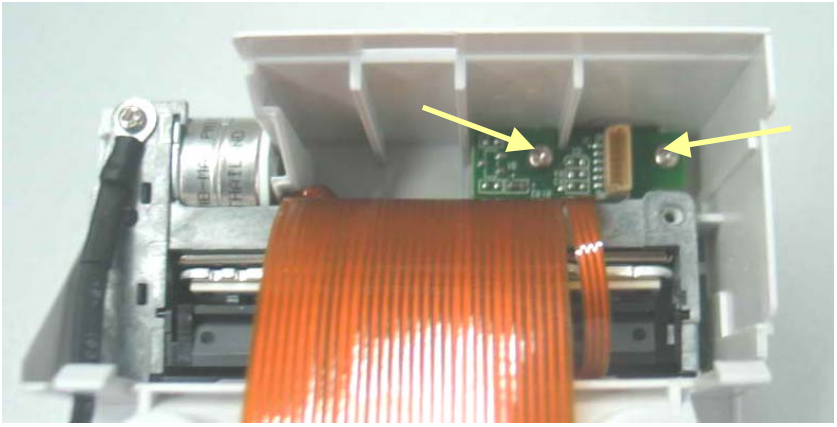
3. Unscrew the M3×6 screw and unplug the recorder grounding cable and the cable between the recorder and the mother board.

4. Pull the two clips backwards and remove the recorder driving board.

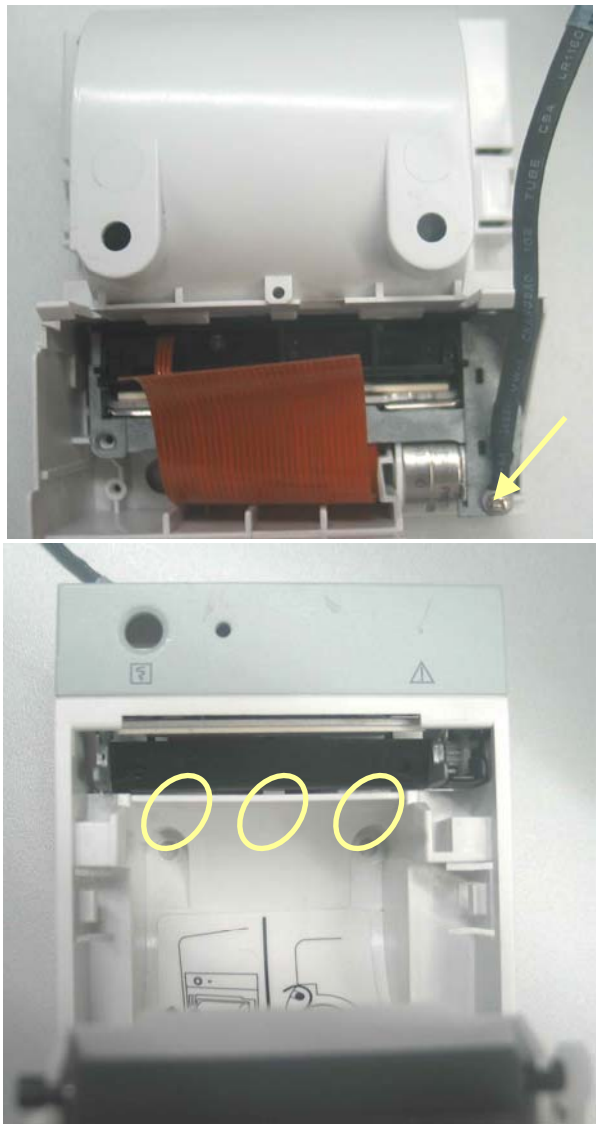
5. Pull the press bar upwards about 1 mm and then unplug the flexible cable. Remove the cable that connects the driving board and the button board. Unscrew the PT2×6 screw and remove the drive board's grounding cable. Then take out the recorder driving board.



6. Unscrew the two PT2×6 screws and take out recorder's button board.

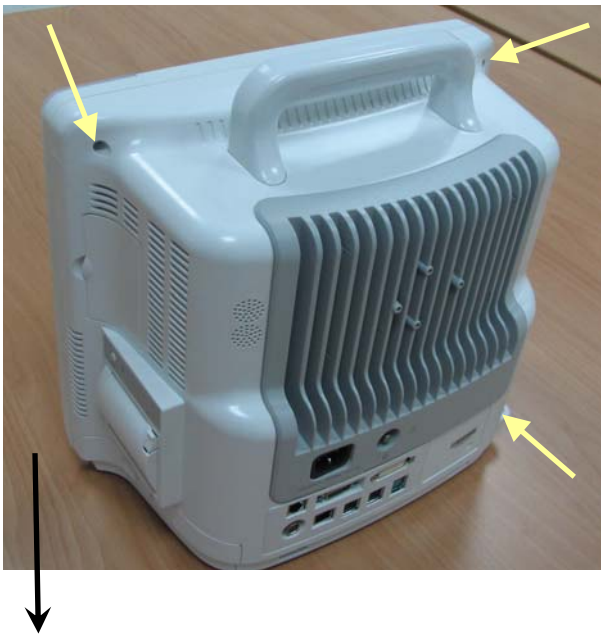


7. Unscrew the PT2×6 screw. Prize the thermal printhead a little using a small flat-bladed screwdriver to remove the printhead.



6.3.2 Separating the Front and Rear Housing

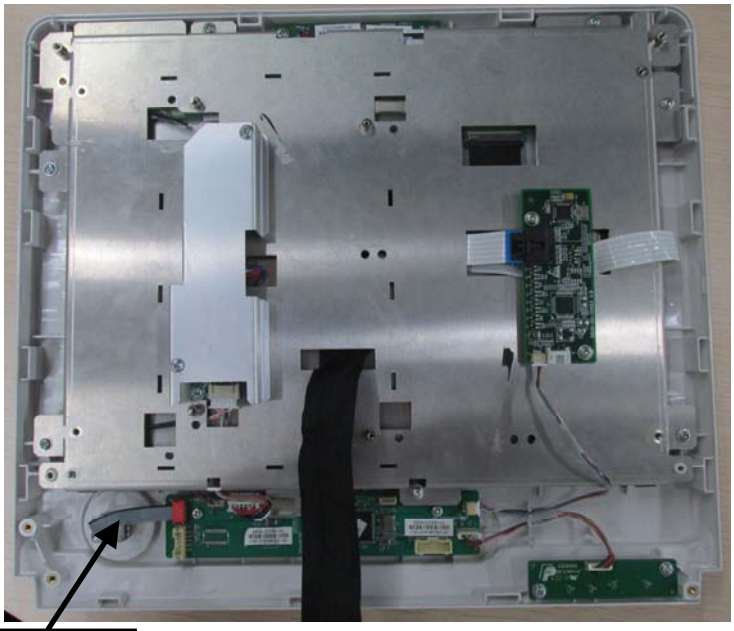
1. Remove the hook and then unscrew the four M3×12 screws, one of which can be seen only when the battery door is openned.



NOTE

- **Exercise care when pulling the front housing out. Take care not to damage the cables and connectors.**
- **Avoid pressing the knob on the table.**

2. Separate the front and rear housing and unplug the connecting cable between button board and main board as well as the cable between the LCD and the main board.



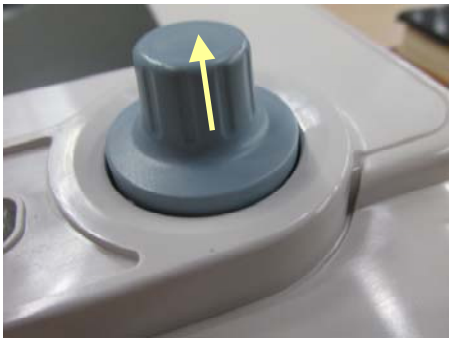
Avoid pressing the knob on the table.

6.3.3 Removing the Power Switch & LED Board

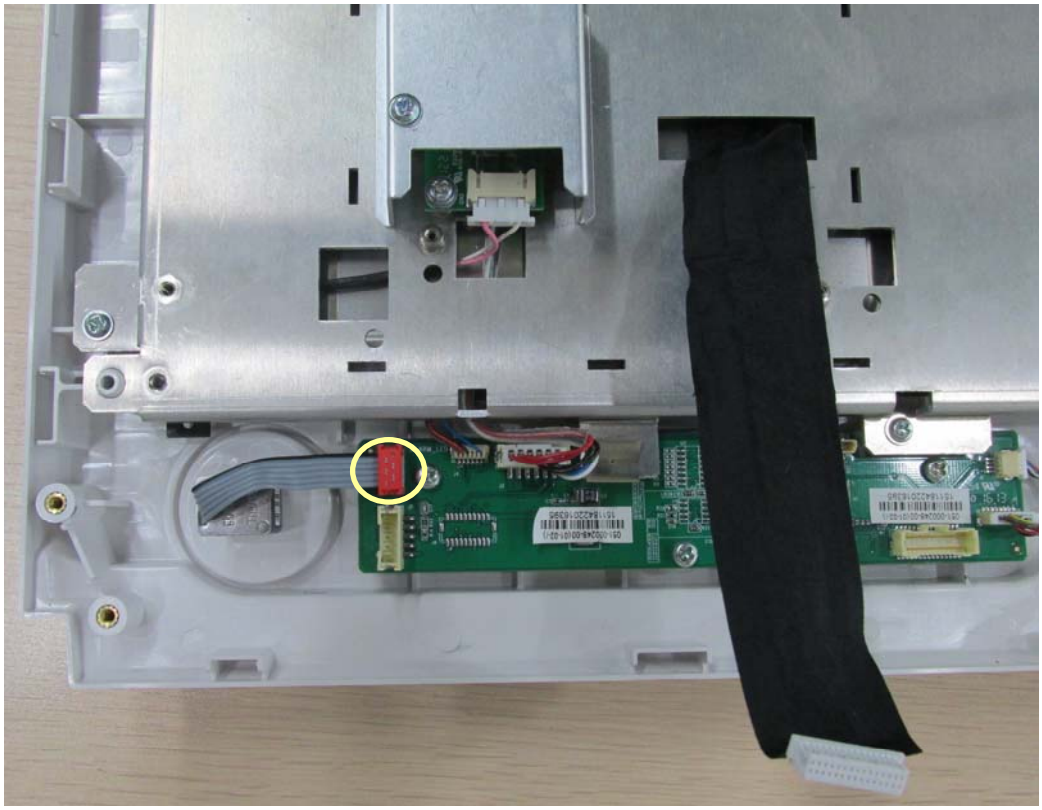
Unplug the connecting cable between power switch & LED board and the button board. Unscrew the two M3×6 screws and remove the power switch & LED board.

6.3.4 Removing the Knob Encoder

1. Pull out the knob encoder and unscrew the nut.

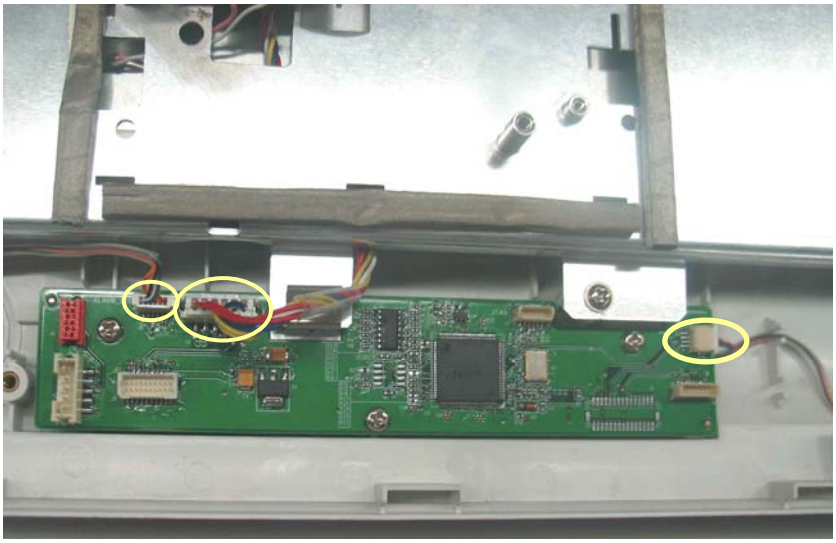


2. Disconnect the cable that connects the knob encoder and the button board to remove the knob encoder.

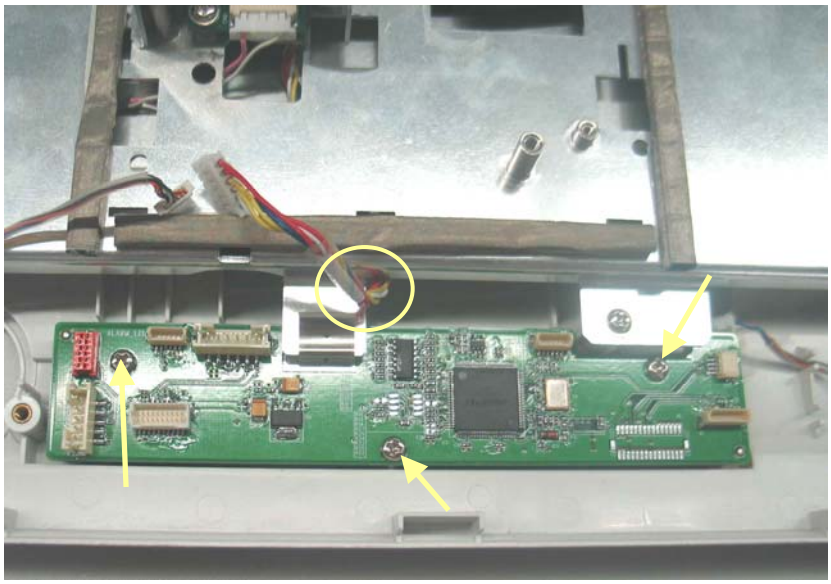


6.3.5 Removing the Button Board

1. Disconnect the cables from the button board to the alarm LED board, backlight board and touchscreen control board.



2. Remove the grounding spring and then remove the three PT3×8 screws and take out the button board.

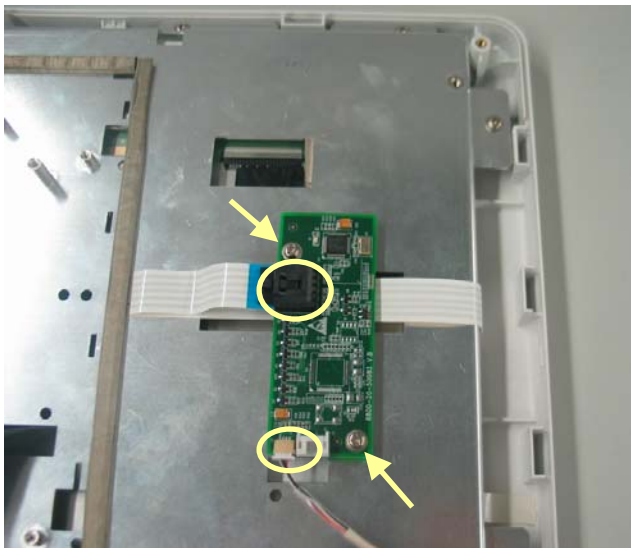


NOTE

- **Do not forget the grounding spring when reassembling..**

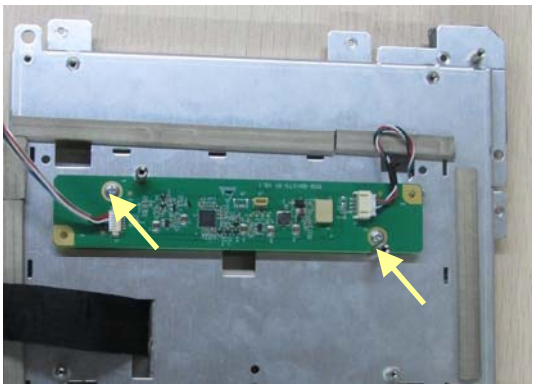
6.3.6 Removing the Touchscreen Control Board

Unplug the cables respectively from the touchscreen and button board to the touchscreen control board. Then, remove the two M3×6 screws and remove the touchscreen control board.



6.3.7 Removing the Backlight Board

Unplug the cables respectively from the button board and the LCD to the backlight board. Remove the two M3×6 screws and remove the backlight board.

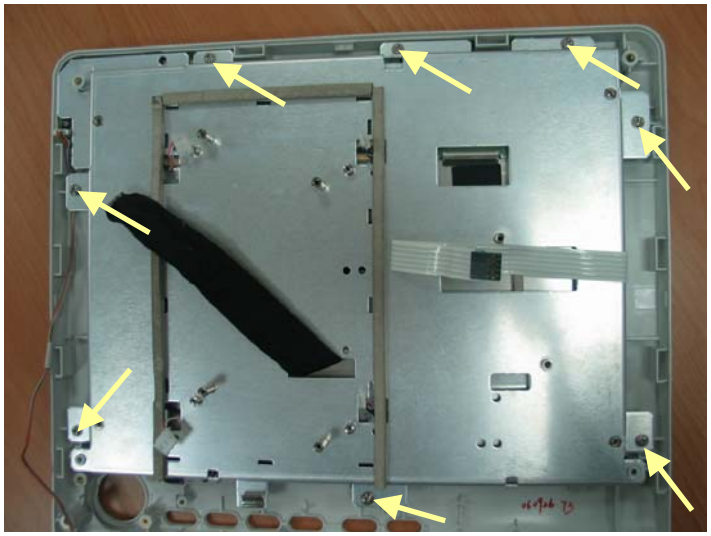


6.3.8 Removing the LCD

CAUTION

- **Do not touch the LCD.**
- **Disassemble the LCD in an environment as dust-free as possible.**

1. Unscrew the eight M3×6 screws and remove the LCD with care. Do not touch the LCD surface and prevent it from being contaminated by dust.



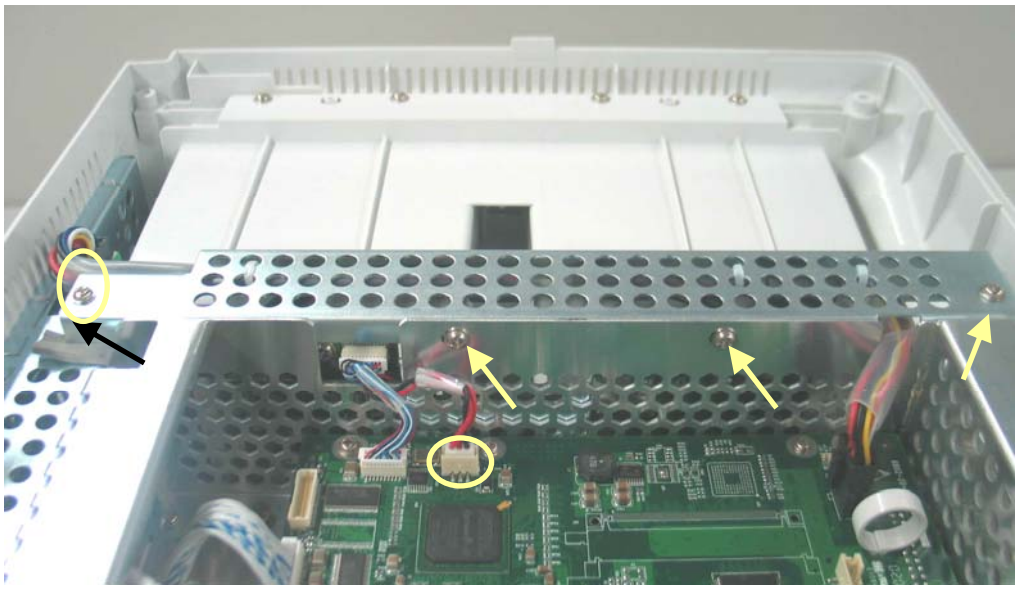
2. Unscrew the four M3×6 screws underneath the screen cover and then remove the LCD.

6.3.9 Removing the Alarm Lamp Board

After removing the LCD, disconnect the cable that connects the alarm lamp board and the button board, and then, unscrew the two PT2×6 screws to remove the alarm lamp board.

6.3.10 Removing the Fan Assembly

Unplug the cable that connects the fan assembly and the mother board. Then, unscrew the four M3×6 screws and remove the fan assembly.

