

**iPM 12/iPM 10/iPM 8  
iPM 7/iPM 6/iPM 5**

**Patient Monitor**

**Service Manual**



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## Revision History

This manual has a revision number. This revision number changes whenever the manual is updated due to software or technical specification change. Contents of this manual are subject to change without prior notice.

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# Preface

## Manual Purpose

This manual provides detailed information about the assembling, disassembling, 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. Observance of the manual is a prerequisite for proper equipment maintenance and prevents equipment damage and personnel 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.

## Abbreviations

Abbreviations used in this manual are:

MPM	multi-parameter module
SMR	satellite module rack
CMS	central monitoring system
PCB	printed circuit board

## Passwords

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

- User maintenance: 888888 (User adjustable)
- Factory maintenance: 332888
- Demo mode: 2088
- Configuration mode: 315666 (User adjustable)

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**FOR YOUR NOTES**

# 1 Safety

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## 1.1 Safety Information

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### 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, will 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 to ensure that you get the most from your product.
- 
-

### 1.1.1 Dangers

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

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 **WARNING**

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- **All installation operations, expansions, changes, modifications and repairs of this product are 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 or the battery.**
  - **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.**
  - **Disposal of the packaging material should observe the applicable waste control regulations. and keeping it out of children’s reach.**
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### 1.1.3 CAUTION

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 **CAUTION**

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- **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 receiver to the power line, check that the voltage and frequency ratings of the power line are the same as those indicated on the unit’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 NOTE

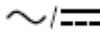
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**NOTE**

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- **Refer to Operator’s Manual for detailed operation and other information.**
-

## 1.2 Equipment Symbols

	Caution, consult accompanying documents		
	Power ON/OFF (for a part of the equipment)		Battery indicator
	Alternating current		ALARM PAUSED
	AUDIO PAUSED		Graphical recorder
	Freeze/unfreeze waveforms		Main menu
	NIBP start/stop key		Inserted direction
	Alternating/Direct current		Direct current
	Equipotentiality		VGA output
	USB connector		Network connector
	Gas outlet		Input/output
	DATE OF MANUFACTURE		Serial number
	AUTHORISED REPRESENTATIVE IN THE EUROPEAN COMMUNITY		Electrostatic sensitive devices
	DEFIBRILLATION-PROOF TYPE CF APPLIED PART		DEFIBRILLATION-PROOF TYPE BF APPLIED PART
	The product bears CE mark indicating its conformity with the provisions of the Council Directive 93/42/EEC concerning medical devices and fulfils the essential requirements of Annex I of this directive.		
	<p>The following definition of the WEEE label applies to EU member states only.</p> <p>This symbol indicates that this product should not be treated as household waste. By ensuring that this product is disposed of correctly, you will help prevent bringing potential negative consequences to the environment and human health. For more detailed information with regard to returning and recycling this product, please consult the distributor from whom you purchased it.</p> <p>* For system products, this label may be attached to the main unit only.</p>		

### NOTE

- Some symbols may not appear on your equipment.

