Passport 17m

Patient Monitor

Service Manual

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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.**

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- 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.
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- Malfunction of the instrument or part whose serial number is not legible.
- Others not caused by instrument or part itself.

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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

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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.

NOTE

- **Prior to logging into the iView system, you must connect the keyboard to the special USB connector.**

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 (SpO2), pulse rate (PR), non-invasive blood pressure (NIBP), invasive blood pressure (IBP), pulmonary artery wedge pressure (PAWP), cardiac output (C.O.), carbon dioxide (CO2), oxygen (O2), anesthetic gas (AG), impedance cardiograph (ICG), bispectral index (BIS), respiration mechanics (RM), and central venous oxygen saturation (ScvO2)

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

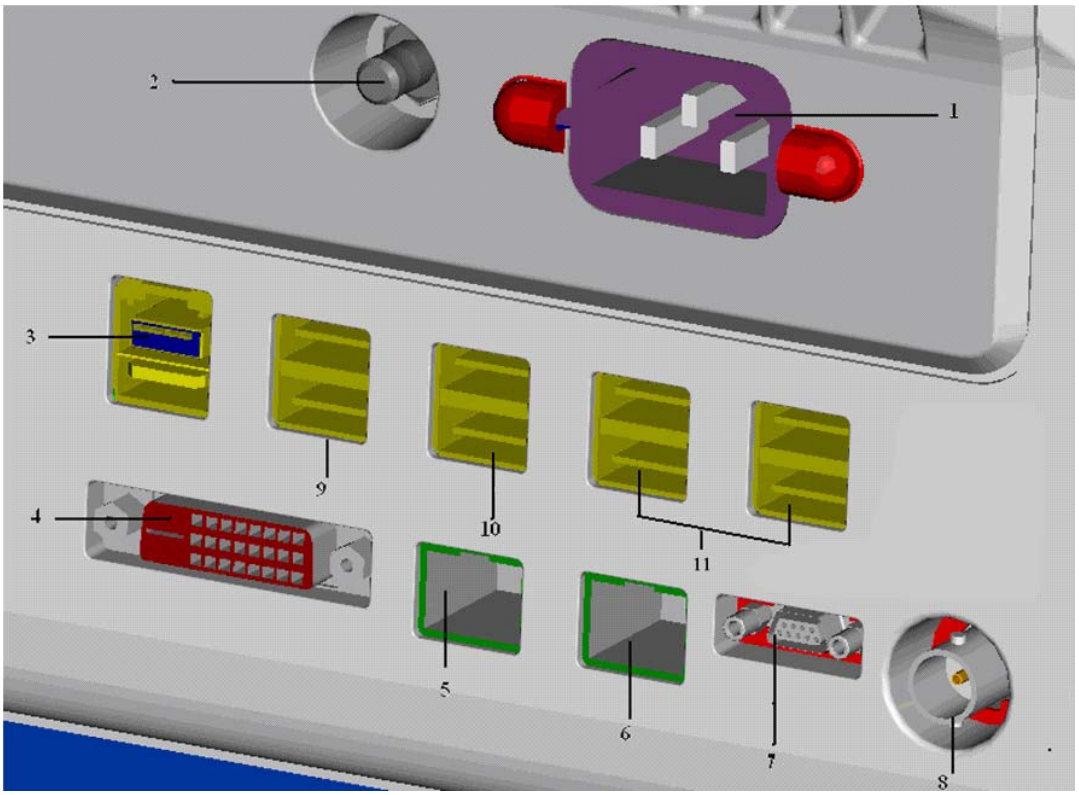
The patient monitor can be mounted on a wall bracket. The wall bracket can be ordered separately. Each mounting bracket is delivered with a complete set of mounting hardware and instructions.

CAUTION

- **Use mounting brackets Mindray supplies or approves. If another compatible mounting bracket is used, sure it can be safely support the Passport 17m monitor.**
- **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 17m 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. SMR Connector: Powered USB connector which is used with the special powered USB cable necessary to connect and operate the SMR.
4. Video Output: It is a DVI-D connector used to connect a secondary display.
5. iView Network Connector: It is a RJ45 connector that connects iView system to external network.
6. Network Connector: It is a RJ45 connector used to connect an ethernet network or a PC.
7. Analog Output and Defibrillator Connector: It is a Micro-D connector used to output analog signals and defibrillator synchronization signals.
8. Auxilliary Output Connector: It is a BNC connector used to output nurse call signals.
9. Secondary USB Connector: used to connect the mouse and keyboard of the secondary display.
10. Special USB Connectors: used for iView maintenance and data transfer.
11. General USB Connector: used to connect any USB-compatible peripheral device.

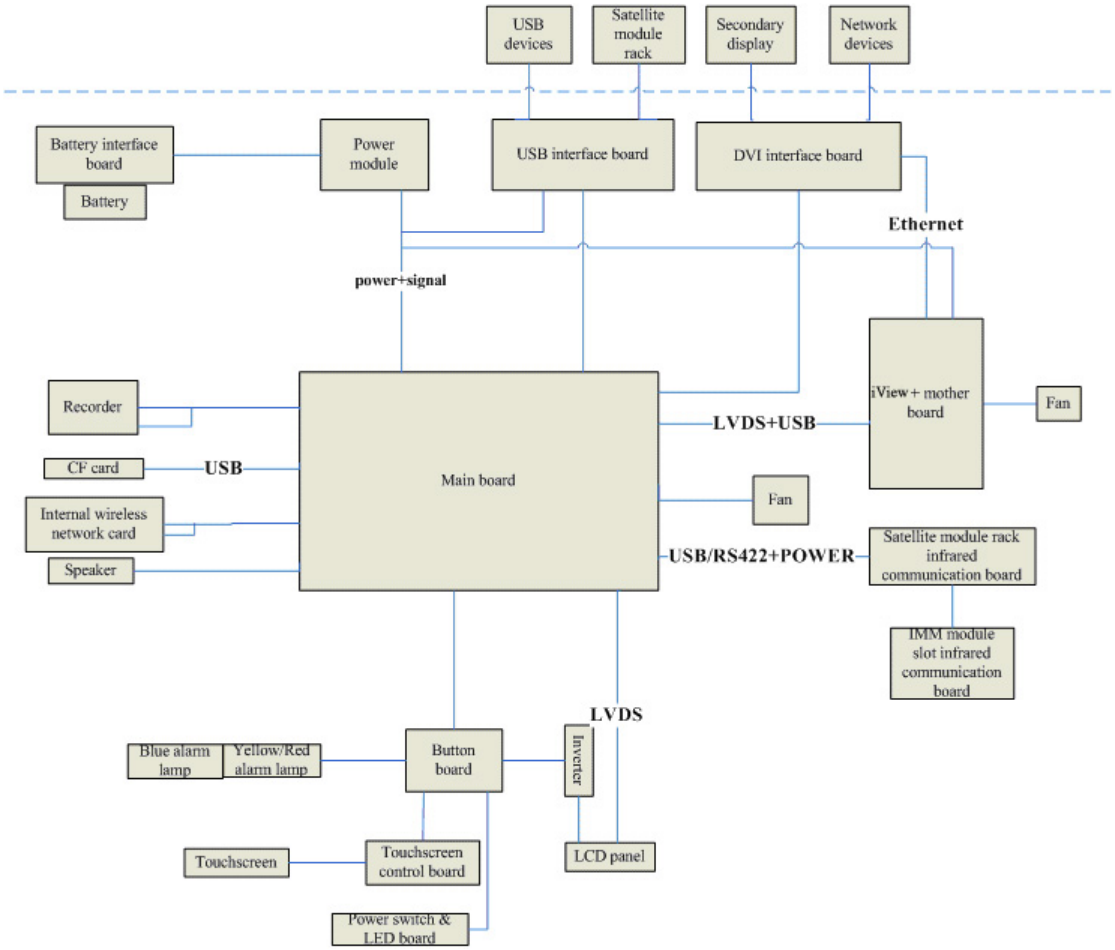
2.3 Main Unit

The patient monitor consists of:

- Input system: button board, knob, touchscreen, power switch and LED board
- Output system: LCD panel, alarm LED board, recorder, speaker
- Processing and communications system: main board, iView assembly, integral module rack
- Power management system: battery, battery interface board, power module
- Equipment interface system: USB 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.



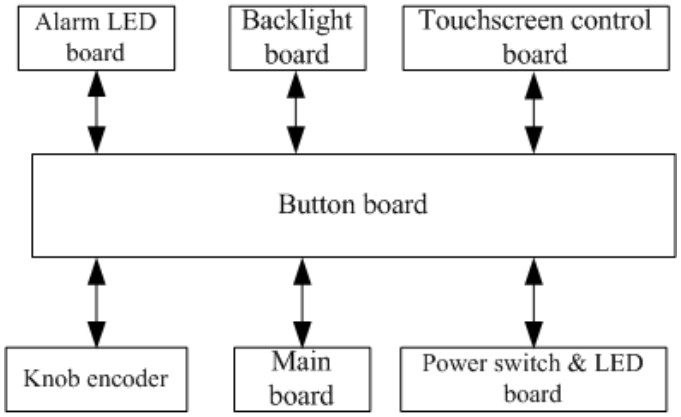
2.3.1 Input System

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
- Backlight board
- Alarm LED 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. Signals and power supply of the backlight board are transferred by the button board.

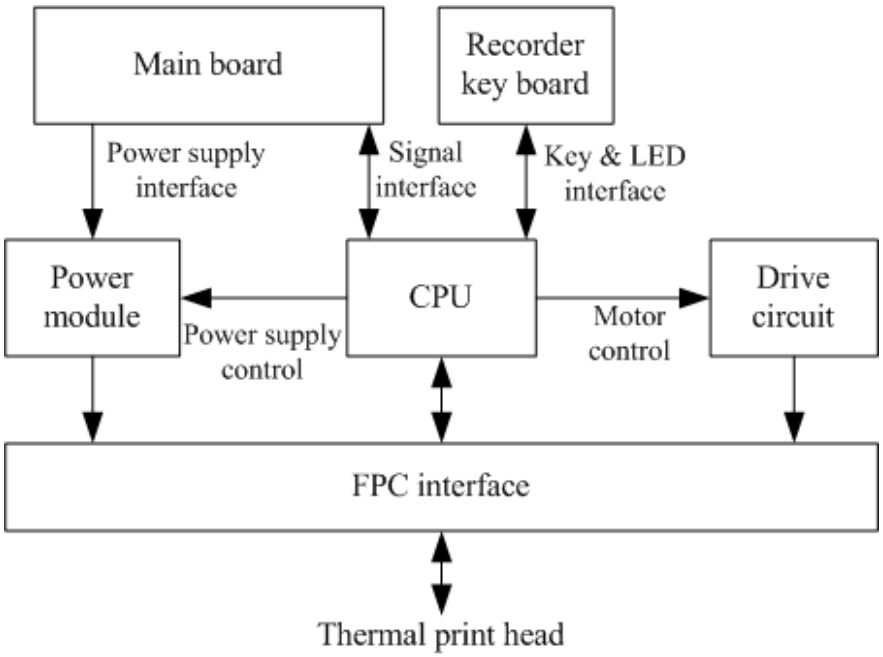
Alarm Lamp

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 coming from the main board and transmits it to the thermal printhead for printing. The recorder has a hardkey (start/stop recordings) and a green LED on its front. It is connected to the main board.

The following diagram shows its operating principle.



Module	Description
Power interface	Introduces a DC from the main board.
Power module	Converts the input A/C power into appropriate D/C voltages which power individual modules.
CPU	Controls all the communications between modules.
Signal interface	Controls all 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 board and the LED board are controlled directly by the CPU board.

Speaker

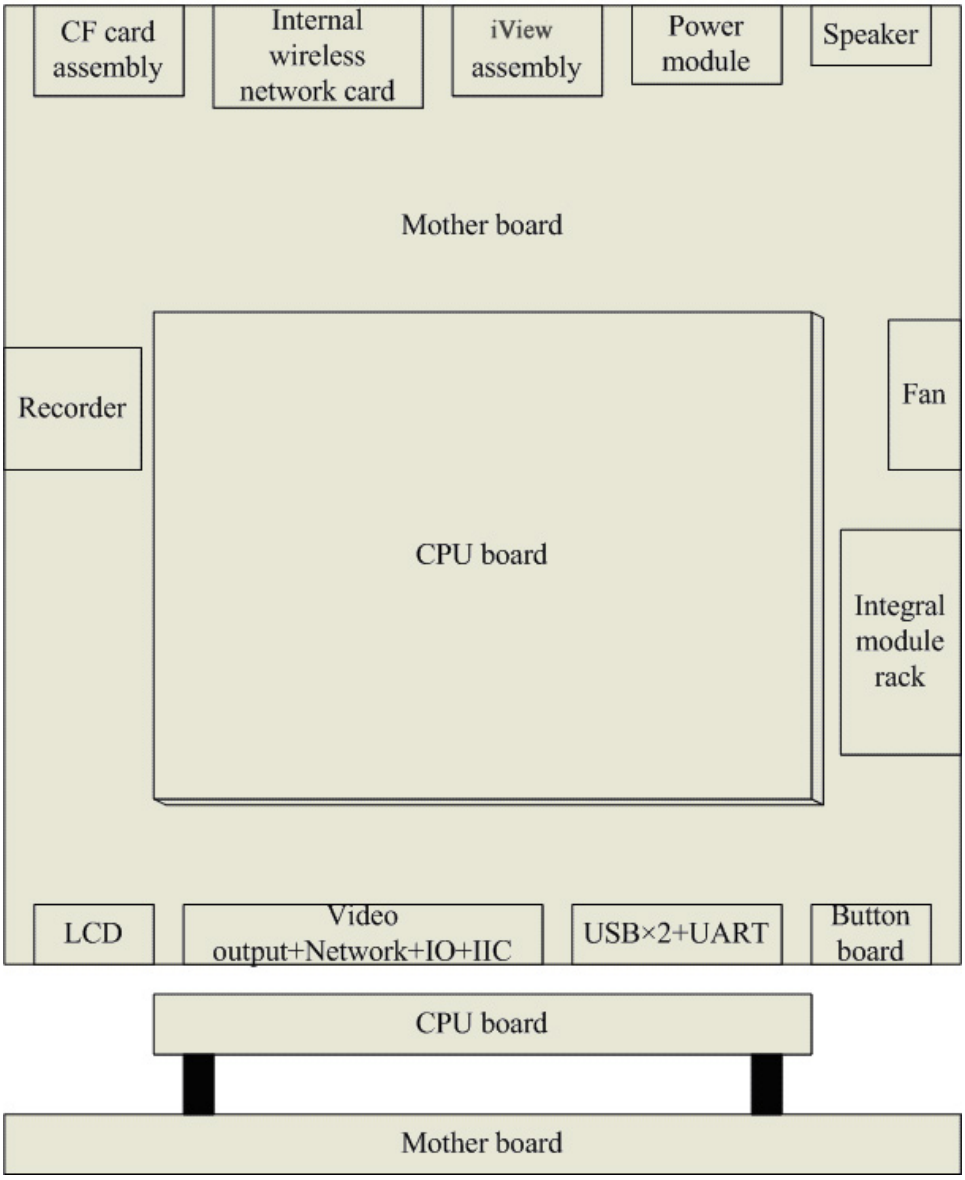
The speaker provides sound for alarms, key strokes, heart beats and pulse, and allows PITCH TONE and multi-level tone modulation. It is connected with the main board and is directly driven by the main board.

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, realtime 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:

- LCD port: connects a built-in display.
- Video output+network+IO+IIC: connects the digital video interface board.
- USB×2+UART: connects the USB interface board.
- Button board port: connects the button board.
- Integral module rack port: connects integral module rack communication board.
- Fan port: connects the fan.
- Speaker port: connects the speaker.
- Power module port: connects the power module.
- iView port: located at the back of the mother board for connecting the iView components.
- CF port: connects the CF card assembly.
- Recorder port: connects the recorder.
- Internal wireless network card port: connects the internal wireless network card

iView System

iView sytem includes iView mother board, computer board, hard disk, etc. iView system connects to the main control board, DVI interface board and USB interface board. The iView system transmits the network signal to the host network interface through DVI interface board.

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 is 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 door is located at the bottom of the patient monitor. The battery power is introduced to the power module via the battery interface board, and then processed and distributed to each component by the power module.

NOTE

- **Two batteries must be used simultaneously when the patient monitor operates on battery power.**

Battery Interface Board

The battery interface board connects batteries to the power module, enabling charging and discharging between the batteries and the power board.

Power Module

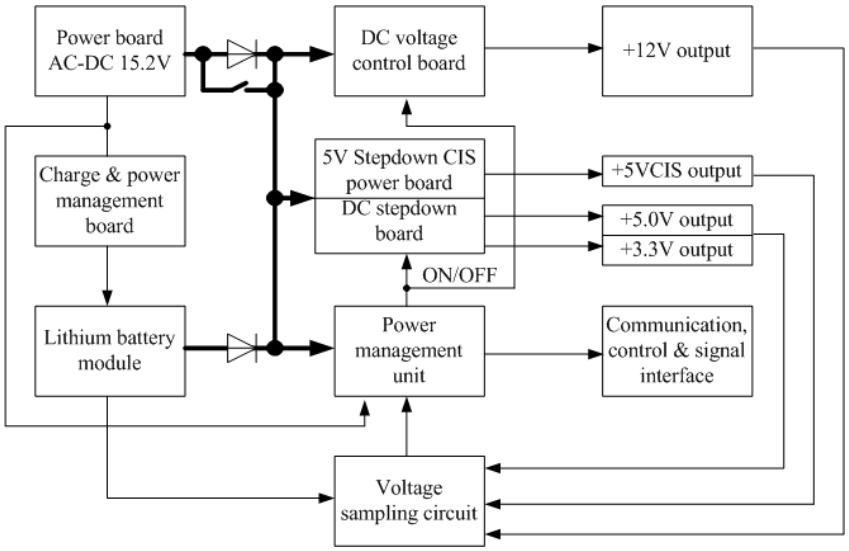
The power module is located at the back of the patient monitor. The main part of the power module is the power board, which contains 4 PCBs: charging & power management board, voltage drop DC inverter, voltage rise and drop DC inverter, and voltage drop 5 V CIS power board.

The power module transforms 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.

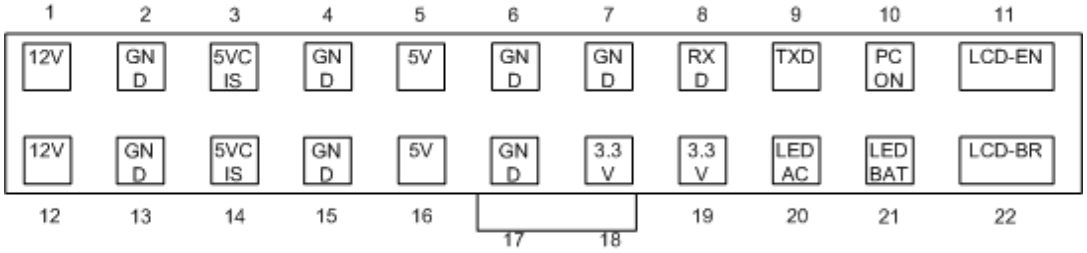
Power module has an AC input socket at its backside, and a socket at its front provides 4 connections to the batteries, main board, iView components and USB interface board respectively. The power module protects itself and the patient monitor by switching off AC input or DC output in case of overcurrent, short circuit and overvoltage.The power module provides 4 DC outputs:

Outputs	Description
+3.3 VDC	Goes to the LCD, mother board, CPU board, DVI interface board and integral module rack.
+5.0 VDC	Goes to the DVI interface board, recorder, CF storage card board and USB interface board.
+5.0 VDC CIS	Goes to the iView assembly.
+12 VDC	Goes to the recorder, LCD inverter, integral module rack, parameter modules and USB interface board.

The systematic principle diagram of the power module is as follows:



The following diagram shows the pins of the power module socket (excluding the pins of the battery power socket. On power board, pin 1 has a triangle symbol):



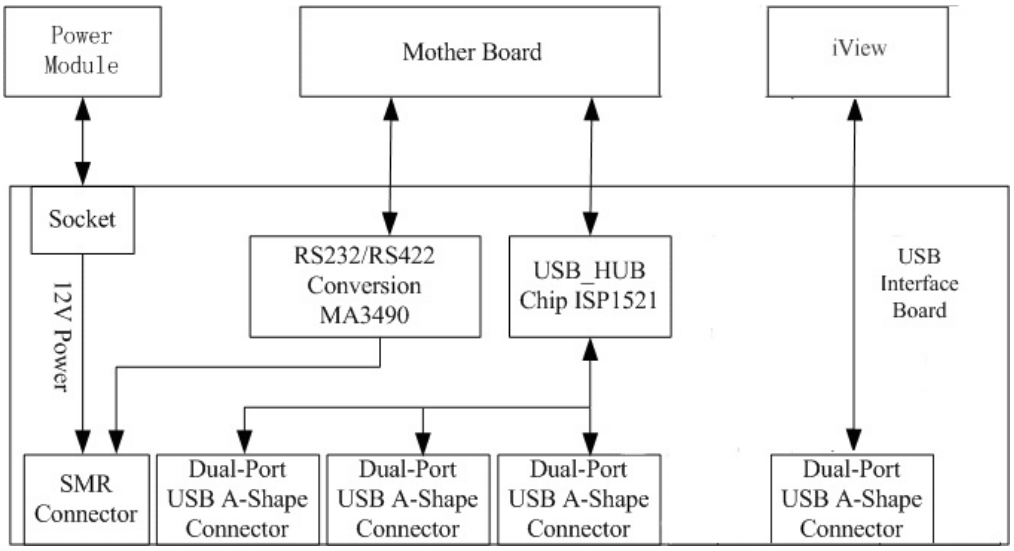
Pin ID	Marking	Description	Cable color
2, 4, 6, 7, 13, 15, 17	GND	The output grounding terminal of the power board.	Black
8	RXD	Receives serial communications (from the main board).	Purple
9	TXD	Sends serial communications (to the main board).	Brown
10	PCON	Power on/off control signal. A TTL pulse signal inputted from the back board. Every time 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 and no less than 2 s for power off.	Blue
11	LCD-EN	Backlight on/off control signal. The main board sends a backlight on/off control signal to the power board through the serial interface. The power board processes the received signal and then outputs a high or low signal depending on the received signal.	Green
12, 1	12 V	The positive end of the 12 VDC coming from the power board.	Yellow
14, 3	5 V CIS	The positive end of the 5 VDC CIS coming from the power board.	Purple
16, 5	5 V	The positive end of the 5 VDC coming from the power board.	Red

Pin ID	Marking	Description	Cable color
18, 19	3.3 V	The positive end of the 3.3 VDC coming from the power board.	Orange
20	LED- AC	AC power status indication signal	White
21	LED- BAT	Battery status indication signal.	Grey
22	LCD-BR	Backlight brightness control voltage.	Brown

2.3.5 Equipment Interface System

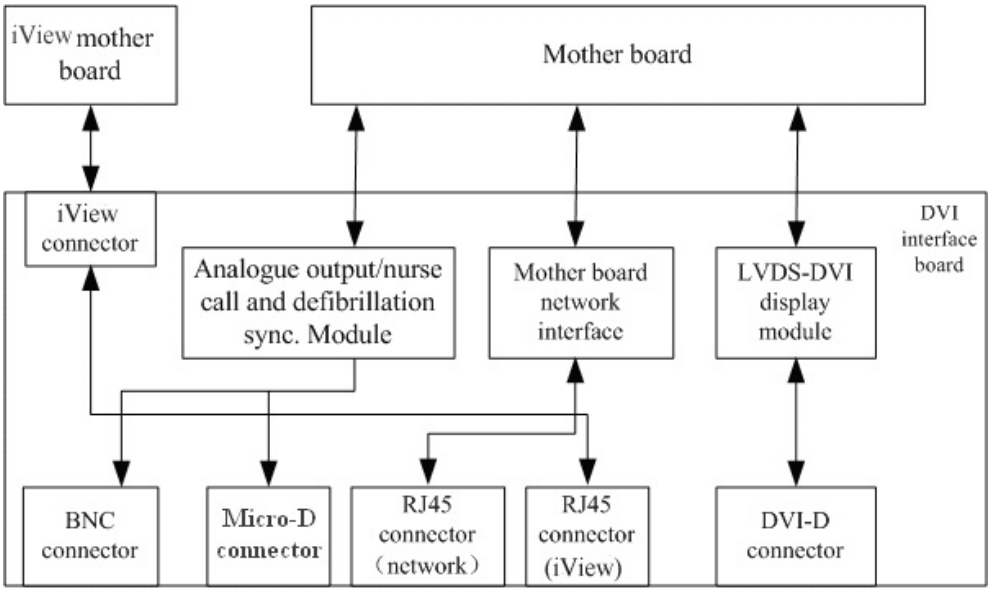
USB Interface Board

The USB interface board is compatible with such USB interfaces as USB2.0, USB1.1 and USB1.0. It is connected with the main board and the power module. It receives USB differential signals coming from the main board and then distributes them to a maximum of six USB interfaces via two ISP1521 chips. The USB interface board of the iView system directly connects to two USB interfaces (on the USB board) of the host. The UART signal output by the main board is converted into RS422 signal by the USB interface board. The USB interface board receives 5 VDC and 12 VDC inputs from the power module, of which the 5 VDC goes to the USB interface board and the 12 VDC outputted to the SMR connector through a fuse.



DVI Interface Board

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



Interface	Description
iView Connector	Connects the iView mother board.
BNC connector	Outputs nurse call signals.
Micro-D connector	Outputs analog signals and defibrillator synchronization signals.
RJ 45 connector (network)	A standard RJ45 connector, providing 10/100 BASE-TX Ethernet communications channels. It connects an Ethernet network or a PC.
RJ 45 connector (iView)	A standard RJ45 connector for connecting a iView network.
DVI-D connector	Connects a secondary display.

CF Card assembly

The CF assembly serves the non-volatile CF storage card which is used for data storage and transfer. 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 consists 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 Parameter Board

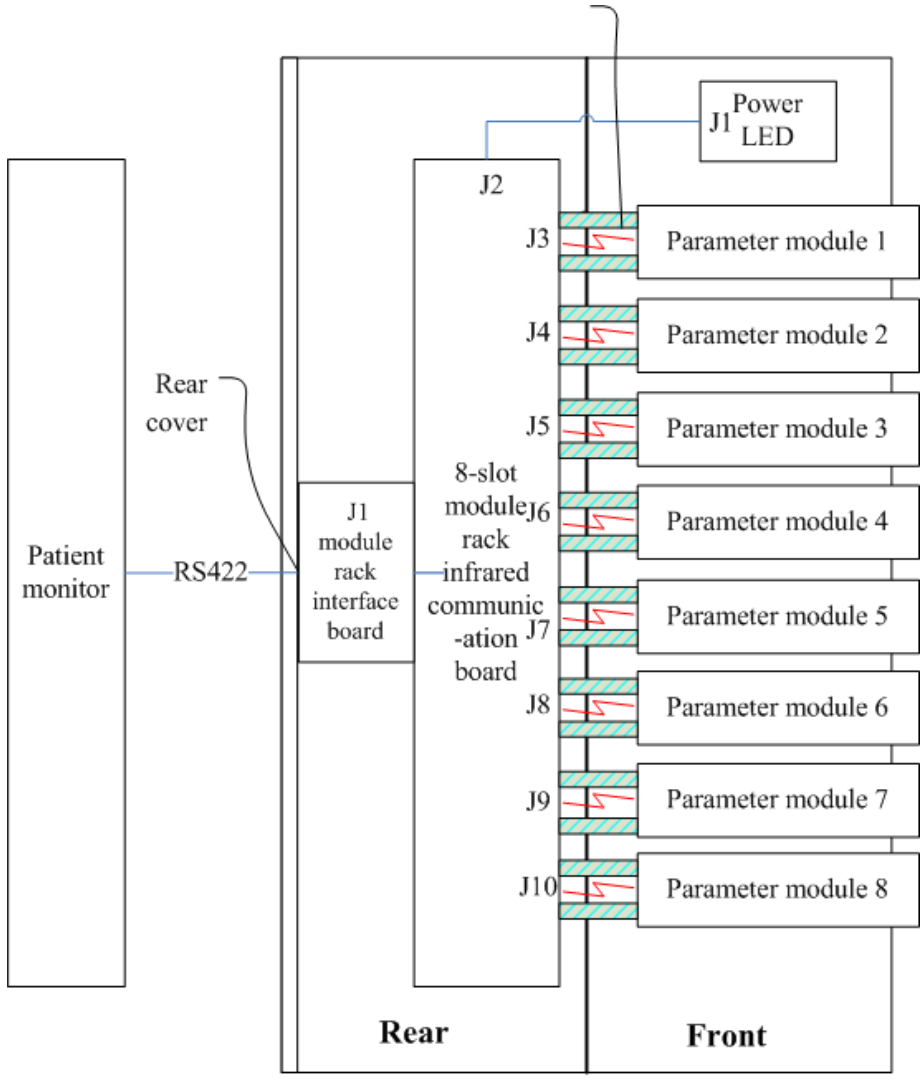
The parameter board is a parameter measurement component.

2.5 Satellite Module Rack

The satellite module rack (SMR) is independent of the patient monitor, 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 supplies power to each parameter module via the contact screw.
- It accomplishes communications 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.