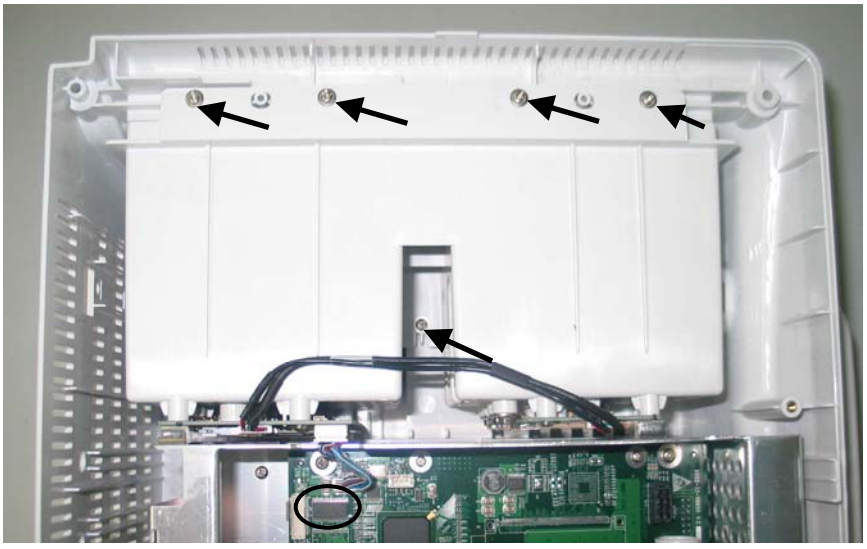


6.3.11 Removing Battery Compartment Assembly

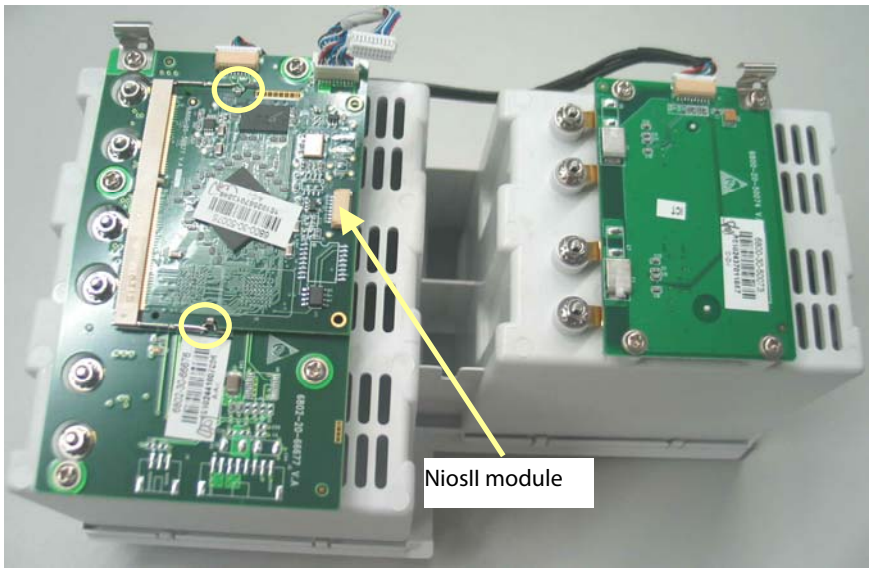
Unplug the cable that connects the battery compartment assembly and the mother board. Then, unscrew the three M3 ×6 screws and take out the battery compartment assembly.

6.3.12 Removing the Integral Module Rack

1. Disconnect the cable that connects the integral module rack and the mother board. Unscrew the five M3×8 screws and remove the integral module rack.



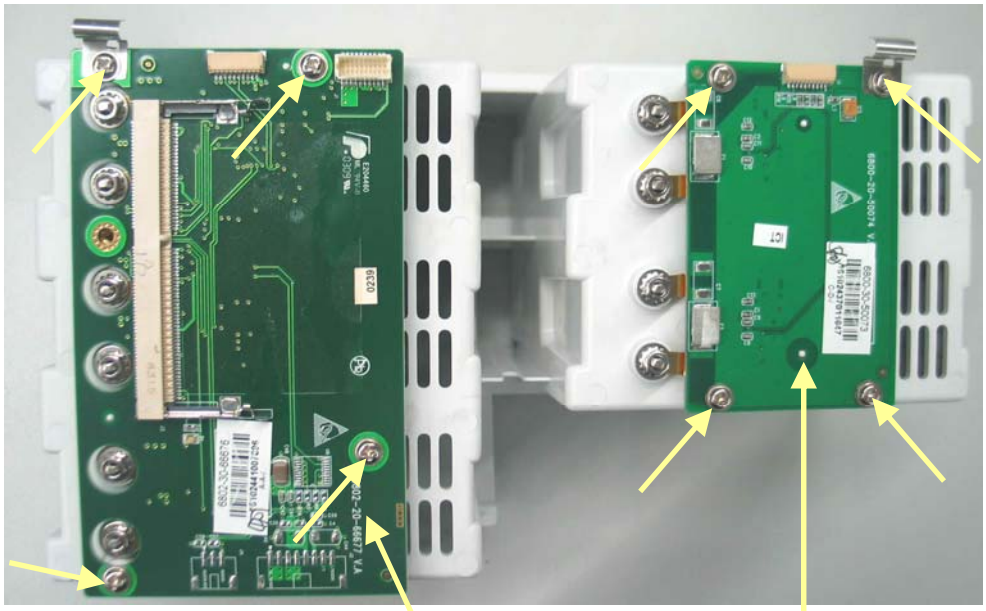
2. Disconnect the cable that connects the MPM module rack communication board and the 3-slot module rack communication board. Release the two snaps and unplug the NiosII module on the 3-slot module rack.



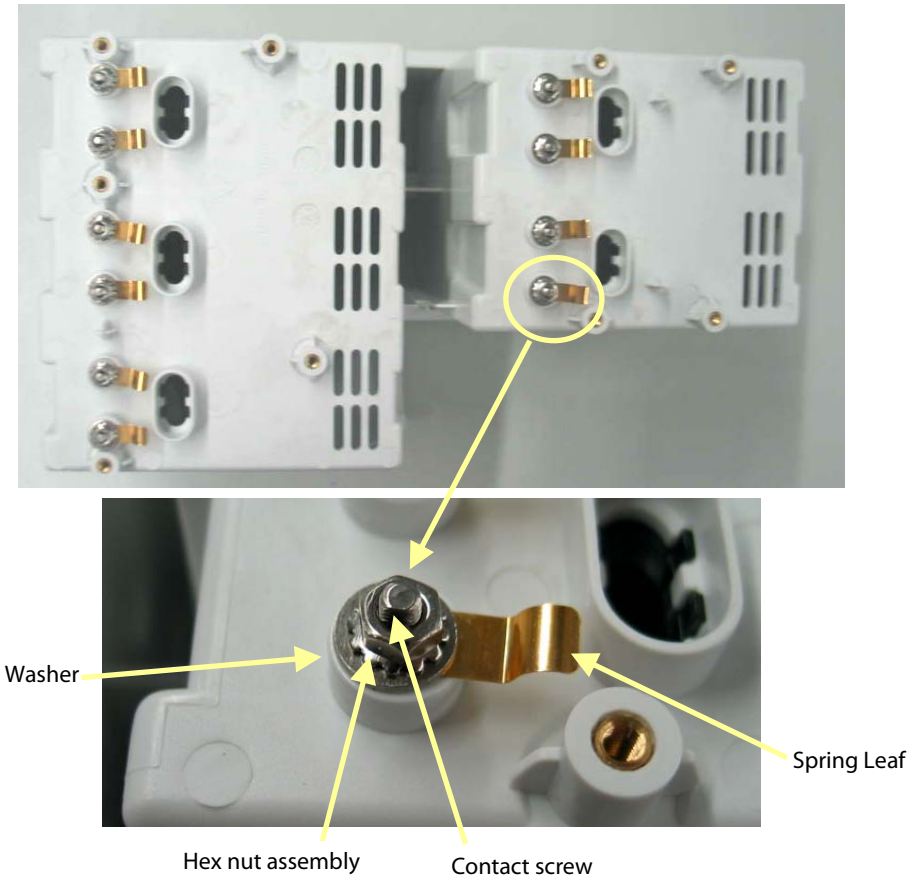
3. Unscrew the eight M3×6 screws and then remove the 3-slot module rack communication board and MPM module rack communication board.

NOTE

- **Do not forget the grounding spring when reassembling..**

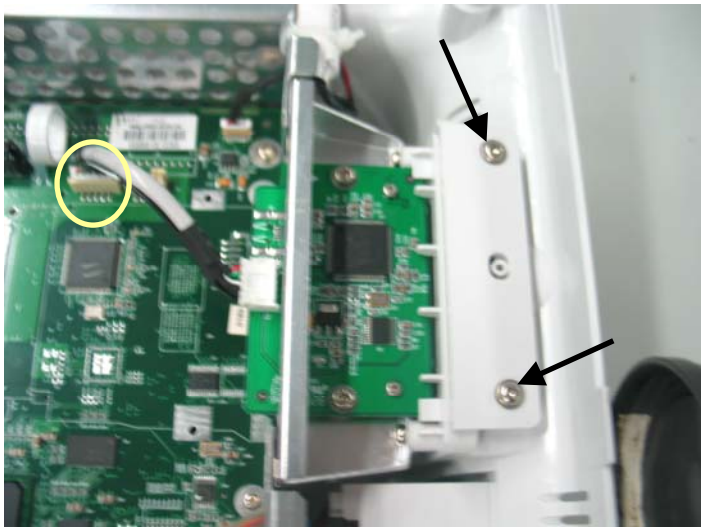


4. Unscrew the hex nut assy using the hex nut driver. Then separate the washer, spring and contact screw from each other.



6.3.13 Removing the CF Card Assembly

1. Unplug the cable that connects the CF card assembly and the mother board. Then, unscrew the two M3×6 screws and remove the CF card assembly.



2. Unscrew the two M3×6 screws and remove the CF card assembly with the shield.

NOTE

- **When reassembling the CF card assembly, be sure to install the CF card door first.**

6.3.14 Removing the wireless AP assembly

6.3.14.1 For 2.4G Wi-Fi Module

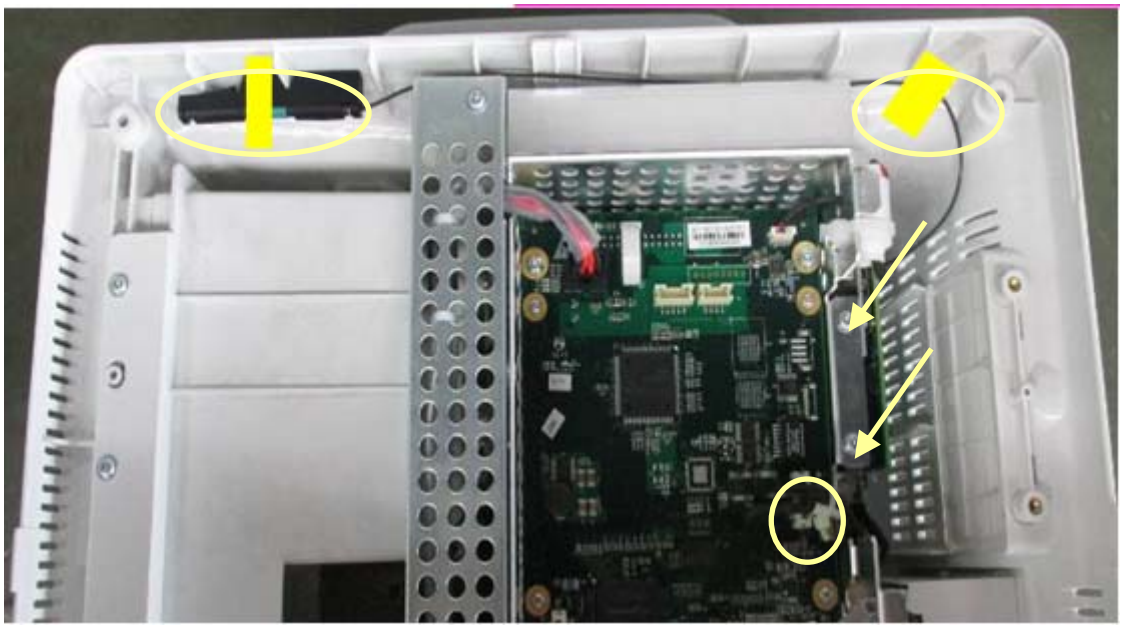
1. Disconnect the wireless AP cable. Then unscrew the two M3×6 screws to remove the wireless AP assembly.

2. Unscrew the two M3×6 screws to remove the wireless AP.

6.3.14.2 For 5G WI-FI Module

1. Disconnect the wireless AP cable. Then unscrew the two M3×6 screws to remove the wireless AP assembly.

2. Remove the adhesive that secure the antenna cable, and then remove the antenna and sleeve.

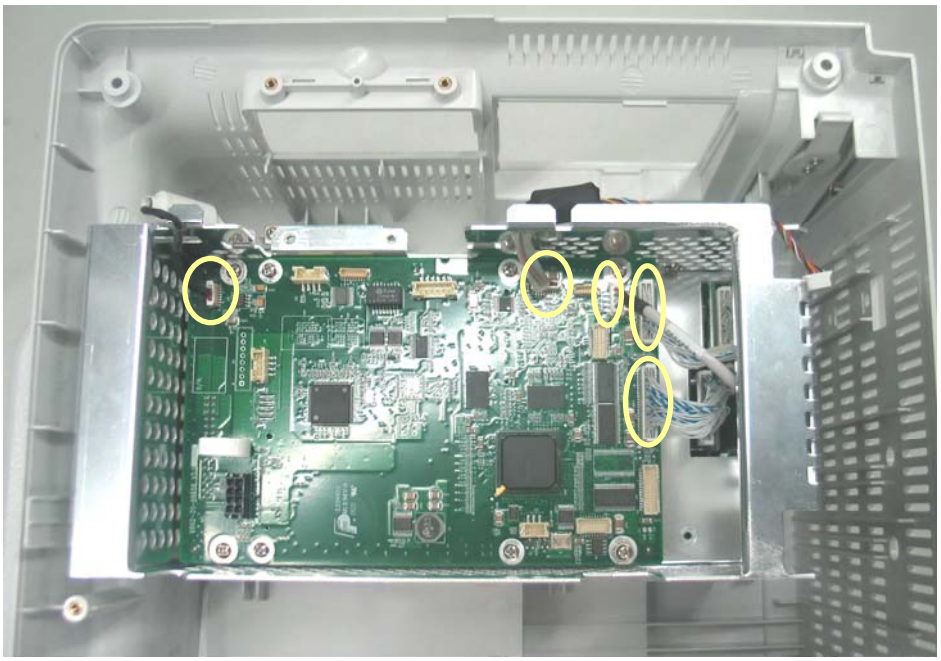


3. Unscrew the three M3×6 screws to remove the wireless module:

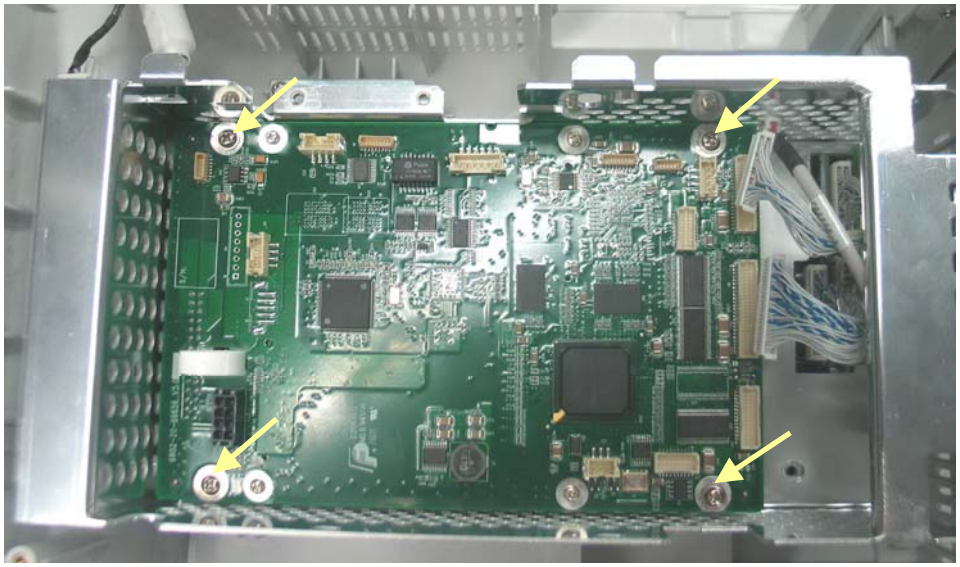
6.3.15 Removing the Main Board

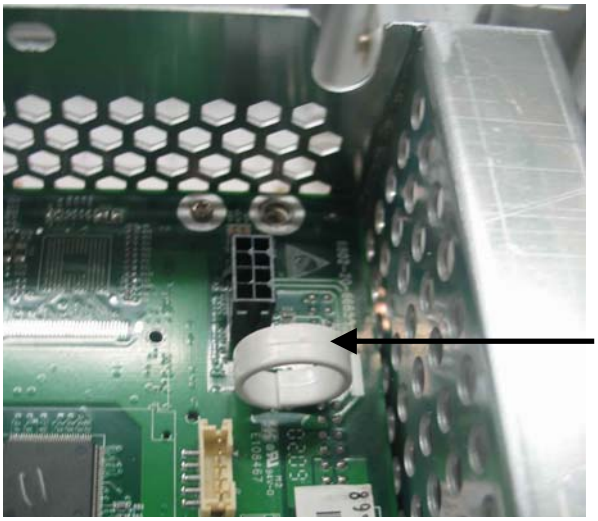
1. Unplug all the cables on the mother board. The numbers beside the connectors indicates what device is connected with the connector.

J4	Button board	J17	speaker
J5	Recorder	J19	LCD
J6	DVI interface board	J9	Wireless AP
J7	Battery interface board	J23	Fan
J10	CF card board	J25	3-slot module rack communication board
J12	power board	J18、J26	USB_Hub board



2. Unscrew the 4 M3×6 screws and take out the main board assembly.

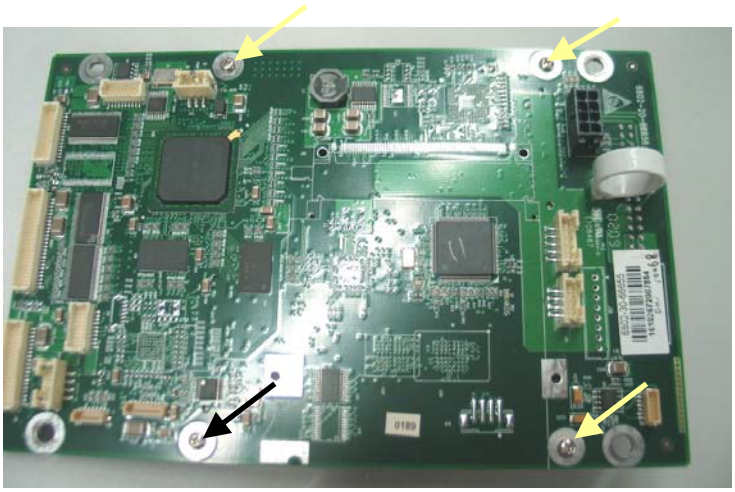




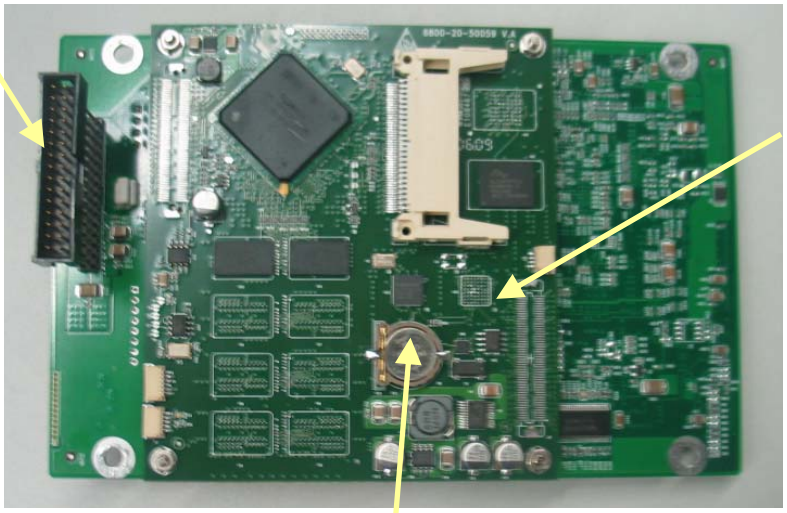
NOTE

- **Since the main board assembly is connected with the power module via a butt socket and the CPU radiator may be adhered to it, the main board assembly should be removed with force. Take care not to damage the butt socket.**

3. Unscrew the 4 M2.5×6 screws on the CPU board and vertically separate the CPU board and the mother board. Take care not to damage the butt socket.