**FOR YOUR NOTES**

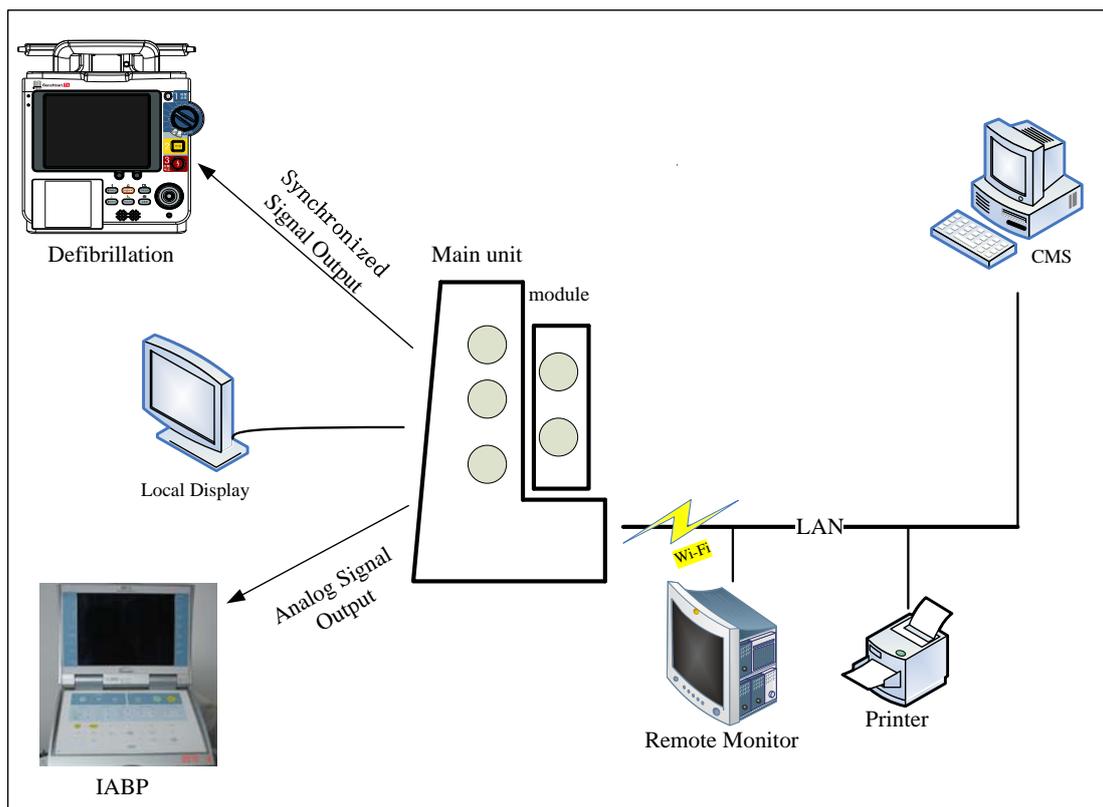
# 2 Theory of Operation

## 2.1 The Basics

This patient monitor is designed to monitor a fixed set of physiological parameters including ECG, respiration (Resp), temperature (Temp), SpO<sub>2</sub>, pulse rate (PR), non-invasive blood pressure (NIBP), invasive blood pressure (IBP), cardiac output (C.O.), carbon dioxide (CO<sub>2</sub>), and anesthetic gas (AG).

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 and wave.
- Incorporates multiple input devices such as buttons, knob, and touchscreen.
- Enables program upgrade over the network.
- Integrates the information of other devices, which include but are not restricted to defibrillator.



The above figure shows a system consists of the iPM patient monitor and its peripheral devices. The iPM patient monitor:

- Can be used for monitoring the physiological parameters, giving alarms and reviewing patient data, etc.
- Supports recorder.
- Supports nurse call signal, synchronization defibrillation signal, and analog output signal.
- Supports Wi-Fi module, wired network, remote view, and communication with the HyperVisor Central Monitoring System.
- Supports a secondary display.
- Supports AC power source and battery power source (iPM 8/iPM 5 patient monitors additionally supports DC power source).
- Supports clinical data acquisition, which has two ways: by SD card and by USB drive.  
The system software should support data output function, for SD card is a built-in device.

## 2.2 System Connections

### 2.2.1 Installation Support

The patient monitor can be mounted on a wall bracket or on a trolley support. The wall bracket or trolley support can be ordered optionally. Each type of mounting bracket is delivered with a complete set of mounting hardware and instructions. Refer to the documentation delivered with the mounting hardware for instructions on assembling mounts.