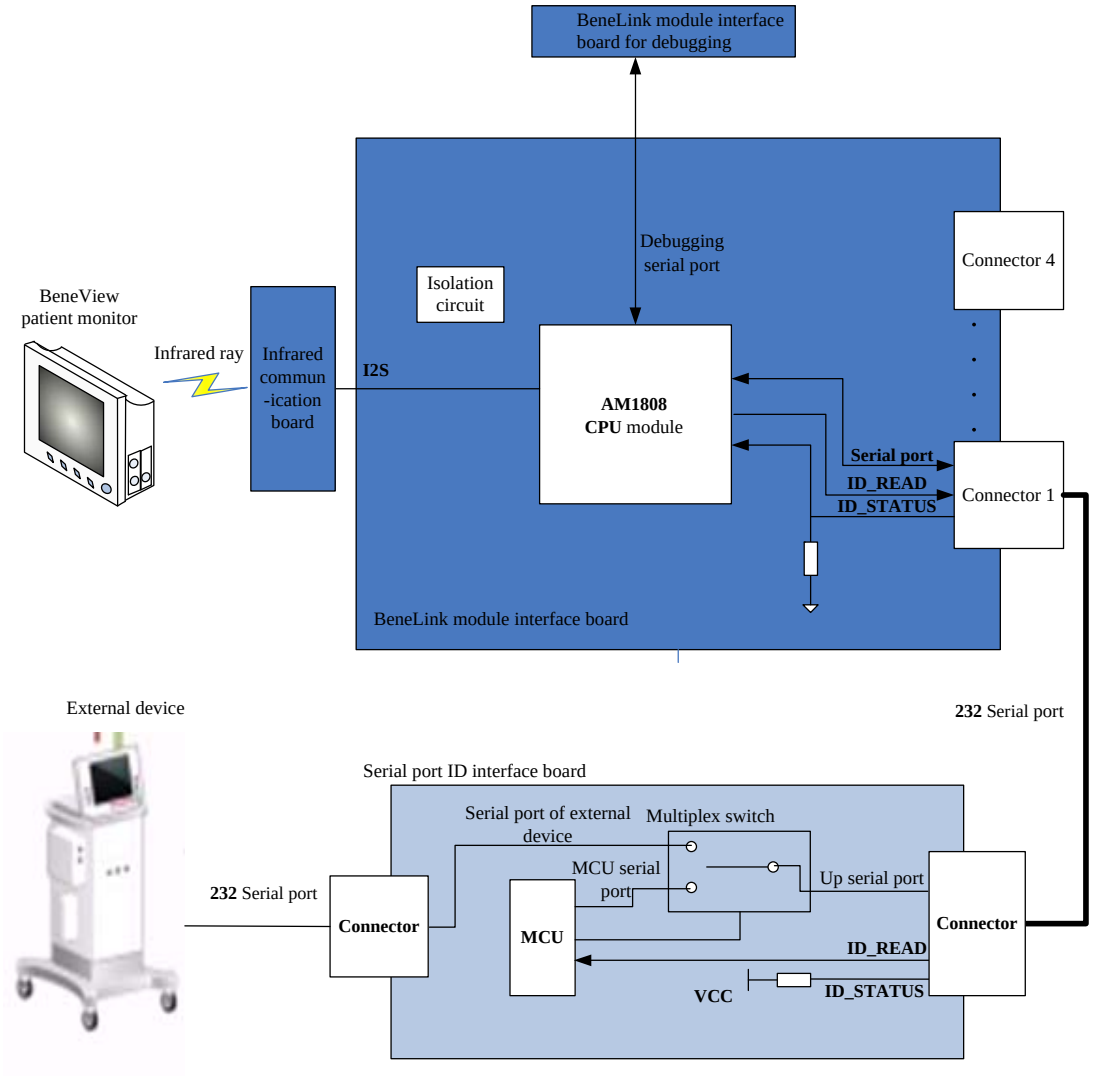
The following diagram shows the structure of the SMR.



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 the 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 Testing and Maintenance

3.1 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.**

3.2 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.

3.2.1 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	

3.2.2 CO_2 Tests

3.2.2.1 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 [**CO_2 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 CO_2 >>**] → [**Calibrate CO_2 >>**], 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 [**CO_2 Purging**] is displayed on the screen after a short time. Block the gas inlet for another 30s. If alarm message [**CO_2 FilterLine Err**] is shown, it indicates that the module does not leak.

3.2.2.2 CO_2 Accuracy Test

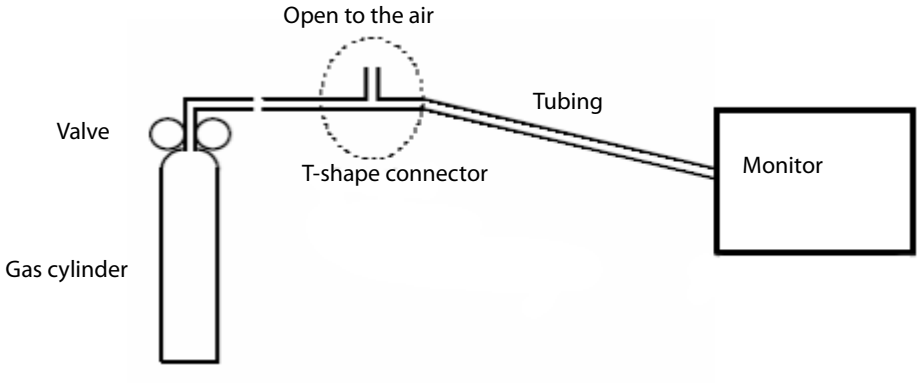
Tools required:

- 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 CO_2 >>**] → [**Calibrate CO_2>>**].

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.

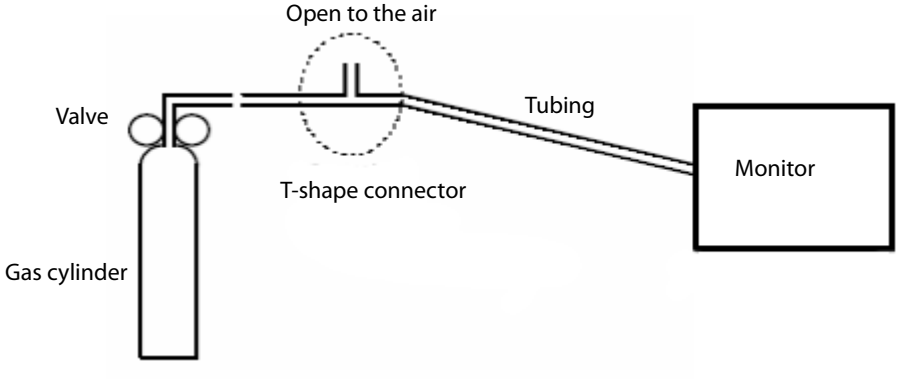
3.2.2.3 CO_2 Calibration

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.

3.2.3 AG Tests

3.2.3.1 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.

3.2.3.2 Accuracy Test

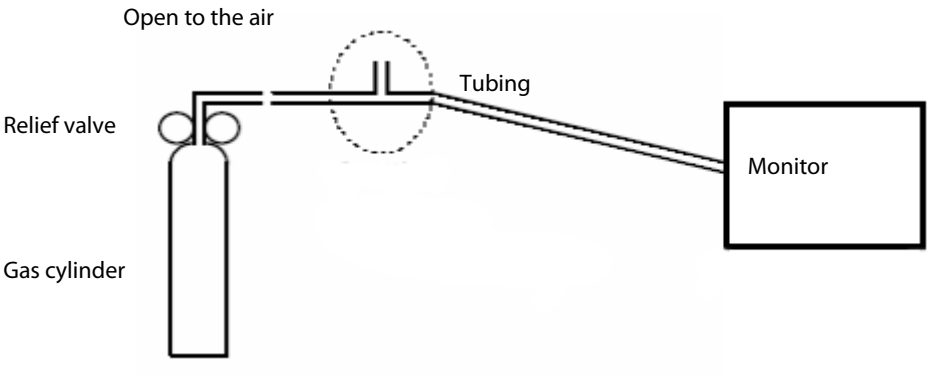
Tools required:

- 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.**

3.2.3.3 Calibration

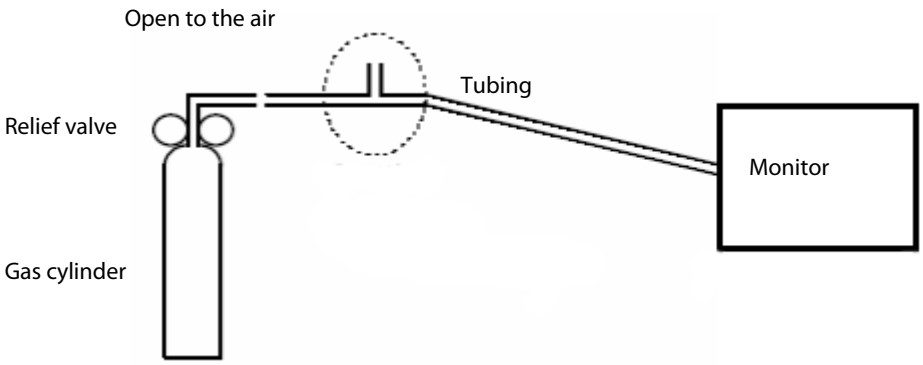
Tools required:

- 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

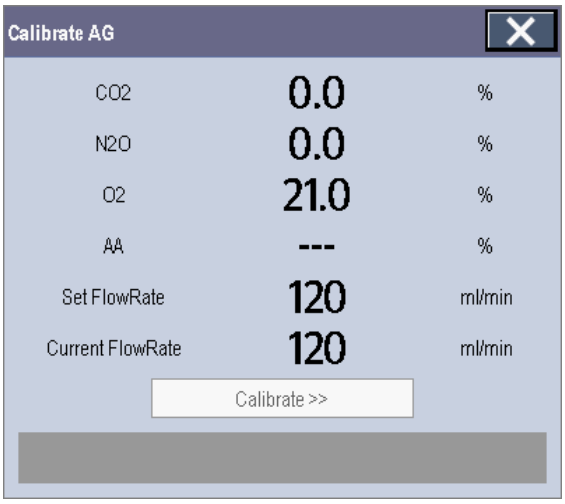
Follow this procedure to perform a calibration:

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.

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.**

3.3 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.

3.3.1 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		
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		
BeneLink module check		1. When first installed. 2. Following any repair or replacement of the external device.

3.3.2 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.

3.3.3 ECG Tests

3.3.3.1 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.

3.3.3.2 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**].

3.3.4 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.

3.3.5 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.**

3.3.6 NIBP Tests

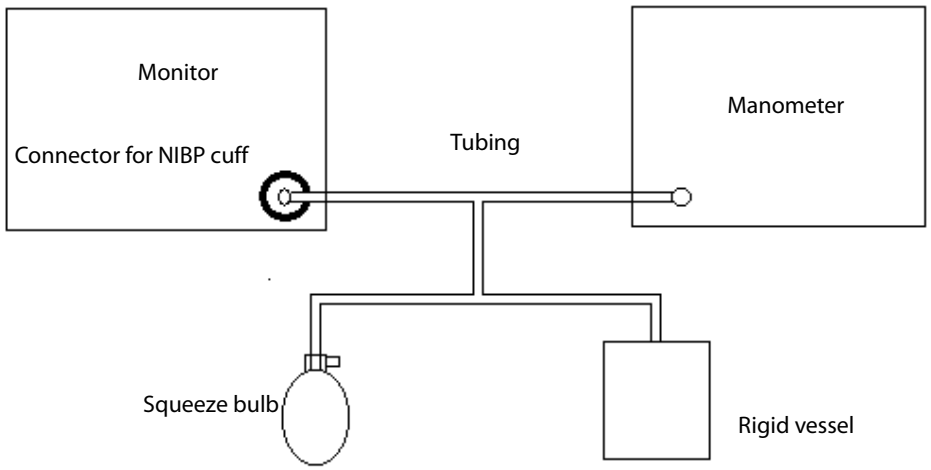
3.3.6.1 NIBP Accuracy Test

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.**

3.3.6.2 NIBP Leakage Test

NOTE

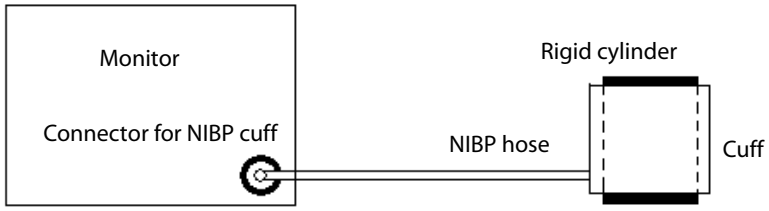
- **You should perform the NIBP leakage test before any other NIBP test.**

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.

3.3.7 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.

3.3.8 IBP Tests

3.3.8.1 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.

3.3.8.2 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:

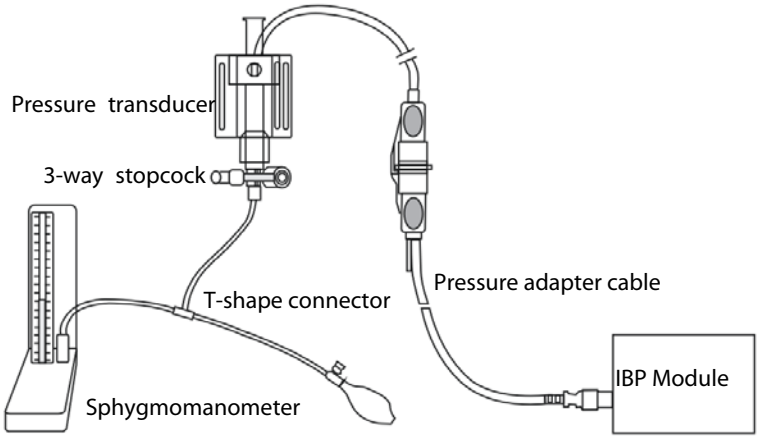
Tools required:

- 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.

3.3.9 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.

3.3.10 CO_2 Tests

See section 3.2.2 CO2 Tests.

3.3.11 AG Tests

See section ***3.2.3 AG Tests.***

3.3.12 BIS Test

Tools required:

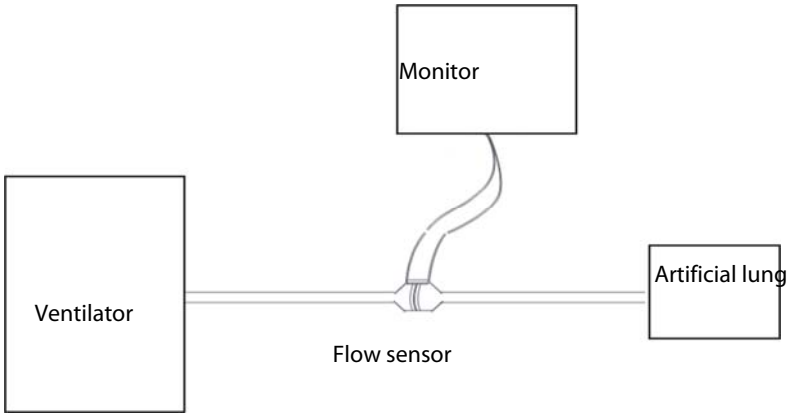
- None.

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.

3.3.13 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.

3.3.14 CCO/SvO_2 Tests

3.3.14.1 Interconnecting Function

Tools required:

- None.

1. Connect and set the patient monitor and Vigilance monitor per the procedures in the Operators' 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.

3.3.14.2 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.

3.3.15 $ScvO_2$ 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.

3.3.16 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.

3.3.17 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.

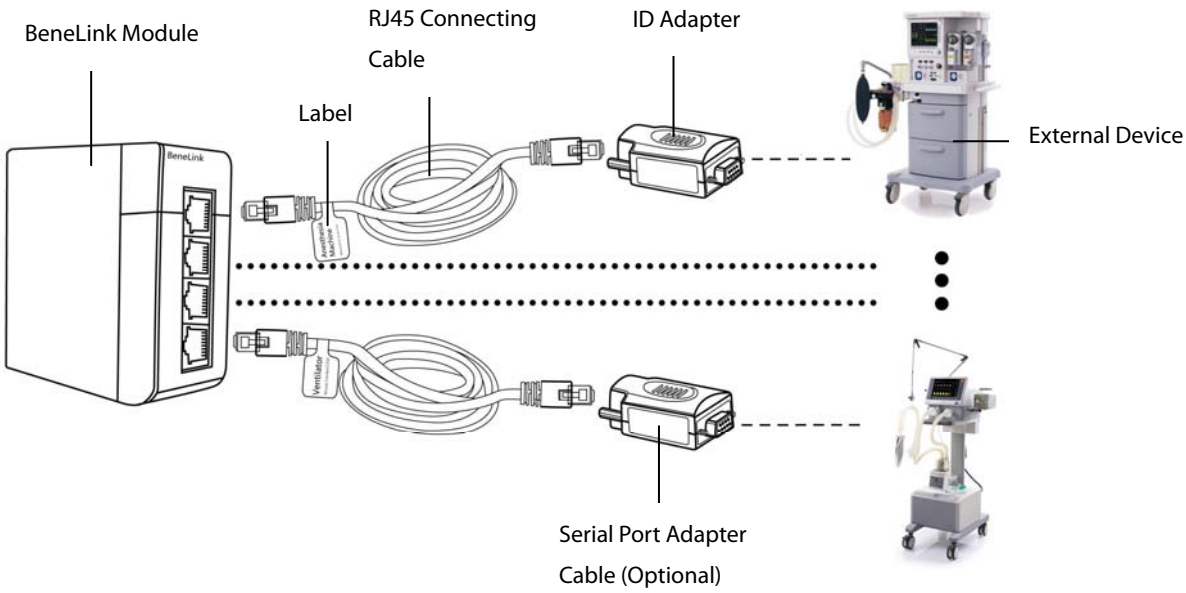
3.3.18 BeneLink Module Check

3.3.18.1 Device Connection and Setup

Tools required:

- External device (anesthesia machine, ventilator, and so on)
- 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 extermal 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
	Philips Respironics V60	VPRT： 5637A9C9 SDNA:5636A9CA	Type B
	Puritan Bennett 840	SNDF: 5042AFBE(recommended) SNDA: 5031AFCF(supports fewer parameters than protocol	No need to use the adapting cable. The ID adapter can be plugged into the serial port of the external device directly.

Category	External Device	ID for ID adapter	Type of serial port adapting cable
		SNDF)	
	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

3.3.18.2 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 17m 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 ventilatior 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 ventilatior 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 ventilatior 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.	/

Category	External Device	Setup	Remark
Ventilator	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)	/
	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

Category	External Device	Setup	Remark
Ventilator	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
	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	/

Category	External Device	Setup	Remark
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	/

3.4 Electrical Safety and Other Tests

3.4.1 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.
iView System Maintenance		1. When first installed. 2. Whenever the iView board is replaced. 3. When the system software is updated.

3.4.2 Electrical Safety Test

See Appendix A Electrical Safety Inspection for electrical safety tests.

3.4.3 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.

3.4.4 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.

3.4.5 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.

3.4.6 Network Print Test

Note

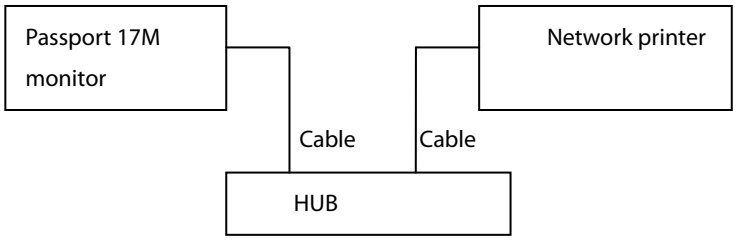
- **Use the recommended printers specified in the operator's manual (PN: 046-005013-00).**

Tools required:

- Hub and network cable

3.4.6.1 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**].

3.4.6.2 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.

3.4.7 Battery Check

Tools required:

- None.

3.4.7.1 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 Operators' Manual.
4. Remove the AC power cord and verify that the patient monitor still works properly.

3.4.7.2 Performance Test

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

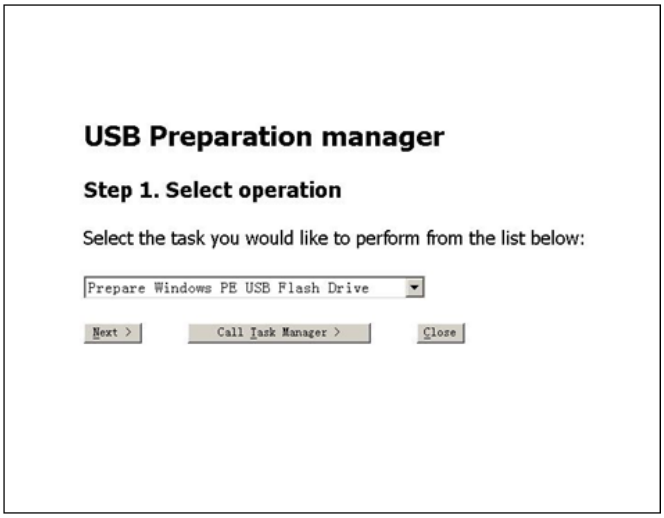
3.4.8 iView System Maintenance

3.4.8.1 Making USB Startup Disk

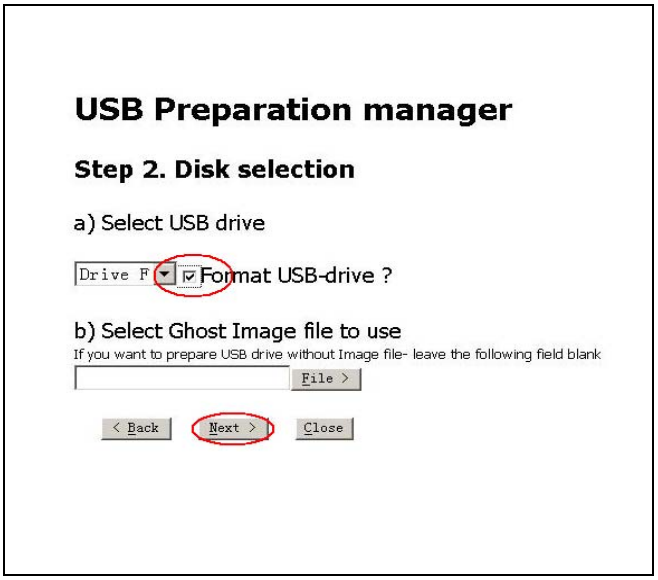
Tools required:

- MakeUSB (PN: 110-002149-00)
- USB drive with capacity greater than 4GB

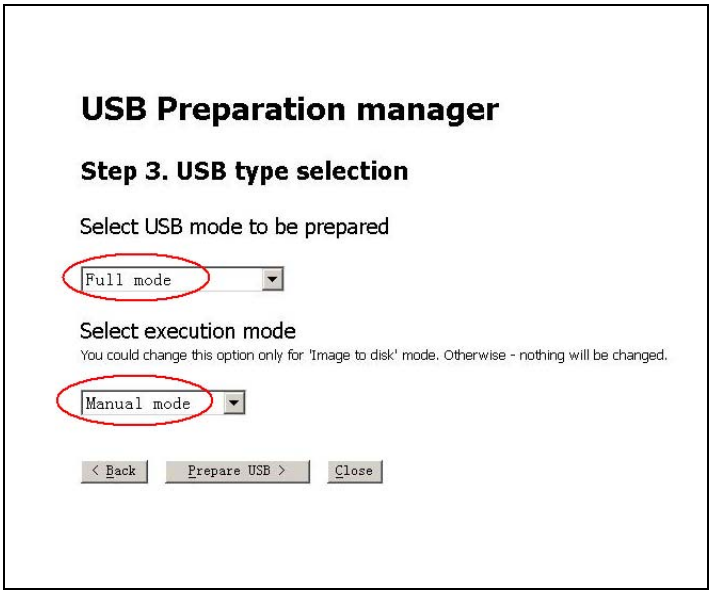
1. Insert the USB drive into the PC.
2. Run "prepareUSB.hta" file in the MakeUSB folder.
3. Select [**Prepare Windows PE USB Flash Drive**] in the drop-down list, and select [**Next>**].



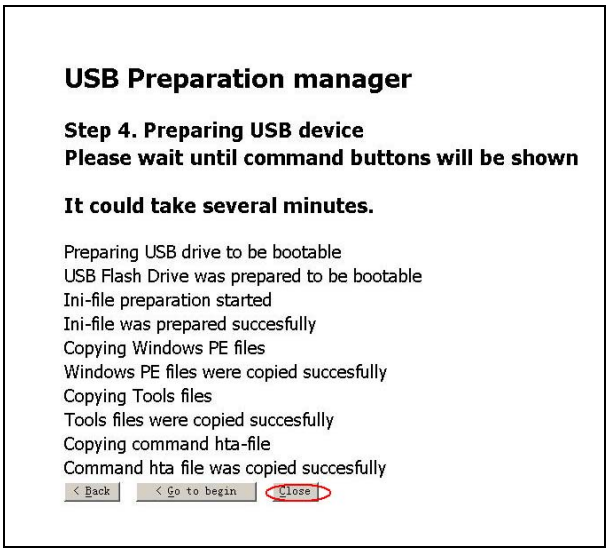
4. Select the drive label of the USB drive in the drop-down list, and put a check mark in the box labeled [**Format USB-drive?**]. [**Select Ghost Image file to use**] is unselected by default. Then select [**Next>**].



5. The system selects [**Full mode**] and [**Manual mode**] by default. Select [**Prepare USB>**] to start making the startup disk.



6. Select [**Close**] to finish.



3.4.8.2 Restoring the System

Connecting the External USB Cable

Connect the iView maintenance USB disk which stores the system image files and keyboard. You must use the special iView USB connector to restore the system.

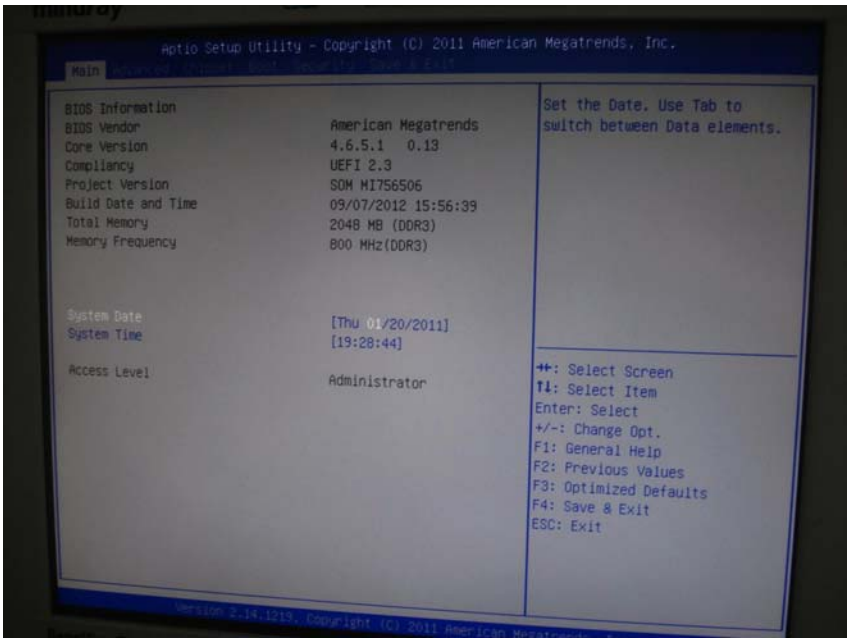
Setting BIOS Screen

1. Start up the patient monitor and press [**F2**] key repeatedly.
2. Select [**Main Menu**] → [**Maintenance>>**] → [**User Maintenance>>**] → enter the required password → [**iView Maintenance>>**] → [**iView Setup**], and when the system switches to BIOS setup screen, release the [**F2**] key.
3. Move the cursor to [**Boot**] by pressing [←] or [→] keys on the keyboard. Then press [**Enter**] on the keyboard.
4. Move the cursor to [**1st Boot**], and press [**Enter**] on the keyboard.
5. Select [**USB**] and press [**Enter**] on the keyboard.
6. Move the cursor to [**Save&Exit**], and press [**Enter**] on the keyboard. Move the cursor to [**Yes**] and press [**Enter**] on the keyboard to save the setup.

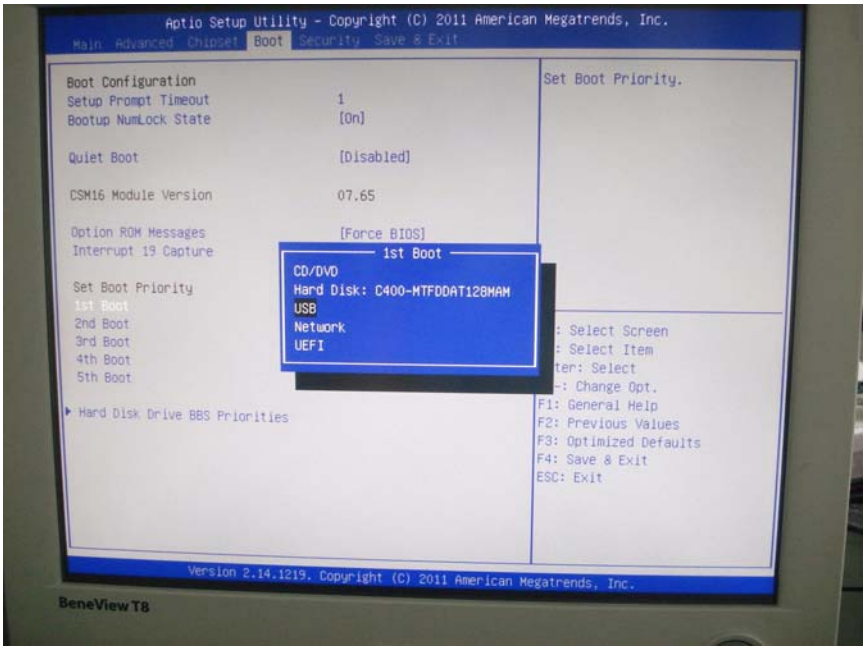
Restoring the system

To recover the iView system, follow these steps:

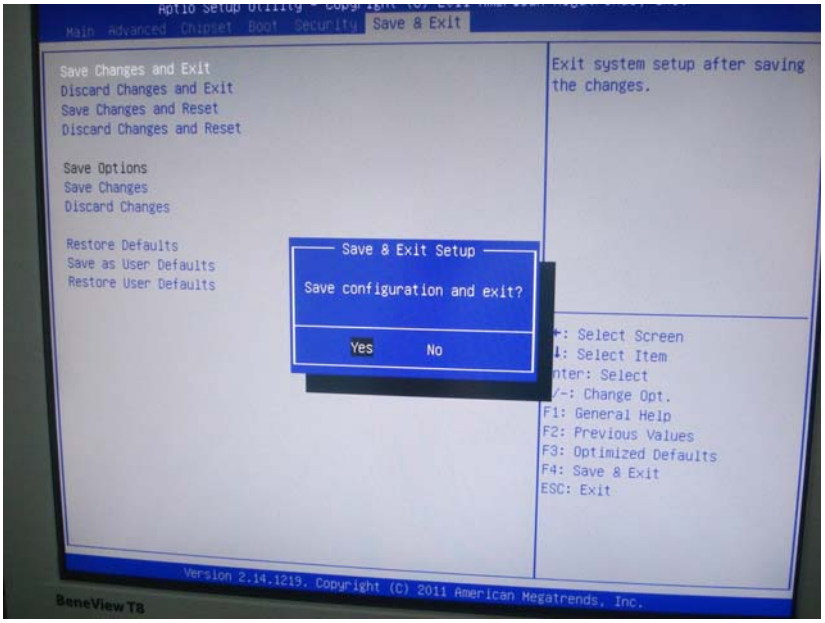
1. Start iView system, and press [**F2**] to enter BIOS. Select [**Maintenance>>**] → [**User Maintenance >>**] → enter the required password → [**iView Maintenance>>**] → [**iView Setup**], and enter the following screen.