Butt socket to power modul

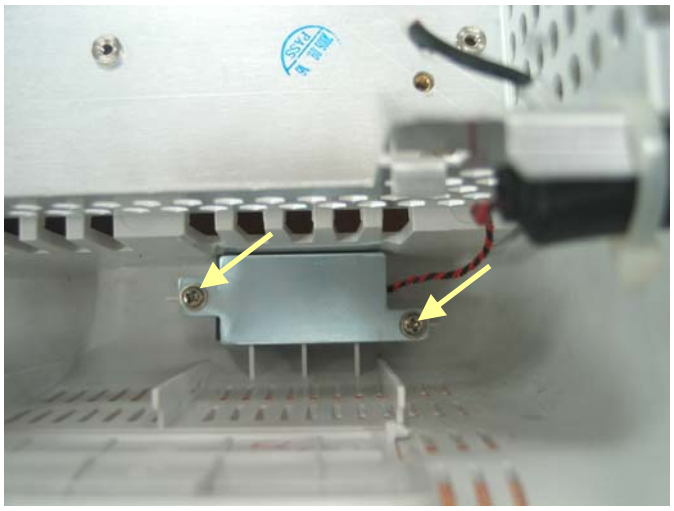


CPU board

Button cell

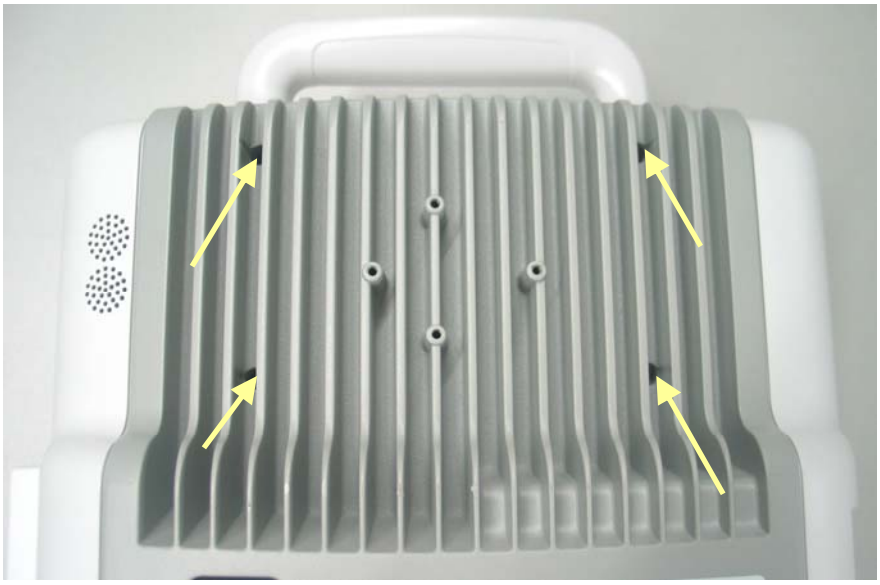
6.3.16 Removing the Speaker

Unscrew the two M3×6 screws and remove the speaker.

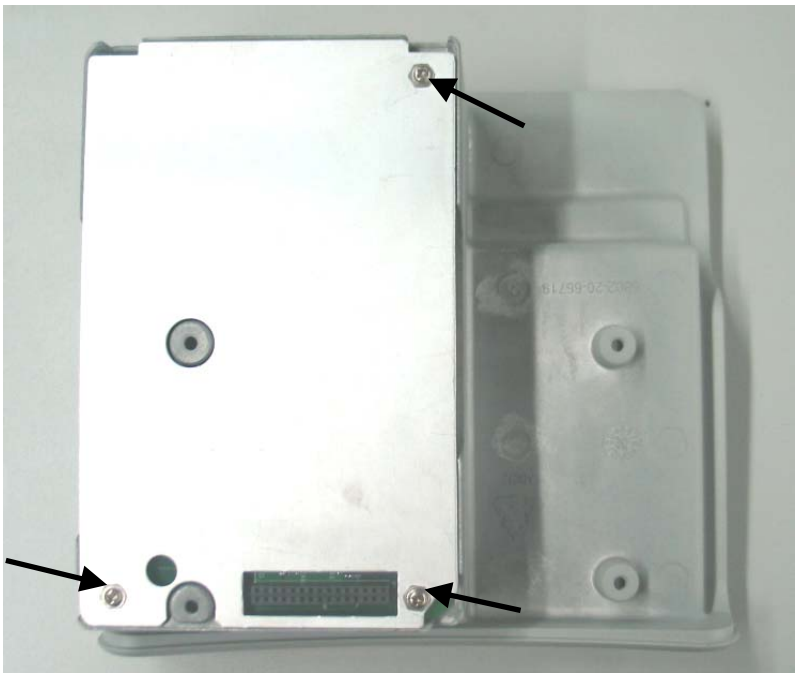


6.3.17 Removing the Power Module Assembly

1. Unscrew the four M3×12 screws and remove the power module assembly.

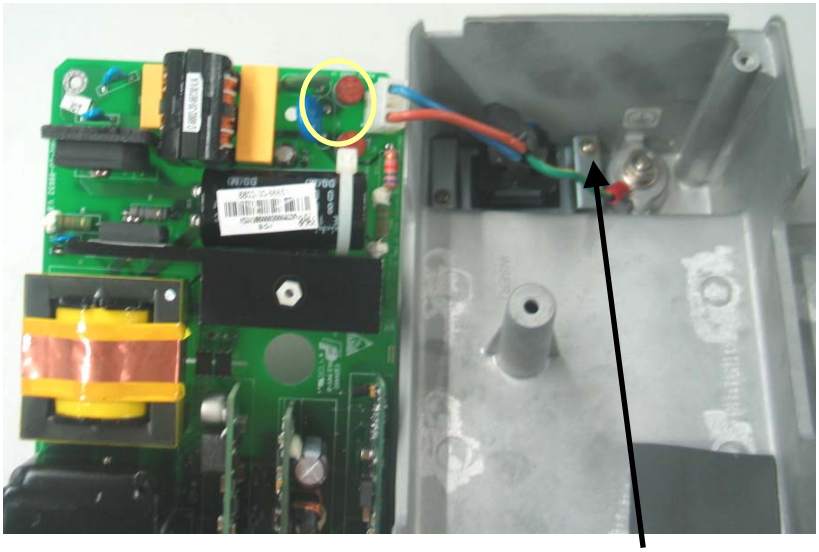


2. Unscrew the three M3×12 screws and remove the power supply cover.



3. Lift the power board with a small flat screwdriver. Then, turn it over.

4. Unplug the cable between the AC input filter and the power board, then remove the power board.



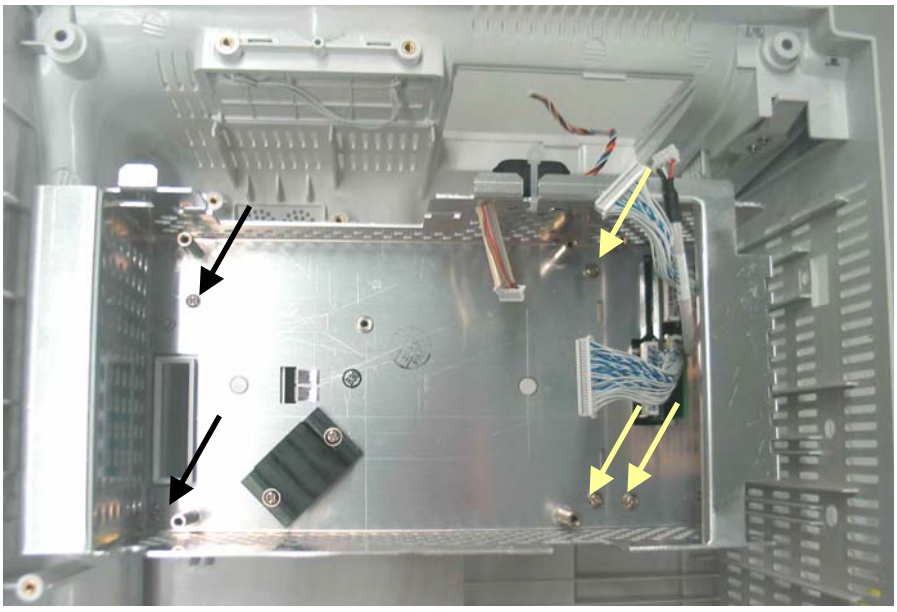
Equipotential Pillar

NOTE

- **Since the power board may be adhered to the insulator, be careful not to damage the parts, connectors and cables on the power board when prizing it.**

6.3.18 Removing the Main Support

Unscrew the five M3×6 screws and disassemble the main support.



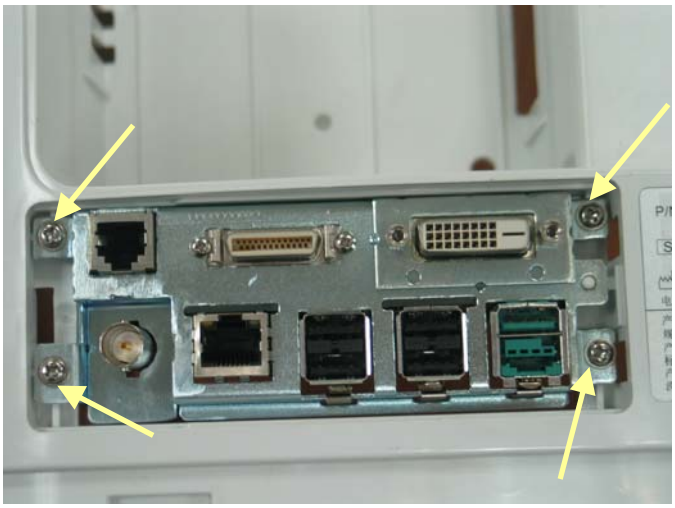
Note

- **Be sure to remove the power module first before removing the main support.**

6.3.19 Removing the Interface Board Assembly

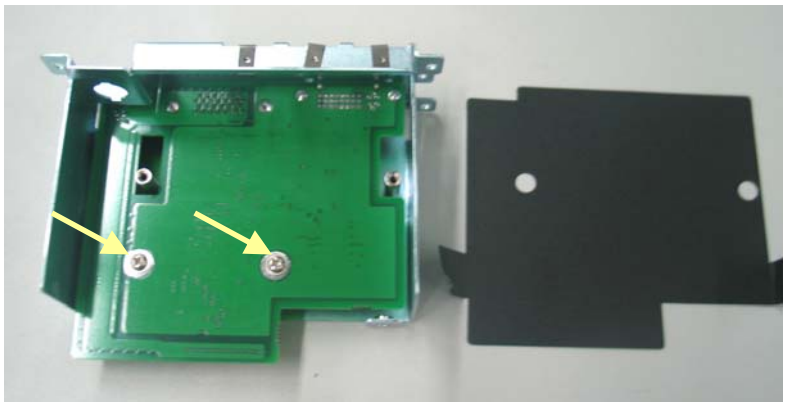
1. Release the clip that locks the interface board and push it outwards.

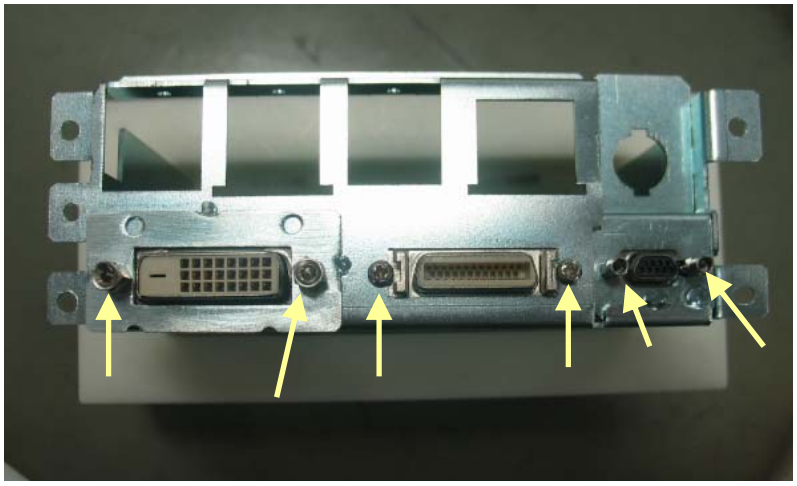
2. Open the interface board cover and unscrew the four M3×6 screws, then, unplug the interface board assembly.



3. Unplug the cables on the interface board. Then unscrew the two M3×6 screws and remove the USB_Hub board.

4. Remove the insulating pad from the interface board. Unscrew the two M3×6 screws on the DVI interface board. Than unscrew the two screws beside the DVI socket , the two screws beside micro-D socket and the two M2.5×6 screws.



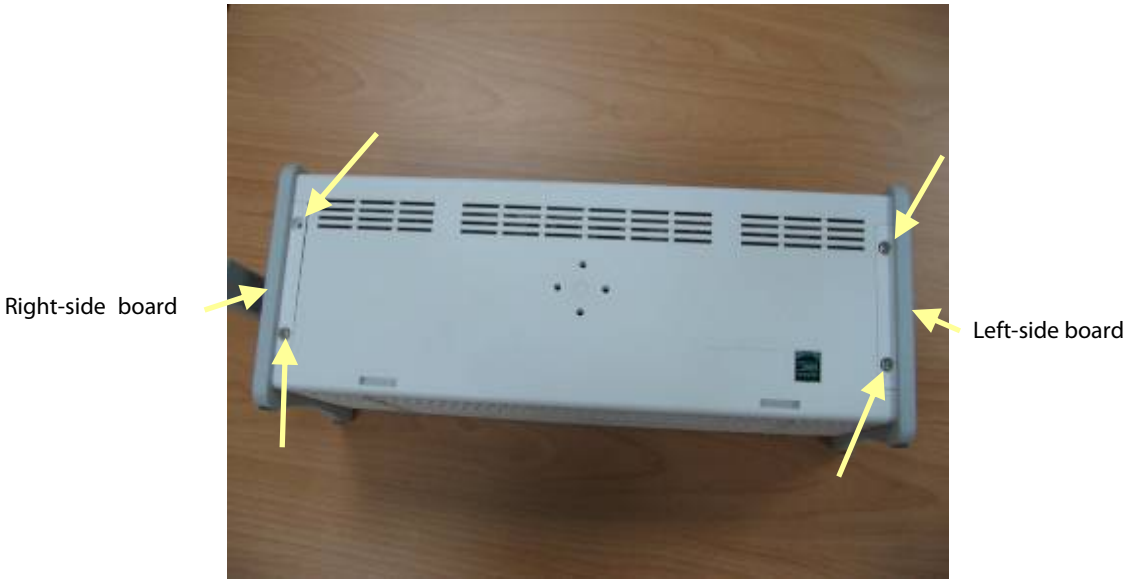


NOTE

- **Be careful not to damage the insulating pad between the DVI interface board and the USB_Hub board. Replace, if damaged.**

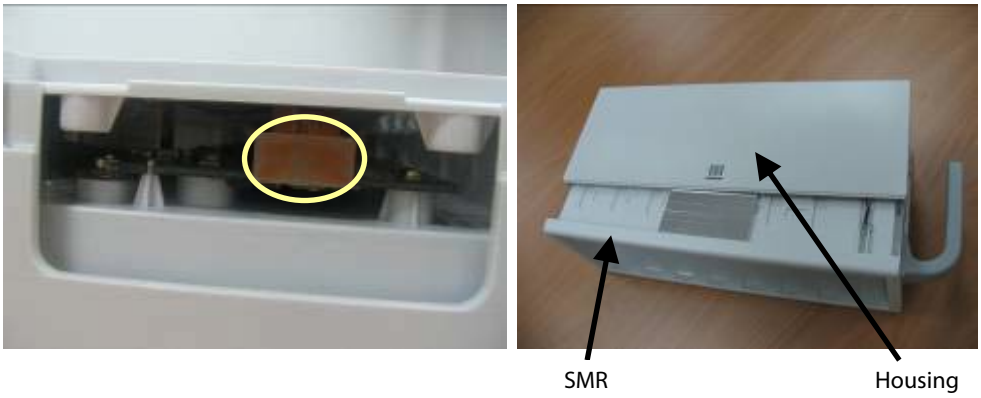
6.4 Removing the SMR Assembly

1. First remove the 4 screw covers and then unscrew the 4 M3×8 screws.

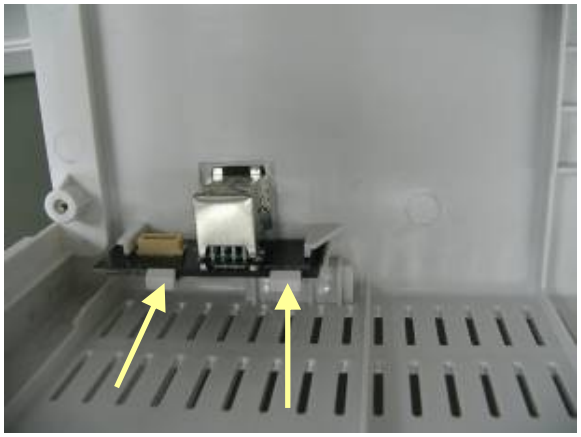


2. Pull the left- and right-side boards outwards. Be sure to place the rubber ring in position when reassembling the right-side board.

3. From the left side, remove the cable that connects the SMR interface board and the SMR communication board. Then take out the SMR from its housing.

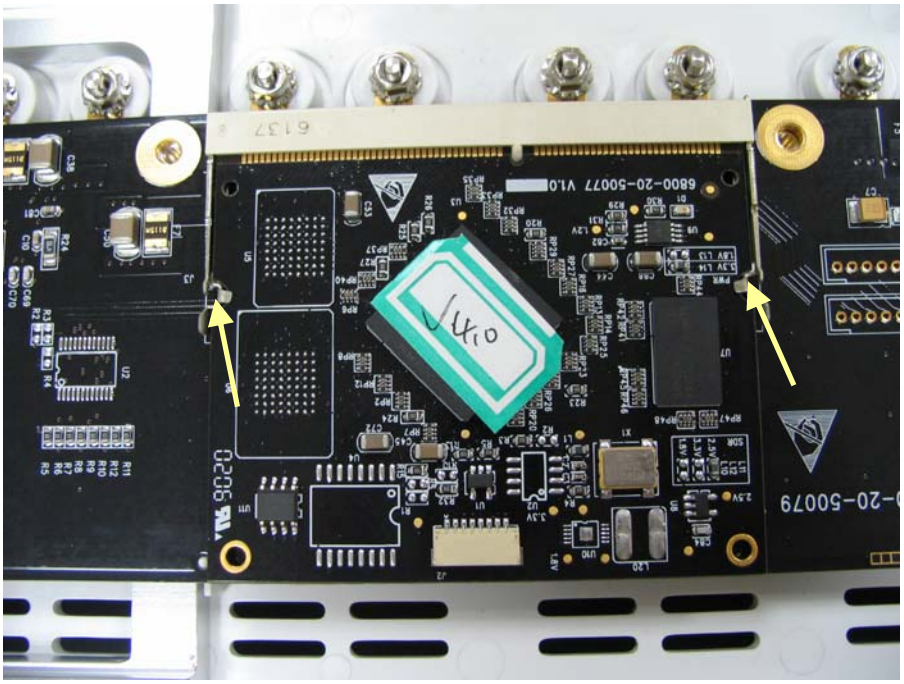


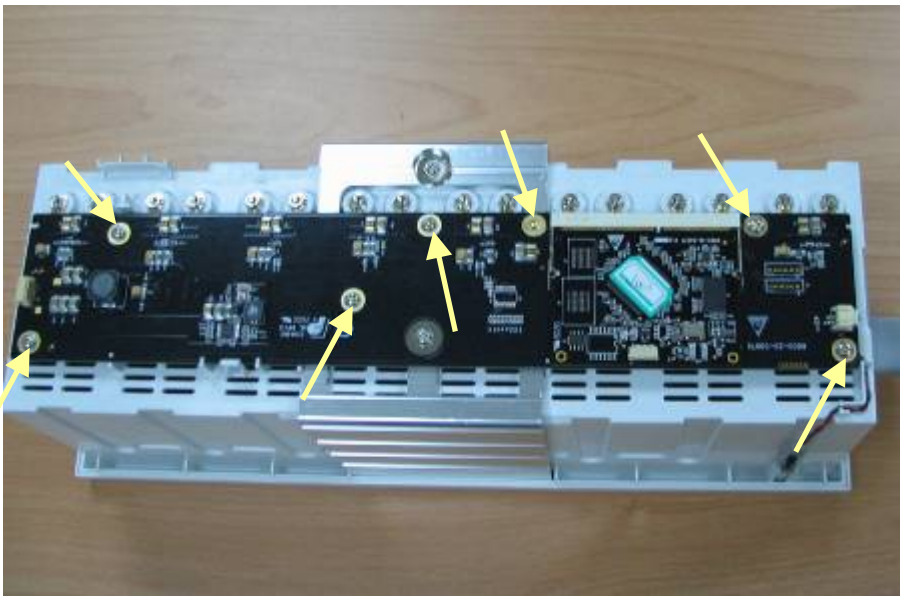
4. Release the two clips and take out the SMR interface board. Be sure not to damage the snap slot on the left side.