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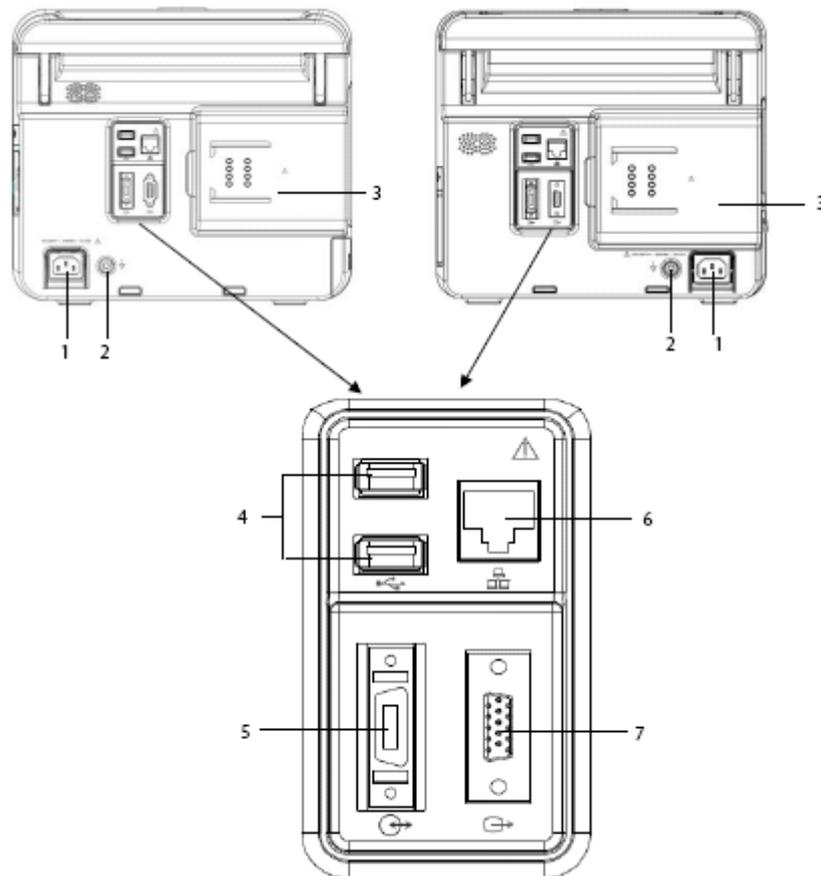
#### CAUTION

- **Use mounting brackets we supply or approve. If other compatible mounting bracket is used, be sure it can be safely used on the patient monitor.**
  - **The mounting bracket should be installed by our qualified service personnel, or engineers who have adequate knowledge on it.**
  - **If other mounting solution is used, the installation personnel and the customer should verify if it can be safely used on the patient monitor, and the customer assume the responsibility for any risk resulting from that. Indicates a potential hazard or unsafe practice that, if not avoided, could result in minor personal injury or product/property damage.**
-

## 2.2.2 Connectors for Peripheral Devices

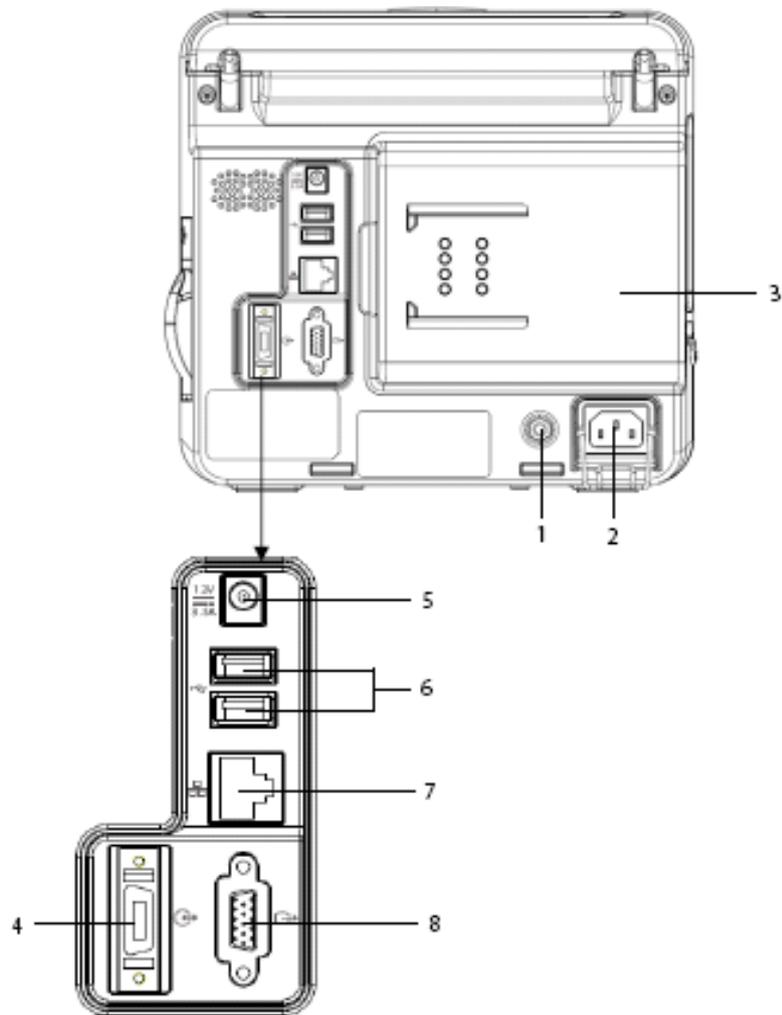
On the back of the patient monitor you can find all connectors for peripheral devices.