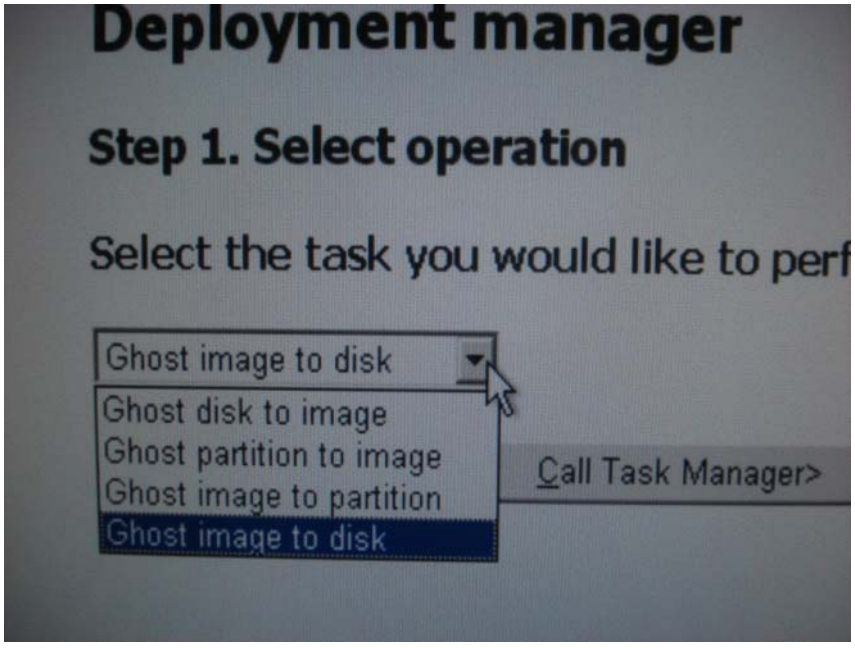
2. Select [**Boot**] in the menu bar, and then select option of [**1st Boot**] in the submenu. Press enter key, and select [**USB**] in the popup window.



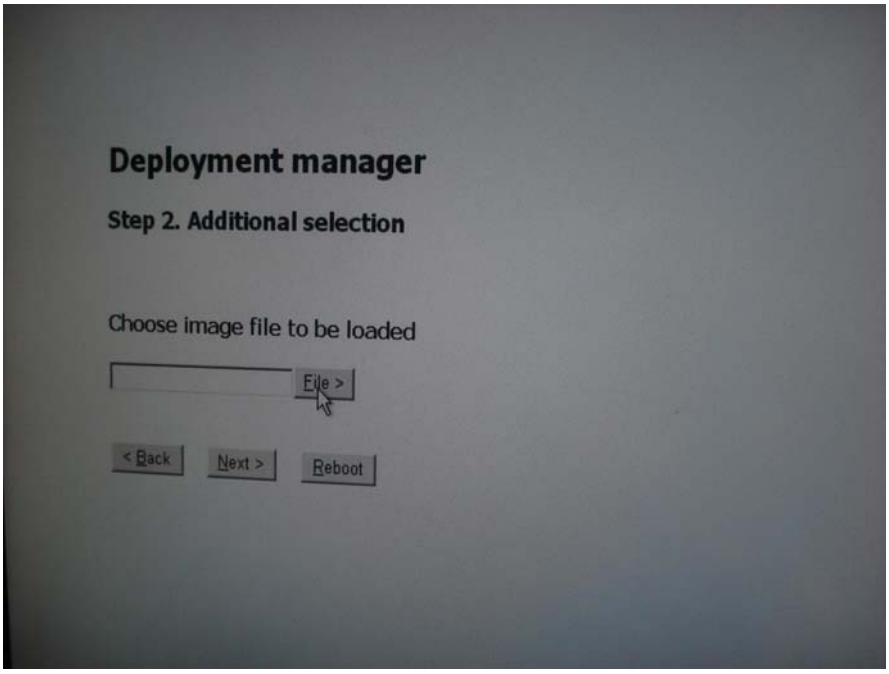
3. Select [**Save&Exit**] in the menu bar. Then select the option of [**Save Changes and Exit**] in the submenu and press [**Enter**] key. After that, select [**Yes**] to exit.

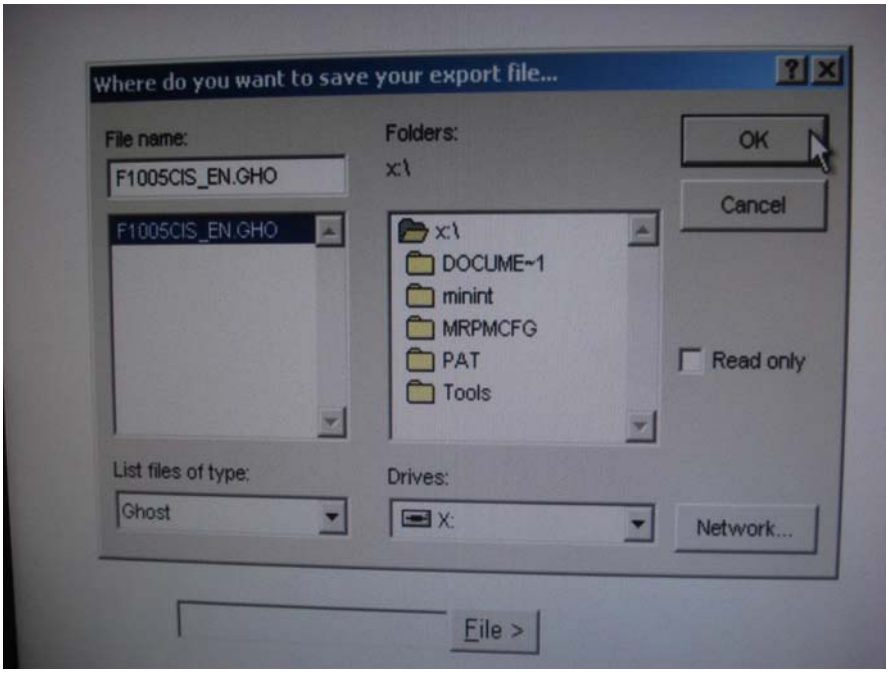


4. Insert the USB disk for iView maintenance (P/N: 115-017183-00) into the special USB connector for iView system on the rear housing of the Passport 17m. The following screen will be displayed. Click the arrow, and the drop-down list will appear. Select [**Ghost image to disk**] from the list. Click [**Nex**t].



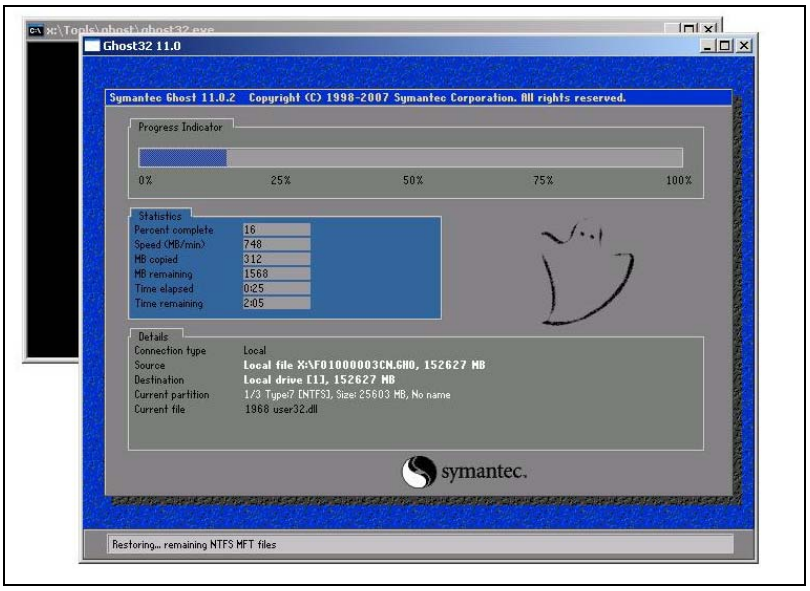
5. Click [**File**] as shown in the below figure, and then choose the path to the image file you wish to load.. Click [**OK**]. Then select [**Next**].

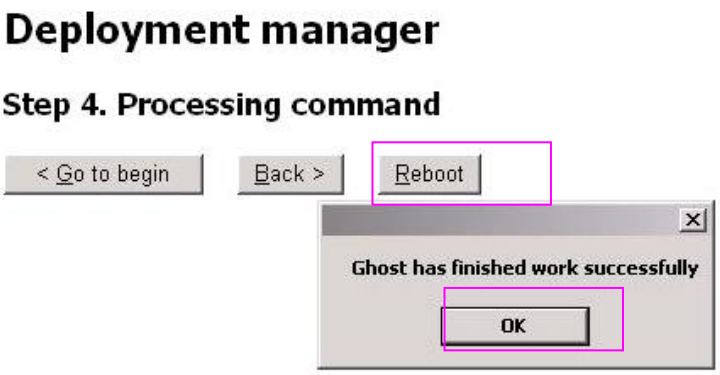




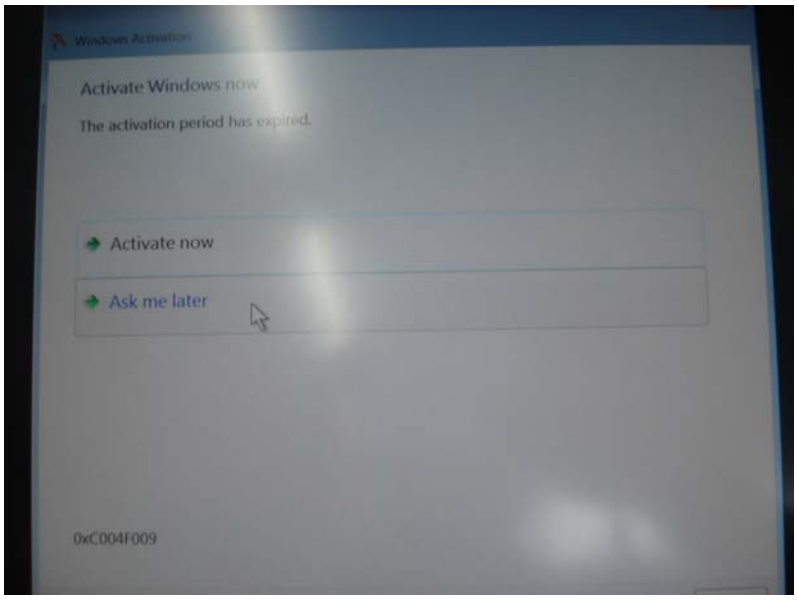
6. Select [**Run>**] to start the image recovery process.


Deployment manager
Step 3. Ghost command line
You should see selected file name in the first string in text area
-clone,mode=restore,dst=1,src="X:\F1005CIS_EN.gho"
-sure
-fx
< Back
Run >
Reboot

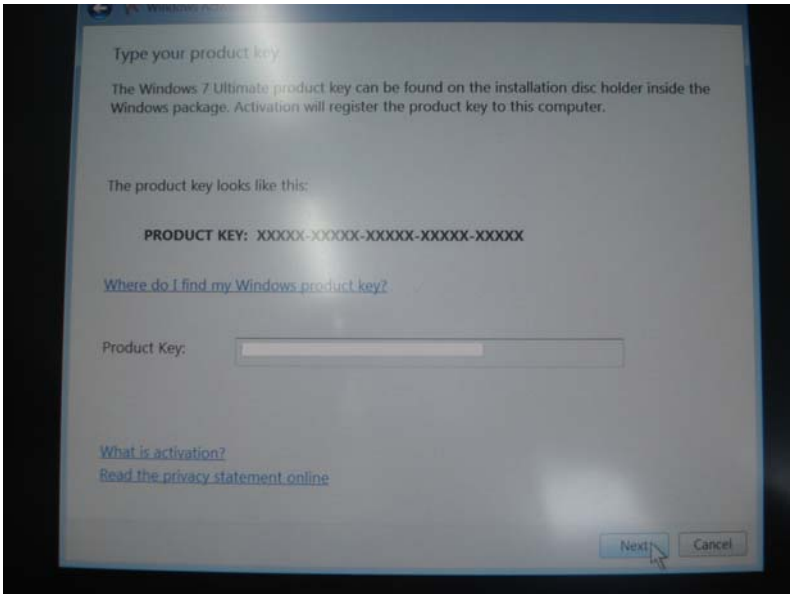

Ghost32 11.0
Symantec Ghost 11.0.2 Copyright (C) 1998-2007 Symantec Corporation. All rights reserved.
Progress Indicator
0%
25%
50%
75%
100%
Statistics
Percent complete 16
Speed (MB/min) 748
MB copied 312
MB remaining 1568
Time elapsed 0:25
Time remaining 2:05
Details
Connection type Local
Source Local file X:\F01000003CN.GHO, 152627 MB
Destination Local drive [1], 152627 MB
Current partition 1/3 Type:7 [NTFS], Size: 25603 MB, No name
Current file 1968 user32.dll
symantec.
Restoring... remaining NTFS MFT files


Deployment manager
Step 4. Processing command
< Go to begin
Back >
Reboot
Ghost has finished work successfully
OK

7. Click [**OK**], and then click [**Reboot**]. When the monitoring screen of Passport 17m appears, remove the iView maintenance USB disk. The system will restart in the Windows 7 mode. A prompt to activate WIN7 will appear.
8. Start the activation of Windows 7 system and enter the following screen.



9. Input the key number.



3.4.8.3 Setting Automatic Login

iView system is set to be automatically logged in by default. However, if the registry is modified, which requires a manual login, you can restore to the automatic login by doing the following:

1. Select [**Run**] in the [**Start**] menu of the Windows system.
2. Type in 'regedit', and then click [**OK**]. The [**Registry Editor**] window will pop up.
3. In the [**Registry Editor**] window, determine what the following three value entries are under HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Winlogon. Check and change (if necessary) the value according to what is shown below (the value is case sensitive).

   ◆ "AutoAdminLogon" = "1"

   "DefaultUserName" = "CIS"

   "DefaultPassword" = "MINDRAY"

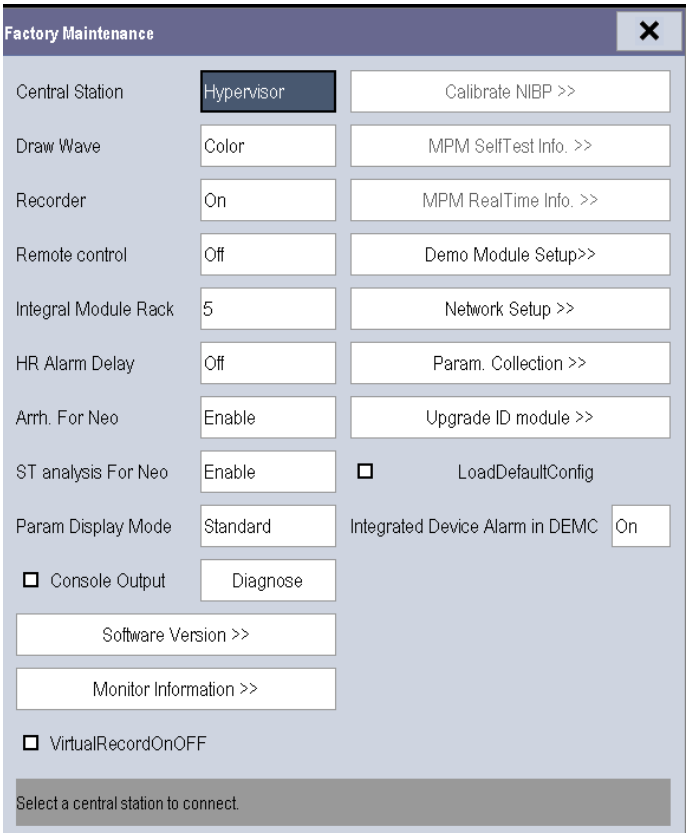
If some value entry does not exist for any of the three items listed, you have to create one: right click the mouse, select [**New**] → [**String Value**], and enter the string as the name of the new value entry along with the correct value.

3.5 Factory Maintenance

3.5.1 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.



3.5.2 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.

3.5.3 Enabling/Disabling the Recorder

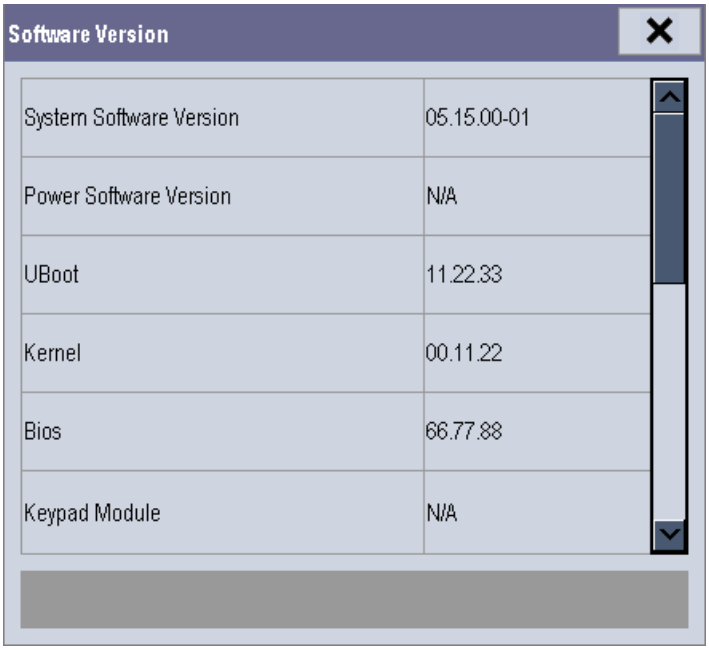
To enable/disable the recorder, select [**Recorder**] and toggle between [**On**] and [**Off**].

CAUTION

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

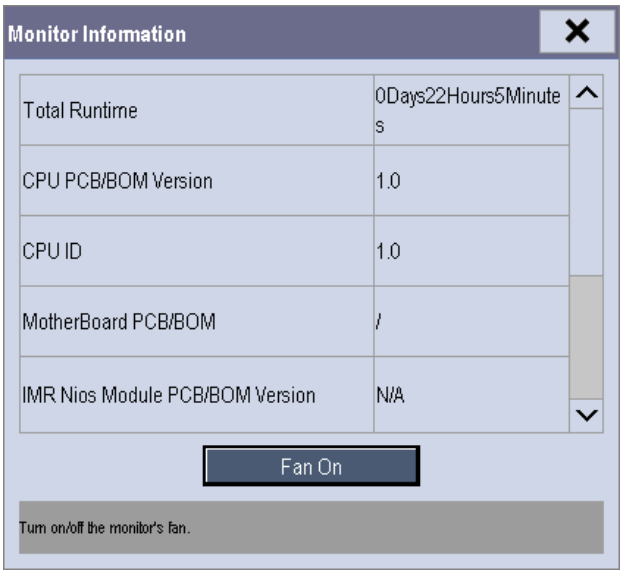
3.5.4 Checking Software Version

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



3.5.5 Checking Monitor Information

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



FOR YOUR NOTES

4 Troubleshooting

4.1 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.

4.2 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.***

4.3 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 >>**].

4.4 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>>**].

4.5 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 17m's Operation Manual.

4.6 Troubleshooting Guide

4.6.1 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 ***4.6.9 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.

4.6.2 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 snow 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.
Touch screen accuracy is off	Touchscreen needs to be calibrated	Calibrate the touchscreen.

4.6.3 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.
	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.

Symptoms	Possible Cause	Corrective Action
	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.

4.6.4 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 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.

4.6.5 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

4.6.6 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.

4.6.7 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.

4.6.8 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.

4.6.9 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 +5.0 VDC CIS 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.**

4.6.10 Network Related Problems

Symptoms	Possible Cause	Corrective Action
The patient monitor cannot be connected to iView system.	No connection to the LAN	1. Verify the cables and connectors are in good condition and that the network is properly connected. 2. Verify the hub or switch is properly configured.
	iView assembly failure	1. Restart the patient monitor; verify a beep is heard. 2. After starting, select [**Main Menu**] → [**Maintenance>>**] → [**User Maintenance>>**] → enter the password required → [**iView Maintenance>>**]. The [**iView Setup**] option should be enabled and switching between the normal monitor screen and the iView screen is possible. 3. If step 1 and 2 fail, verify the voltages supplied to the iView assembly are correct. If the power supply works properly, replace the iView assembly.
	DVI interface board failure	Replace DVI interface board.
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.
	iView assembly failure	Replace iView assembly.

4.6.11 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 iView network 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.

4.6.12 Technical Alarm Messages

Please refer to the Operators' manual.

4.6.13 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		

4.6.14 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 ***3.3.18.1 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

5 Repair and Disassembly

5.1 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

5.2 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.**

5.3 Basic Disassembly

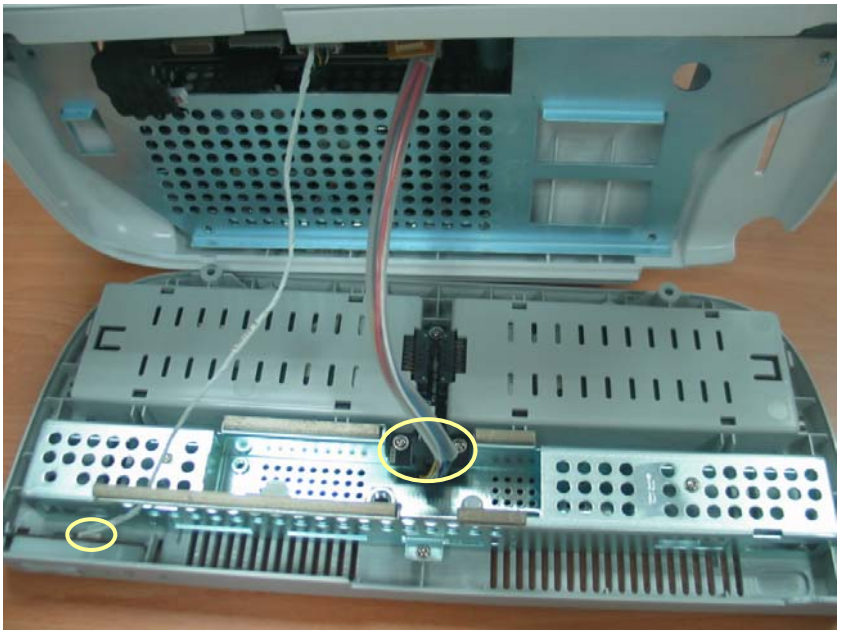
5.3.1 Disconnecting the Base

NOTE

- **Be sure to disassemble the base first before proceeding with other parts.**

1. The retainer that prevents the power plug from coming out is located beside the AC port in the rear case of the monitor. Remove this retainer and then place the monitor face up and remove the four M4×12 screws, as shown in the figure below.

2. Pull out the base and then unplug the two cables marked in the picture, one connecting the Power Switch & LED board and the button board, and the other connecting the battery interface board and the power supply assembly.

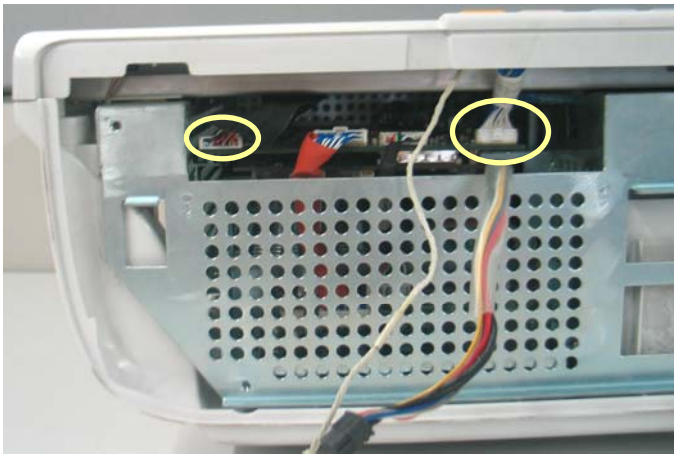


NOTE

- **Exercise care when pulling the base out. Be sure not to damage the cables and connectors.**

5.3.2 Separating the Front and Rear Half of the Monitor

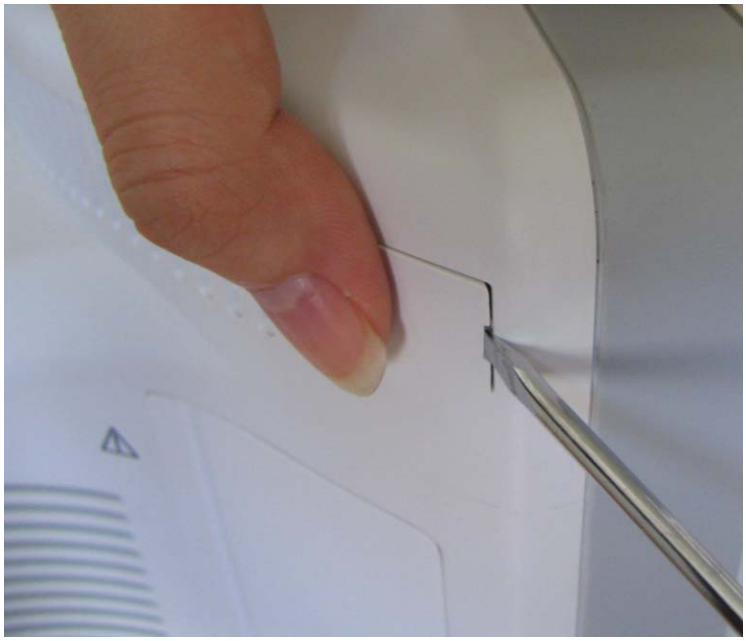
1. Keep the monitor (without the base) face up. Disconnect the cables marked in the picture, one connecting the LCD panel and the mother board, and the other connecting the button board and the mother board.



NOTE

- **Release the clip before disconnecting the cable between the button board and the mother board.**

2. Carefully place the monitor face down. Pry up the four screw covers with a small flat-bladed screwdriver and unscrew the four M3×12 screws. Then unscrew the M3×12 screw in the handle.



Avoid pressing the knob on the table.

NOTE

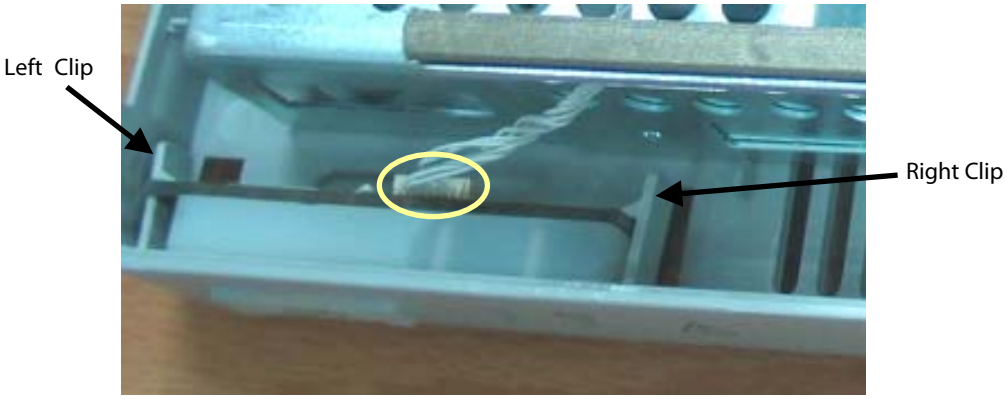
- **Press the cover with a thumb when prying it.**
- **Avoid pressing the knob on the table.**

3. Lift the rear cover assembly to separate it from the front cover assembly.

5.4 Further Disassembly

5.4.1 Removing the Power Switch & LED Board

1. Locate the cable marked in the picture and disconnect it from the power switch & LED board.



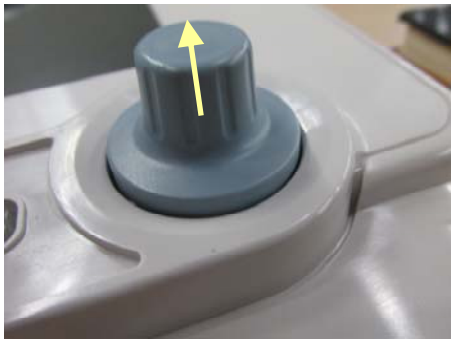
2. Release the clips with fingers. At the same time pinch the power switch & LED board, push it to the left and take it out along with the power switch.

NOTE

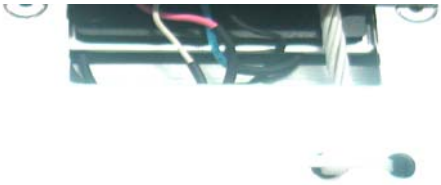
- **Exercise care whe releasing the clips.**
- **When installing the LED board along with the power switch, put it on the left clip, push the right clip to the right slightly, and then press the LED board down.**

5.4.2 Disconnecting the Encoder Assembly

1. Pull the encoder knob off the shaft. Unscrew the hex nut.



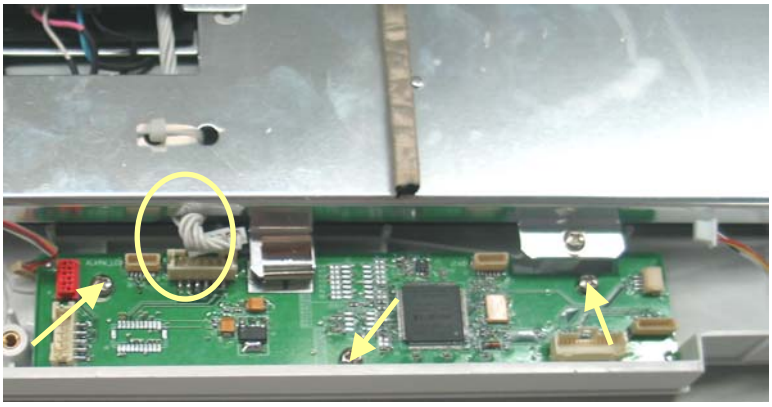
2. Disconnect the cable that connects the encoder and the button board to remove the encoder.