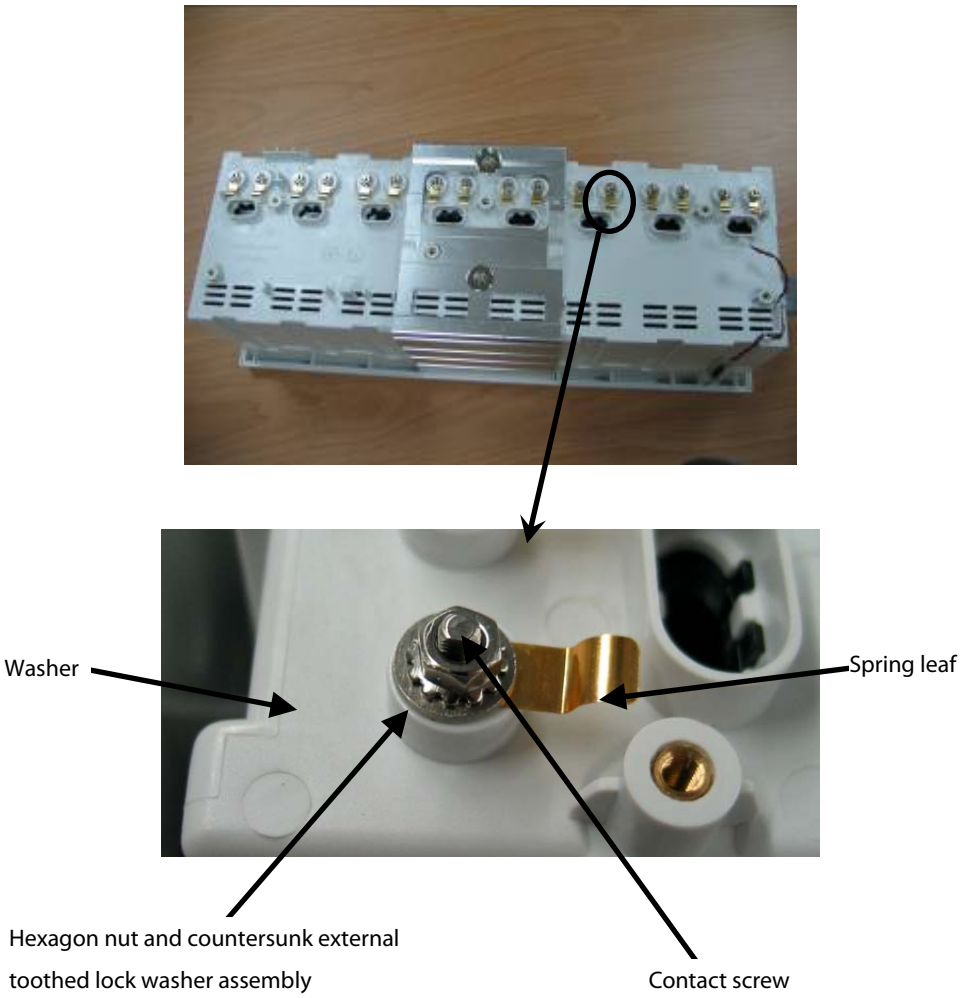
5. Remove the LED indicator, the light conductor and the cable that connects the SMR communication board and the LED board.

6. Release the clips and take out the Nios II module. Then unscrew the six M3×6 screws and remove the SMR communication board.





7. Use a socket wrench to unscrew the hexagon nut and countersunk external toothed lock washer assembly which can be further separated into the washer, spring leaf and contact screw.



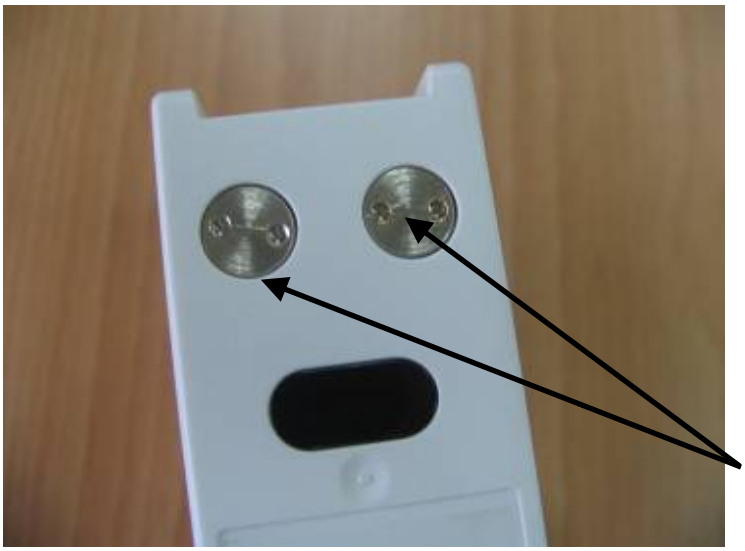
6.5 Disassembling Modules

WARNING

- **After reassembling a module, a patient leakage current test must be performed before it is used again for patient monitoring.**

6.5.1 Disassembling the BeneLink Module

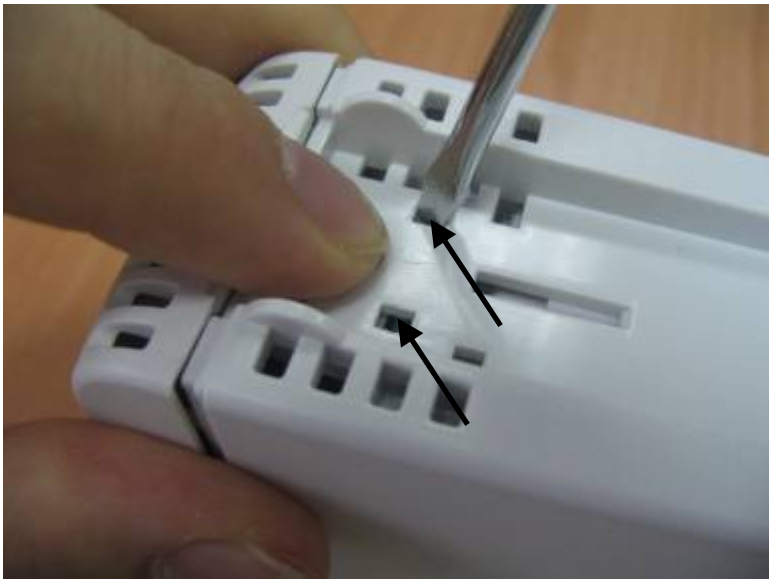
1. Remove the two contact screws and M3 spring washers on the back of the module with needle nose pliers.



2. Unlock the snap lock by pressing it down about 1 mm with a flat screwdriver. At same time, push the snap plate forward with your thumb until the snap lock separates from the module housing. Lift the front of the snap plate with the flat screwdriver and remove it from the BeneLink module.

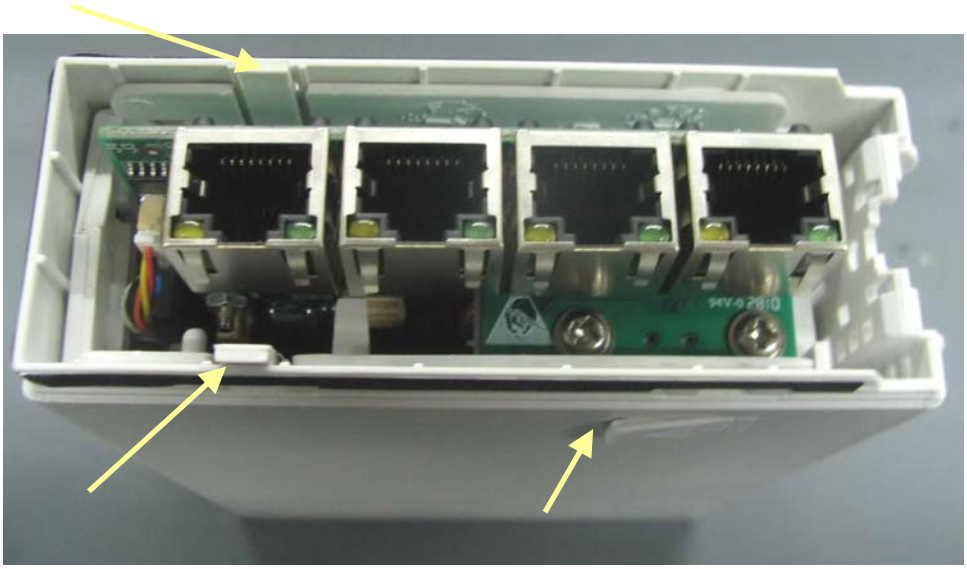
Snap plate

3. Remove the M3×6 screw using a #1 Phillips screwdriver. Then, press down, in turn, the two clips that engage the front panel. At same time, separate the front panel from the module's outer housing.

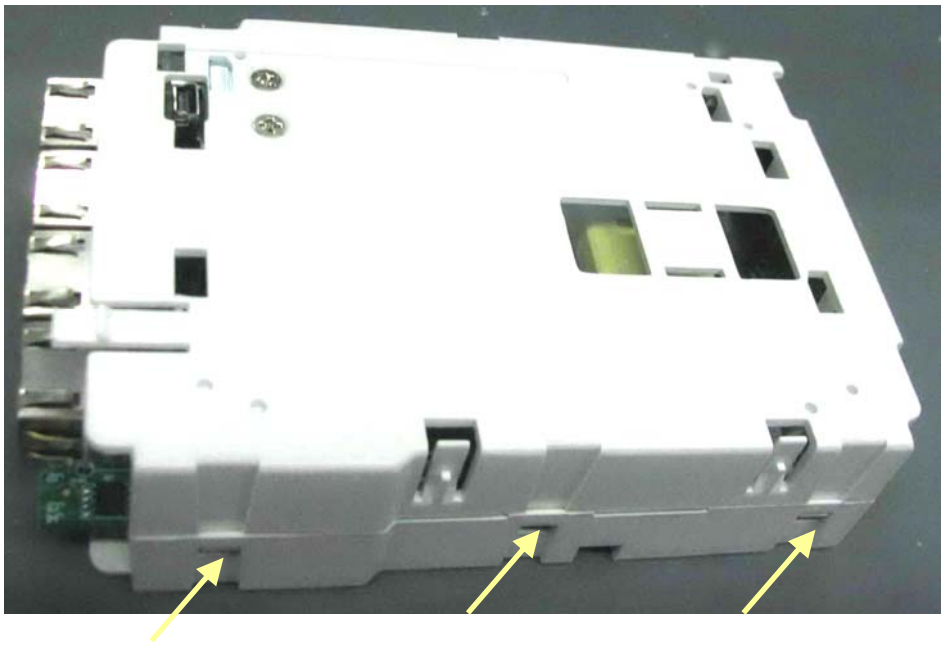


4. Remove the contact screws, the spanner, and the front cover by referring to steps 1 to 3 as described in section ***6.5.1Disassembling the BeneLink Module***.

5. Take off the small cover board on one side of the rear cover. Then press the two clips about 1mm and take off the housing.

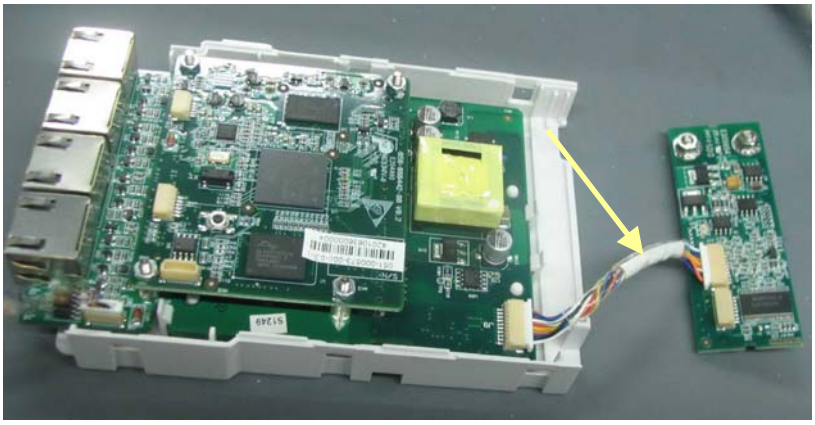


6. Release the three snaps to separate the two halves of the module side cover.

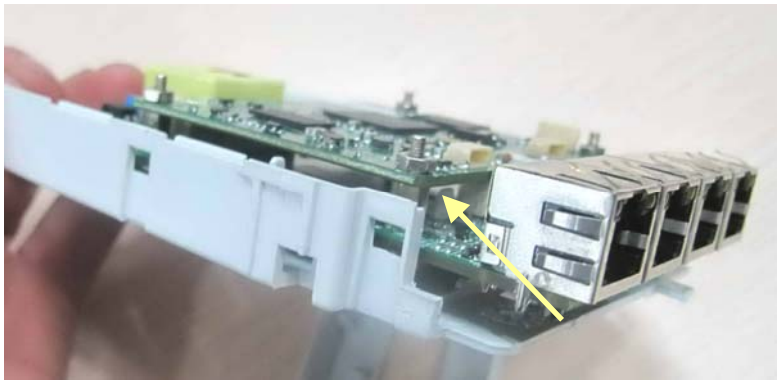


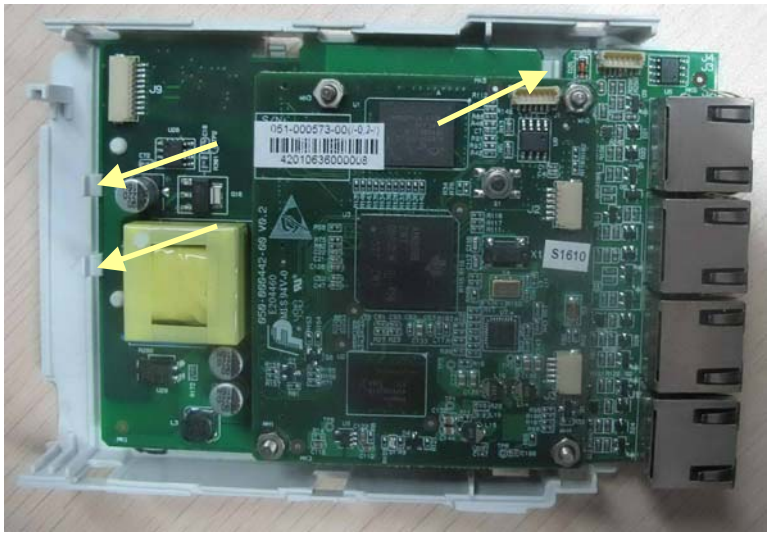
7. Take off the cable between the USB board and the interface board.

8. Take off the cable between the infrared communication board and the interface board to remove the infrared board.



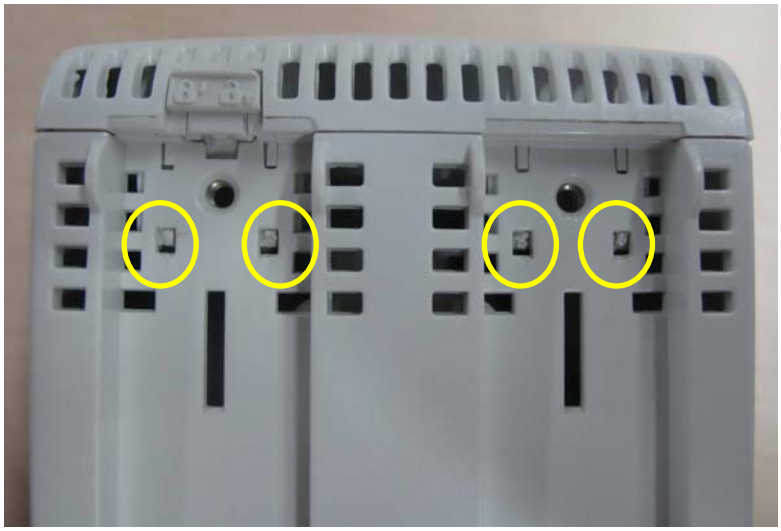
9. Unclench the four clips with a tweezer to remove the interface board.

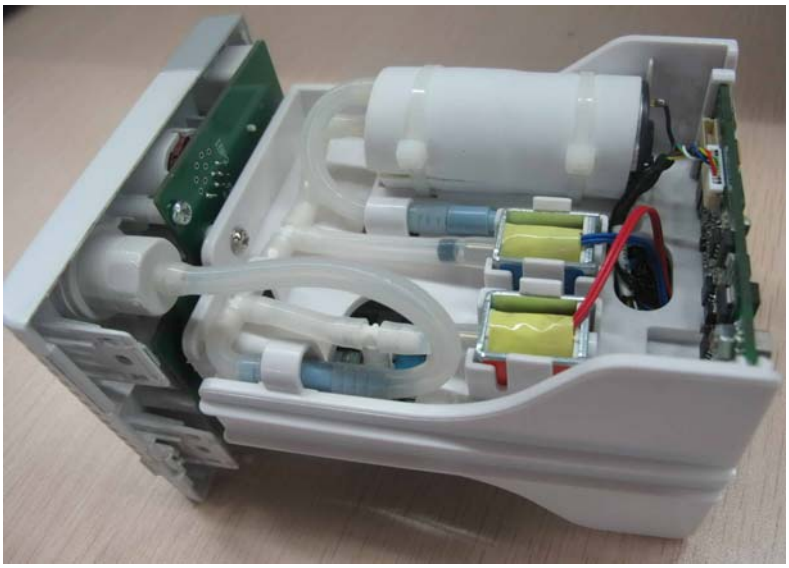




6.5.2 Disassembling the MPM Module

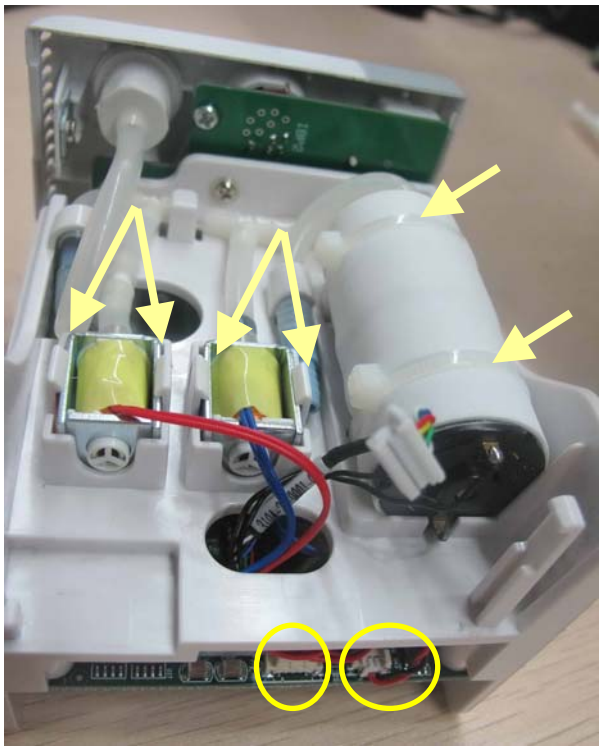
1. Remove the contact screws and the spanner by referring to steps 1 to 3 as described in section ***6.5.1 Disassembling the BeneLink Module***.
2. Remove the two M3×6 screws. Then press down, in turn, the four clips that engage the front cover with a small flat-bladed screwdriver. At the same time, pull off the rear cover.