### iPM 6/7/10/12 Rear View



1. AC power input: used to connect an AC power source (100 to 240 VAC, 50/60 Hz).
2. Equipotential terminal: used to connect the equipotential terminal of other equipments, eliminating potential difference between different pieces of equipment.
3. Parameter Module slot: used to connect the parameter module.
4. General USB Connector: used to connect any USB-compatible peripheral device.
5. Multifunctional connector: used to output analog signals and defibrillator synchronization signals.
6. Network Connector: an RJ45 connector, used to connect an Ethernet network or a PC.
7. VGA Connector: used to connect a secondary display.

## iPM 5/8 Rear View



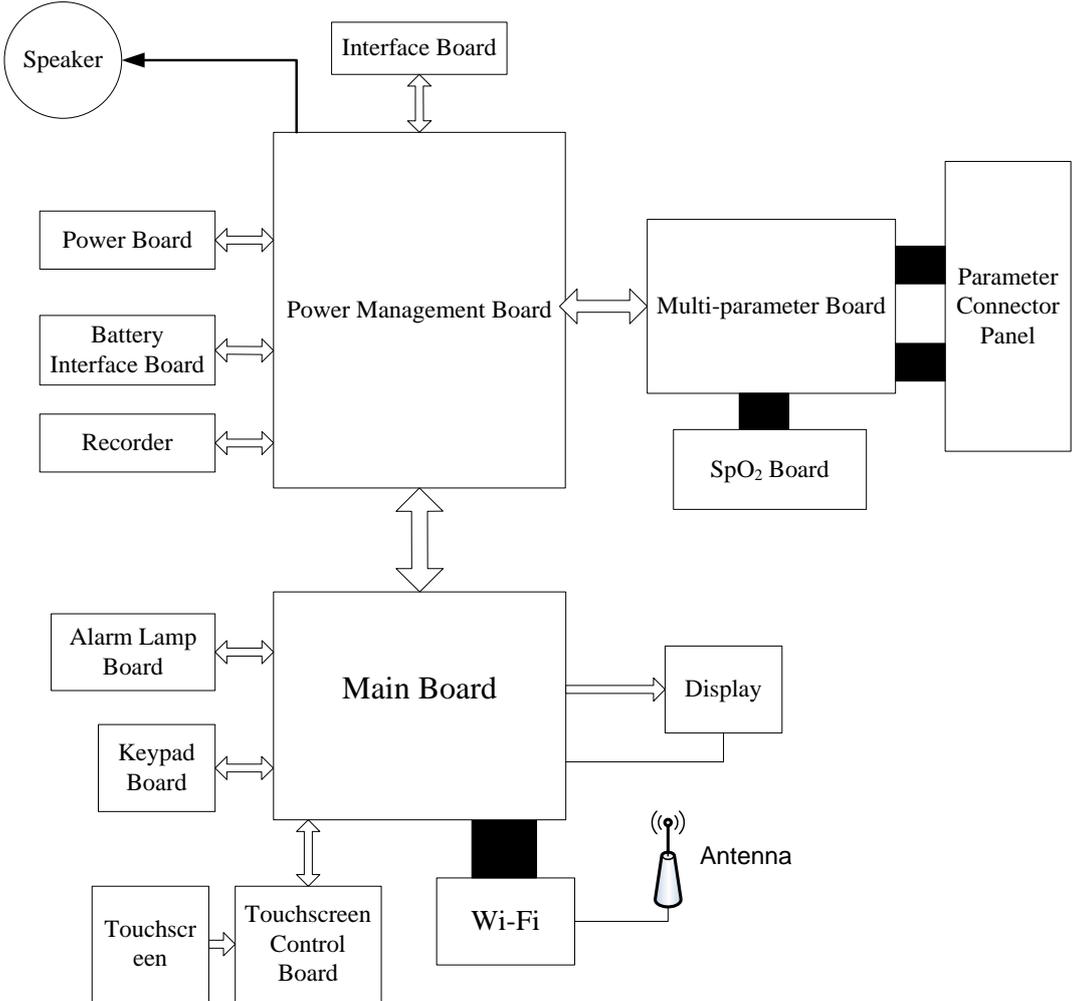
1. Equipotential terminal: used to connect the equipotential terminal of other equipments, eliminating potential difference between different pieces of equipment.
2. AC power input: used to connect an AC power source (100 to 240 VAC, 50/60 Hz).
3. Parameter Module slot: used to connect the parameter module.
4. Multifunctional connector: used to output analog signals and defibrillator synchronization signals.
5. DC power input
6. General USB Connector: used to connect any USB-compatible peripheral device.
7. Network Connector: an RJ45 connector, used to connect an Ethernet network or a PC.
8. VGA Connector: used to connect a secondary display.