5.4.3 Removing the Button Board

1. Disconnect the cables from the button board to the power switch & LED board, encoder, alarm LED board, backlight board and, touchscreen control board and the mother board.

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

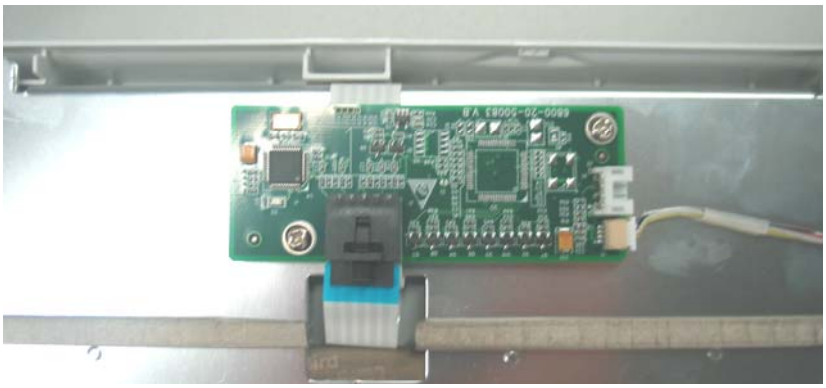


NOTE

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

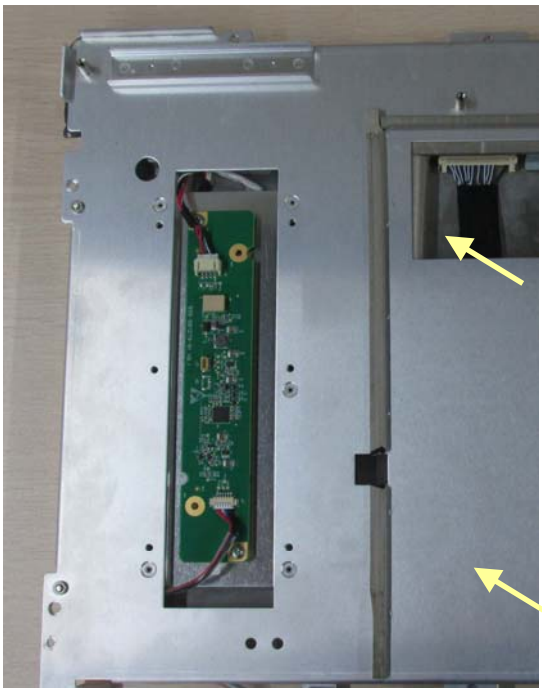
5.4.4 Removing the Touchscreen Control Board

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



5.4.5 Removing the Backlight board

Unplug the cables from the button board and the LCD to the inverter. Then, remove the two M3×6 screws and remove the backlight board.

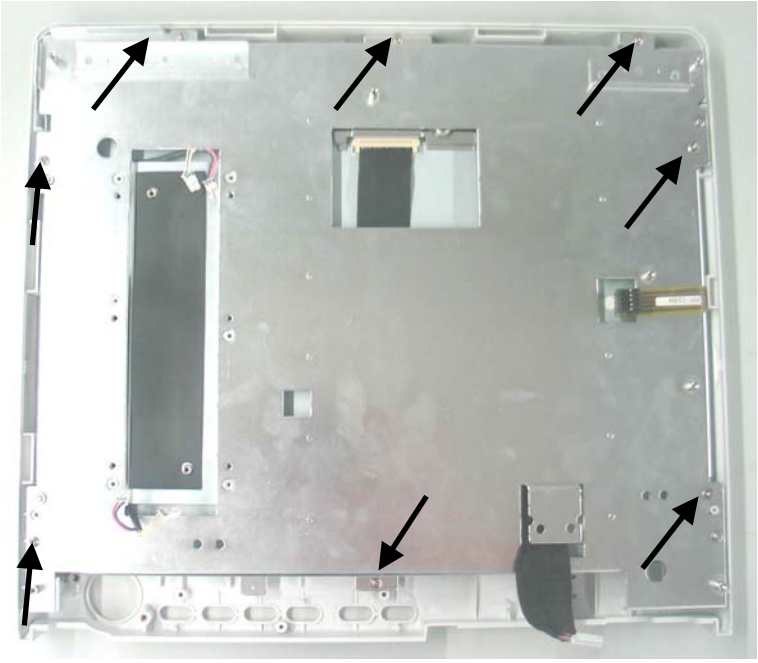


5.4.6 Removing the LCD Screen

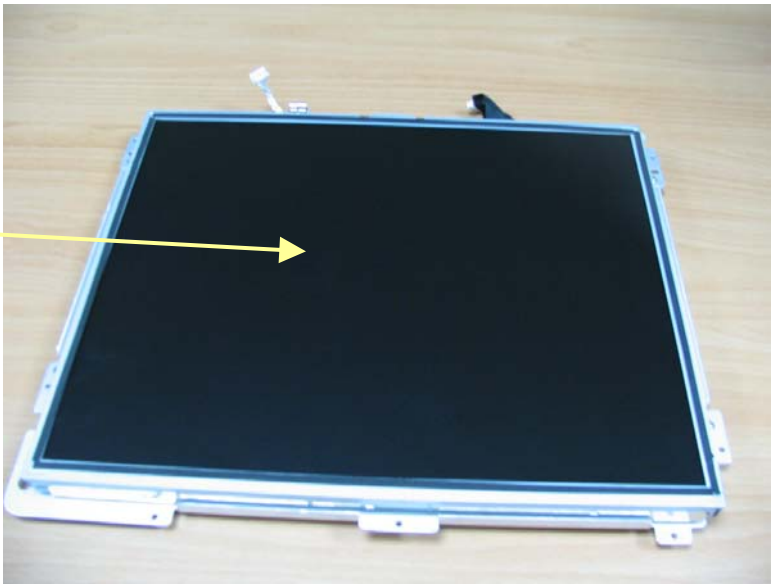
CAUTION

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

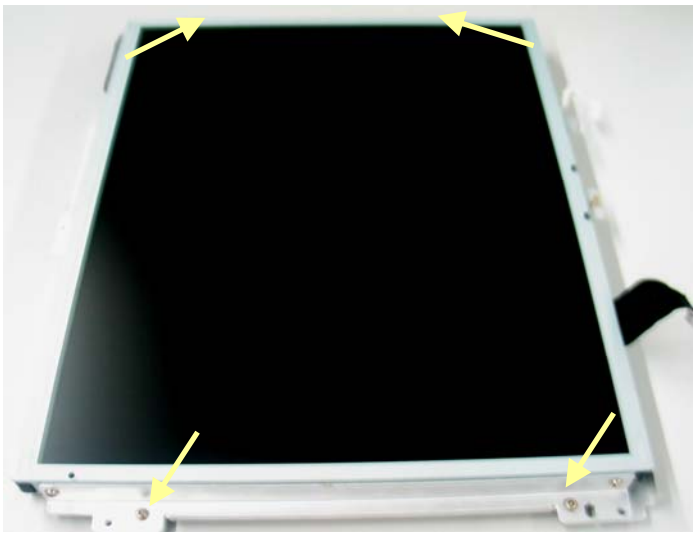
1. Carefully remove the eight M3×6 screws and take the screen assembly out. To prevent the screen from being contaminated by dust, do not touch the screen.



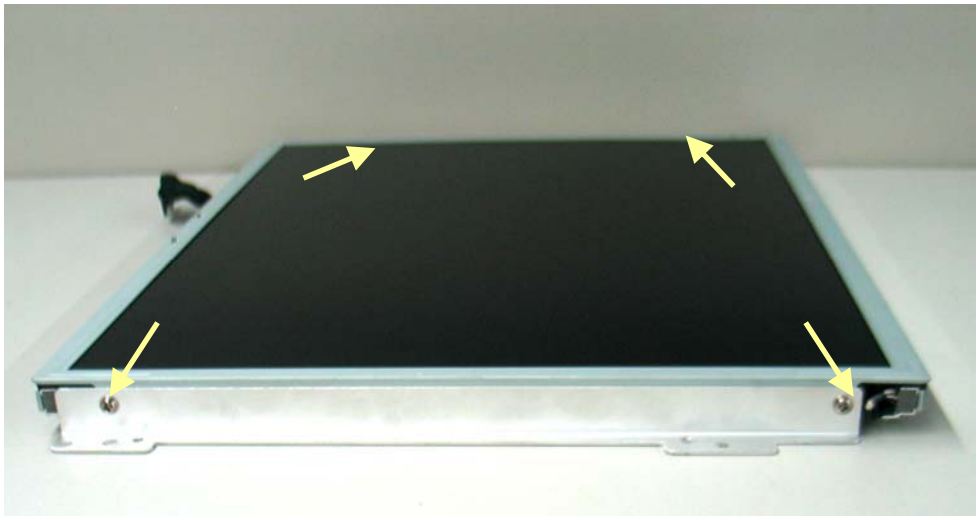
Do not touch the
LCD panel



2. Remove the four M3×6 screws and take out the LCD screen.



3. Remove the four M3×6 screws and separate the LCD screen from the two supports.



5.4.7 Removing the Alarm Lamp Board

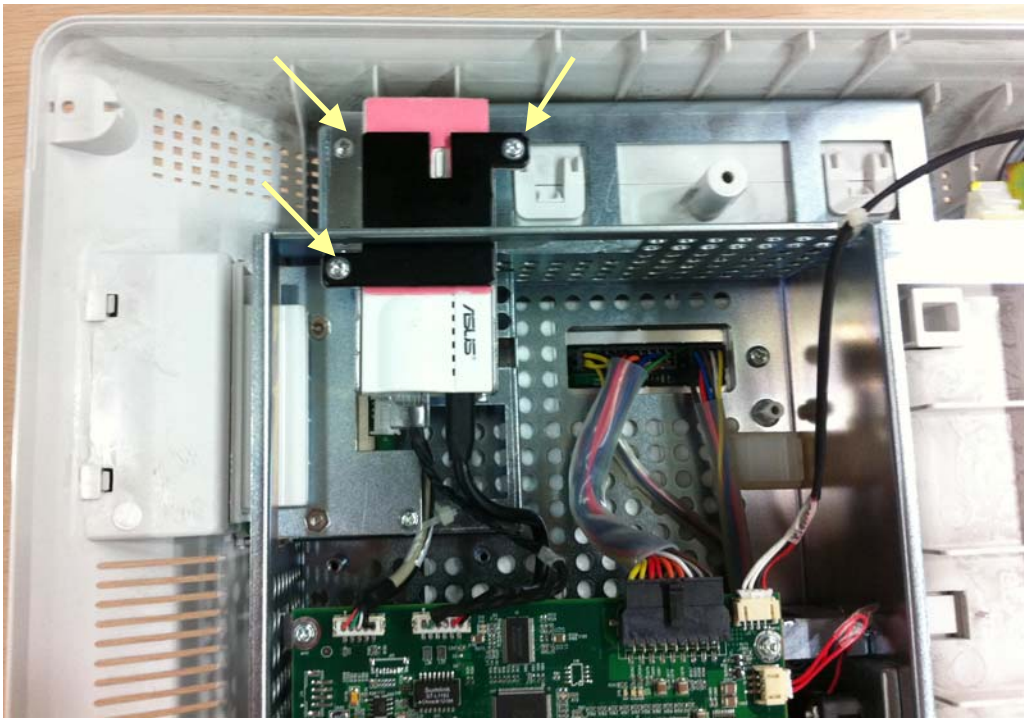
After removing the LCD panel, disconnect the cable that connects the alarm lamp board and the button board, and then remove the two PT2×6 screws to remove the alarm lamp board.

NOTE

- **Exercise care when removing the alarm lamp board because it may be adhered to the LCD assembly (as shown in the above figure).**

5.4.8 Removing the Wireless AP

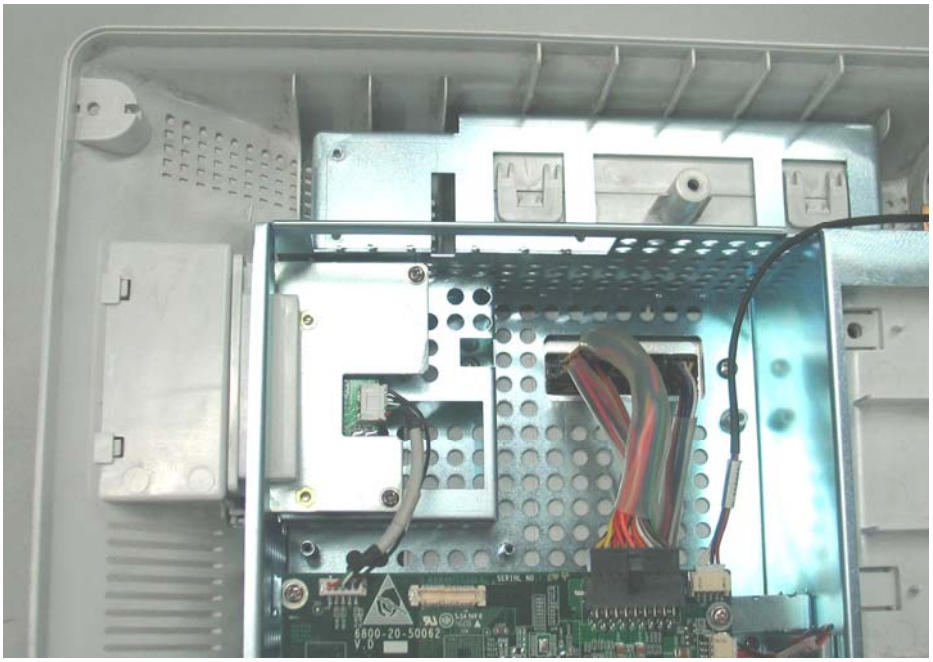
1. Unplug the wireless AP cable from the main board. Remove the three M3×6 screws and take out the wireless AP assembly.



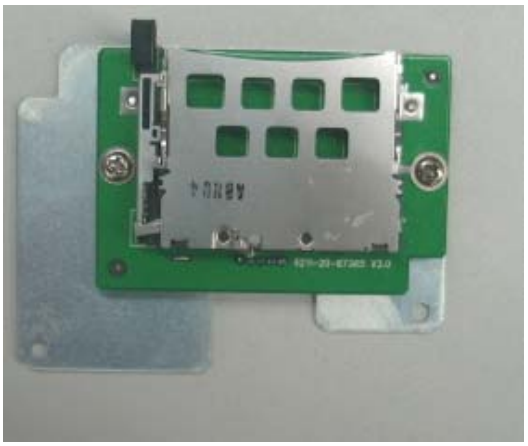
2. Remove the two M3×6 screws and then remove the wireless AP.

5.4.9 Removing the CF Assembly

1. Disconnect the cable between the CF driver board and main board. Remove the two M3×6 screws and take out the CF assembly.



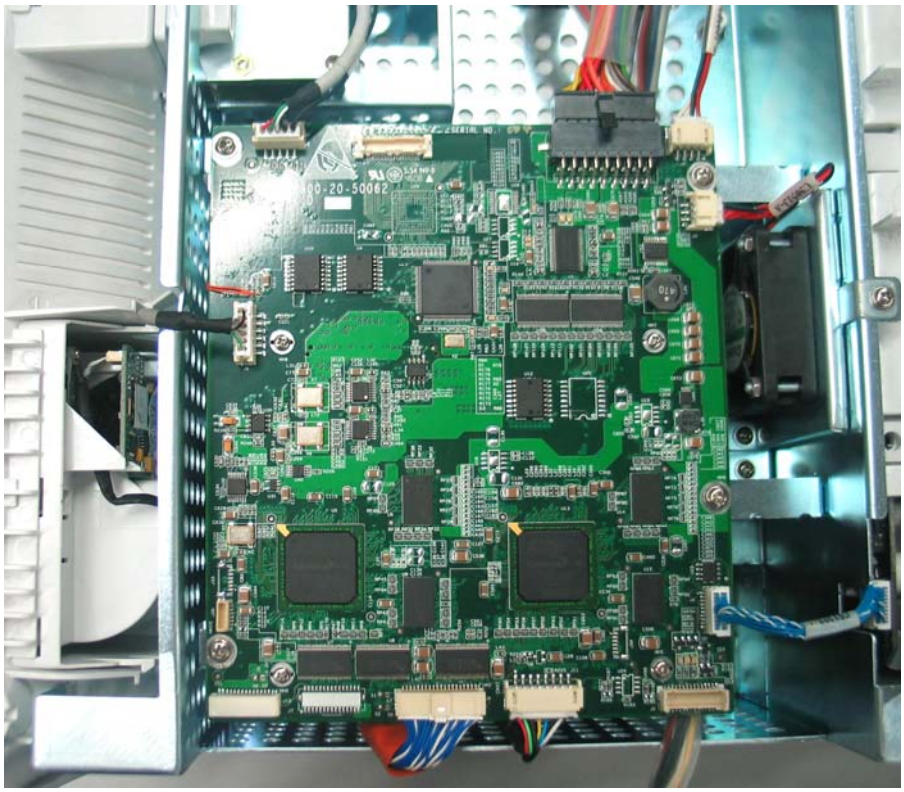
2. Remove the two M3×6 screws and take out the CF driver board.



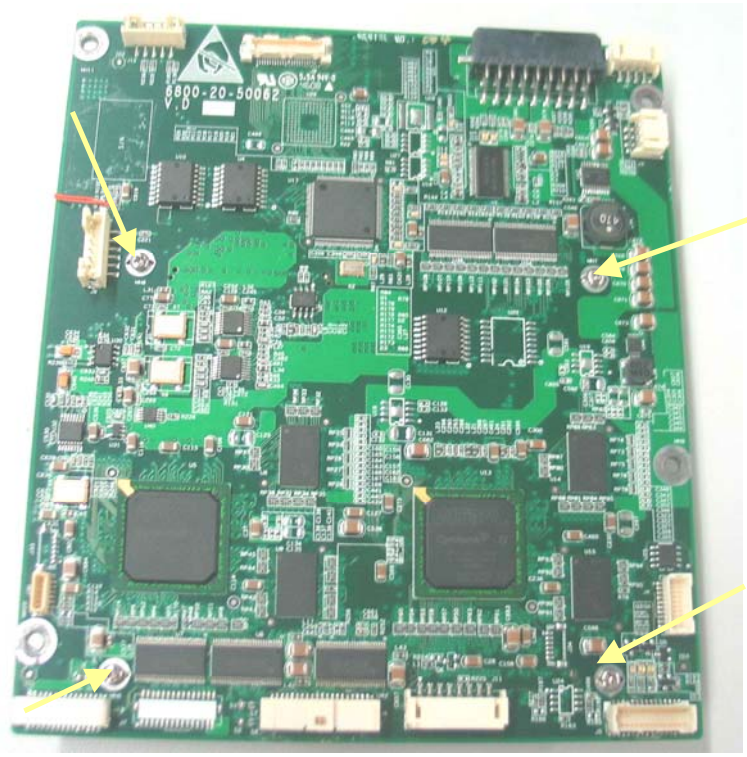
5.4.10 Removing the Main Board

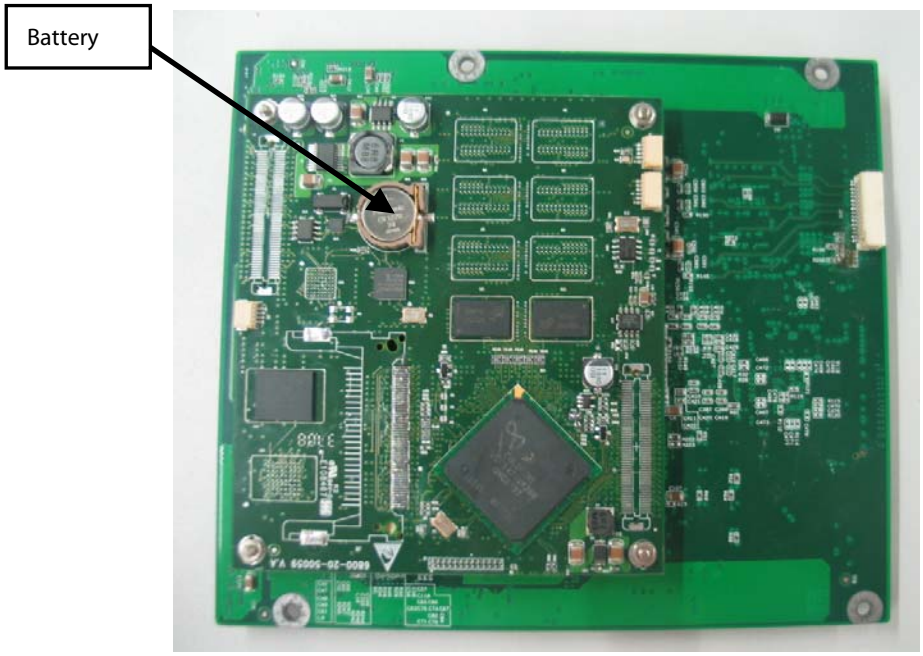
1. Pull out all the connectors on the mother board. There are numbers beside the connectors, which are listed below.

Number	Connected to
J1	Power module
J2	Speaker
J3	Fan
J4	Integral module rack
J5	Button board
J6	DVI interface board
J7	LCD panel
J8	Recorder
J16	Wireless AP
J10	iView assembly
J11	USB interface board
J12	CF assembly
J22/J23	CPU board, which is connected to the mother board with a socket



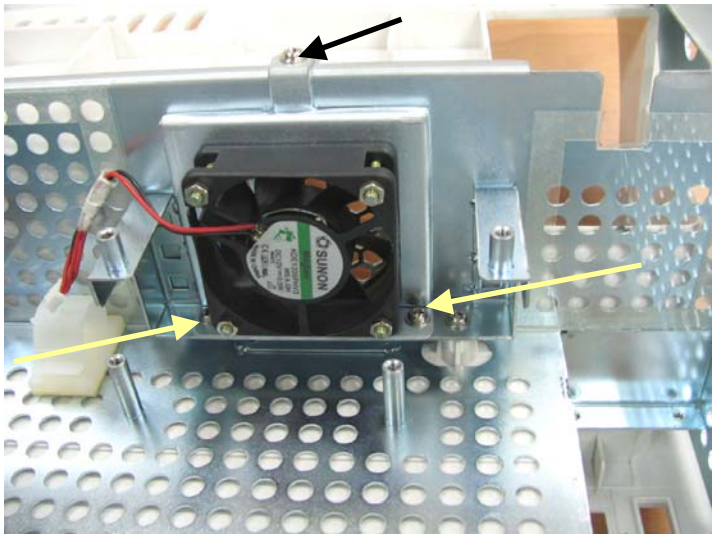
2. Remove the four M3×6 screws as shown in the figure below and take out the main board that includes the mother board and the CPU board.
3. Remove the four M2.5×6 screws and separate the mother board from the CPU board. Be sure not to damage the socket that connects the two boards. There is a battery on the CPU board.





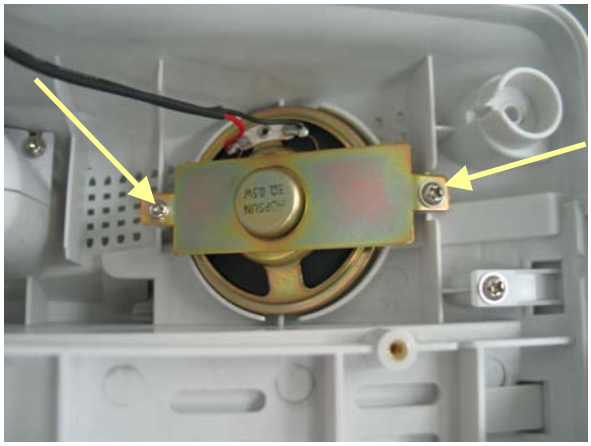
5.4.11 Removing the Fan

Unplug the fan connector from the mother board. Remove the three M3×6 screws and remove the fan.



5.4.12 Removing the Speaker

Unplug the speaker connector from the mother board. Remove the two M3×6 screws and remove the speaker.

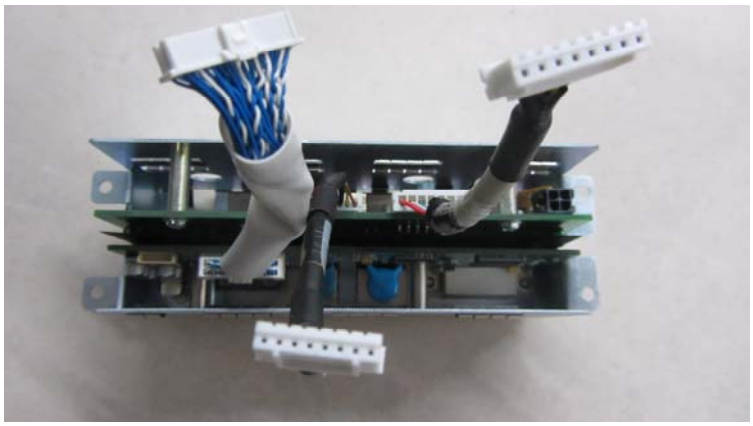


CAUTION

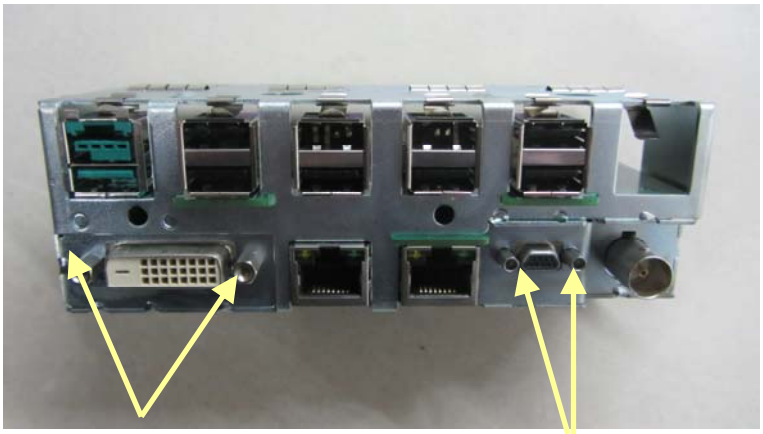
- **When installing a speaker, be sure to route the wires so they are not pinched during assembly.**

5.4.13 Removing the Interface Board Assembly

1. Remove the four M3×6 screws and remove the interface board assembly.



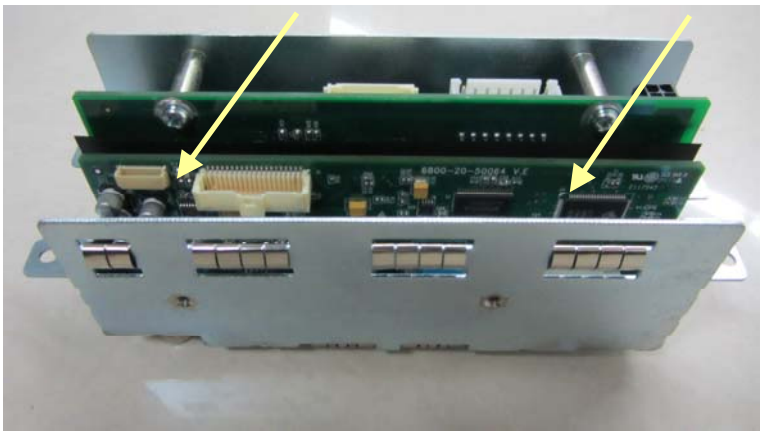
2. Remove the screws beside the DVI socket and micro-D socket. Then remove the two M3×6 screws in the holes. You can then remove the DVI interface board.



Screws beside DVI socket Screws beside micro-D socket

Two M3×6 Screws in Holes

3. Remove the two M3×6 screws and take out the USB interface board.

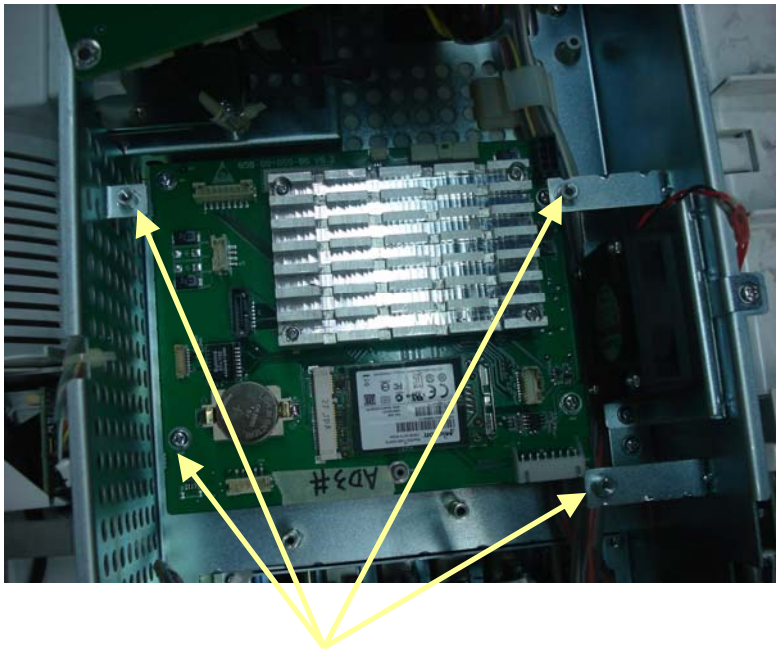


NOTE

- **The DVI interface board must be removed before the USB interface board.**
- **Be careful not to damage the insulation between the DVI interface board and the USB interface board. If it is damaged, replace it.**

5.4.14 Removing the iView Assembly

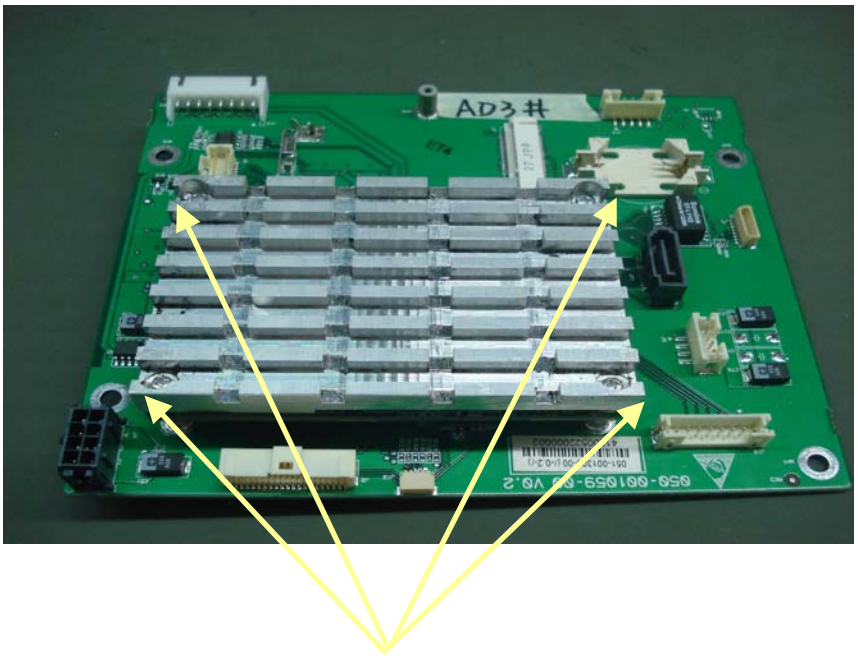
1. Remove all the connecting cables between the iView mother board and power board, USB interface board, mother board and the DVI interface board. Remove the four M3×6 screws, and remove the iView assembly.