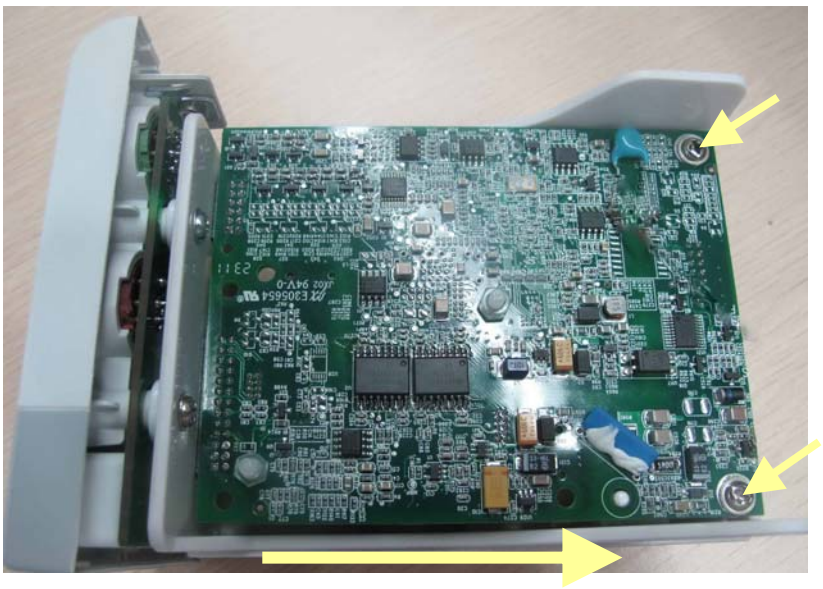


3. Disconnect the cable of the infrared communication board, and release the latching tab to remove the infrared communication board.

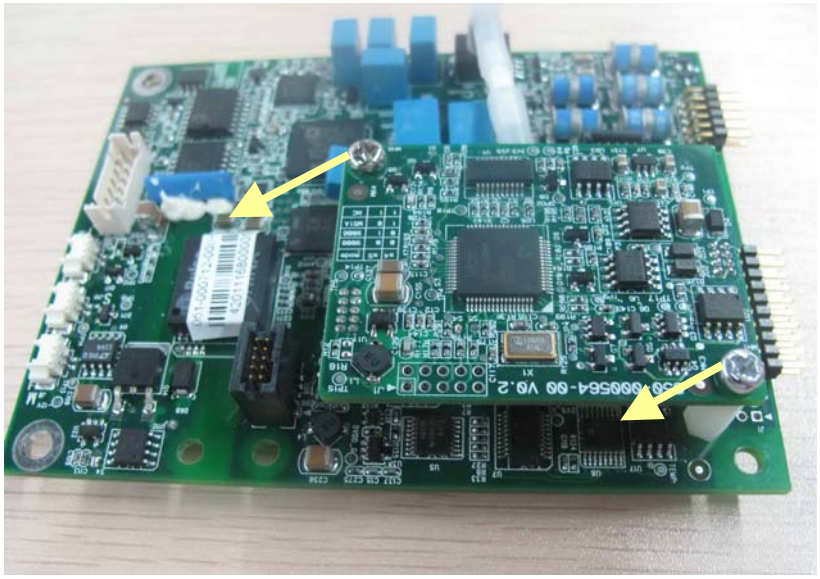
4. Disconnect the cables of the NIBP inflation pump and the relief valves from the parameter board. Snip off the cable ties to remove the pump. Release the tabs to remove the valves.



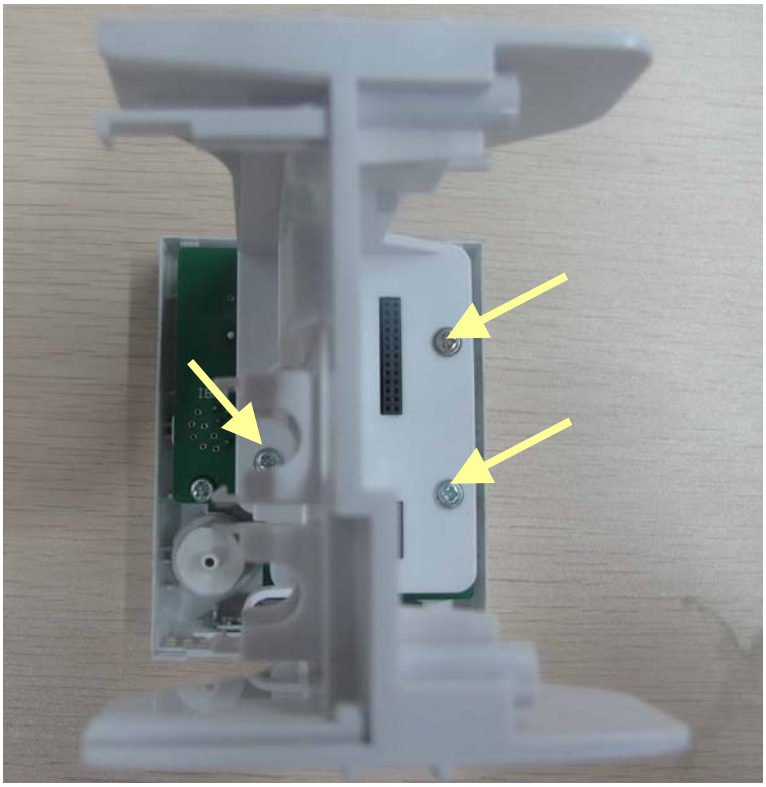
5. Remove the two M3×8 screws on the parameter board. Then pull off the parameter board rearward as shown below.



6. Remove the two M3×4 screws on the SpO_2 board to separate the SpO_2 board and the parameter board.



7. Remove the three M3×8 screws to separate the front panel assembly from the chassis.



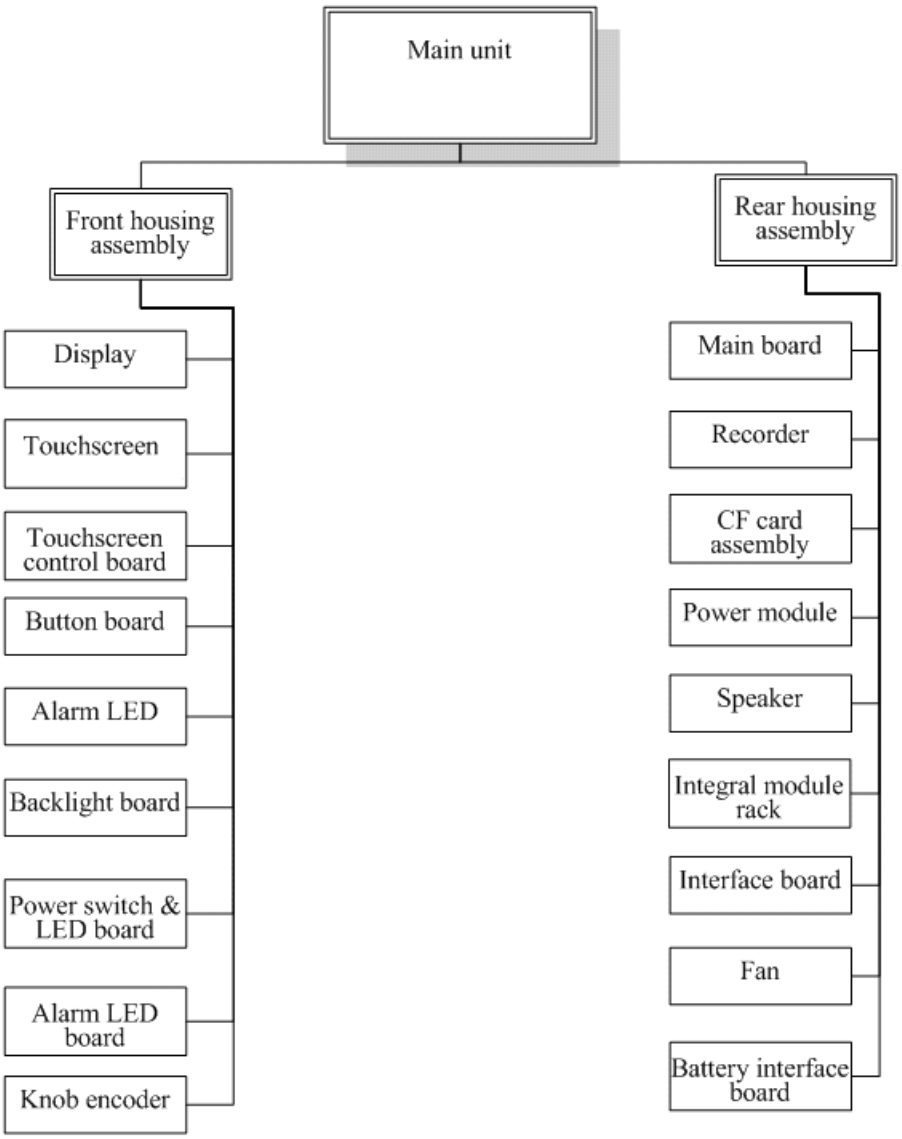
FOR YOUR NOTES

7 Parts

7.1 Introduction

This chapter contains the exploded views and parts lists of the main unit, satellite module rack and the parameter modules of the patient monitor. It helps the engineers to identify the parts during disassembly of the patient monitor and spare parts replacement.

Hardware architecture of the main unit is shown below:

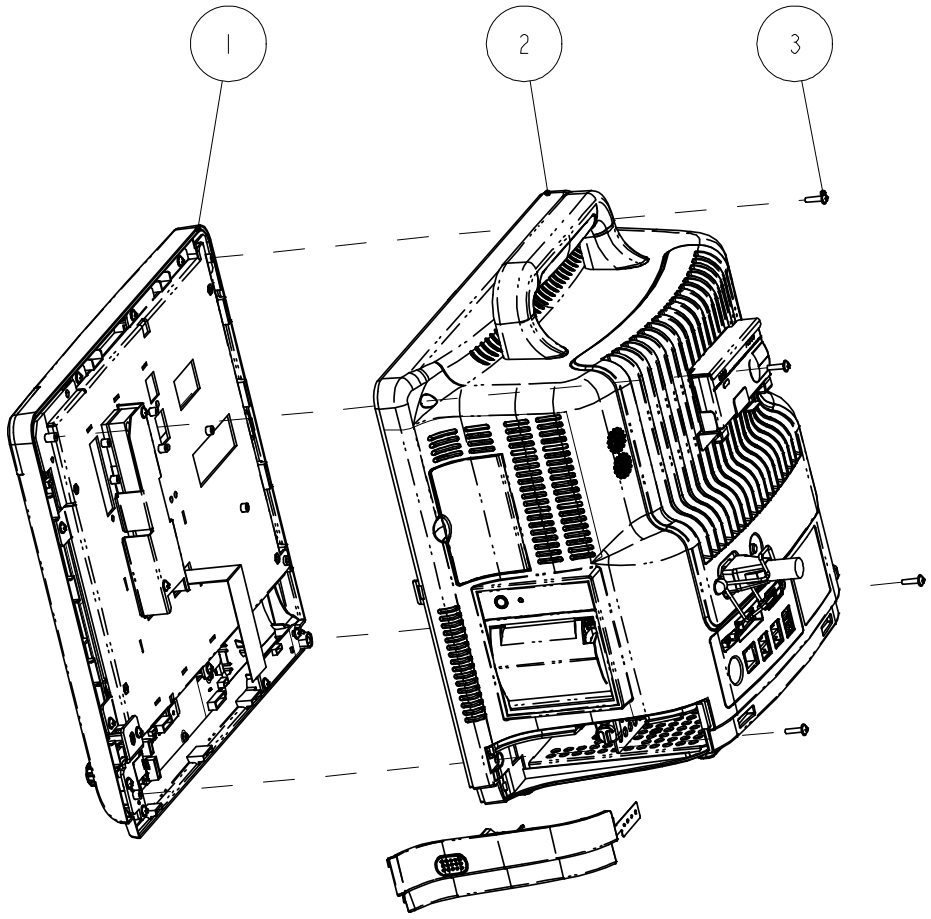


NOTE

- **Please provide the FRU part number if you want to purchase the spare parts.**

7.2 Main Unit

Exploded View



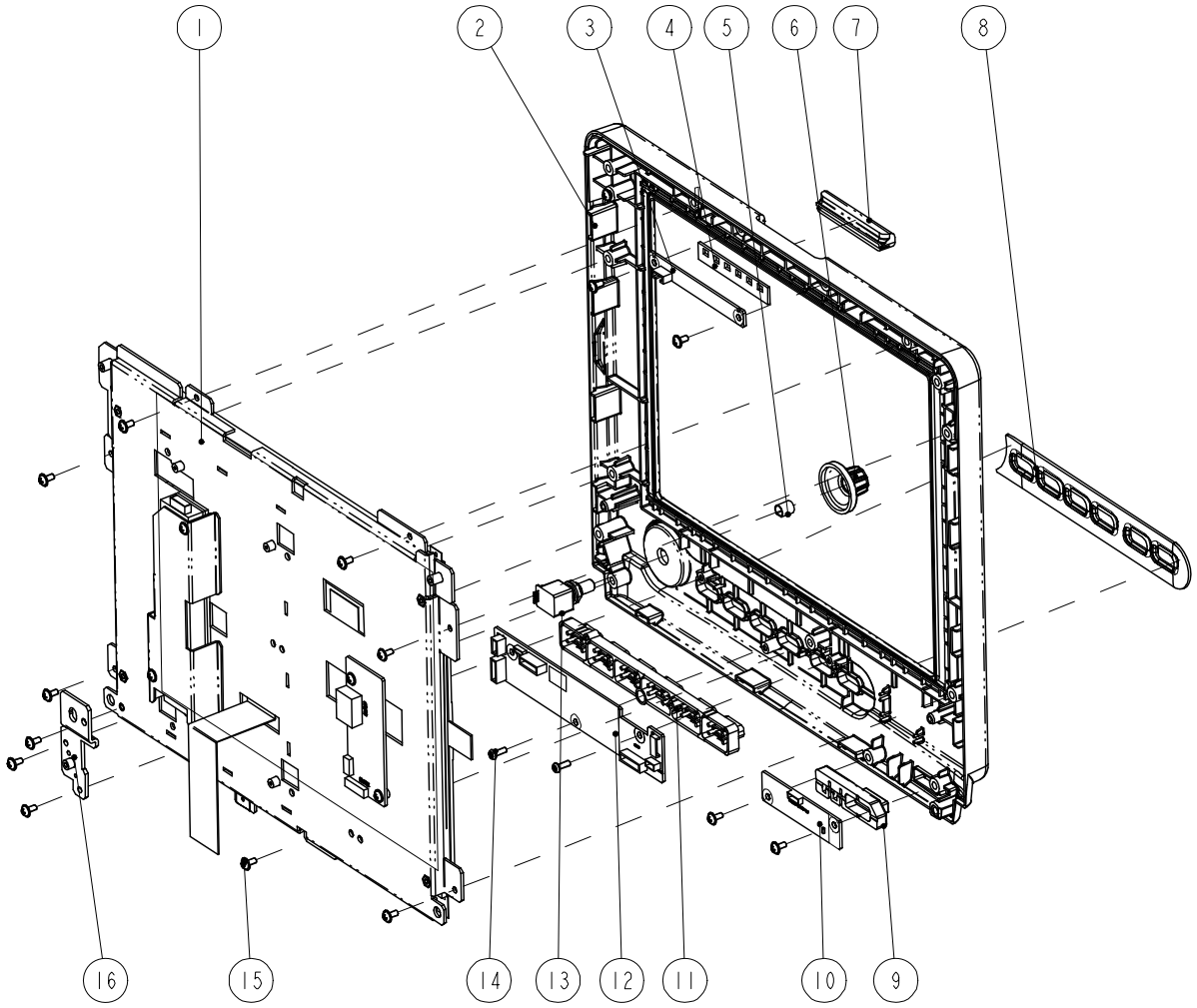
Parts List

SN	Description	FRU part number	Qty
1	Passport 12m front housing assembly (touchscreen)	/	1
2	Main unit	/	1
3	Phillips screw M3×12	/	4

7.3 Front housing Assembly

7.3.1 12.1" LCD with Touchscreen

Exploded View



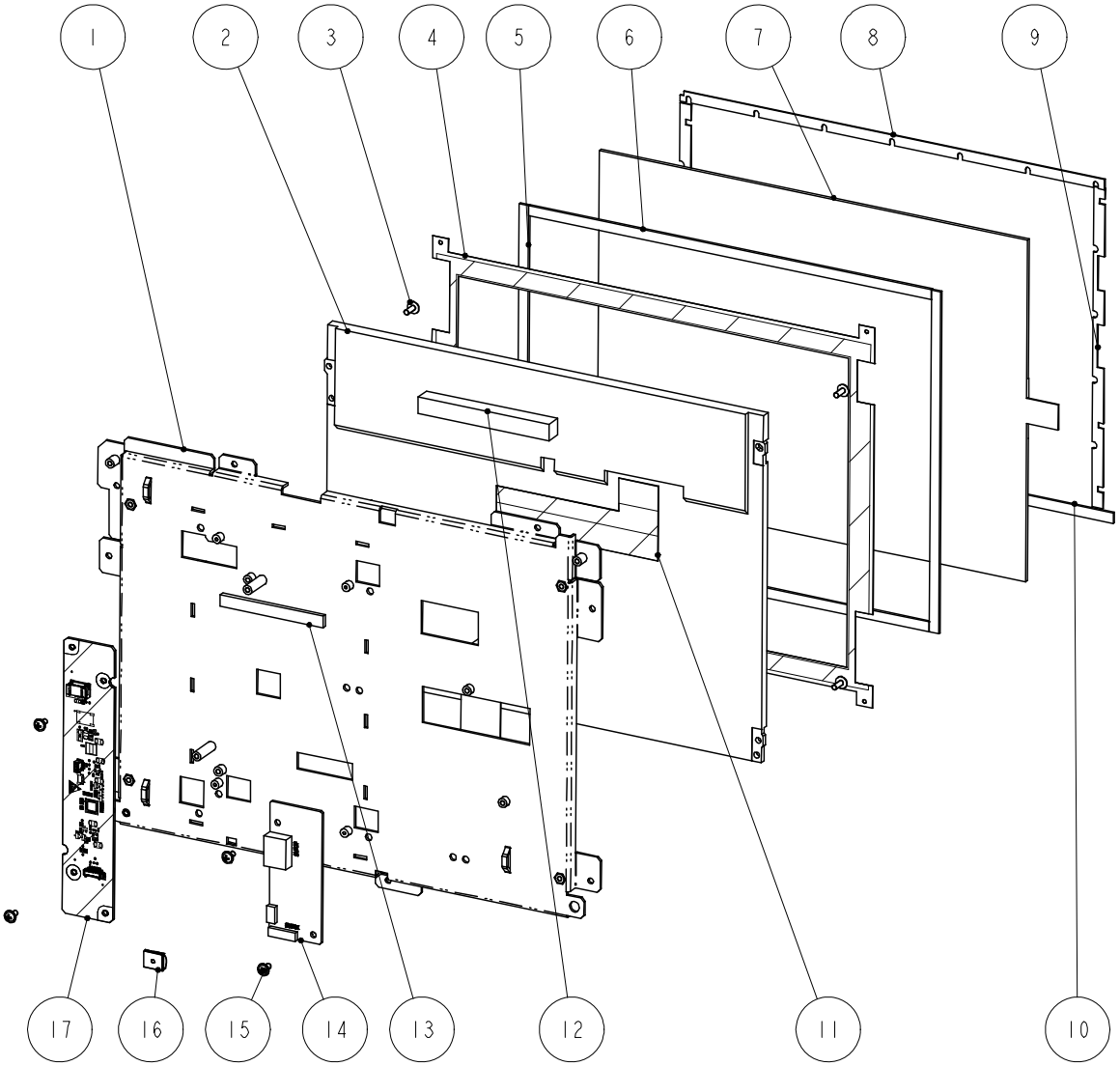
Parts list

SN	Description	FRU part number	Qty
1	12.1" LCD TFT assembly of PP12m	115-021914-00	1
2	Front cover of Passport12m	115-030579-00	1
3	6301 alarmboard PCBA	051-000879-01	1
4	Alarm gasket	/	1
5	Knob spring	115-022497-00	1
6	monitor knob		1
7	Alarm light of PP8	043-003642-00	1
8	Overlay of Passport17m	049-000626-00	1
9	Power button	6802-20-66691-51	1
10	Power switch and indicator	6802-30-66680	1
11	Keyboard of Passport 17m	043-003610-00	1
12	T5 Keyboard(Touch screen/Optical Encoder)	115-004220-00	1