### 2.3 Main Unit

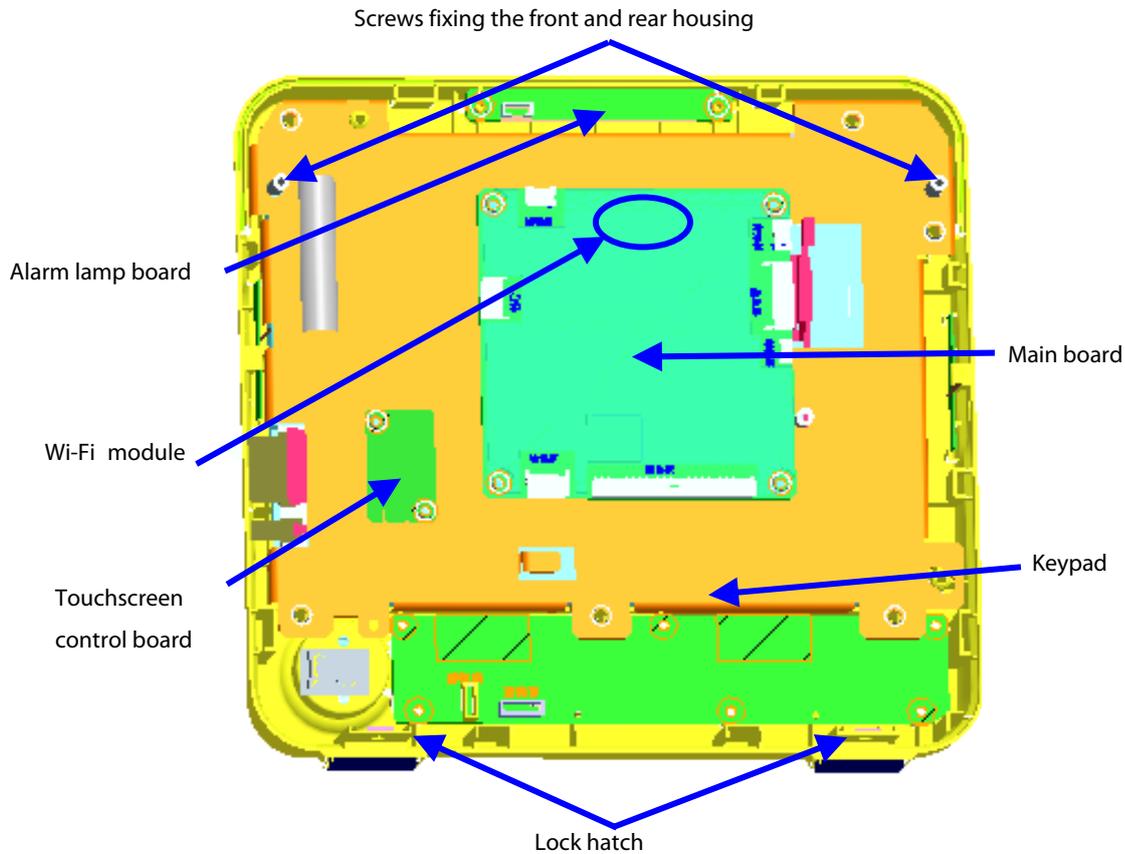
The main unit of the patient monitor consists of two parts:

- Front housing assembly: main board, keypad board assembly (knob), display, touchscreen, alarm lamp board, power switch, and indicator board.
- Rear housing assembly: power board (AC/DC), power management board, battery pad, interface board, recorder, speaker, and multi-parameter module which includes three types of SpO<sub>2</sub> stacking board.

The following figure shows the main unit architecture of the patient monitor.



## 2.4 Front Housing Assembly



### 2.4.1 Main Board

The main board is the control center of the system. It provides communication, display, and data storage functions, including:

- Display drive and backlight control
- Wired and wireless network
- Data Storage
- Printing
- Serial port communication
- Connection with touchscreen control board
- Audio drive
- EEPROM drive
- USB drive

### 2.4.2 Keypad

The keypad scans and detects the input of keys and knobs, integrates the power on/off key, and connects AC and battery indicators.

### 2.4.3 Alarm Lamp Board

The alarm lamp board is located at the top of front housing. It has two-color indicators, red and yellow. The alarm lamp board directly connects the main board through a cable. It is controlled directly by the main board.

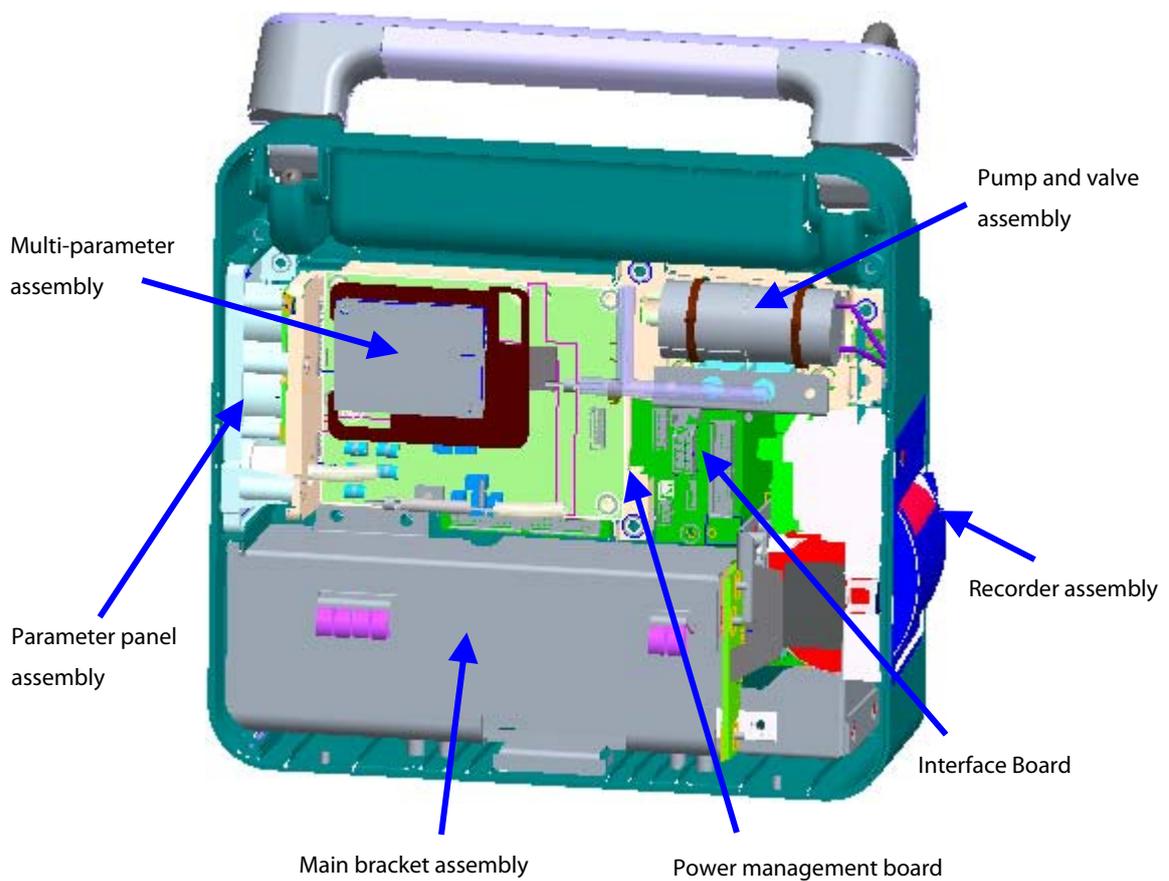
### 2.4.4 Touchscreen and Touchscreen Control Board