M3× 6 sscrews

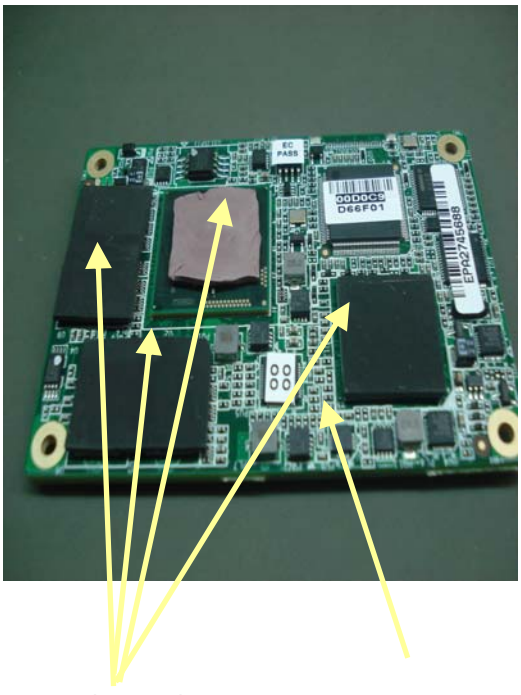
2. Remove the SSD hard disk and battery from assembly

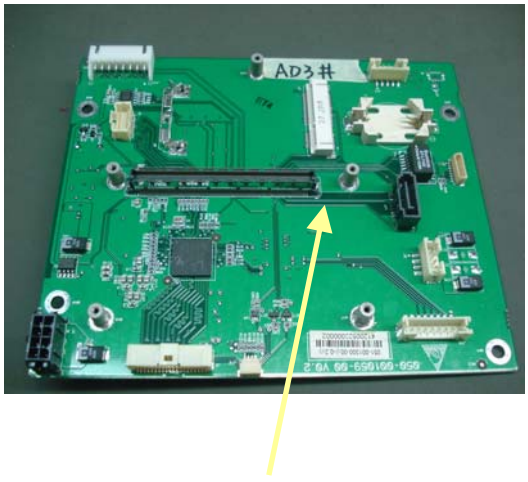
3. Remove the four pan head cross recessed screws and remove the cooling fin in the industrial control board.



Pan head cross recessed screws

4. Separate industrial control board from mother board. Remove the heat conductive adhesive on the mother board.





Heat-conductive glue

Industrial control board

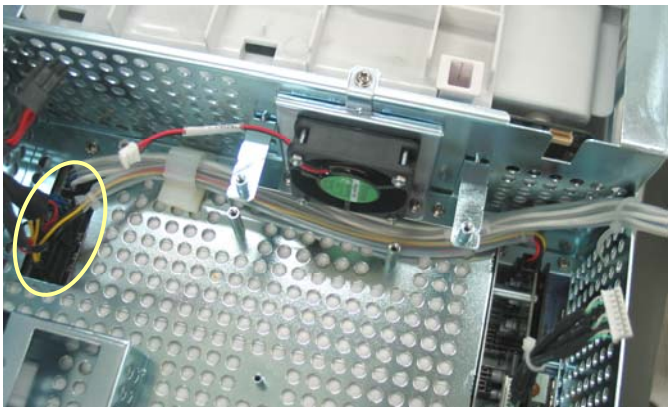
Mother board

NOTE

- **Make sure the heat-conductive adhesive is applied before reinstallation. Remember to install the standoffs on the CIS mother board when reassembling.**

5.4.15 Removing the Power Supply Assembly

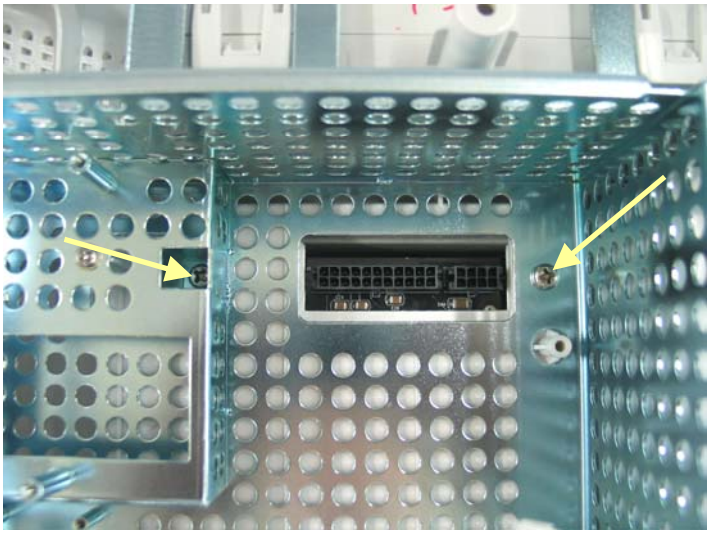
1. Disconnect the four cables coming from the main control board, the iView assembly, the DVI interface board and the battery interface board. These are all connected to the power supply socket.



NOTE

- **For some cables, you have to release the clips before disconnecting them.**

2. Remove the two M4×20 screws. Be sure to hold the power supply assembly to prevent it from falling when removing these screws.

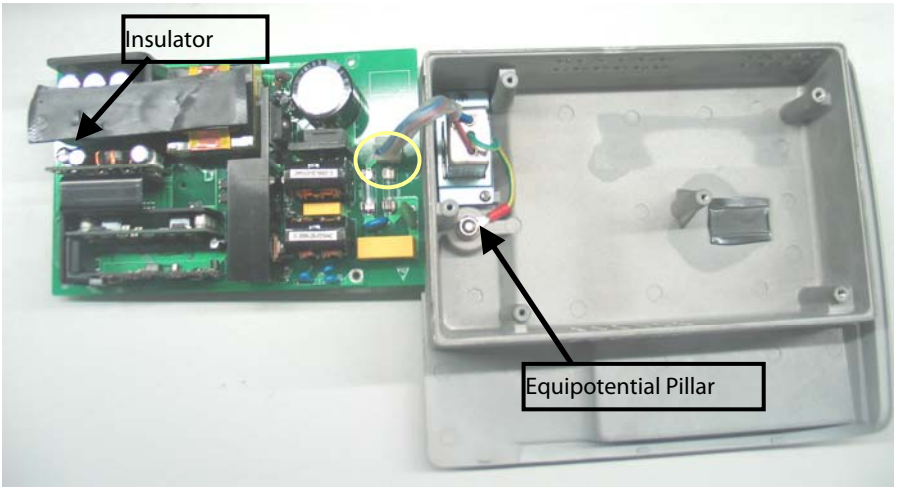


3. Lift the power supply assembly slightly to separate it from the two studs on the rear cover and then remove the assembly.

Studs

4. Remove the two M3×12 screws and remove the power supply cover.

5. Remove the two M3×6 screws. Pry out the board with a small flat-bladed screwdriver in the gap between the power supply board and the housing. Then turn the board over and unplug the cables from it.



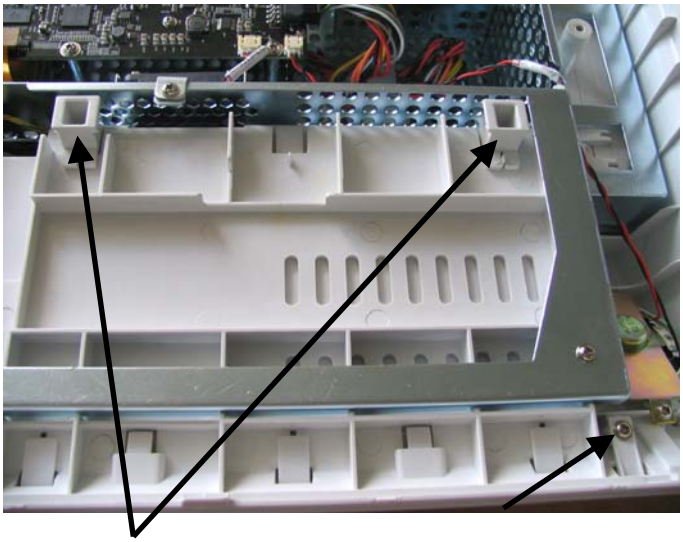
NOTE

- **The power supply board may be stuck to the insulator, be careful not to damage the connector and cables when separating the two.**

5.4.16 Removing the Integral Module Rack

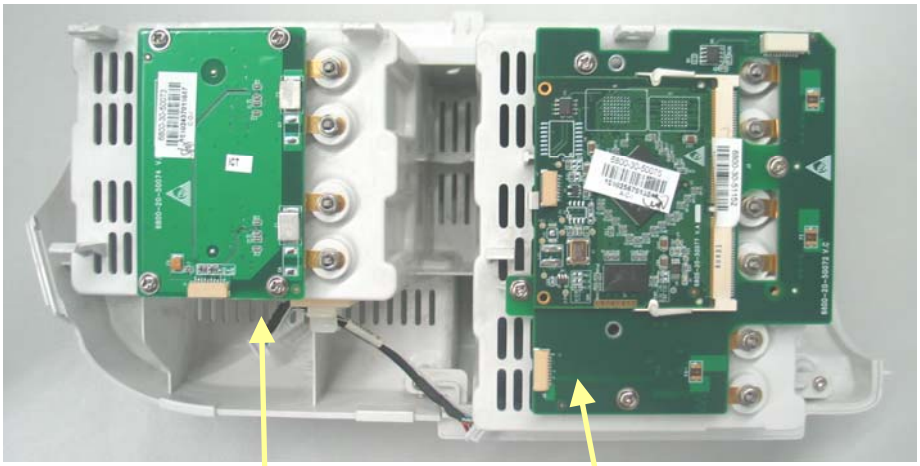
The following disassembly procedure uses the 3-slot module rack as an example. You can disassemble other size module racks by referring to this procedure.

1. Disconnect the cable that connects the integral module rack with the mother board. Remove the two bolts and then remove the M3×6 screw.



2. Pry the snaps out about 1mm away with a small flat-bladed screwdriver. Then insert the small flat-bladed screwdriver into the position marked in the picture below and pry it out about 1mm so that the module rack becomes disengaged from the back cover.

3. If the module rack still engages with the back cover, insert a small flat-bladed screwdriver into the position marked in the picture and pry it out about 1mm to release the hidden snap between the integral module rack and the back cover. Then pull out the module rack.



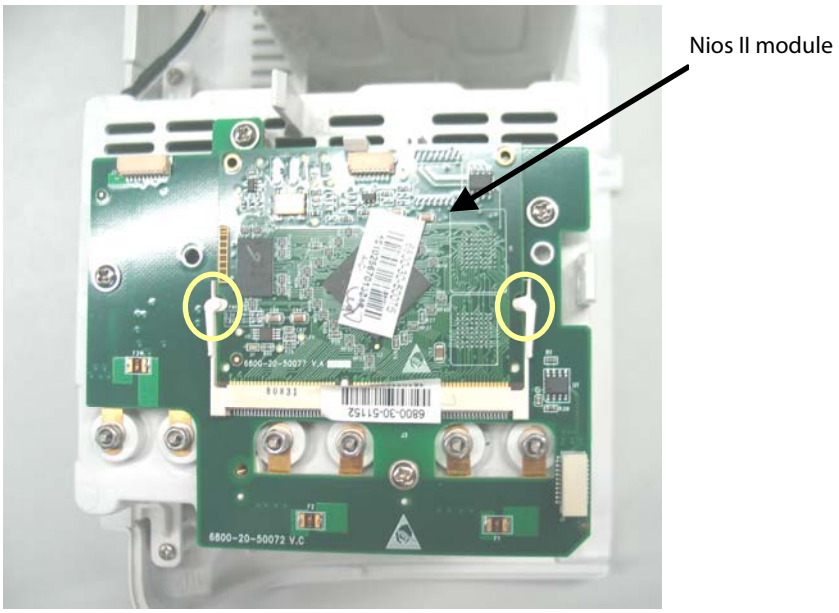
MPM Communication Board

3-slot module Rack Communication Board

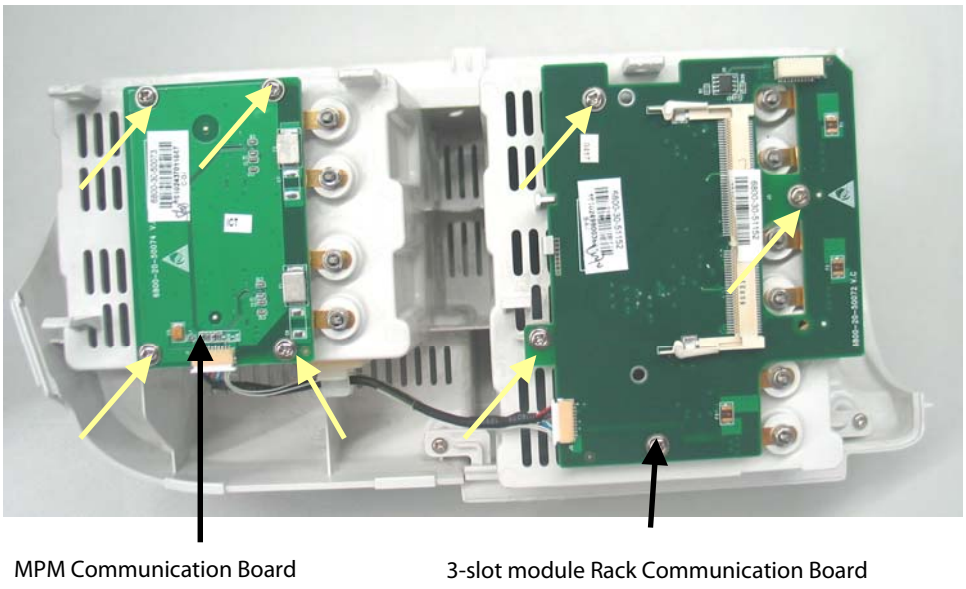
CAUTION

- **Be sure to release the hidden snaps first when removing the integral module rack.**

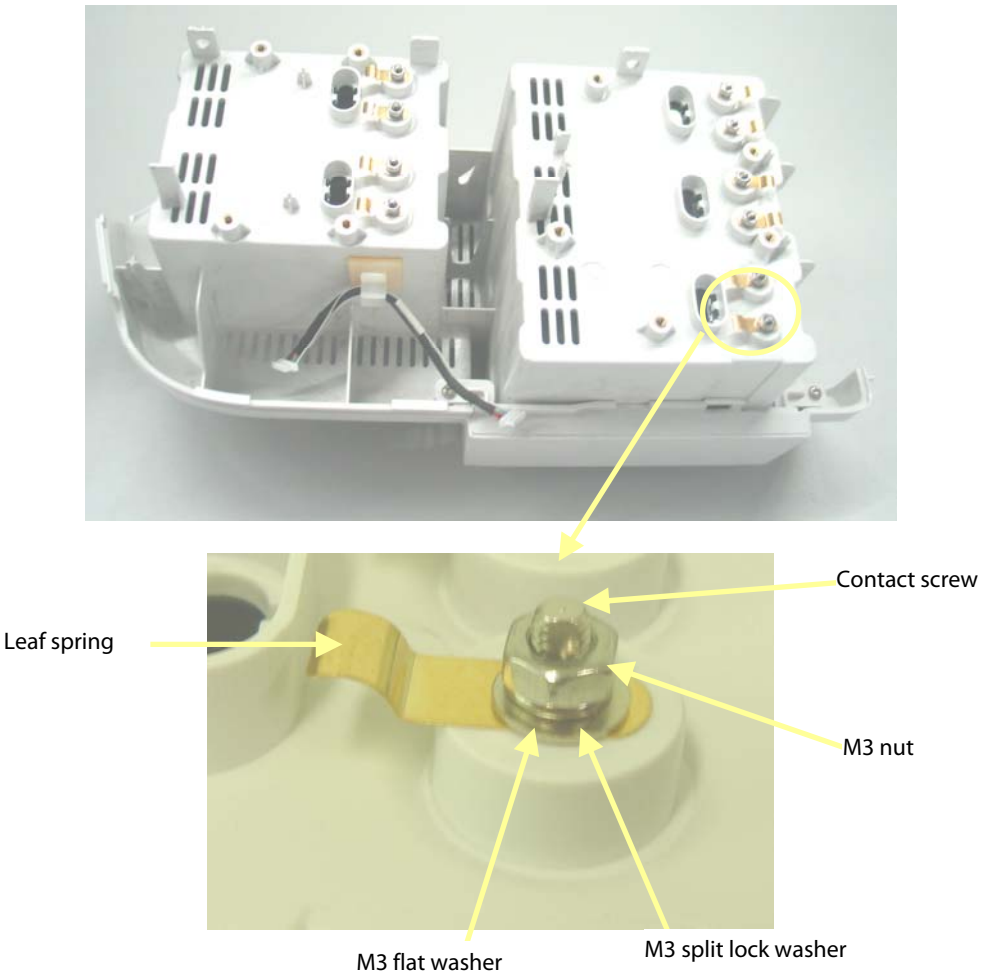
4. Release the three clips on the 3-slot module rack communication board and remove the Nios II module.



5. Remove the four M3×6 screws and take out the 3-slot module rack communication board. Remove the four M3 ×6 screws and take out the MPM Communication Board.

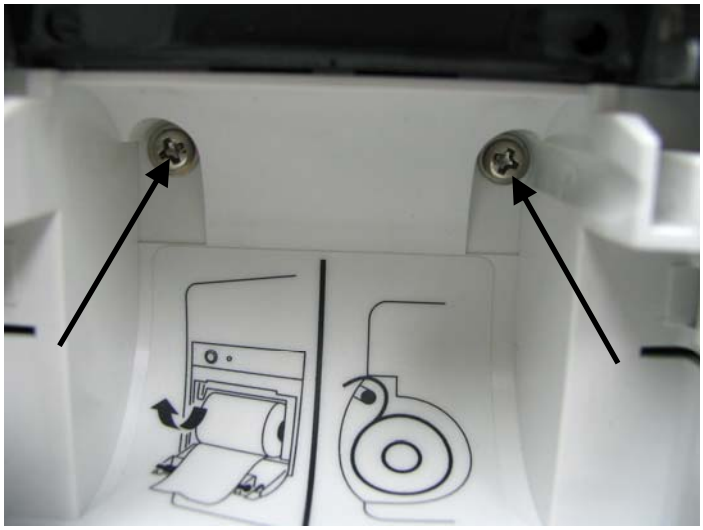


6. Remove the hex nut assy using the hex nut driver or socket wrench. Then separate the washer, leaf spring and contact screw from each other.

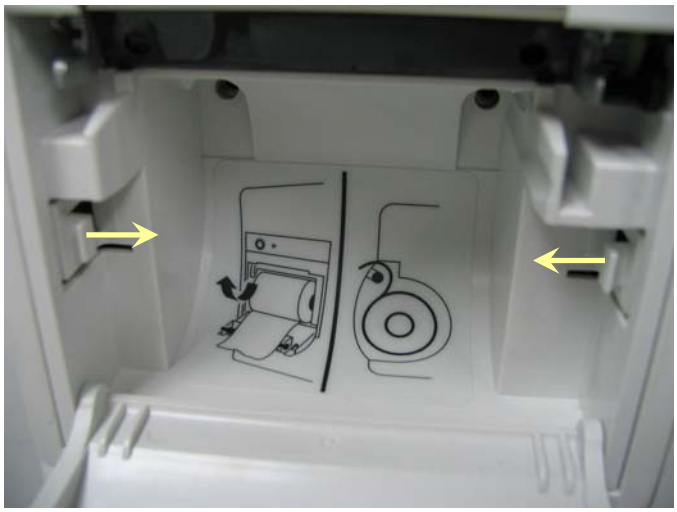


5.4.17 Removing the Recorder

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



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

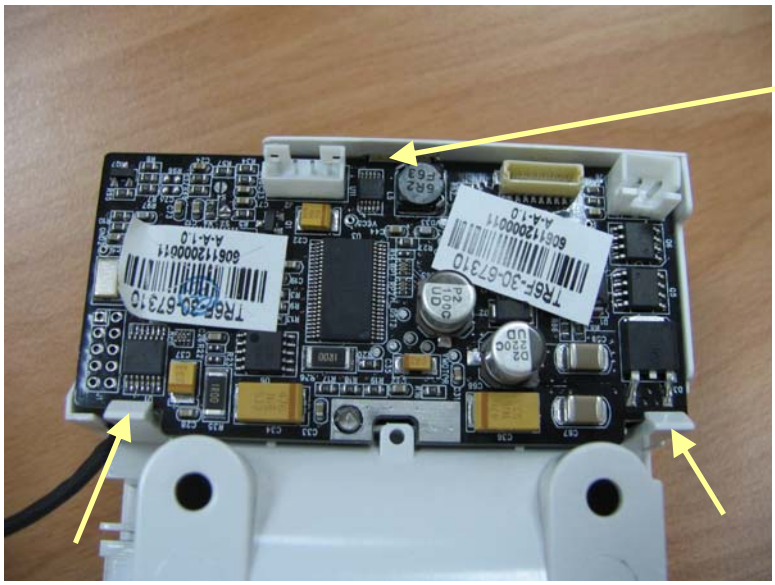


NOTE

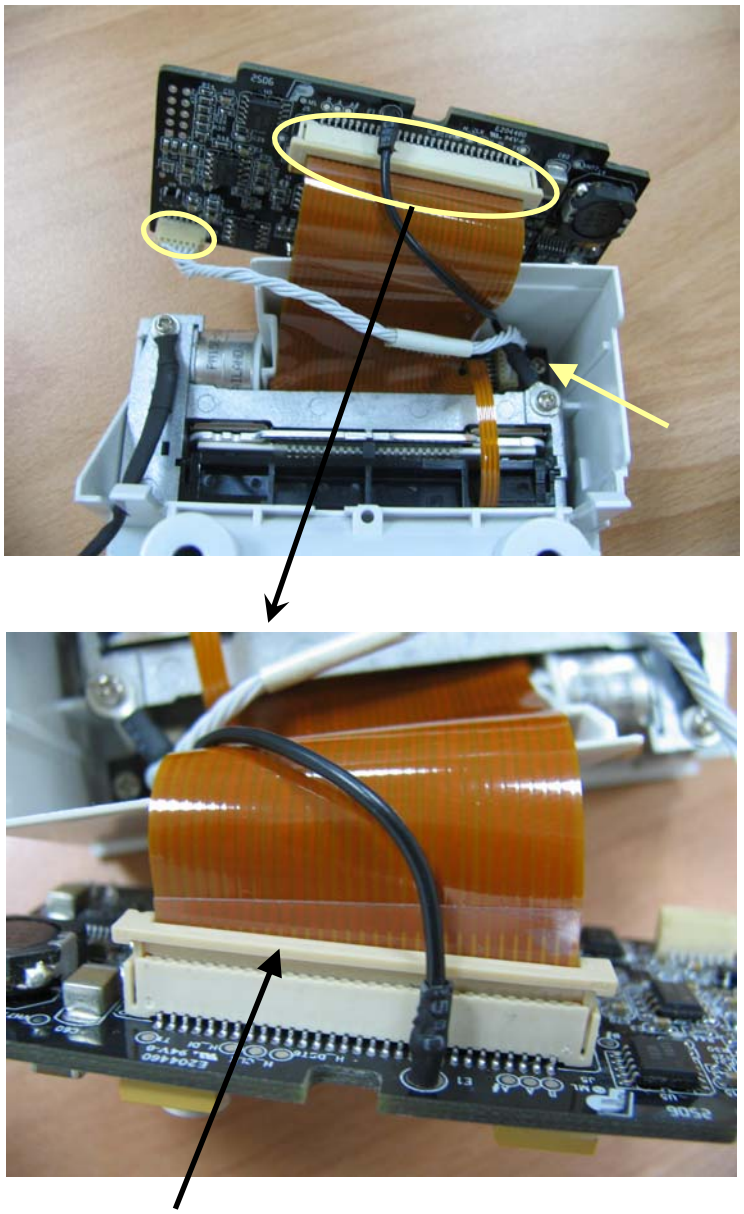
- **Be sure not to damage the connecting cables or connectors when pulling out the recorder.**

3. Remove the M3×6 screw and remove the cables marked in the picture.

4. Release the two clips and take out the recorder drive board. Pay attention to the snap in the front.

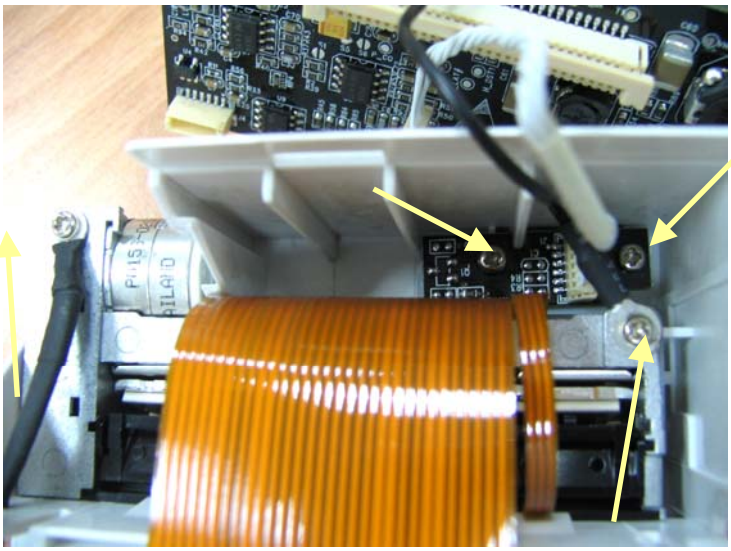


5. Release the ribbon cable by pulling up on the pressure connector bar. Remove the cable that connects the drive board and the button board. Remove the PT2×6 screw and remove the drive board's grounding cable. Then take out the recorder drive board.

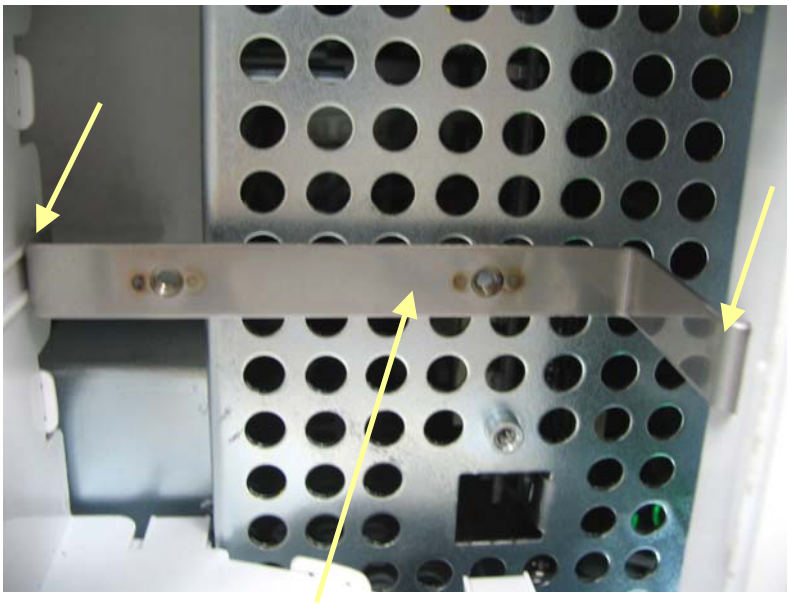


Pressure connector bar

6. Remove the two PT2×6 screws and take out the thermal printhead. Then remove the two PT2×6 screws and remove the recorder's button board.