SN	Description	FRU part number	Qty
13	Encoder, Optical,16 pos. 5VDC Dip6	0000-10-10789	1
14	Phillips tapping screw PT2×6	/	3
15	Screw, Pan Head W/Washer Phillips M3×6	/	14
16	Sheet metal of front housing	/	1
/	Alarm light board cable	009-004019-00	1
/	Power switch cable	6802-20-66671	1
/	Touch screen control board to keyboard cable	6802-20-66672	1

7.3.2 12.1" LCD TFT assembly of PP12m

Exploded View



Parts list

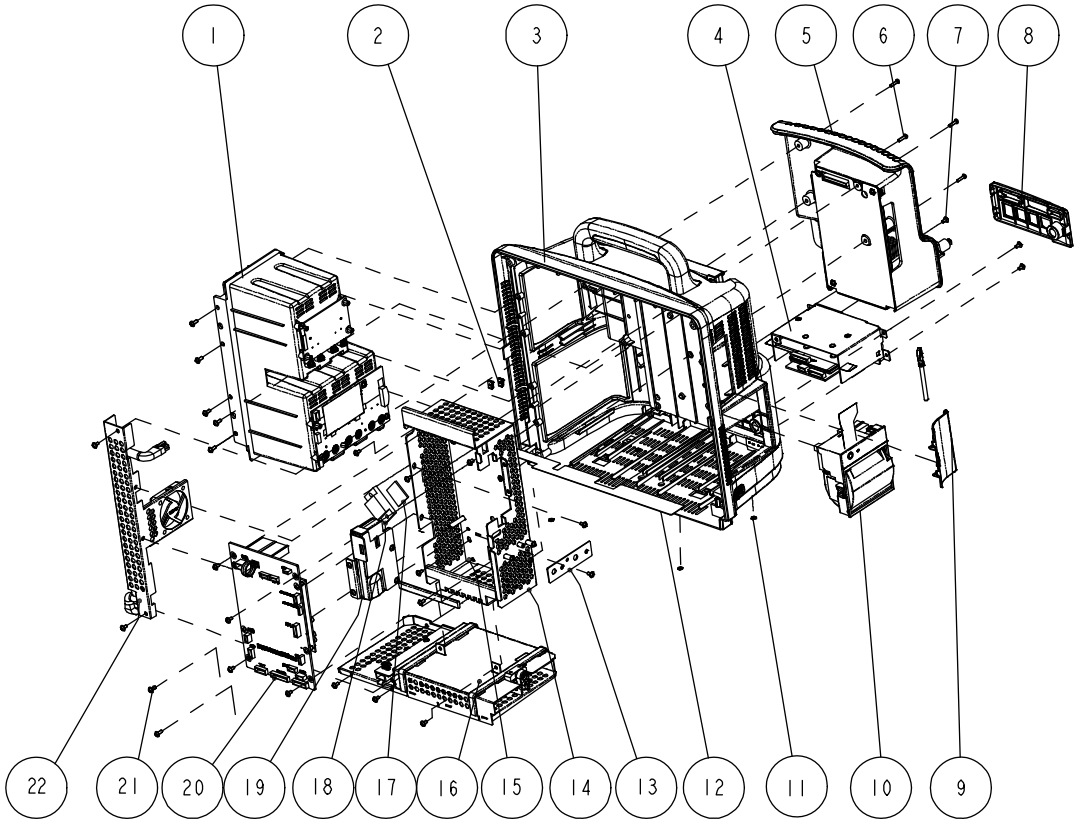
SN	Description	FRU part number	Qty
1	metal plate of front cover (M12)	/	1
2	LCD Display screen TFT 12.1" 800*600 3.3V 400cd/m2	021-000160-00	1
3	cross pan head screw with washer GB9074.5 M3×8	/	4

SN	Description	FRU part number	Qty
4	Screen cover	/	1
5	Touchscreen strip 4	/	2
6	Touchscreen strip 3	/	2
7	Touch Screen 12.1"	0000-10-10799	1
8	Touchscreen strip 1	/	2
9	Touchscreen strip 2	/	2
10	Waterproof strip	/	1
11	Flat wire	009-005252-00	1
12	Conductive foam	/	1
13	Conductive foam, 9.5*3.2mm	/	1
14	Touch screen control board	6800-30-50082	1
15	Screw, Pan Head W/Washer Phillips M3×6	/	6
16	Spring, EMI	/	1
17	Invertor board (0623)	051-001820-00	1

7.4 Main Unit

7.4.1 Main Unit Assembly

Exploded View

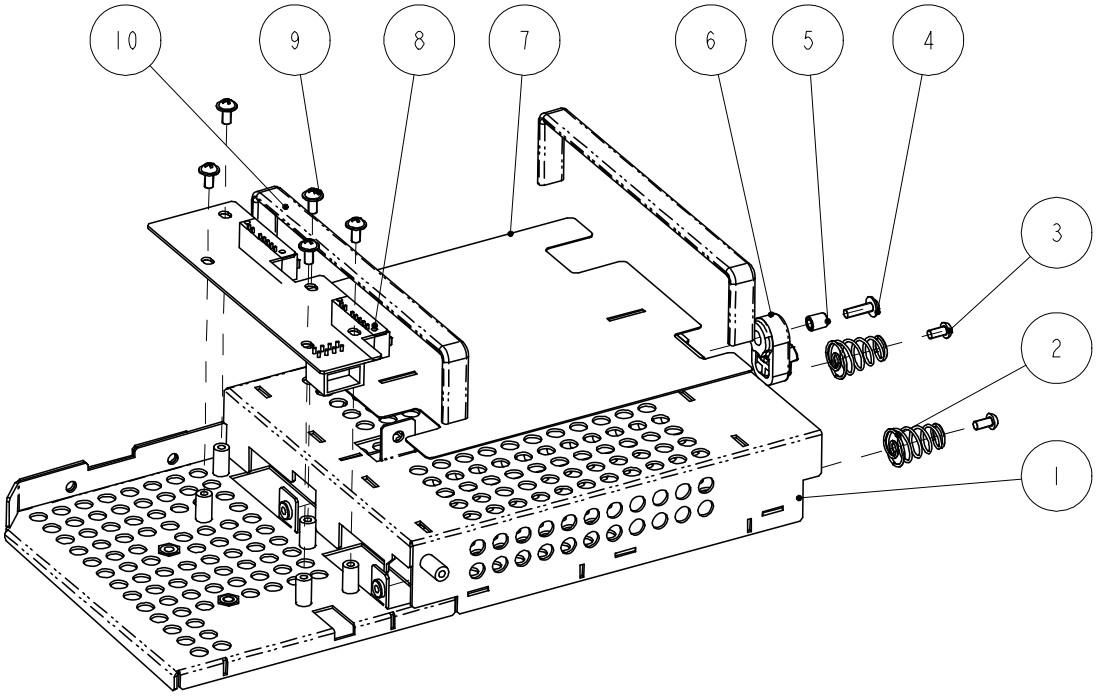


Parts List

SN	Description	FRU part number	Qty
1	Integral module rack	/	1
2	Shield Reed	/	2
3	Rear housing assembly	801-6802-00017-00	1
4	Interface board assembly	115-015992-00	1
5	Power module assembly	044-000446-00	1
6	Phillips screw M3×12	/	4
7	Phillips screw M3×6	/	25
8	Interface board cover(New)	043-000059-01	1
9	CF card door	043-004097-00	1
10	TR6F recorder	801-6800-00080-00	1
11	Screw cap	/	2
12	Small fireproof sheet T5	047-014207-00	1
13	Printer mounting plate	6802-20-66718	1
14	Main support assembly	/	1
15	Shield foam 9.5*3.2mm	/	0.2
16	Battery compartment assembly	801-6802-00014-00	1
17	CPU heat conducting block	/	1
18	CPU heatsink	/	1
19	Wireless AP kit (Silex)	115-024690-00 (2.4GHz)	1
	6804 5G WIFI transfer kit	115-037631-00 (5GHz)	
20	Master control board assembly	115-030586-00	1
21	Phillips screw M3×8	/	7
22	Fan assembly	801-6800-00033-00	1

7.4.2 Battery Compartment Assembly

Exploded View

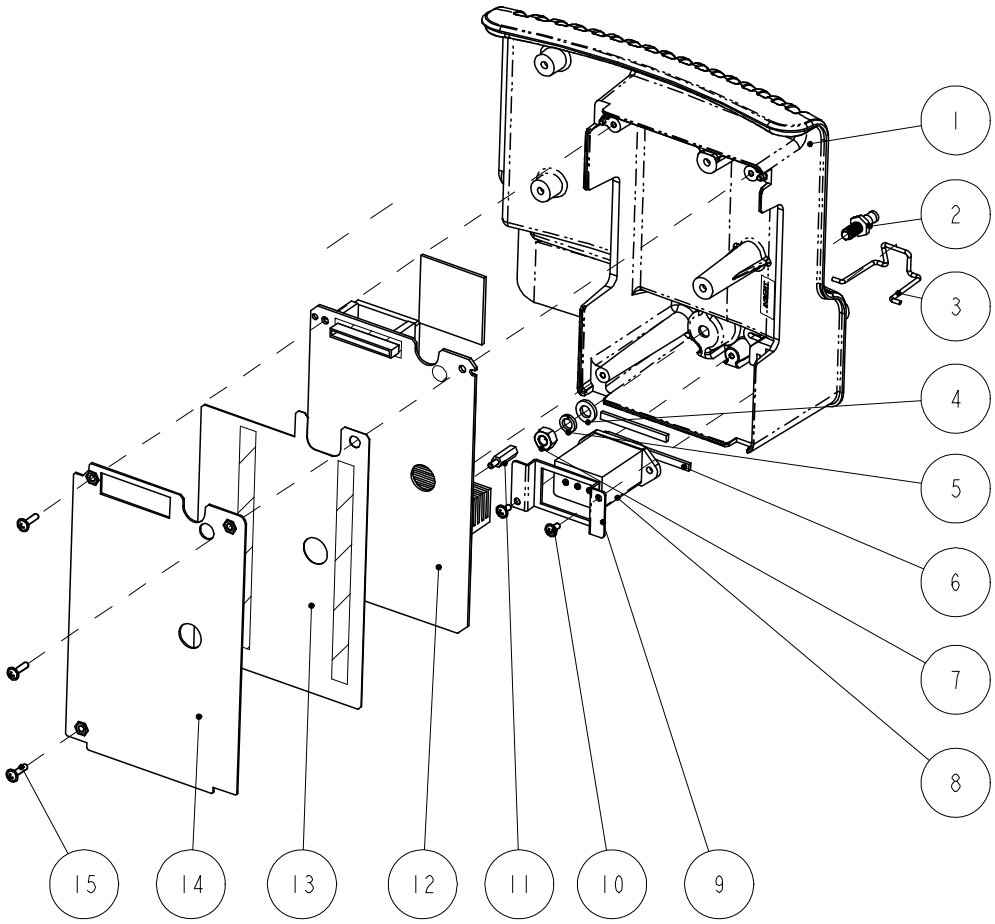


Parts List

SN	Description	FRU part number	Qty
1	Battery compartment	/	1
2	Spring	/	2
3	Phillips screw M3×6	/	2
4	Phillips screw M3×10	/	1
5	Battery latch fixture	/	1
6	Battery latch	/	1
7	Fireproof sheet	/	1
8	Battery interface board (PN: 6802-30-66653)	801-6802-00014-00	1
9	Phillips screw M3×6	/	5
10	Conducting block 9.5×3.2	/	2

7.4.3 Power Module assembly

Exploded View

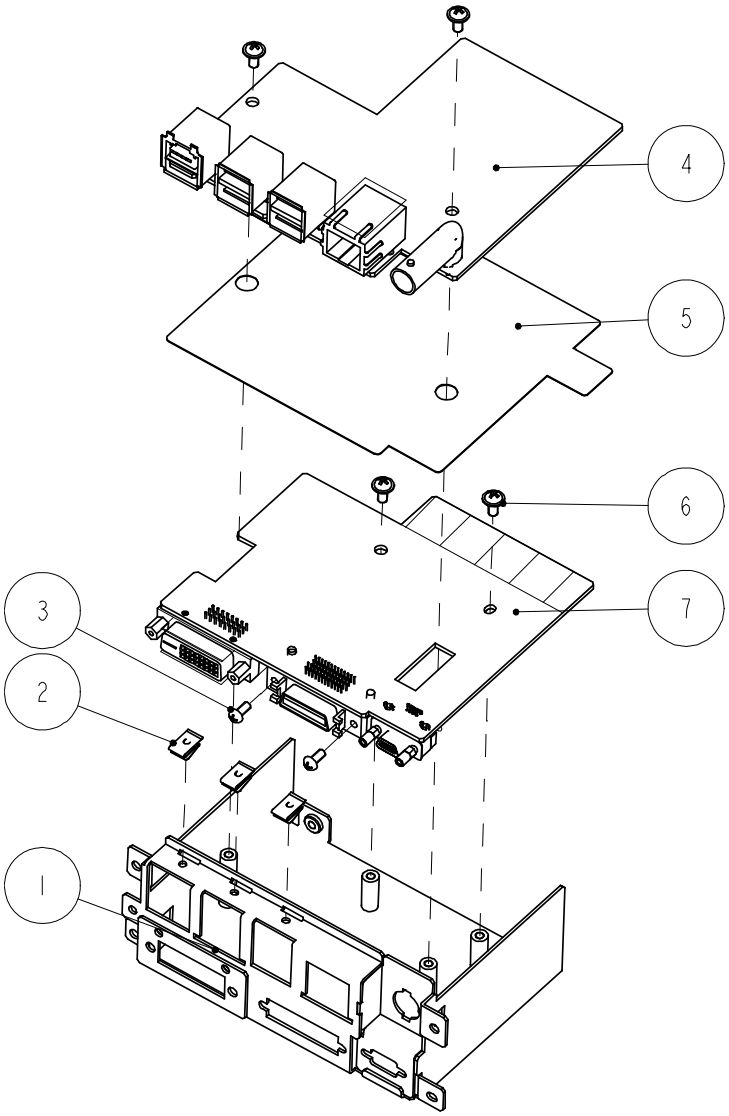


Parts List

SN	Description	FRU part number	Qty
1	Power supply compartment	044-000446-00	1
2	Grounding pole	/	1
3.	Retainer for power supply plugs	/	
4	Flat washer, GB97.1 6	/	1
5	Spring washer, GB93 6	/	1
6	Waterproof strip for power socket	/	2
7	Stainless steel nut, GB6170 M6	/	1
8	AC input socket and cable	009-000255-00	1
9	power socket fixture	/	1
10	Phillips screw M3×6	/	2
11	Plastic double-ended bolt M3×15+6-8	/	1
12	Power board	6802-30-66651	1
13	Insulating plate	/	1
14	Power supply cover	6802-20-66720	1
15	Phillips screw M3×12	/	3

7.4.4 Interface Board Assembly (6802-30-66769)

Exploded View

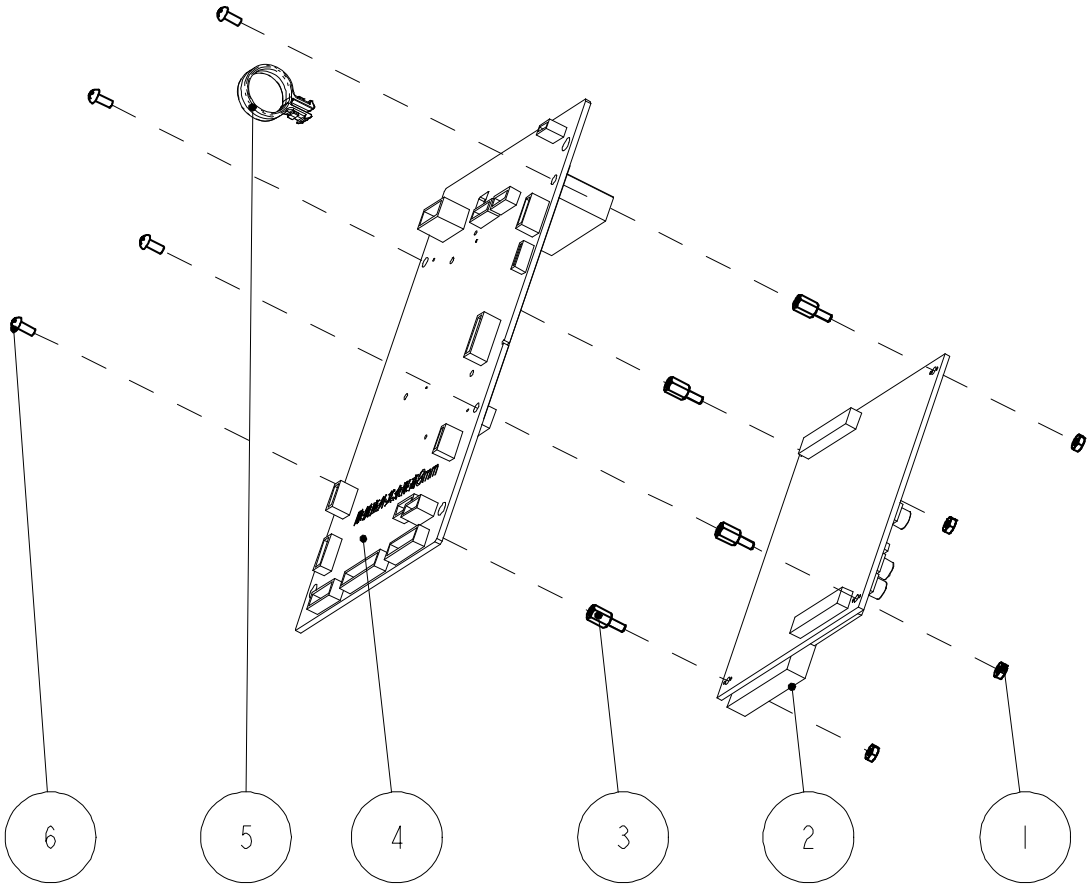


Parts List

SN	Description	FRU part number	Qty
1	Interface board frame (new interface)	115-015992-00	1
2	Spring leaf		3
3	Phillips screw M2.5×6		2
4	USB_Hub board (no analog output, PN: 051-000020-01)		1
5	Interface board insulating plate		1
6	Phillips screw M3×6		4
7	DVI interface board (can support IABP)		1