The touchscreen control board drives the touchscreen and implements communication with the patient monitor.

### 2.4.5 Wi-Fi Module

The Wi-Fi module enables the patient monitor to connect to 802.11 g/n wireless network.

## 2.5 Rear Housing Assembly



The rear housing assembly consists of the parameter panel assembly, multi-parameter assembly, pump and valve assembly, recorder assembly, main bracket assembly (including the battery compartment and battery interface board), power management board, and interface board.

### **2.5.1 AC/DC Power Board**

The AC/DC power board transforms the input AC into DC power, which is the power source for all voltages in the patient monitor.

### **2.5.2 Power Management Board**

The power management board mainly performs DC/DC conversion, power management, and transmission of external connector signals:

- DC/DC conversion: outputs 12 V and 5 V DC power
- Power on/off control
- Charge/Discharge control
- Signal transmission

### **2.5.3 Interface Board**

The interface board supports the USB ports, network ports, multifunctional ports, and VGA ports.

### **2.5.4 Battery Interface Board**

The battery interface board introduces the battery power to the internal system.

### **2.5.5 Recorder**

The recorder receives data from the main board and sends them to the thermal printhead for printing.

### **2.5.6 Multi-parameter Board**

The multi-parameter board provides the following functions:

- Supports 2-channel 3-/5-lead ECG monitoring (and 12-lead in future), and I/II lead Resp monitoring
- Provides power for and communicates with Mindray/Nellcor/Masimo SpO<sub>2</sub> board
- Supports 2-channel Temp monitoring
- Supports 2-channel IBP monitoring
- Supports NIBP monitoring
- Processes all algorithms and communicates with the main board via UART
- Realizes analog output (four channels, one for ECG, two for IBP, and the other for Defib sync output)
- Isolates the parameter modules from the earth
- Isolates ECG from other parameters

### 2.5.7 SpO<sub>2</sub> Board

The multi-parameter module supports the independently developed Mindray SpO<sub>2</sub> board, which provides SpO<sub>2</sub> measurement as good as other boards but with smaller size and lower consumption. It is also compatible with Nellcor NELL-1 SpO<sub>2</sub> board and Masimo MS-2013 SpO<sub>2</sub> board.

SpO<sub>2</sub> board is used to collect SpO<sub>2</sub> signals transmitted by the multi-parameter module and process SpO<sub>2</sub> algorithms.

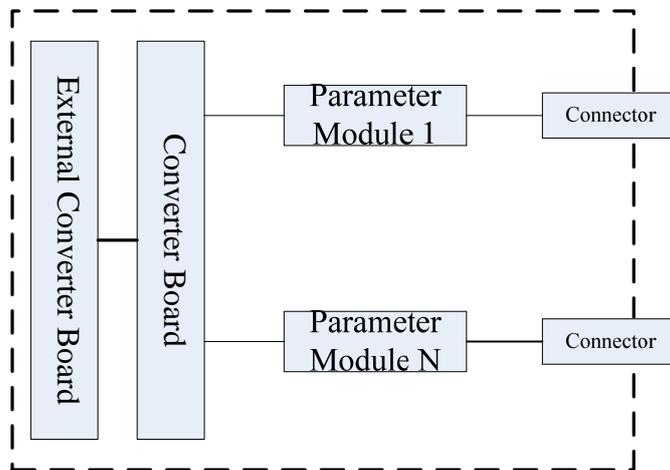
### 2.5.8 Parameter Connector Board

The parameter connector board transmits the ECG signal, Temp signal, SpO<sub>2</sub> signal, and IBP signals collected through cables to the multi-parameter board.