7. Remove the recorder mounting bracket right side first.

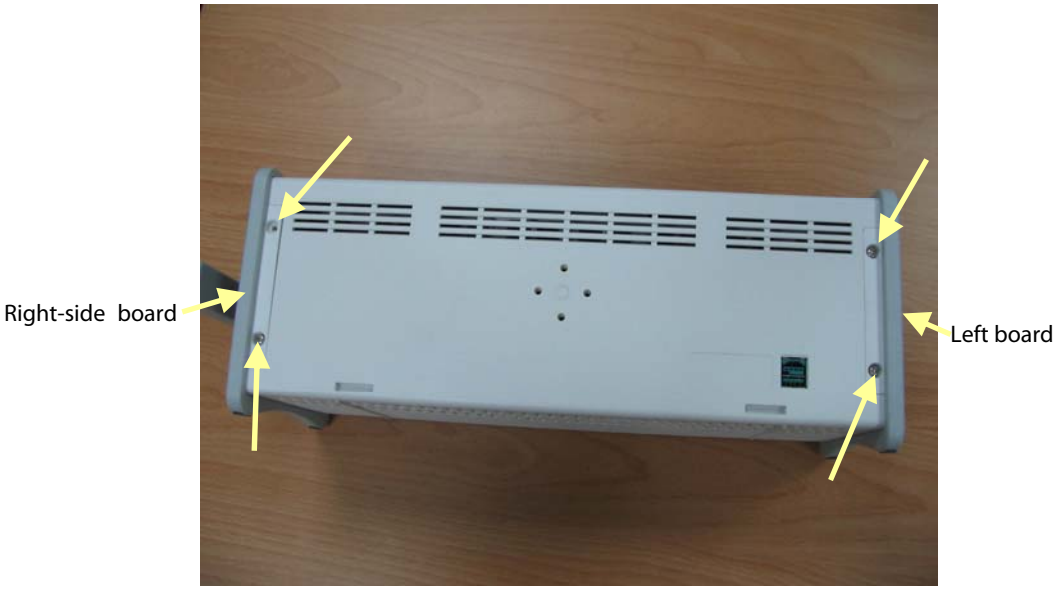


Recorder mounting bracket

8. Hold and then pinch the recorder housing so that the recorder housing becomes disengaged from the monitor housing. Then take out the recorder housing.

5.5 Removing the SMR Assembly

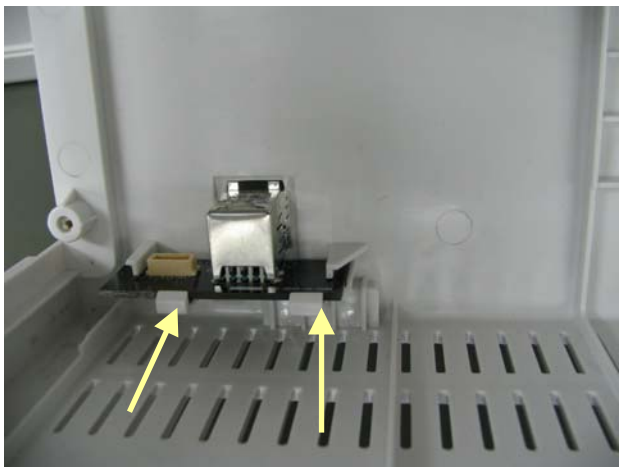
1. First remove the 4 screw covers and then remove the 4 M3×8 screws.



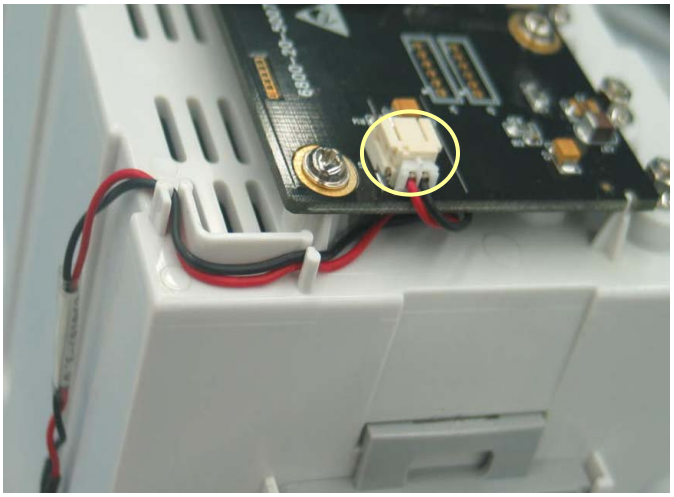
2. Pull off the left- and right-side boards. Be sure to place the rubber loop in position when reassembling the right board.

3. From the left side, remove the cable that connects the module rack interface board and the 8-slot module rack communication board. Then take off the SMR cover.

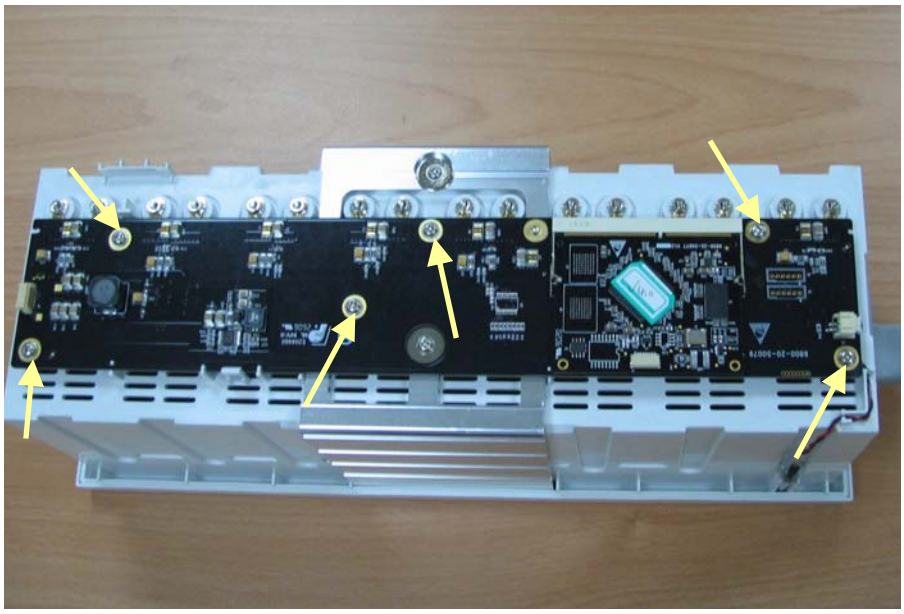
4. Release the two clips and take out the module rack interface board. Be sure not to damage the snap slot on the left side.



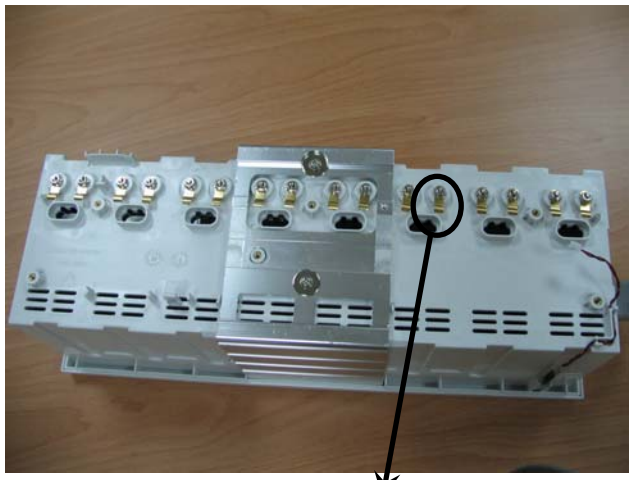
5. Remove the cable that connects the 8-slot communication board and the LED board, the LED indicator and the light tube.

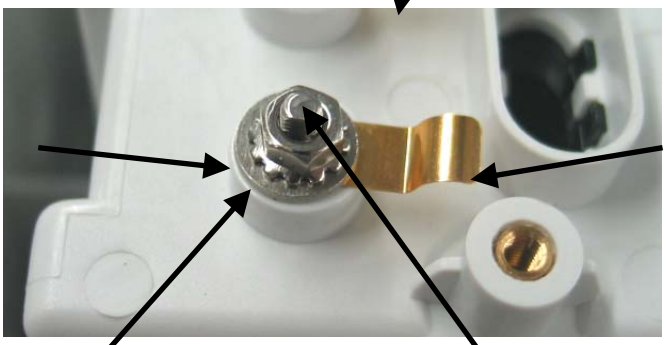


6. Release the clips and take out the Nios II module. Then remove the six M3×6 screws and remove the 8-slot module rack communication board.



7. Use the hex nut driver or socket wrench to remove the hex nut and lock washer assembly which can be further separated into the flat washer, leaf spring and contact screw.





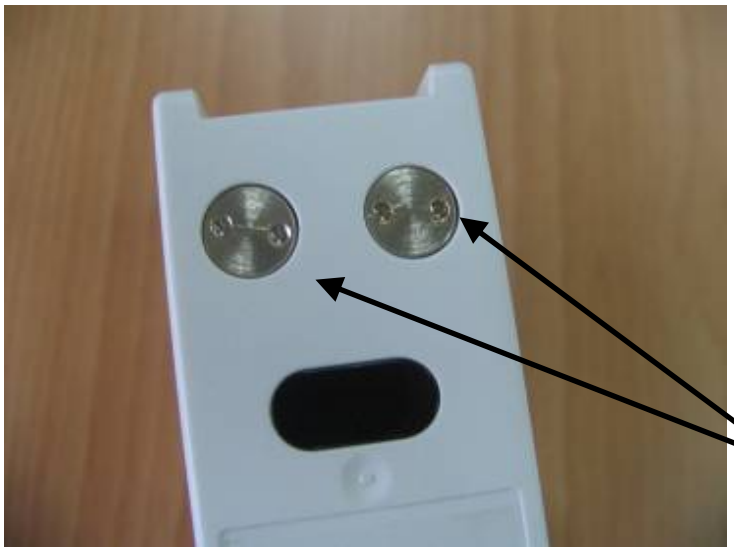
5.6 Disassembling Modules

WARNING

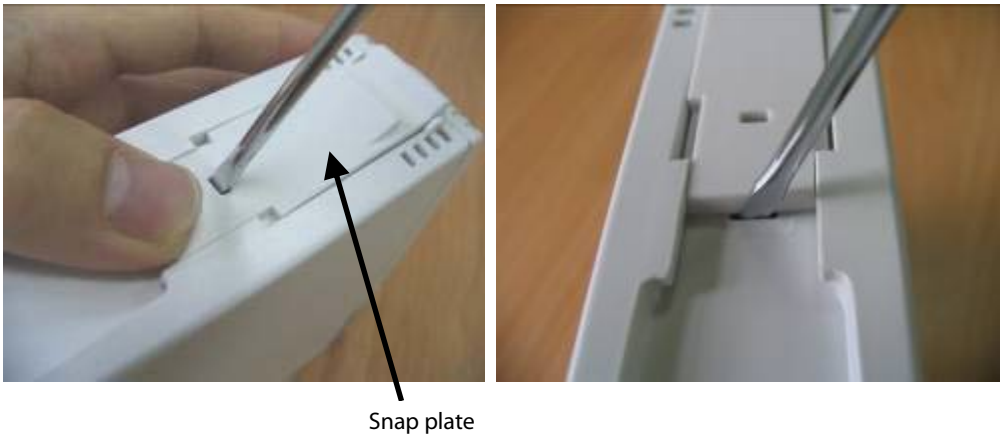
- **After reassembling a module, a patient leakage current test must be performed before it is used again for patient monitoring.**

5.6.1 Disassembling the BeneLink Module

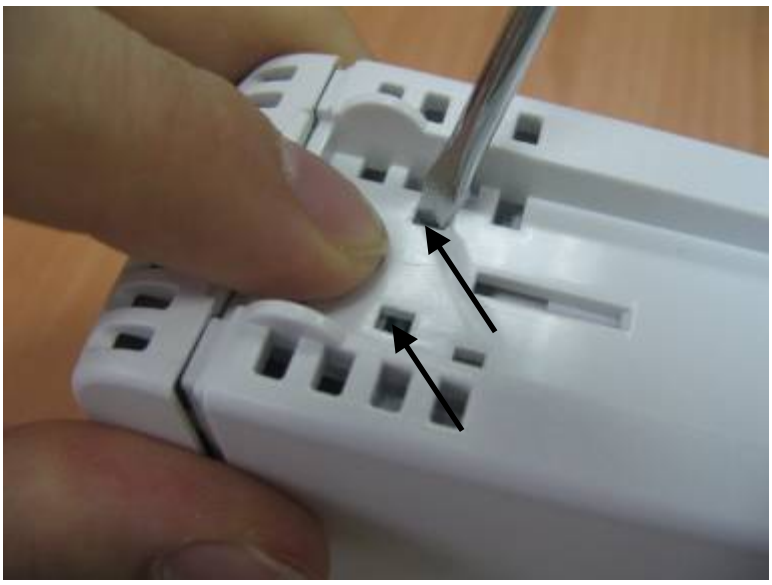
1. Remove the two contact screws andM3 spring washers on the back of the module with needle nose pliers.



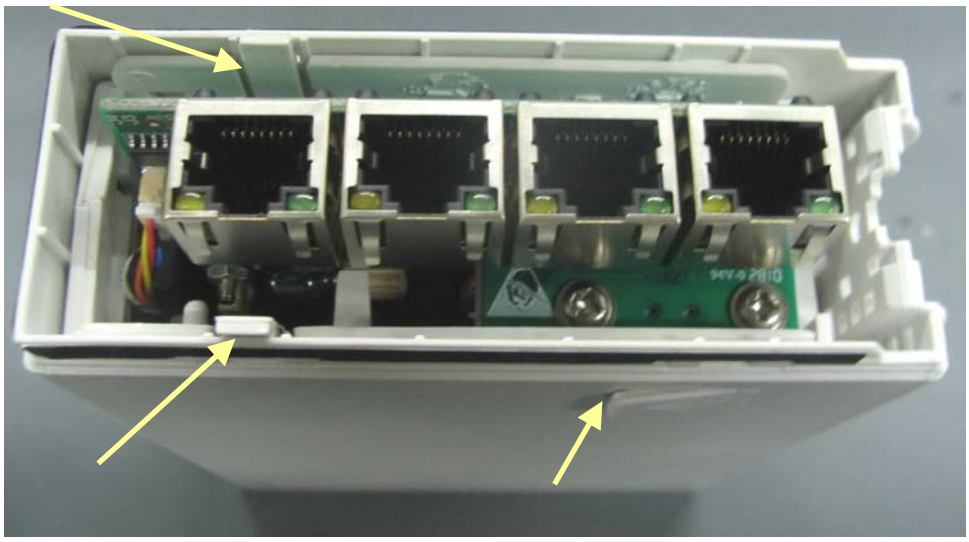
2. Unlock the snap lock by pressing it down about 1 mm with a flat screwdriver. At same time, push the snap plate forward with your thumb until the snap lock separates from the module housing. Lift the front of the snap plate with the flat screwdriver and remove it from the BeneLink module.



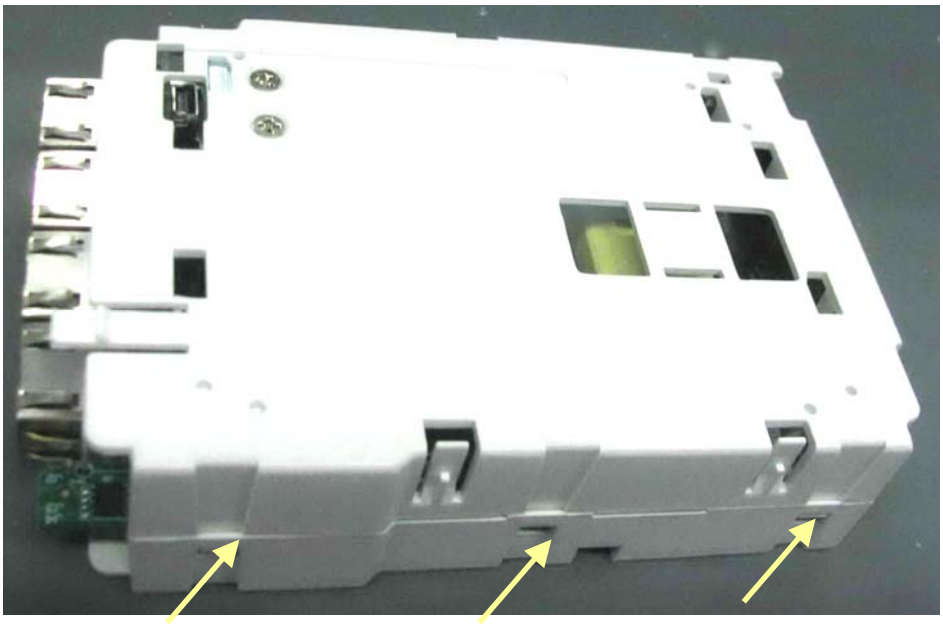
3. Remove the M3×6 screw using a #1 Phillips screwdriver. Then, press down, in turn, the two clips that engage the front panel. At same time, separate the front panel from the module's outer housing.



4. Remove the contact screws, the locking clip, and the front cover by referring to steps 1 to 3 as described in section ***5.6.1 Disassembling 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.

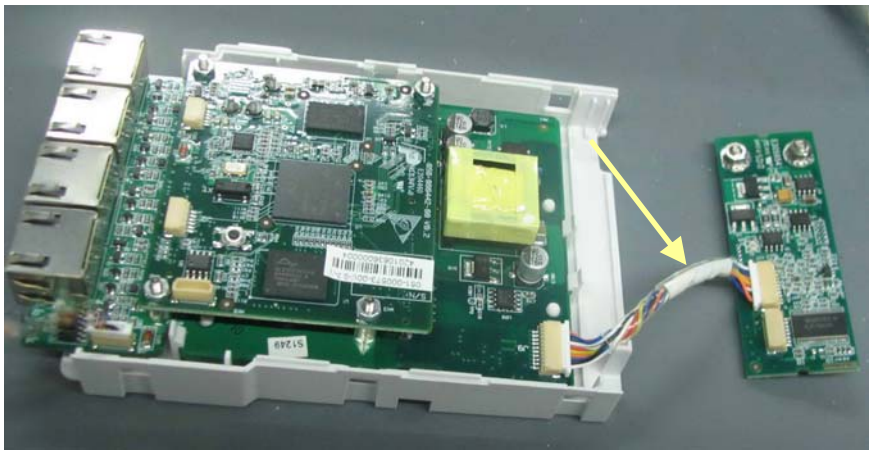


3. Release the three snaps to separate the two halves of the module side cover.

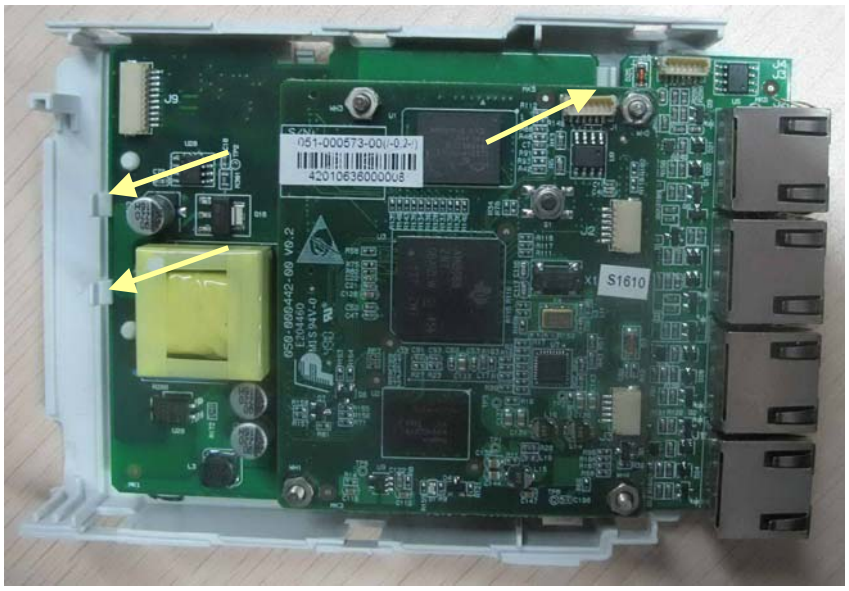


4. Take off the cable between the USB board and the interface board.

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

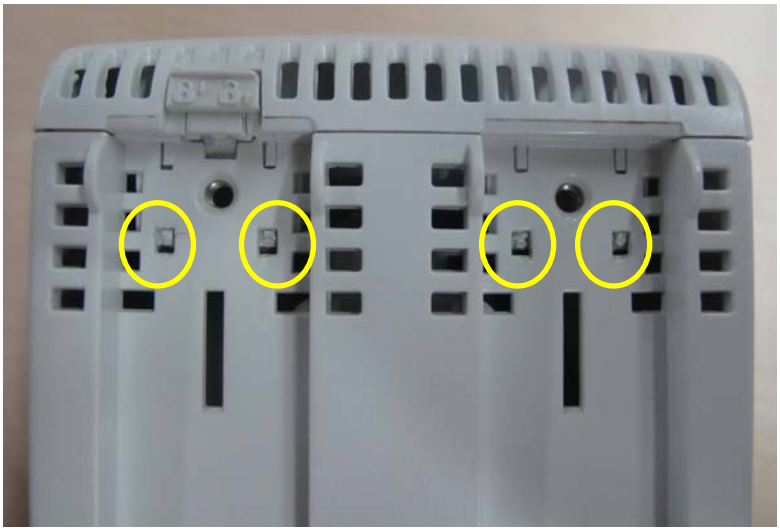


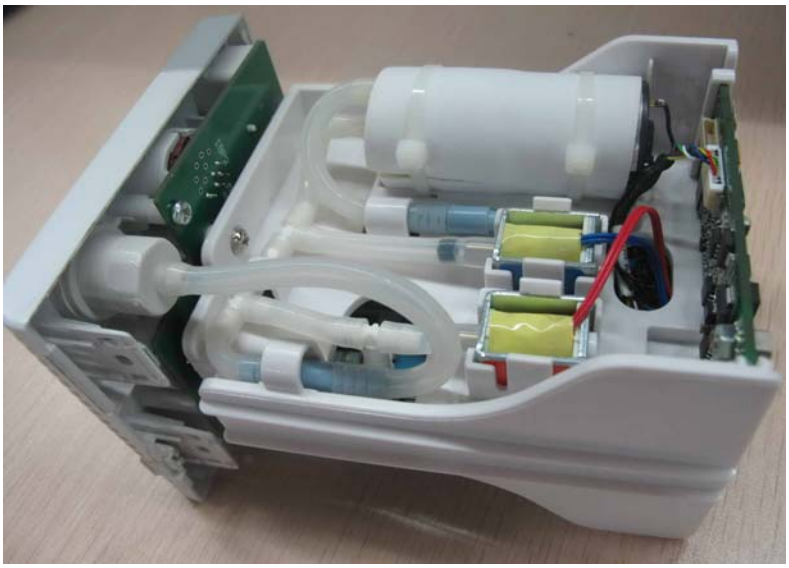
6. Release the four clips to remove the interface board.



5.6.2 Disassembling the New MPM Module

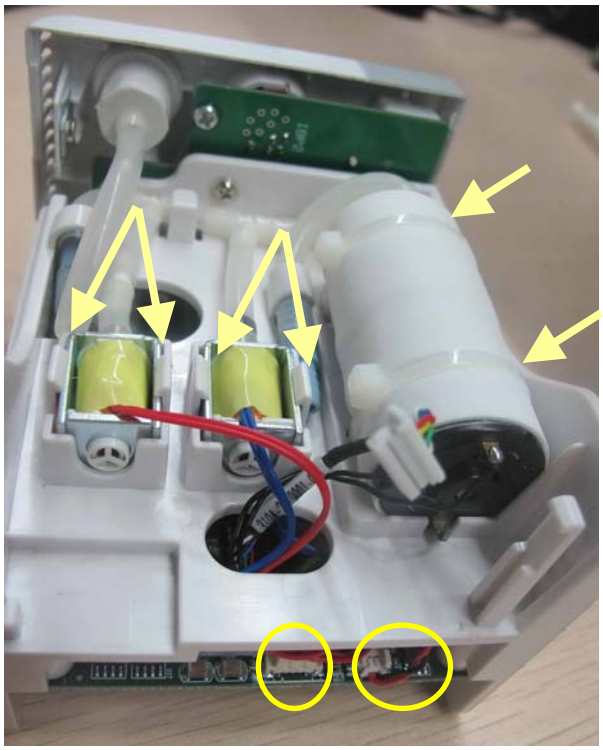
1. Remove the contact screws and the locking clip by referring to steps 1 to 3 as described in section ***5.6.1 Disassembling the BeneLink Module***.
2. Remove the two M3×6 screws. Then press down, in turn, the four clips that engage the front cover with a small flat-bladed screwdriver. At the same time, pull off the rear cover.



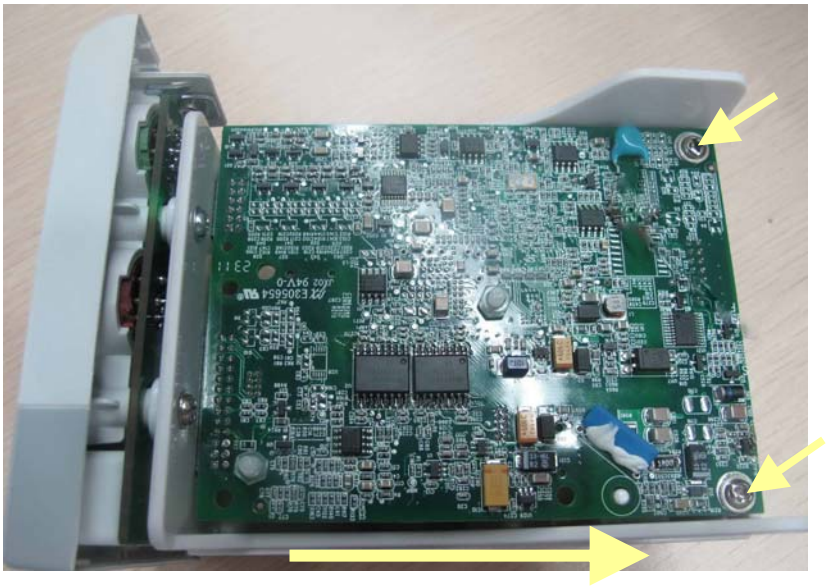


3. Disconnect the cable from the infrared communication board, and release the snap lock to remove the infrared communication board.

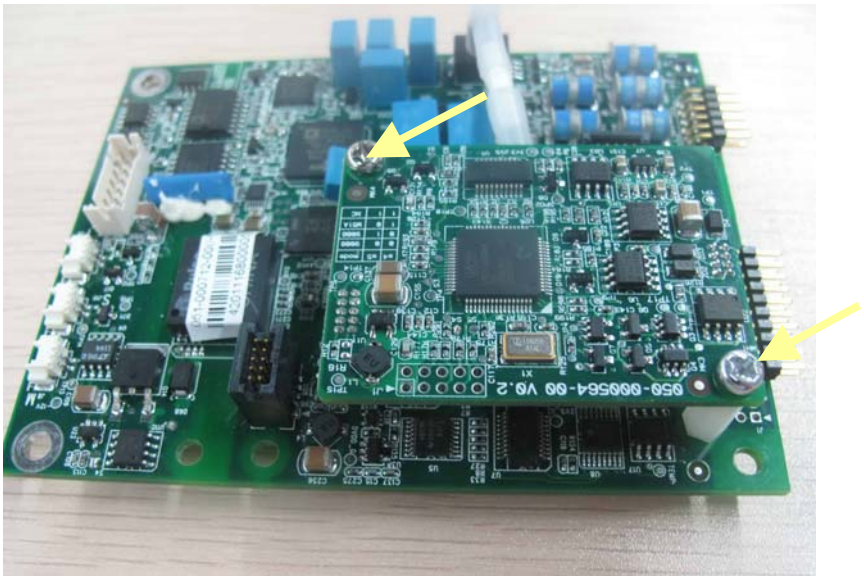
4. Disconnect the cables from the NIBP inflation pump. Disconnect the relief valves from the parameter board. Snip off the cable ties to remove the pump. Release the snap locks to remove the valves.



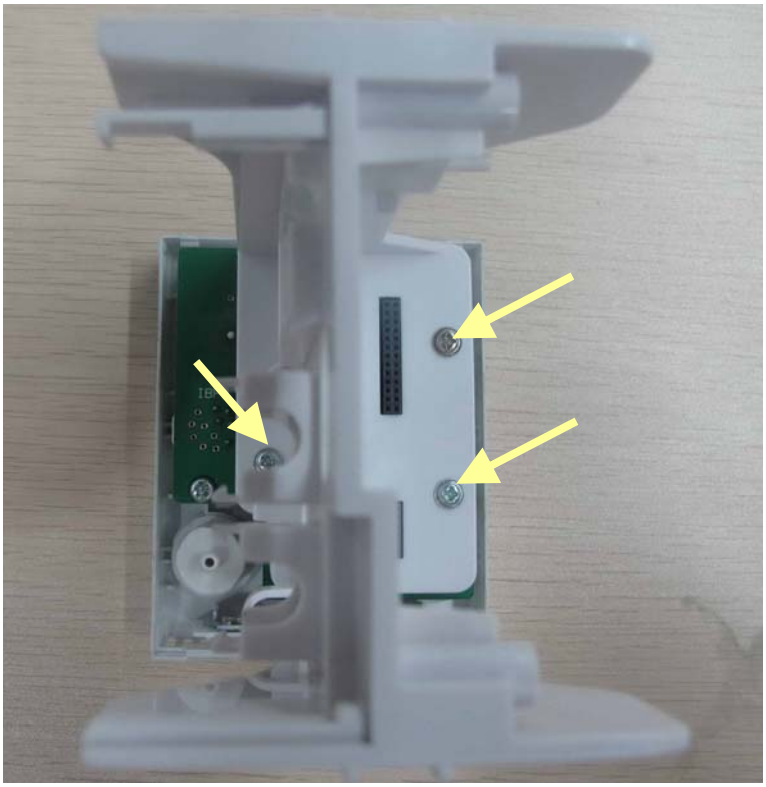
5. Remove the two M3×8 screws on the parameter board. Then pull off the parameter board rearward as shown below.



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 and the holder.