7.4.5 Main Board Assembly

Exploded View

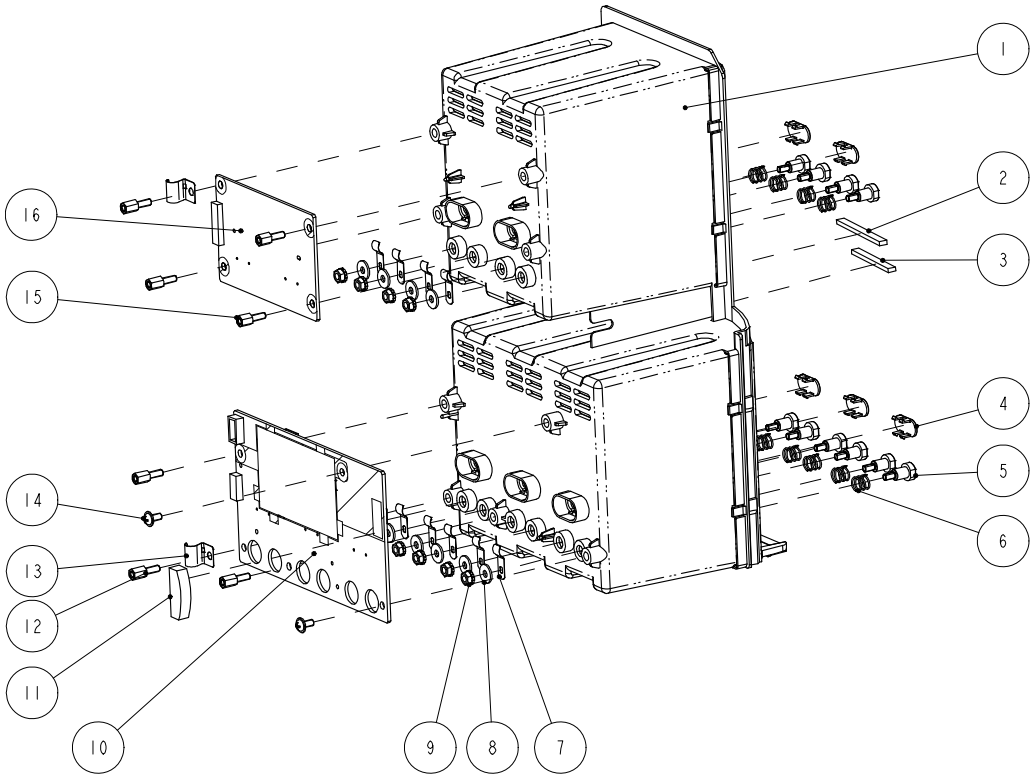


Parts List

SN	Description	FRU part number	Qty
1	Nut, GB6170 M2.5	115-030586-00	4
2	MCF547x CPU module (basic configuration/non-lead process, PN: 6800-30-50058)		1
3	Screw M2.5x7+6-6		4
4	6802 mother board (full configuration, PN: 051-000223-00)		1
5	PCB handle		1
6	Phillips screw M2.5×6		4

7.4.6 Integral module rack

Exploded View

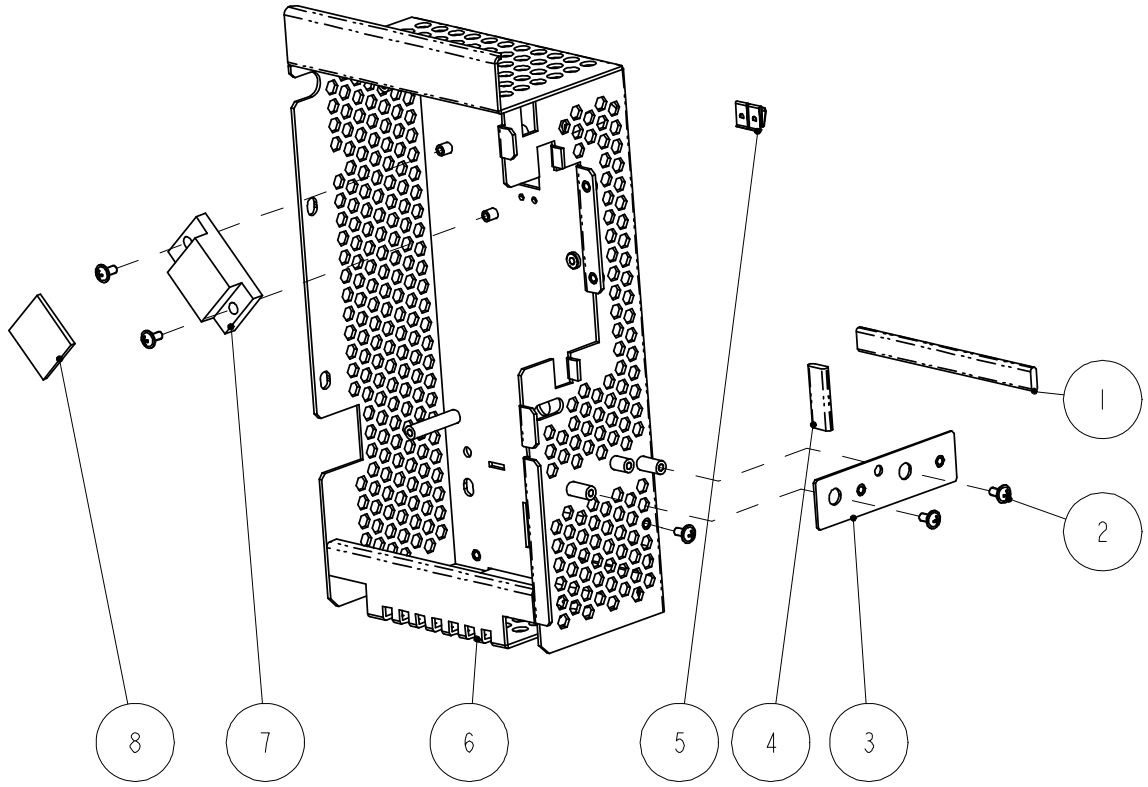


Parts List

SN	Description	FRU part number	Qty
1	Integral module rack	801-6802-00016-00	1
2	Waterproof strip 2 for integral module rack	/	1
3	Waterproof strip 1 for integral module rack	/	1
4	Infrared light filter	/	5
5	Contact screw	/	10
6	Contact spring	/	10
7	Spring leaf	/	10
8	Flat washer, GB96 3	/	10
9	M3 nut with spring washer	/	10
10	6802 3-slot communication board	051-000244-00	1
11	Rubber foot	/	1
12	Stud screw M3×7+6-6	/	5
13	Spring coil	/	2
14	Pan head screw M3×6	/	2
15	Stud screw M3×6+8-5	/	2
16	MPM module rack communication board	6800-30-50073	1

7.4.7 Main Support Assembly

Exploded View

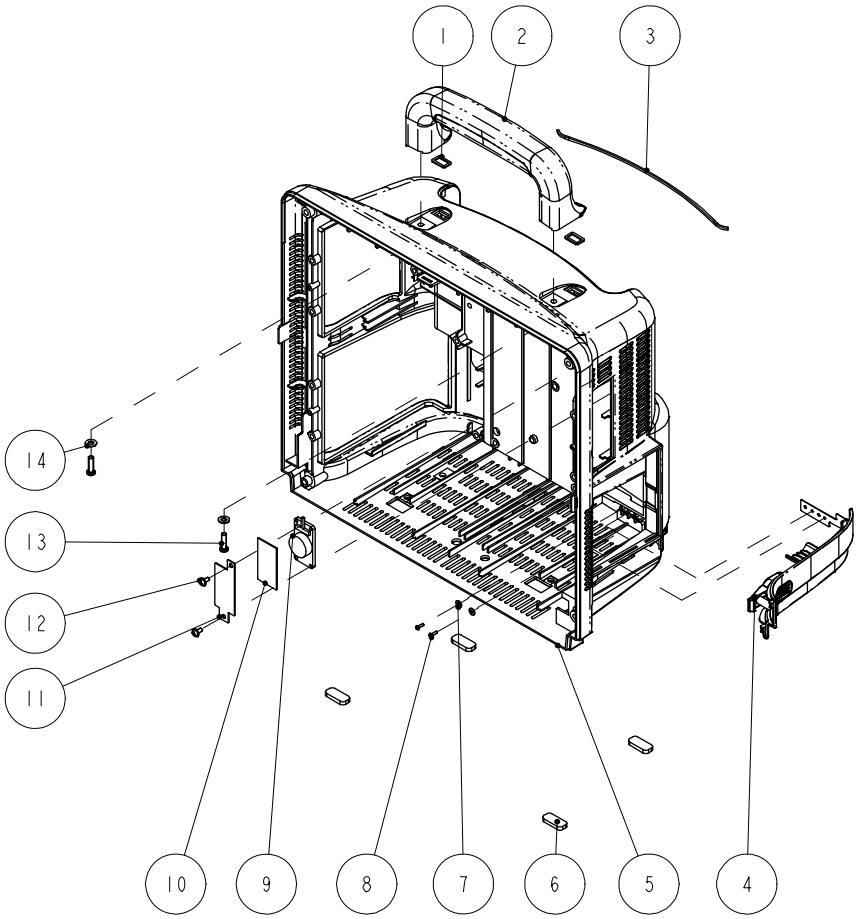


Parts List

SN	Description	FRU part number	Qty
1	Conducting block 9.5×3.2	/	1
2	Phillips screw M3×6	/	5
3	Recorder mounting plate	6802-20-66718	1
4	Conducting block 9.5×3.2	/	1
5	Leaf	/	2
6	Main support	/	1
7	CPU radiator	/	1
8	CPU heat conductor	/	1

7.4.8 Rear Housing Assembly

Exploded View

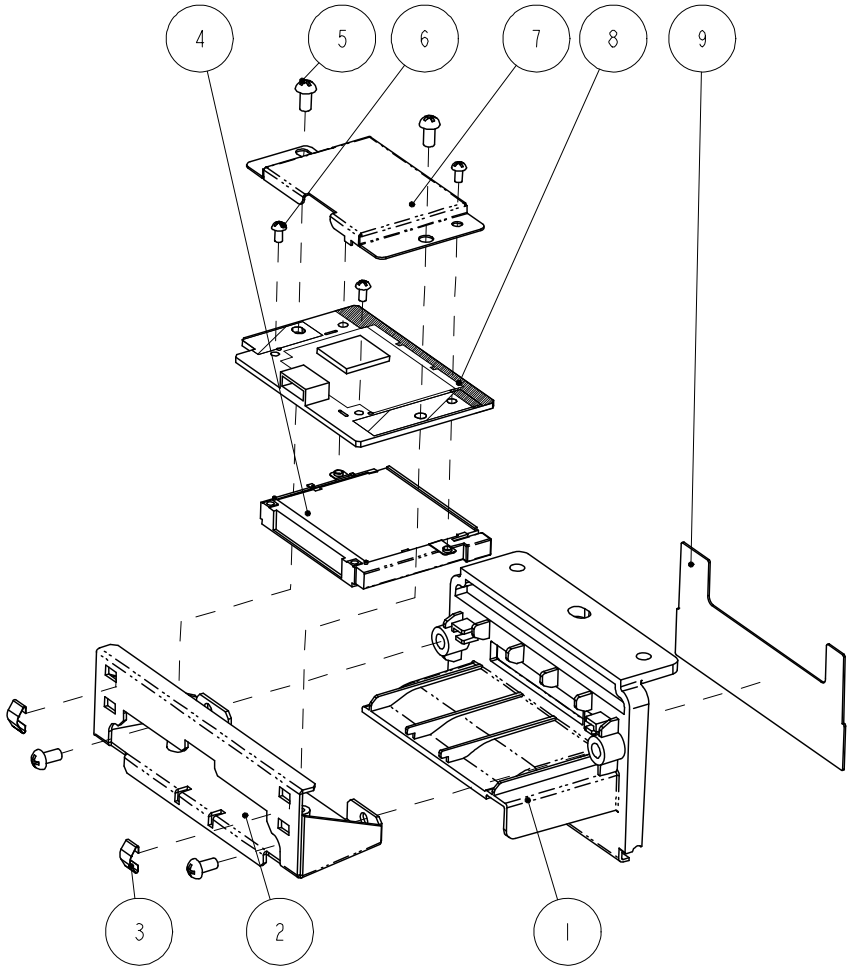


Parts List

SN	Description	FRU part number	Qty
1	Handle waterproof pad	/	1
2	Handle	043-004099-00	1
3	Waterproof strip for the power supply	/	2
4	Battery door assembly	801-6802-00015-00	1
5	Rear housing	043-004091-00	1
6	Cushion	/	2
7	PhillipFlat washer, GB97.1 2.5	/	2
8	Phillips tapping screw PT2×6	/	4
9	Speaker and cables	020-000007-00	1
10	Phillips screw M3×6	/	1
11	Speaker cover	/	1
12	Cross pan head screw with washer M3×6	/	2
13	Tapping screw PT4×14	/	2
14	Flat washer, GB97.1 4	/	2

7.4.9 CF Card Assembly(115-001906-00)

Exploded View

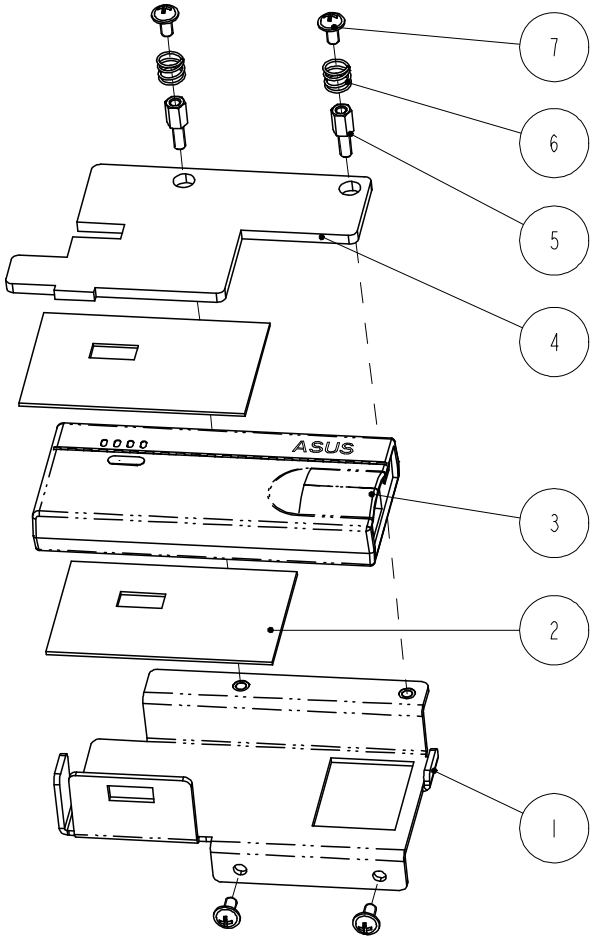


Parts List

SN	Description	FRU part number	Qty
1	Card cover	043-004098-00	1
2	CF card board fixture	6802-20-66726	1
3	Leaf, 178S30(1EA=406mm)	801-6802-00082-00	2
4	Ejector for CF card socket (50pin)	801-6802-00003-00	1
5	Phillips screw M3×6	/	4
6	Phillips screw M2×4	/	4
7	CF card shield	042-000317-00	1
8	9211 CF card board (shield can be installed)	051-000104-00	1
9	Slot cover overlay	/	1

7.4.10 Internal Wireless AP Assembly

Exploded View



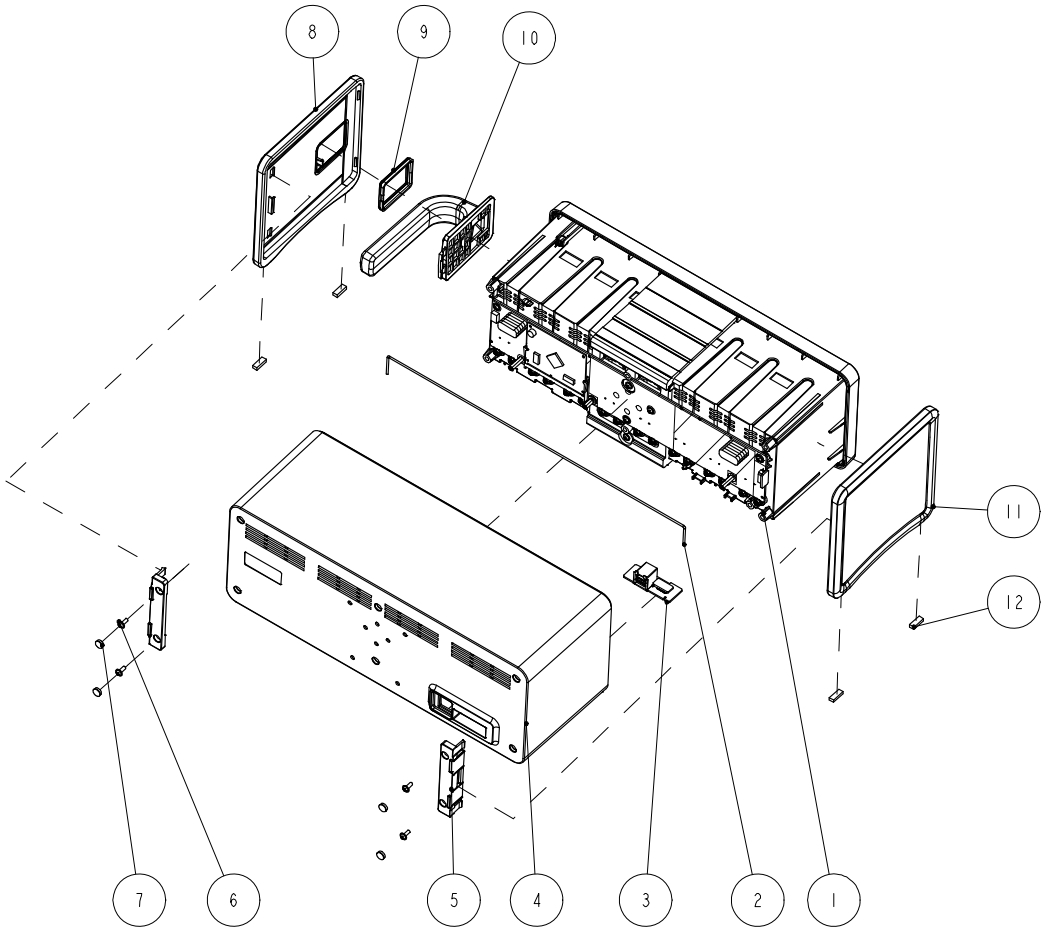
Parts List

SN	Description	FRU part number	Qty
1	Wireless AP holder for T5	042-000600-01	1
2	Thermal pad for wireless card	047-008023-00	2
3	Wireless router 150Mbps Wi-Fi	023-000505-00	1
4	Cover for wireless LAN (T5)	042-007522-00	1
5	Screw boss M3×7+8-6	/	2
6	Spring	/	2
7	Cross pan head screw with washer M3×6	/	4
8	Cable for AP wireless (6100)	009-002895-00	1

7.5 SMR

7.5.1 SMR Assembly

Exploded View

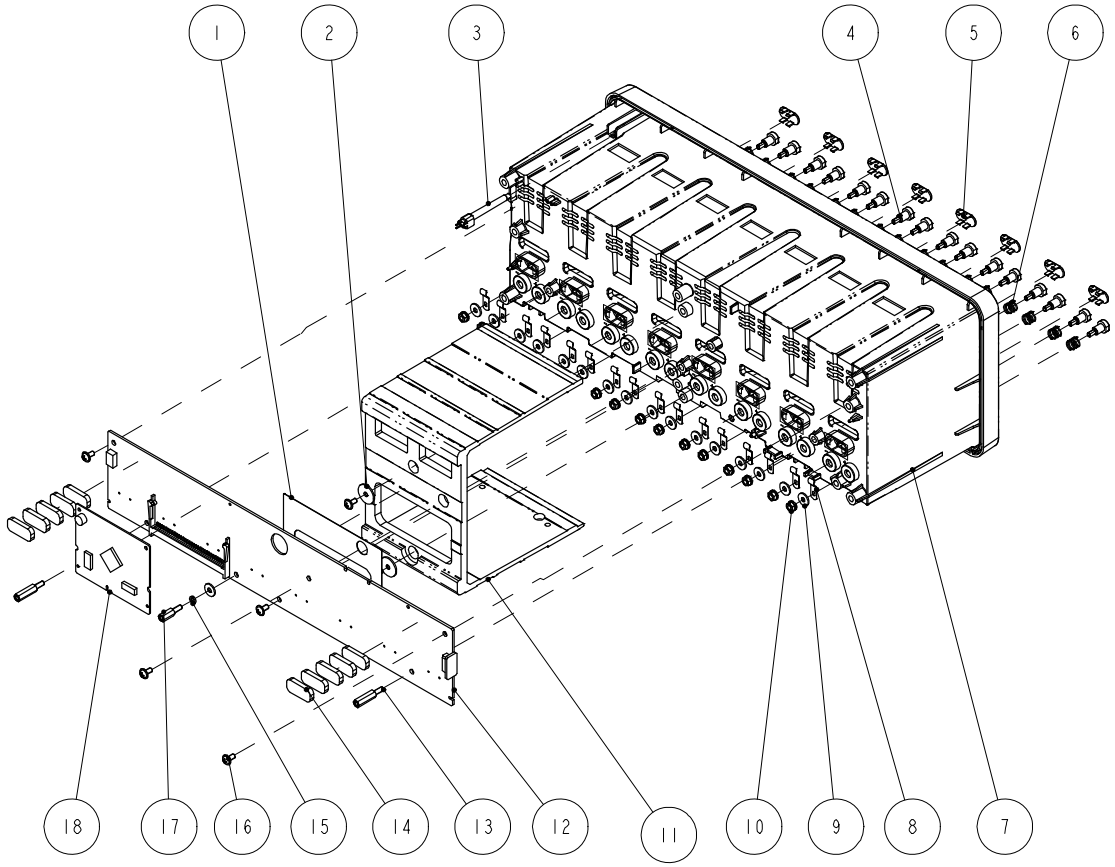


Parts List

SN	Description	FRU part number	Qty
1	Inside assembly	801-6800-00018-00	1
2	Hose		1
3	Interface board (PN: 6800-30-51154)		1
4	Rear housing		1
5	Side plate fixture		2
6	Phillips screw M3×8		4
7	Screw cap 2		4
8	Side plate, right		1
9	Rubber washer		1
10	Handle		1
11	Side plate, left		1
12	Cushion		4

7.5.2 SMR Inner Assembly

Exploded View



Parts List

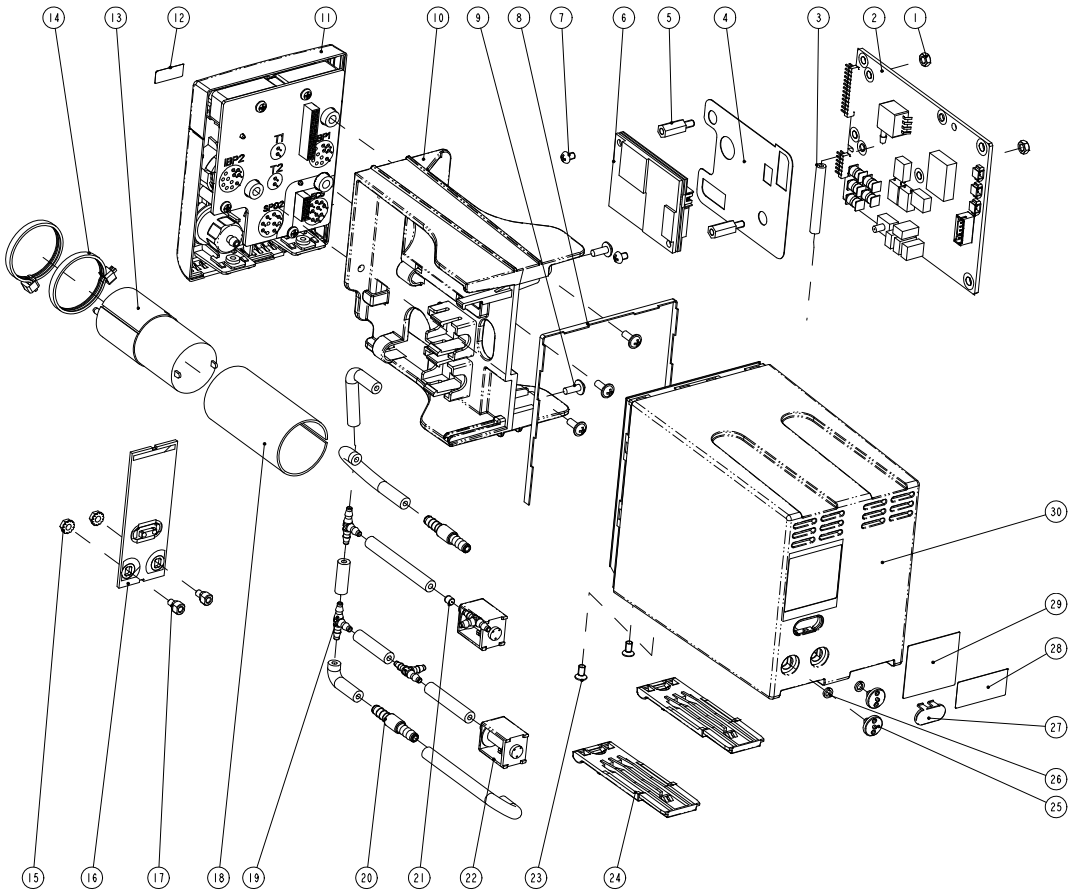
SN	Description	FRU part number	Qty
1	Insulating plate	801-6800-00018-00	1
2	Torsion spring washer		2
3	Light conducting pole		1
4	Contact spring		16
5	Contact screw		16
6	Infrared light filter		8
7	SMR inside assembly		1
8	Spring leaf		16
9	Washer		16
10	Hex nut assy		16
11	Reinforced section steel		1
12	8-slot module rack communication board (PN: 6800-30-51153)		1
13	stub screw M3×16+8-8		2
14	Rubber feet	6800-20-50233	10
15	spring washer GB93 3	/	1
16	Phillips screw M3×6	/	6

SN	Description	FRU part number	Qty
17	stud screw M3×10+8-8, coated with antirust nickel	/	1
18	Nios II module	/	1

7.6 MPM Module

MPM module applies the integrative parameter board (ECG ASIC).

Exploded View



Parts List

SN	Description	FRU part number	Qty
1	Plastic hex nut M3	/	2
2	M51A Multi-parameter module, 5-lead, standard (PN: 051-000976-01)	/	1 As configured
	M51A Multi-parameter module, 5-lead, full (PN: 051-000977-01)	/	
	M51A Multi-parameter module, 12-lead, full (PN: 051-000978-01)	/	
	M51A Multi-parameter module, 5-lead, full, IBP, Masimo (PN: 051-001037-01)	/	

SN	Description	FRU part number	Qty
	Cable for infrared Communication board	/	
3	Silicone tube, 3/32 in. × 7/32 in. × 100ft	/	1.65 inch
4	Plastic hex screw stud, M3×12	/	2
5	Insulation sheet for SpO_2 board	/	1
6	9008 V2.0 SpO_2 board (PN: 051-000943-00)	/	1 As configured
	Nellcor SpO_2 board (PN: 0671-00-0102-01)	/	
	Masimo, MS-2013, SpO_2 board (PN: 040-001149-00)	/	
7	Phillips screw M3×4	/	2
8	Waterproof seal 02	/	1
9	Cross pan head screw with washer M3×8	/	5
10	Holder	/	1
11	New MPM front panel assembly, Nellcor SpO_2	115-011210-00	1 As configured
	New MPM front panel assembly, Nellcor SpO_2 Without IBP	115-011213-00	
	New MPM front panel assembly, Masimo2013 SpO_2 Without IBP	115-011214-00	
	New MPM front panel assembly, Masimo2013 SpO_2	15-011211-00	
12	Label	/	1
13	NIBP pump		
14	Cable tie, CHS-4×150mm	/	2
15	M3 nut with washer	/	2
16	New M51A Infrared communication board	/	1 As configured
	New M51A Infrared communication board, no IBP	/	
17	Screw	/	2
18	Pump cushion	/	1
19	Tee connector, White, Nylon	/	4
20	Inline Filter	/	2
21	630F Reducer	/	1
22	Valve	/	1
23	Flat head screw, Phillips M3×6	/	2
24	Locking clip	/	2
25	Screw	/	2
26	Spring Washer	/	2
27	Infrared lens	/	1
28	Barcode label		
29	Patent label		
30	Rear cover	/	1

7.7 Replaceable Parts

To replace the parts, please refer to ***Chapter 5 Repair and Disassembly*** and the exploded views above.

NOTE

- **Here is a list of the most commonly replaced parts. If you need more parts, please contact our Customer Service Department.**

7.7.1 Main Unit

FRU	Description
Front housing assembly	
051-001820-00	Backlight board
022-000014-00 or 022-000001-00	TPI inverter
009-005252-00	Flat Cable Of AU Screen
021-000160-00	LCD screen (G121STN01.0)
0000-10-10799	Touchscreen 12.1″
0000-10-10749（optional）	Touchscreen 12.1″
6800-30-50082	Touchscreen control board
6800-30-51095 (optional)	Touchscreen control board （should be used in connection with the optional touchscreen 0000-10-10749）
043-003546-00	Passport 12m front housing
115-004220-00	T5 button board (touch screen, optical encoder)
051-000879-01	Alarm LED board
115-022497-00	Encoder assembly
6802-30-66680	Power switch & LED board
6802-20-66732	Connecting cable between converter and keypad (Sharp)
6802-20-66673	Cable connecting the inverter and the button board
6802-20-66650	Flat cable connecting the LCD and the mother board
009-004019-00	Alarm lamp board
6802-20-66671	Cable connecting the power switch & LED board and button board
FRU	**Description**
Front housing assembly (continued)	
6802-20-66672	Cable between the touchscreen control board and the button board
Main unit	
043-000184-00	Recorder cover
6802-20-66665	Cable connecting the recorder and the mother board
6802-20-66666	Cable connecting the CF card and the mother board
6802-20-66684	Cable connecting the button board and the mother board
043-004115-00	Interface board cover

6802-20-66717	Main support
6802-20-66718	Recorder fixing plate
6802-30-66763	Battery compartment assembly
6802-30-66653	Battery interface board
6802-20-66799	Cable connecting the Integral module rack and the mother board
6802-30-66767	Master control board assembly
6802-30-66769	Interface assembly
115-001906-00	6802 CF card assembly (211 driving board)
023-000845-00 023-000846-00	CF card
6802-30-66768	Fan assembly
6802-20-66668	Speaker and cables
115-001290-00	TR6F recorder
6802-30-66770	Power module assembly
6802-30-66651	Power board
6800-30-50073	MPM module rack communication board
6800-30-50075	NiosII module
6802-20-66669	Cable connecting the main unit and the infrared communication board
051-000244-00	6802 3-slot module rack communication board
049-000626-00	Passport 17m key pad
049-000680-00	Passport 17m key pad(French)
6802-30-66766	Rear housing assembly
6800-20-50672	Cable connecting the main board and the DIV interface board
6800-20-50673	Cable connecting the main board and the USB_Hub board
6802-20-66664	Cable connecting the DVI interface board and the mother board
6802-20-66675	Cable connecting USB_Hub board and the mother board
6802-30-66659	USB Hub board
FRU	**Description**
Main unit (continued)	
6802-30-66657 or 051-000019-00	DVI interface board or DVI interface board (can support IABP)
6800-20-51104	Cable connecting the SMR receptacle interface board and infrared communication board
009-000248-00	Cable connecting the inverter and button board
009-004546-00	Cable connecting the LED backlight board and screen
009-005252-00	Flat connection cable for AU screen

7.7.2 SMR

FRU	Description
6800-30-50075	NiosII module
6800-30-50078	SMR communication board
6800-30-50080	SMR interface board
6800-30-50667	SMR indicating lamp assembly
043-004118-00	SMR inside assembly
043-004120-00	SMR rear housing
043-004051-00	SMR handle

7.7.3 Parameter Modules and Cables

FRU	Description
115-015012-00	BIS Module
115-013335-00	SpO_2 module(Masimo MS-2013)
6800-30-50488	RM module
6800-30-50137	Mindray sidestream CO_2 module (M02B, 2 slots)
115-020189-00	Mindray sidestream CO_2 module (M02C, 1 slot)
6800-30-50501	AG module (with O_2/BIS)
6800-30-50502	AG module (with O_2)
115-029852-00	C.O. module
115-029851-00	IBP module
6800-30-50558	ORIDION CO_2 module
115-003480-00	CCO/SvO_2 module
115-007273-00	$ScvO_2$ module
115-007276-00	BeneLink module
115-022715-00	MPM-2 module(Masimo SpO_2 (MS-2013), 3/5lead,FDA)
115-022716-00	MPM3 module(Nellcor SpO_2, 3/5lead, FDA)
115-022718-00	MPM5 module (Masimo SpO_2 (MS-2013), 12-lead, FDA)
115-022719-00	MPM6 module(Nellcor SpO_2, 12lead, FDA)
115-030471-00	Assistant inset box
6800-30-50132	Nellcor SpO_2 flexible cable kit
6800-30-50130	Masimo SpO_2 flexible cable kit
6800-20-50662	Air pump cable
6800-20-50663	Fast-release valve cable
6800-20-50664	Slow-release valve cable
6800-20-50674	Cable from ICG module to infrared communication board

FRU	Description
6800-20-50683	Mindray CO_2 infrared communication cable
6800-20-50306	AG module cable
6800-21-50310	BIS interface cable
6800-21-50311	CO interface cable
6800-21-50312	IBP interface cable
6800-20-50316	RM infrared detection board cable
6800-20-50160	Module button board cable
040-000125-00	Patient Interface Cable (BIS module service part)
040-000674-00	For service only, BISx Kit (186-0199-MR)
040-000675-00	For service only, BISx4 Kit (186-1030-MR)
040-000676-00	For service only, BISx Host Cable (186-0201-MR)
009-001770-00	RJ45 connecting cable
009-001767-00	Serial port adapting cable, type A
009-001768-00	Serial port adapting cable, type B
009-001769-00	Serial port adapting cable, type C
009-001765-00	Cable, Infrared Board to Interface Board
009-001254-00	AP&CVP socket with signal cable
009-001255-00	$ScvO_2$ socket with signal cable

FOR YOUR NOTES

8 Upgrade

8.1 Introduction

You can upgrade parameter modules, functional assemblies and system software by connecting the patient monitor to a PC running the System Update Tool.

NOTE

- **If you have to disassemble the patient monitor for software upgrade, be sure to eliminate static charges before disassembling the equipment. When disassembling any part labeled with an ESD warning symbol, make sure you are wearing electrostatic discharge protection such as an antistatic wristband or gloves to avoid damaging the equipment.**
- **Properly connect and route the cables and wires when reassembling the equipment to avoid pinched hoses and electrical short circuits.**
- **Use specified screws to assemble the equipment. If the incorrect screws are forcefully tightened, the equipment may be damaged and the screws or part may fall off during use, causing unpredictable equipment damage or human injury.**
- **Follow correct sequence to disassemble the equipment. Otherwise, the equipment may be permanently damaged.**
- **Disconnect all cables before disassembling any parts. Be careful not to damage any cables or connectors.**

8.2 Upgrading Parameter Modules

You can upgrade the following parameter modules:

Parameter module	PN	Description	Remark
MPM module	115-022715-00	MPM-2 module(Masimo MS-2013, 3/5lead, FDA)	/
	115-022716-00	MPM3 module(Nellcor SpO2, 3/5lead, FDA)	/
	115-022718-00	MPM5 module (Masimo MS-2013, 12-lead, FDA)	/
	115-022719-00	MPM6 module(Nellcor SpO2, 12lead, FDA)	/
IBP module	6800-30-50850	IBP module upgrade package (without accessories)	/
C.O. module	6800-30-50849	C.O. module upgrade package (without accessories)	/
CO_2 module	6800-30-50139	M02B CO_2 module upgrade package (for adult and pediatric patients, with accessories)	Sidestream (2 slots)
	6800-30-50141	M02B CO_2 module upgrade package (for neonatal patient, with accessories)	Sidestream (2 slots)
	6800-30-50820	Oridion CO_2 module upgrade package (with accessories)	Microstream
AG module	6800-30-50841	AG module upgrade package (with O_2, BIS, and accessories	/
	6800-30-50842	AG module upgrade package (with O_2 and accessories	/
BIS module	6800-30-50427	BIS module upgrade package (for pediatric patients, with accessories)	/
	6800-30-50880	BIS module upgrade package (with accessories)	/
RM module	6800-30-50853	RM module upgrade package (with accessories)	/
CCO/SvO_2 module	801-6800-00104-00	CCO/SvO_2 module upgrade package	/
$ScvO_2$ Module	115-007590-00	$ScvO_2$ function upgrade kit	/

You can insert and remove parameter modules during patient monitoring. Refer to the Operators' Manual for the use of parameter modules.

8.3 Upgrading Functional Assemblies

You can upgrade the following functional assemblies:

Functional assembly	PN	Description	Remark
SMR	6800-30-50641	SMR kit	/
Wireless network	115-024690-00 (2.4GHz)	Wireless AP kit (Silex)	Internal AP, for fully configured patient monitor
	115-037631-00 (5GHz)	6804 5G WIFI transfer kit	
Recorder	TR6F-30-67318	Recorder upgrade kit	/
Analog output	801-6802-00006-00	DVI interface board (FRU)	/

The patient monitor can be connected to a network through wireless AP. Authorized personnel are required to connect and set up the wireless network, and then carry out the performance test.

8.3.1 Upgrading SMR

The SMR can be connected to the patient monitor through the SMR connector via a powered USB cable.

Refer to the Operator's Manual for details.

8.4 Upgrading Software

Software upgrade must be performed by Mindray, NA authorized service provider. Call Service Dispatch 1 800 288-2121 ext: 7875.

FOR YOUR NOTES

A Electrical Safety Inspection

The following electrical safety tests are recommended as part of a comprehensive preventive maintenance program. They are a proven means of detecting abnormalities that, if undetected, could prove dangerous to either the patient or the operator. Additional tests may be required according to local regulations.

All tests can be performed using commercially available safety analyzer test equipment. Please follow the instructions of the analyzer manufacturer.

The consistent use of a safety analyzer as a routine step in closing a repair or upgrade is emphasized as a mandatory step if an approved agency status is to be maintained. The safety analyzer also proves to be an excellent troubleshooting tool to detect abnormalities of line voltage and grounding, as well as total current loads.

A.1 Power Cord Plug

Test Item		Acceptance Criteria
The power plug	The power plug pins	No broken or bent pin. No discolored pins.
	The plug body	No physical damage to the plug body.
	The strain relief	No physical damage to the strain relief. No plug warmth for device in use.
	The power plug	No loose connections.
The power cord		No physical damage to the cord. No deterioration to the cord.
		For devices with detachable power cords, inspect the connection at the device also.
		For devices with non-detachable power cords, inspect the strain relief at the device.

A.2 Device Enclosure and Accessories

A.2.1 Visual Inspection

Test Item	Acceptance Criteria
The enclosure and accessories	No physical damage to the enclosure and accessories.
	No physical damage to meters, switches, connectors, etc.
	No residue of fluid spillage (e.g., water, coffee, chemicals, etc.).
	No loose or missing parts (e.g., knobs, dials, terminals, etc.).

A.2.2 Contextual Inspection

Test Item	Acceptance Criteria
The enclosure and accessories	No unusual noises (e.g., a rattle inside the case).
	No unusual smells (e.g., burning or smoky smells, particularly from ventilation holes).
	No taped notes that may suggest device deficiencies or operator concerns.

A.3 Device Labelling

Check the labels provided by the manufacturer or the healthcare facility are present and legible.

- Main unit label
- Integrated warning labels

A.4 Scheduled Electrical Safety Inspection

For scheduled electrical safety inspection, perform all the test items listed in ***A.6 ELECTRICAL SAFETY INSPECTION TEST***.

A.5 Electrical Safety Inspection after Repair

The following table specifies test items to be performed after the equipment is repaired. Refer to ***A.6 ELECTRICAL SAFETY INSPECTION*** for the description of the test items.

Repair with main unit not disassembled		Test items: 1, 2, 3
Repair with main unit disassembled	When neither power supply PCBA nor patient electrically-connected PCBA is repaired or replaced	Test items: 1, 2, 3, 4
	When power supply PCBA is repaired or replaced	Test items: 1, 2, 3, 4, 5
	When patient electrically-connected PCBA is repaired or replaced	Test items: 1, 2, 3, 4, 6, 7, 8
	When both power supply PCBA and patient electrically- connected PCBA are repaired or replaced	Test items: 1, 2, 3, 4, 5, 6, 7, 8

A.6 ELECTRICAL SAFETY INSPECTION TEST

Inspection and Testing			Limit
1	Power Cord Plug		
2	Device Enclosure and Accessories		/
3	Device Labeling		/
4	Protective Earth Resistance		Max 0.2 Ω
5	Earth Leakage	Normal condition(NC)	Max: NC: 300μA(refer to UL60601-1) SFC: 1000μA
		Single Fault condition(SFC)	
6	Patient Leakage Current	Normal condition(NC)	Max: CF applied part: NC:10μA, SFC: 50μA BF applied part: NC:100μA, SFC: 500μA
		Single Fault condition(SFC)	
7	Mains on Applied Part Leakage		Max: CF applied part: 50μA BF applied part: 5000μA
8	Patient Auxiliary Current	Normal condition(NC)	Max: CF applied part: NC:10μA, SFC: 50μA BF applied part: NC:100μA, SFC: 500μA

FOR YOUR NOTES

P/N 046-005122-00（3.0）