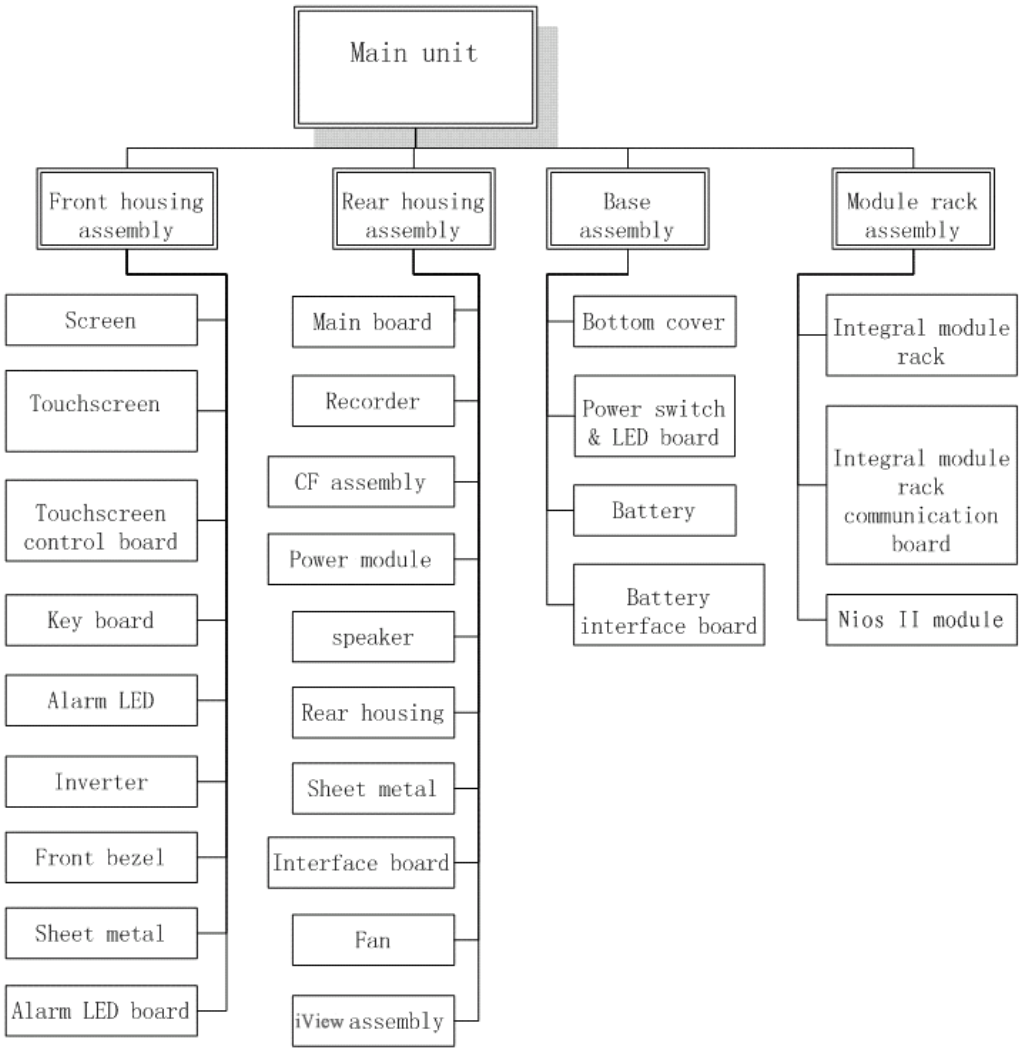
FOR YOUR NOTES

6 Parts

6.1 Introduction

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

Hardware architecture of the main unit is shown below:

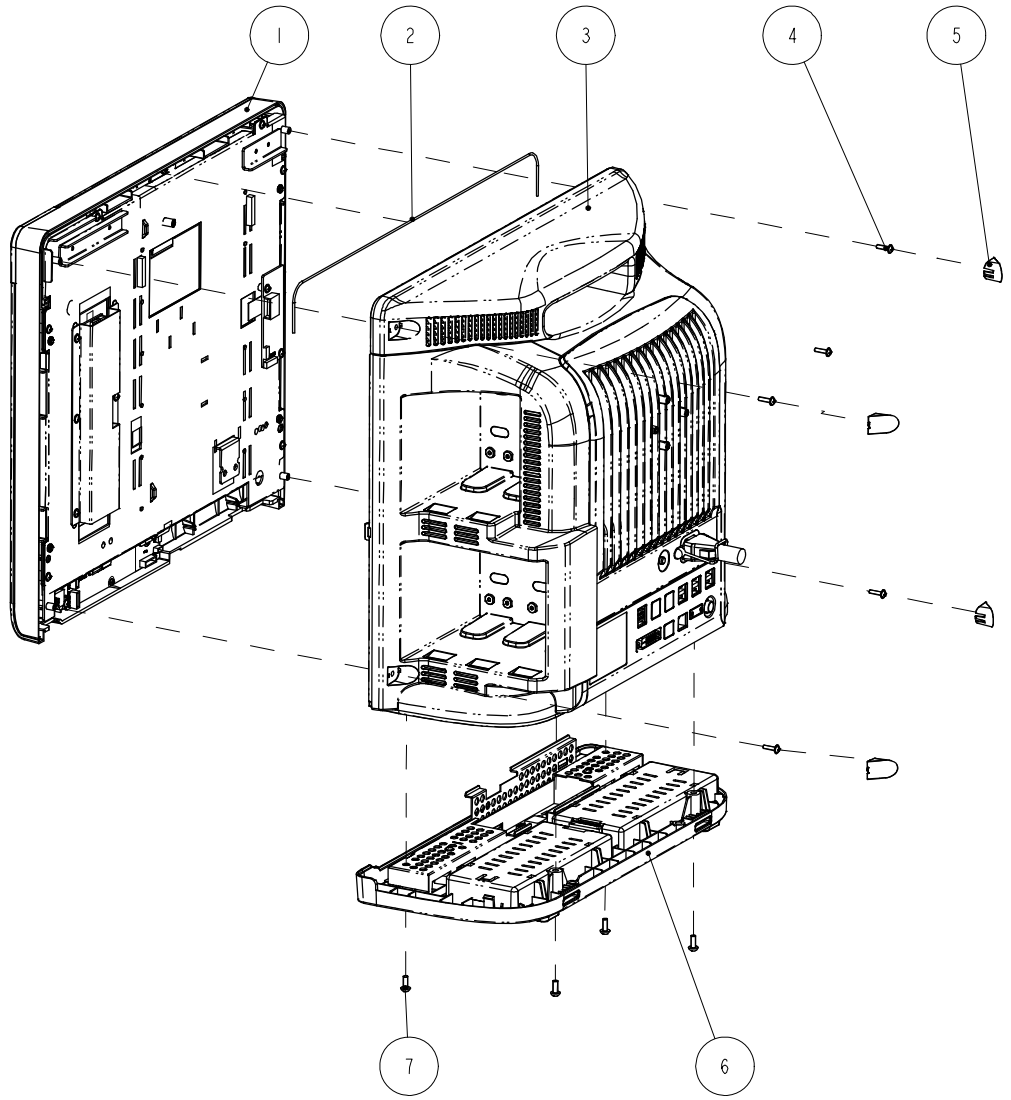


NOTE

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

6.2 Main Unit

Exploded View

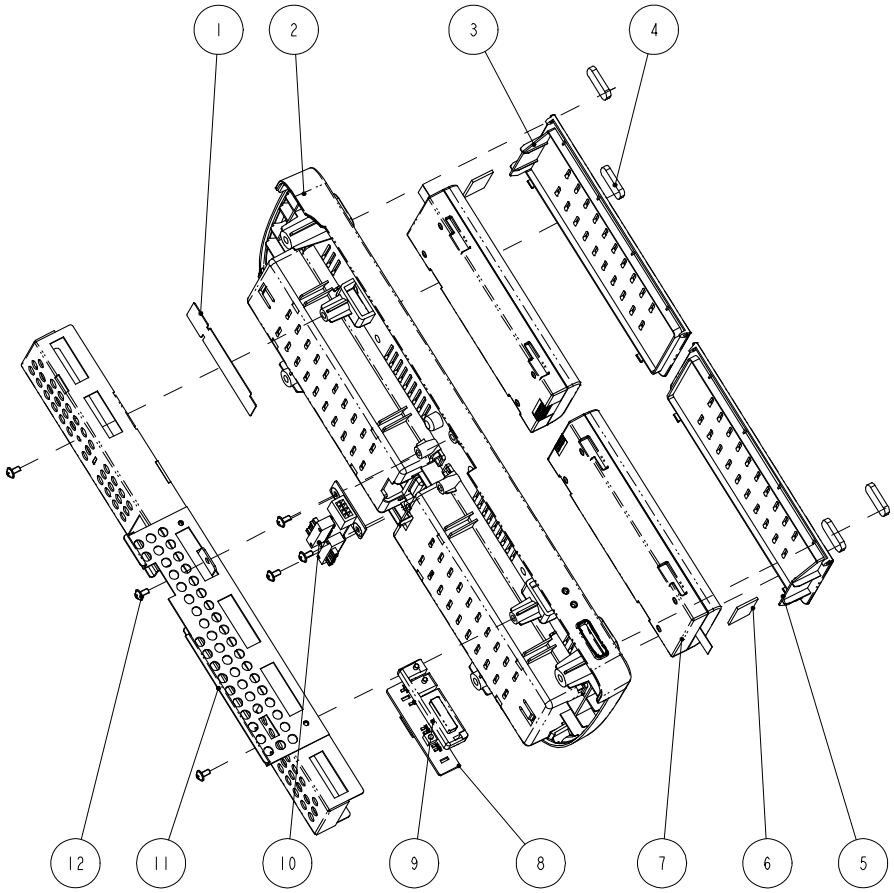


Parts List

SN	Description	FRU part number	Qty
1	Passport 17m front housing assembly(touchscreen)	115-020385-00	1
2	Hose, 0.47 m	/	1
3	Rear housing assembly	/	1
4	Phillips screw M3×12	/	5
5	Screw cap	043-004044-00	4
6	Base assembly	801-6800-00098-00	1
7	Screw, M4×12	/	4

6.3 Base Assembly

Exploded View

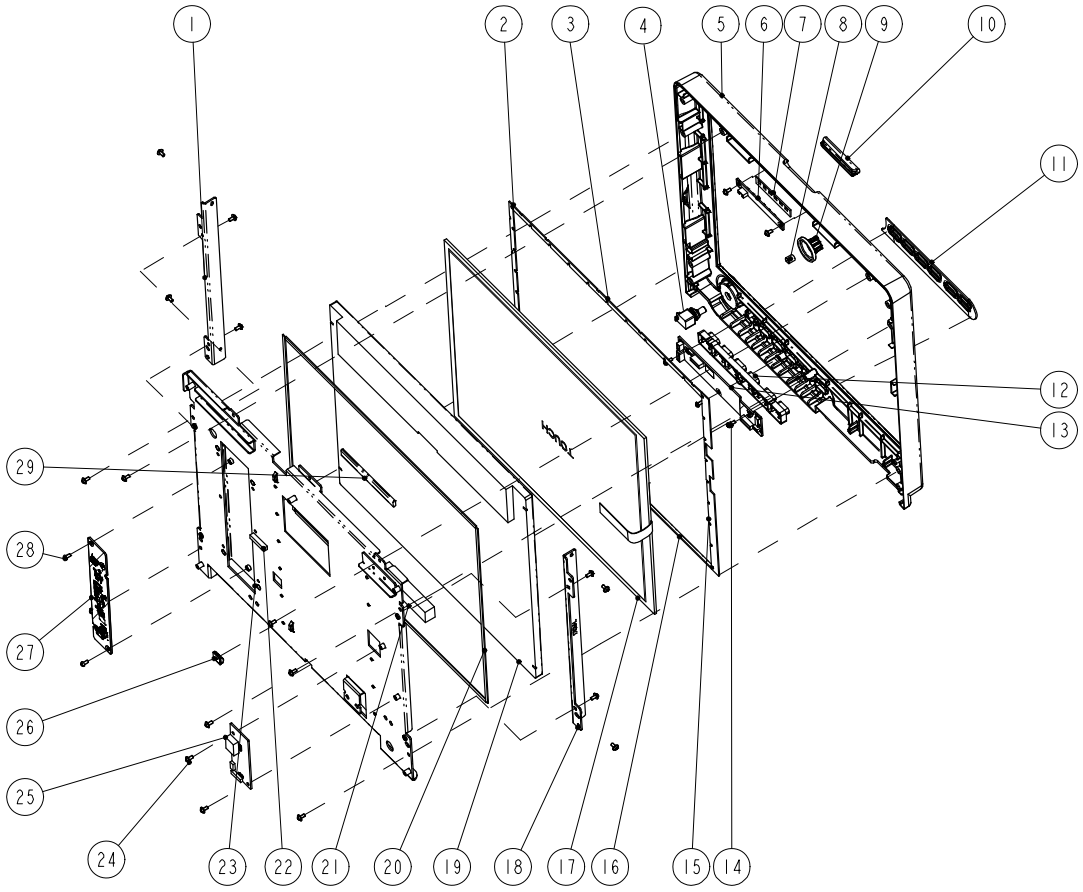


Parts List

SN	Description	FRU part number	Qty
1	Small fireproof sheet T8	047-014206-00	1
2	Bottom cover (T8)	043-004135-00	1
3	Battery cover L	043-004072-00	1
4	Cushion	6800-20-50233	4
5	Battery cover R	043-004071-00	1
6	Battery cover spacer	6800-20-50386	2
7	Lithium battery, 11.1 VDC, 4500 mAh	022-000008-00	2
8	Power switch board	6800-30-50088	1
9	Passport 17m silicon keyboard	049-000626-00	1
10	Battery interface board	6800-30-50108	1
11	Base support	6800-30-50108	1
12	Phillips screw M3×6	6800-20-50212	6

6.4 Front housing Assembly--17" LCD Touchscreen

Exploded View



Parts List

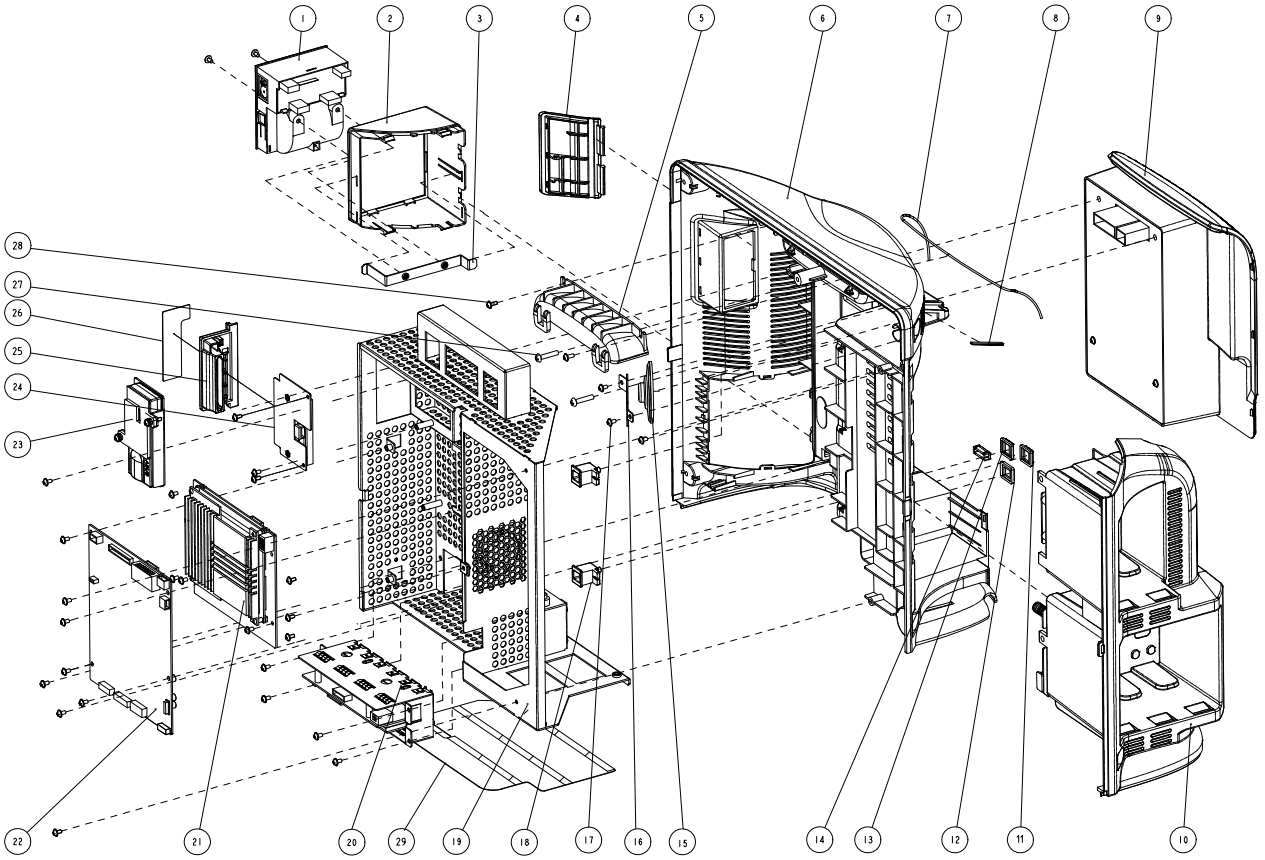
SN	Description	FRU part number	Qty
1	Screen support 2(for 17" touchscreen)	/	1
2	Dust-proof gasket 2	115-030580-00	1
3	Dust-proof gasket 1	115-030580-00	1
4	Optical Encoder 16 steps 5VDC Dip6	0000-10-10789	1
5	Front cover of Passport17m	115-030580-00	1
6	6301 alarm board PCBA	051-000879-01	1
7	Alarm gasket	/	1
8	Clamp spring	115-022497-00	1
9	Encoder of Passport 17m		1
10	Alarm light of PP8	043-003642-00	1
11	Overlay of Passport 17m	049-000626-00	1
12	Keyboard of Passport 17m	043-003610-00	1
13	T8 button board (touchscreen/optical encoder) (without shank)	115-004216-00	1
14	Tapping screw PT3×8	/	3

SN	Description	FRU part number	Qty
15	Dust-proof gasket 3	115-030580-00	1
16	Touchscreen waterproof strip	115-030580-00	1
17	Touchscreen, resistance, 17.1″	0000-10-11071	1
18	Screen support 1(for 17' touchscreen)	/	1
19	LCD screen	021-000157-00	1
20	Dust-proof gasket 4	/	2
21	Dust-proof gasket 5	/	2
22	Conductive foam, 4105AB51K	/	4
23	Screen mounting plate	115-030580-00	1
24	Phillips screw M3×6	/	25
25	Touchscreen control board	6800-30-50082	1
26	Berylium-bronze leaf 92-047	/	1
27	Backlight board	051-001820-00	1
28	Phillips screw M3×6	/	2
29	Conductive foam0501080	/	2

6.5 Rear Housing Assembly

6.5.1 Rear Housing Assembly

Exploded View



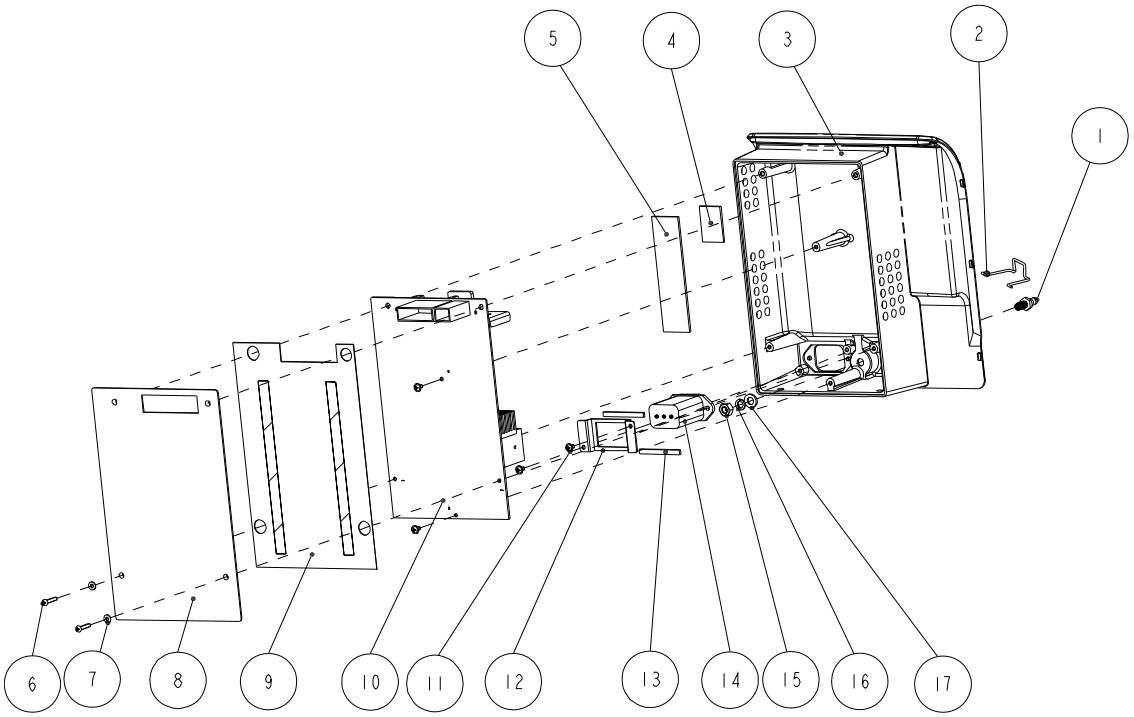
Parts List

SN	Description	FRU part number	Qty
1	TR6F recorder	801-6800-00080-00	1
2	Recorder chamber	043-004046-00	1
3	Recorder support rack	6800-20-50213	1
4	CF card door	043-004075-00	1
5	Handle cover	043-004073-00	1
6	Rear housing (new connector)	043-000060-01	1
7	Hose, 0.3m	/	1
8	Waterproof strip I	/	1
9	Power module assembly	/	1
10	Module rack (maximum configuration)	/	1
11	Grey USB cover	/	1
12	CIS network port cover	/	1
13	USB cover	043-000470-01	1

SN	Description	FRU part number	Qty
14	MiniDB9 cover (T8)		1
15	Speaker	6800-20-50681	1
16	Speaker pad		1
17	Phillips screw M3×6		27
18	Plug	043-004076-00	2
19	Main support assembly	6800-30-50533	1
20	Interface board assembly	/	1
21	iView assembly (SSD hard drive)	115-016498-00	1
22	Main board assembly	/	1
23	6800 wireless AP kit (ASUS)	801-6800-00109-00	1
24	6800 CF card assembly (9211 driving board)	801-6800-00131-00	1
25	WLAN tray	043-004074-00	1
26	WLAN overlay	/	1
27	Phillips screw M4×20	/	2
28	Phillips screw M3×8	/	2
29	Fireproof sheet T8	047-013585-00	1

6.5.2 Power module

Exploded View

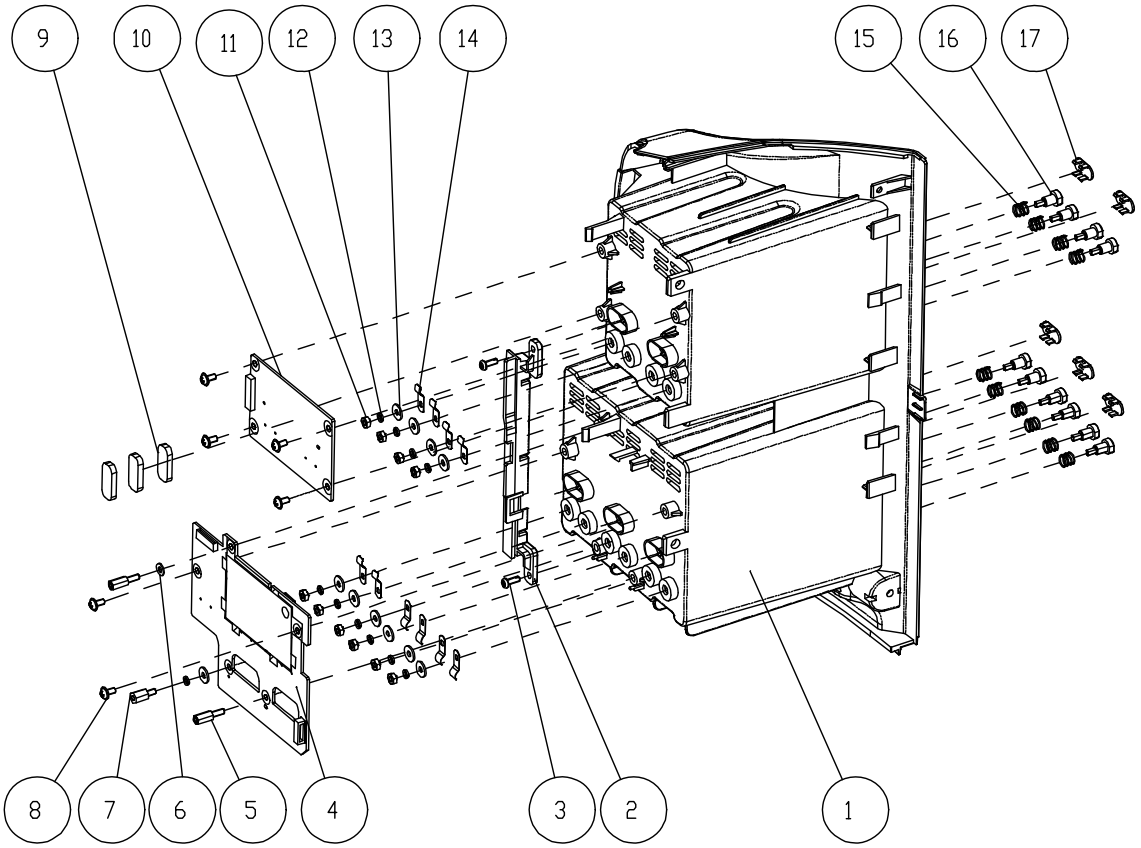


Parts List

SN	Description	FRU part number	Qty
1	Grounding terminal	0509-20-00098	1
2	Power cord retainer	/	1
3	Power module chamber	044-000447-00	1
4	Backlight board insulating sheet	/	1
5	Backlight board insulating plate I, 100×27 mm	/	1
6	Philips pan head screw, M3×12	/	2
7	Large washer class A GB/T96.1-2002 3	/	2
8	Sheet metal for power module	/	1
9	Power board insulating sheet	/	1
10	6800 power board	6800-30-50050	1
11	Phillips screw M3×6	/	4
12	power socket fixture	6800-20-50218	1
13	Waterproof strip for power socket	/	2
14	AC input connector and cable	009-000255-00	1
15	Stainless steel hex nut, GB/T6170-2000 M6 polished	/	1
16	Spring washer	/	1
17	Flat washer	/	1

6.5.3 Integral Module Rack

Exploded View



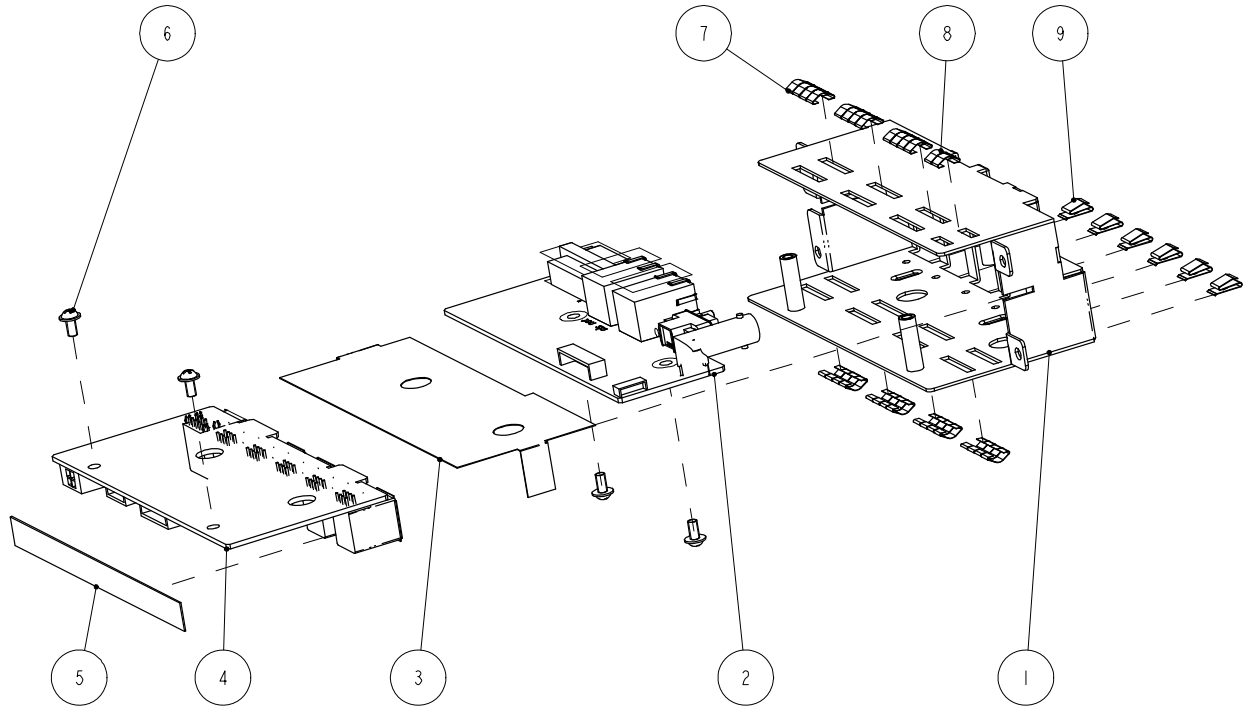
Parts List

SN	Description	FRU part number	Qty
1	Side plate, rear housing-ALL	043-004078-00	1
2	Side plate small cover, rear housing -ALL	043-004042-00	1
3	Tapping screw PT3×8	/	2
4	6800 three-slot module rack communication board	051-000243-00	1
5	stud screw M3×10+8-8, coated with antirust nickel	/	2
6	Large Flat Washer, GB96 3	/	1
7	plastic stud screw M3×8+6-6	/	1
8	Philips pan head screw M3×6	/	6
9	Rubber feet	6800-20-50233	3
10	MPM module rack communication board	6800-30-50073	1
11	Stainless steel hex nut	/	10
12	Flat washer	/	11
13	Spring washer	/	11

SN	Description	FRU part number	Qty
14	Leaf spring	/	10
15	Contact spring	/	10
16	Contact screw	/	10
17	Infrared lens	/	5

6.5.4 Interface Board Assembly

Exploded View (6800-30-50476)

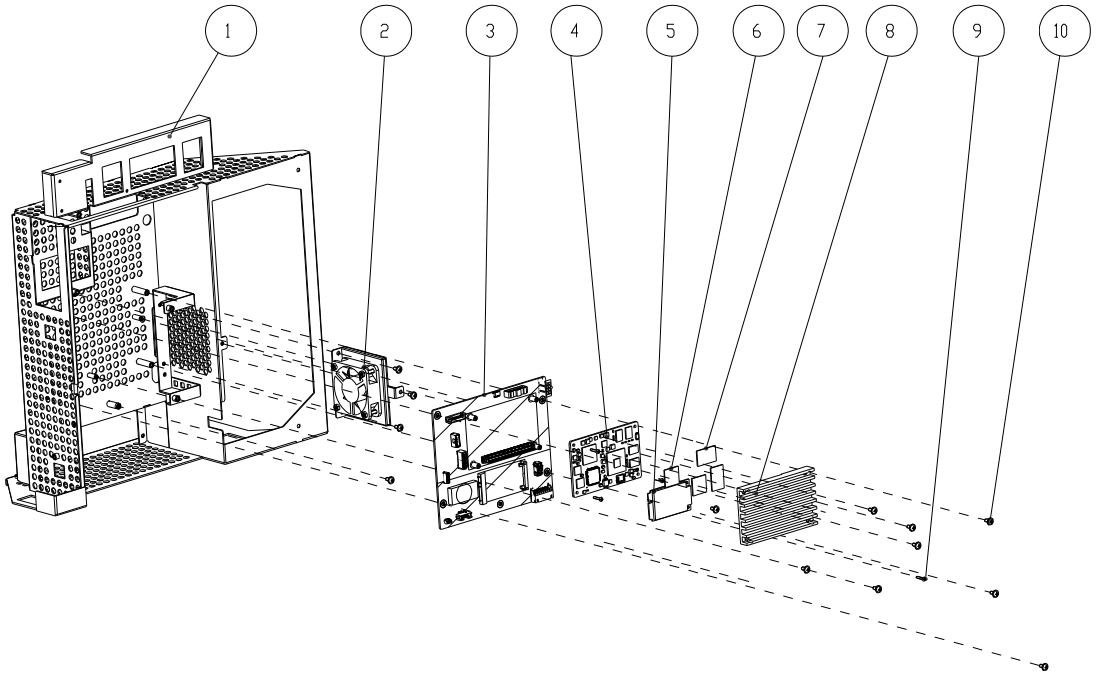


Parts List

SN	Description	FRU part number	Qty
1	T8 interface support (new interface)	/	1
2	6800 DVI interface board (full configuration)	051-000470-00	1
3	Interface board insulating plate	/	1
4	6800 USB interface board (full configuration)	/	1
5	Waterproof strip	/	1
6	Screw, M3×6	/	4
7	Berilium & bronze leaf 187S30（4 leaves）	/	7
8	Berilium & bronze leaf 187S30（2 leaves）	/	1
9	Berilium & bronze leaf 92-106 nickel plated	/	6

6.5.5 Main Support Assembly

Exploded View

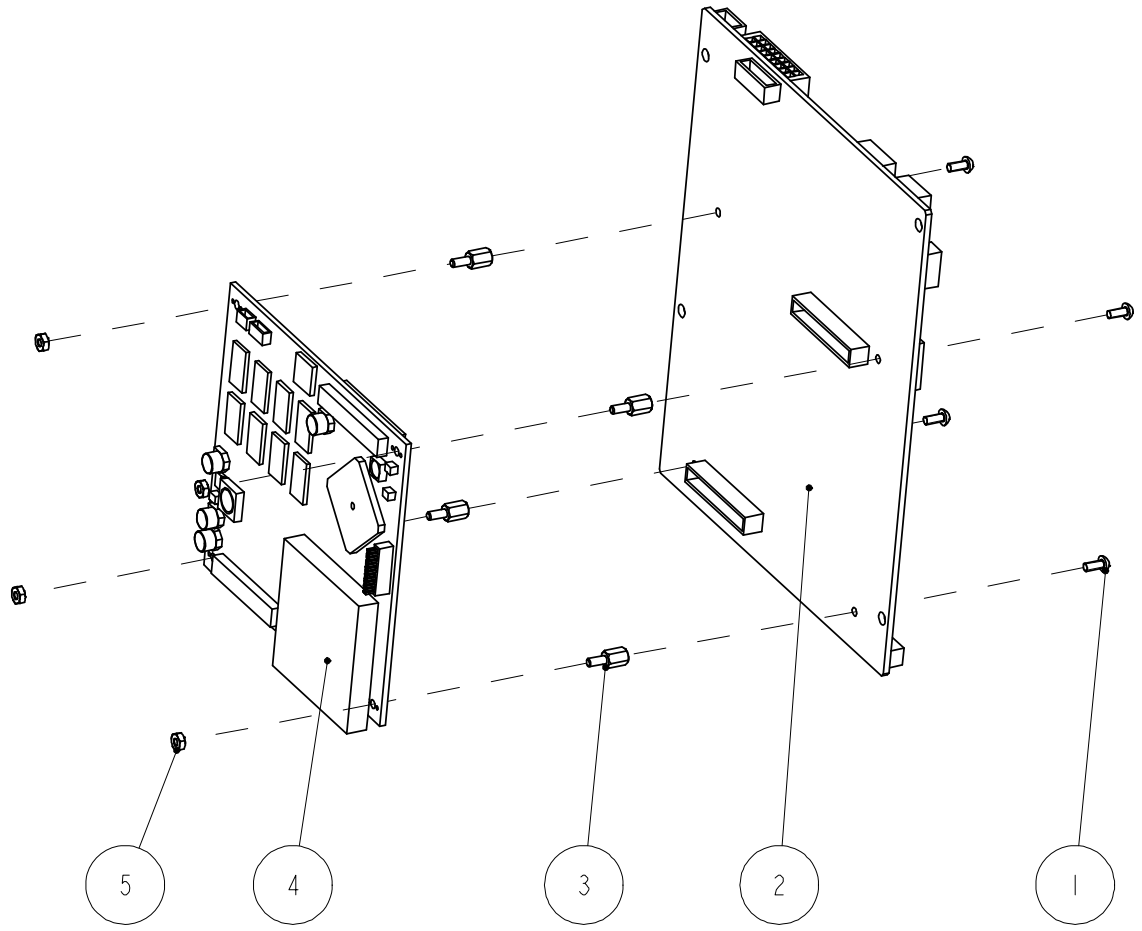


Parts List

SN	Description	FRU part number	Qty
1	Main support	/	1
2	Fan assembly (PN: 6800-30-50509)	801-6800-00033-00	1
3	6800 COME CIS Motherboard PCBA	115-016498-00	1
4	COM N2600 NM10 DDR3 onboard 2GB (PN: 023-000570-00)	/	1
5	SSD 128GB MLC mSATA	115-016498-00	1 (Optional)
6	Thermal Pad/Chomerics/3.0/17×17×1	/	2
7	Thermal Pad/Chomerics/3.0/23×15×1	/	2
8	PC heatsink of iView	/	1
9	Countersunk flat head screw, M2×10	/	4
10	Pan head screw with washer, M3×6	/	7

6.5.6 Main Control Board Assembly

Exploded View

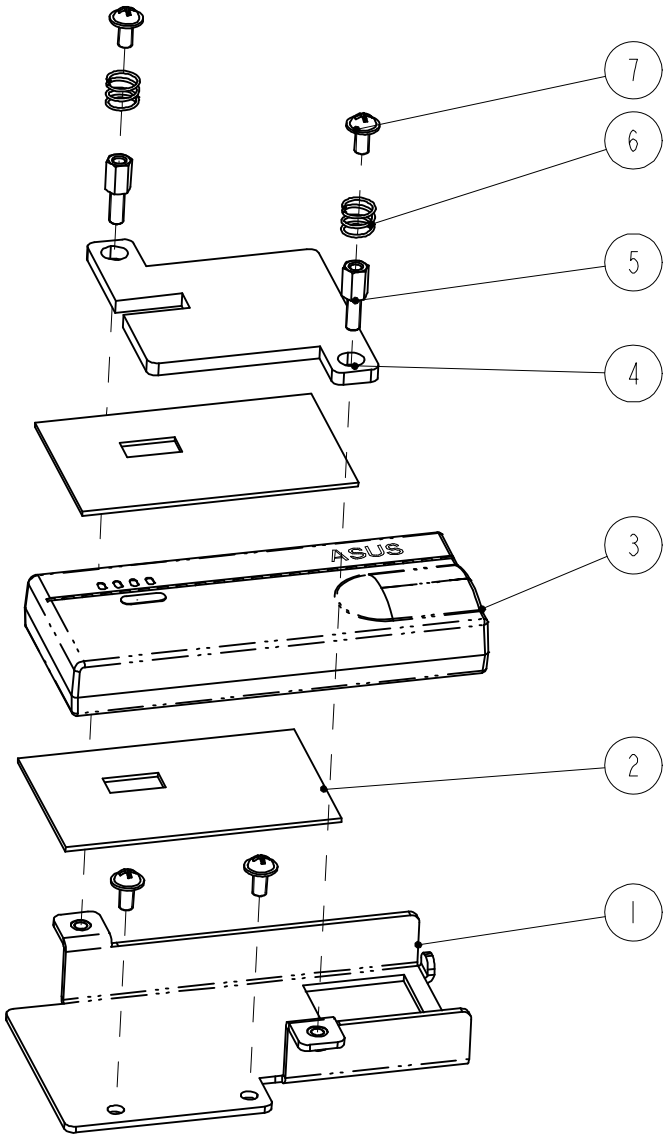


Parts List

SN	Description	FRU part number	Qty
1	Cross head screw M2.5×6	/	4
2	6800 mother board (full configuration)	051-001090-00	1
3	Stud M2.5x7+6-6	/	4
4	MCF547x CPU module (basic configuration/lead-free)	051-000150-02	1
5	Nut GB6170 M2.5	/	4

6.5.7 6800 Wireless AP Kit (ASUS)

Exploded View



Parts List

SN	Description	FRU part number	Qty
1	T8 wireless AP mount support	/	1
2	Thermal pad for wireless card	/	2
3	Wireless router 150Mbps Wi-Fi	023-000505-00	1
4	Cover for wireless LAN (17m)	/	1
5	Screw boss	/	2
6	Spring	/	2
7	Cross pan head screw with washer M3×6	/	4
8	Cable for AP wireless (6100)	009-002895-00	1

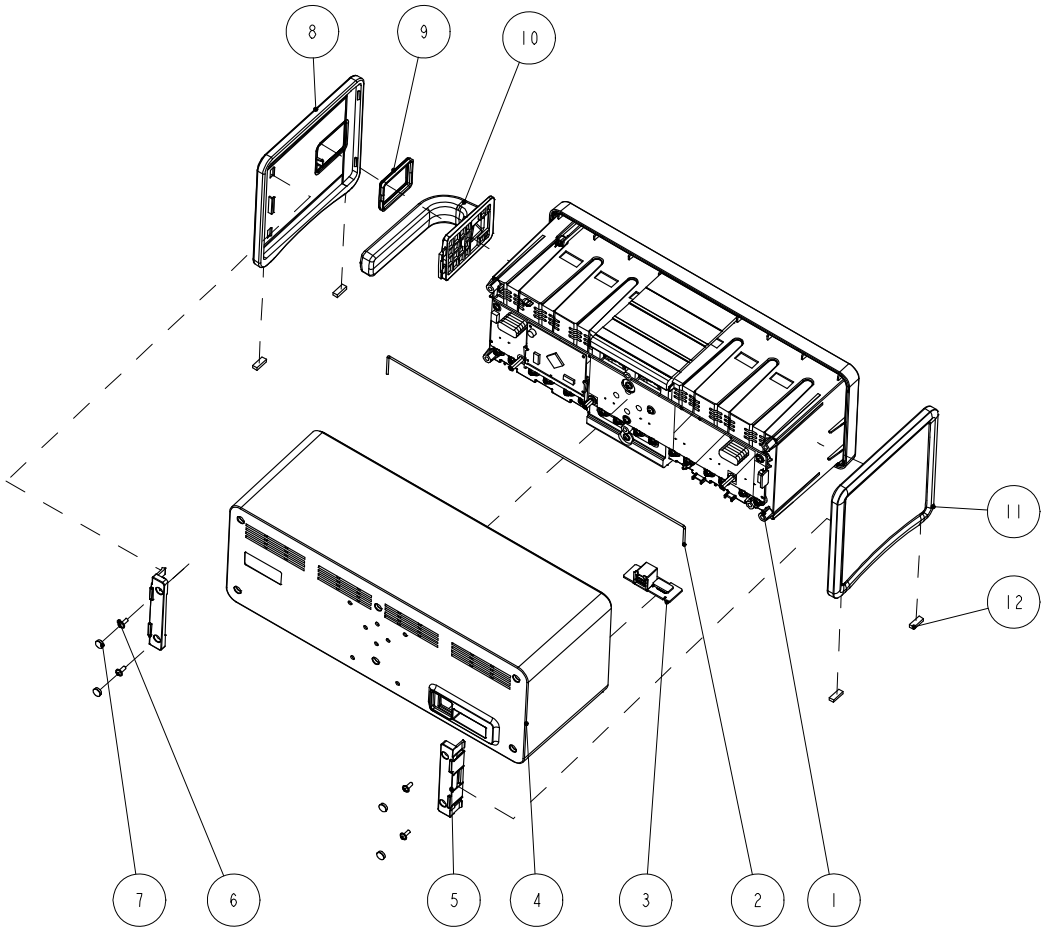
6.5.8 Others

P/N	Description	FRU part number	Qty
iView assembly －115-016498-00			
/	Ethernet cable for DVI interface board	115-016498-00	1
/	iView Motherboard PCBA		1
/	COM N2600 NM10 DDR3 onboard 2GB		1
/	SSD 128GB MLC mSATA		1
/	Thermal Pad /Chomerics/3.0/17×17×1	/	2
/	Thermal Pad/Chomerics/3.0/23×15×1	/	2
/	PC Heatsink of iView	/	1
/	Countersunk flat head screw, M2×10	/	4
/	Pan head screw with washer, M3×6	/	4
/	Stainless steel Phillips screw	/	4
/	iView flat signal wire	115-016498-00	1
TR6F recorder—115-001290-00			
/	Thermal print head	801-6800-00080-00	1
/	Phillips tapping screw PT2×6	/	5
/	Sensor cable label	801-6800-00080-00	1
/	Recorder door (DPM)		1
/	Back spring		1
/	Silicon button		1
/	Overlay		1
/	Cable from recorder drive board to recorder button board		1
/	Overlay		1
/	Recorder button board		1
/	Recorder drive board		1
/	Grounding wire (6101)		1
/	Recorder chamber (DPM)		1
/	Locking clip (DPM)		1

6.6 SMR Assembly

6.6.1 SMR Assembly

Exploded View

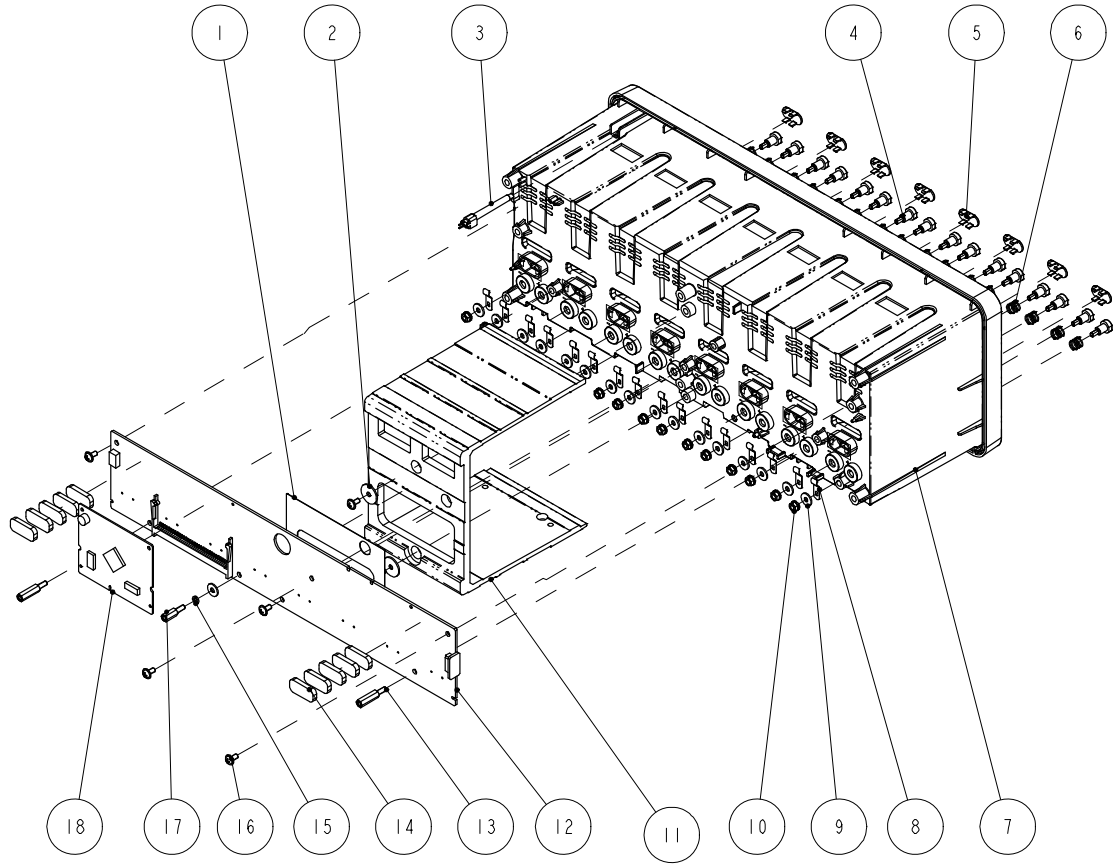


Parts List

SN	Description	FRU part number	Qty
1	Inner 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		4
8	Side plate, right		1
9	Rubber washer		1
10	Handle		1
11	Side plate, left		1
12	Pad		4

6.6.2 SMR Inner Assembly

Exploded View



Parts List

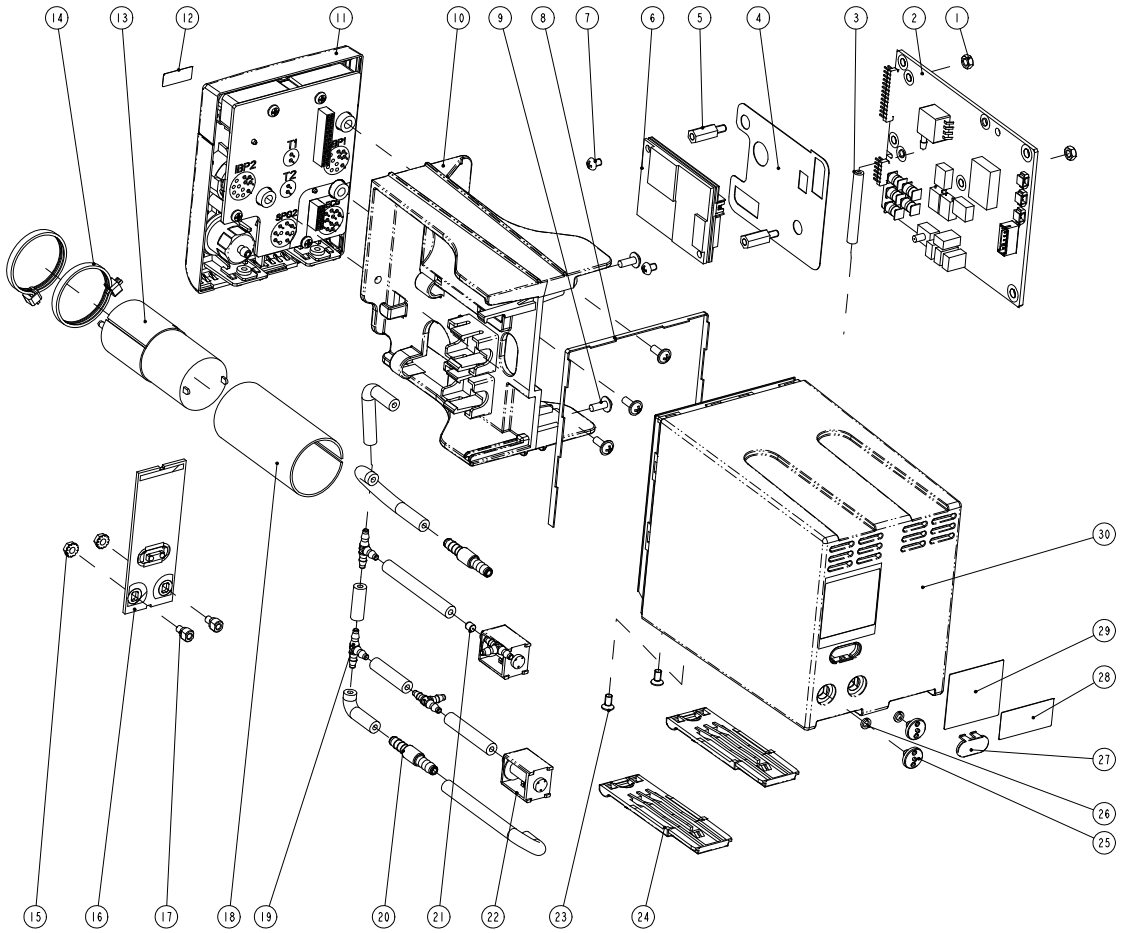
SN	Description	FRU part number	Qty
1	Insulating plate	801-6800-00018-00	1
2	Torsion spring washer		2
3	Light conducting pole		1
4	Contact spring		16
5	Contact screw		16
6	Infrared lens		8
7	SMR inner assembly		1
8	Leaf spring		16
9	Washer		16
10	Hex nut and washer		16
11	Reinforced section steel		1
12	8-slot module rack communication board (PN: 6800-30-51153)		1
13	Screw stud		2
14	Rubber feet	6800-20-50233	10
15	Split lock washer	/	1
16	Phillips screw M3×6	/	6

SN	Description	FRU part number	Qty
17	Screw stud	/	1
18	Nios II module	/	1

6.7 MPM

MPM utilizes ECG ASIC integrated parameter board.

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	/	1
29	Patent label	/	1
30	Rear cover	/	1

6.8 Replaceable Parts

6.8.1 Main Unit

FRU	Description
Rear housing assembly	
043-004045-00	Recorder cover
115-001290-00	TR6F recorder
6800-20-50301	Recorder to main board cable
044-000447-00	Power unit
6800-20-50298	Cable, power board to battery interface board
6800-20-50155	Cable, main unit to infrared communication board
051-000243-00	6800 3-slot module rack communication board
6800-30-50073	MPM module rack communication board
6800-30-50075	Nios II module
023-000845-00 023-000846-00	CF card
043-000060-01	Rear housing (new interface)
6800-20-50672	Cable, main board to DVI interface board
6800-20-50673	Cable, main board to USB interface board
6800-30-50532	Main board assembly
6800-30-50401	WLAN and CF card flexible cable
115-001868-00	6800 CF assembly (9211 driving board)
6800-30-50476	Interface board assembly
6800-30-50509	Fan assembly
6800-20-50681	Speaker & cable
115-016498-00	iView assembly
051-001090-00	6800 motherboard PCBA(All)
051-001278-00	PCBA,6800 USB Interface Board(ALL)
024-000321-00	FAN 12V 9.4CFM 20.1dB 50 x 50 x 15 x 65mm
042-000317-00	CF card shield
051-000104-00	CF Card Control Board
051-000150-02	PCBA, CPU Board
051-000470-00	DVI Interface Board
Front housing assembly	
051-001820-00	Backlight board
043-003545-00	Passport 17m front housing
021-000157-00	LCD screen (G170ETN01.0)
0000-10-11071	Touch Screen
6800-30-50082	Touch screen control board
FRU	**Description**
Front housing assembly (Continued)	
115-001328-00	Button board(1280x1024-1+anti-glare)
115-001327-00	Button board (1280x1024-1+touchscreen)

051-000879-01	6803 Alarm LED board
115-022497-00	Optical encoder assembly
115-030580-00	Front cover (touch screen)
009-004019-00	Alarm light board cable
009-004547-00	Cable connecting the LED backlight board and screen
009-000248-00	Cable connecting the inverter and button board
Base assembly	
043-004135-00	Bottom cover
6800-30-50108	Battery interface board
6800-30-50088	Power switch board
6800-20-50449	Flat cable connecting the main board and DVI interface board
6800-20-50450	Cable connecting the button board and main board
6800-20-50451	Cable connecting the main board and SMR infrared communication board

6.8.2 SMR

FRU	Description
6800-30-50075	Nios II module
6800-30-50078	SMR communication board
6800-30-50080	SMR interface board
6800-30-50667	SMR indicator lamp assembly
043-004118-00	SMR inner assembly
043-004120-00	SMR rear housing
043-004051-00	SMR handle

6.8.3 Parameter Modules

FRU	description	Qty
115-015012-00	BIS Module	1
6800-30-50488	RM module	1
115-003480-00	CCO/SvO_2 module	
115-013335-00	SpO_2 module(Masimo MS-2013)	
6800-30-50137	Mindray sidestream CO_2 module (M02B, 2 slots)	1
115-020189-00	Mindray sidestream CO_2 module (M02C, 1 slot)	1
6800-30-50558	Oridion Microstream CO_2 module	
6800-30-50501	AG module (with O_2/BIS)	1
6800-30-50502	AG module (with O_2)	1
115-029852-00	C.O. module	1
115-029851-00	IBP module	1
115-007273-00	$ScvO_2$ module	1
115-007276-00	BeneLink module	1
115-022715-00	MPM-2 module(Masimo SpO_2 (MS-2013), 3/5lead, FDA)	1
115-022716-00	MPM3 module(Nellcor SpO_2, 3/5lead, FDA)	1
115-022718-00	MPM5 module (Masimo SpO_2 (MS-2013), 12-lead, FDA)	1
115-022719-00	MPM6 module(Nellcor SpO_2, 12lead, FDA)	1
115-030471-00	Benelink module	1

6.8.4 Cables

P/N	Description	Remarks
Main unit		
6800-20-50156	Alarm LED board cable	/
6800-20-50157	Touchscreen control board cable	/
6800-20-50159	Power switch & LED board cable	/
6800-20-50298	Cable from power board to battery interface board	/
6800-20-50301	Cable from recorder to main board	/
6800-20-50304	DVI interface board signal wire	DVI interface board to CIS assembly
6800-20-50305	power board DC output cable	/
009-003228-00	iView flat wire	/
009-003229-00	USB cable	/
6800-20-50334	17″ LCD ribbon cable (17m)	Mother board to LCD
6800-21-50337	AC input filter cable	/
6800-20-50513	Main unit Fan cable	/
6800-20-50672	Cable from mother board to DVI interface board	/
6800-20-50673	Cable from mother board to USB interface board	/
6800-20-50681	Speaker & cables	/
6800-30-50124	Integral module rack flexible cable (17m)	Mother board to integral module rack
6800-30-50126	Button board flexible cable (17m)	Mother board to button board
6800-20-50401	WLAN card flexible cable	Mother board to CF and WLAN assembly
6800-20-50448	Flat connection cable for 17″ screen	/
6800-20-50449	Flat cable connecting the main board and DVI interface board	/
6800-20-50450	Cable connecting the button board and main board	/
6800-20-50451	Cable connecting the main board and SMR infrared communication board	/
009-000248-00	Cable connecting the inverter and button board	/
009-000255-00	Receptacle and cable for AC source	/
009-004019-00	Cable for alarm light board	/
SMR and parameter modules		
6800-20-50155	Main unit infrared communication board cable (integral module rack)	/
6800-20-50160	Button board cable	/
6800-20-50161	Cable from infrared communication board to RS232 connector	/
6800-20-50162	Infrared communication board TTL cable	/
6800-20-50164	Module fan & cable	/
6800-20-50167	SMR LED cable	/

P/N	Description	Remarks
SMR and parameter modules (Continued)		
6800-20-50170	Cable from inverter to button board	from inverter to button board
6800-20-50306	AG cable	/
6800-21-50310	BIS interface cable	/
6800-21-50311	C.O. interface cable	/
6800-21-50312	IBP interface cable	/
6800-20-50316	RM infrared detection board cable	/
6800-20-50319	Cable from SMR to main unit	/
6800-20-50662	gas pump cable	NIBP pump to parameter board
6800-20-50663	Fast-release valve cable	Fast-release valve to parameter board
6800-20-50664	Slow-release valve cable	Slow-release valve to parameter board
6800-20-50674	Cable from ICG module to infrared communication board	/
6800-20-50683	Mindray CO_2 infrared communication cable	/
6800-30-50132	Nellcor SpO_2 flexible cable kit	/
6800-30-50130	Masimo SpO_2 flexible cable kit	/
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 adapter cable, type A	/
009-001768-00	Serial port adapter cable, type B	/
009-001769-00	Serial port adapter 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	/
6800-20-51104	Cable connecting the SMR receptacle interface board and infrared communication board	/

7 Upgrade

7.1 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.**

7.2 Upgrading Parameter Modules

You can upgrade the following parameter modules:

Parameter module	PN	Description	Remark
MPM module	115-022715-00	MPM-2 module(Masimo 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)	
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.

7.3 Upgrading Functional Assemblies

You can upgrade the following functional assemblies:

Functional assembly	PN	Description	Remark
SMR	6800-30-50641	SMR kit	/
Wireless network	801-6800-00108-00	6800 wireless network upgrade kit	Internal AP, for standard- configured patient monitor
	801-6800-00109-00	6800 wireless network upgrade kit	Internal AP, for fully configured patient monitor
	801-6800-00002-00	Wireless network adaptor kit	External AP
Recorder	6800-30-50856	Recorder upgrade kit	/
Analog output	801-6800-00093-00	DVI interface board (FRU)	/
iView assembly	115-016498-00	iView assembly (SSD hard drive)	/

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

7.3.1 Upgrading SMR

The SMR can be connected to the patient monitor through the SMR connector via a powered USB cable. Refer to the Operators's Manual for details.

7.4 Upgrading Software

Software upgrade must be performed by Mindray, NA authorized service personnel. Call Service Dispatch 1 800 288-2121 ext: 7875 or National Repair Center ext: 8119 for more information.

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. These procedures assume the use of a 601PROXL International Safety Analyzer or equivalent safety analyzer. Other popular testers complying with IEC 60601-1 used in Europe, such as Fluke, Metron, or Gerb, may require modifications to the procedure. 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.
		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 odors (e.g., burning or smoky odor, 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*** .

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

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