## 2.6 Modules

The patient monitor can carry multiple parameter modules, which include IBP/C.O., CO<sub>2</sub>, and AG modules. The detailed module configuration is listed below:

- IBP module
- CO<sub>2</sub> Module
- IBP + C.O. Module
- IBP + C.O. + CO<sub>2</sub> (Mindray Sidestream CO<sub>2</sub>/Mainstream CO<sub>2</sub>/Microstream CO<sub>2</sub>) module
- IBP + C.O. + AG (w O<sub>2</sub>/wo O<sub>2</sub>) module



### 2.6.1 Module Converter

The module converter performs signal conversion function.

## 2.6.2 Converter

The converter performs the following functions:

- Converting 12 V to 5 V DC power
- Converting 232 level to TTL level
- Detecting and identifying the modules

## 2.6.3 IBP + C.O. Module

The IBP/C.O. module supports C.O. and 2-channel measurement of IBP. The module consists of an amplification circuit, AD converter, CPU circuit and power isolation circuit.

## 2.6.4 CO<sub>2</sub> Module

The patient monitor supports the following CO<sub>2</sub> modules:

- M02C Sidestream module
- Capnostat Mainstream CO<sub>2</sub> module
- Ordion Microstream CO<sub>2</sub> module

## 2.6.5 AG Module

There are two configurations for the 2.5G Artema AG module: with O<sub>2</sub> and without O<sub>2</sub>.

# 3 Unpacking and Installation

---

## 3.1 Unpacking the Equipment

Open the package and take out the packing list. Check that all the articles included in the packing list are available and the quantity and specification are correct. Make sure that:

- All the optional parts purchased by the customer shall also be checked.
- Notify the supplier if provided components are not correct as compared to the packing list.
- In case of damage during transportation, keep the packing material and notify the supplier immediately.
- Keep the packing material till new equipment is accepted.

The following pictures show the patient monitor and accessory packing.



Main unit packing



Accessory packing

## 3.2 Preparation for Installation

### 3.2.1 Preparation for Installation Site

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

#### Environmental Requirements

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

The environmental specification is as follows:

Main Unit (iPM 5/8)			
Item	Temperature (°C)	Relative humidity (noncondensing)	Altitude (kPa)
Operating environment	0 to 40	15% to 95%	57.0 to 107.4
Storage environment	-30 to 70	10% to 95%	16.0 to 107.4

Main Unit (iPM 6/7/10/12)			
Item	Temperature (°C)	Relative humidity (noncondensing)	Altitude (kPa)
Operating environment	0 to 40	15% to 95%	57.0 to 107.4
Storage environment	-20 to 60	10% to 95%	16.0 to 107.4

Mainstream CO <sub>2</sub> module			
Item	Temperature (°C)	Relative humidity (noncondensing)	Altitude (kPa)
Operating environment	0 to 40	15% to 90%	57.0 to 107.4
Storage environment	-20 to 60	10% to 90%	53.3 to 107.4

Sidestream CO <sub>2</sub> module			
Item	Temperature (°C)	Relative humidity (noncondensing)	Altitude (kPa)
Operating environment	5 to 40	15% to 95%	57.3 to 105.3
Storage environment	-20 to 60	10% to 95%	57.3 to 105.3

Microstream CO <sub>2</sub> module			
Item	Temperature (°C)	Relative humidity (noncondensing)	Altitude (kPa)
Operating environment	0 to 40	15% to 95%	57.3 to 105.3
Storage environment	-20 to 60	10% to 95%	57.3 to 105.3

#### NOTE

- The environmental specifications of unspecified parameters are the same as those of iPM 6/7/10/12 main unit.

### 3.2.2 Electrical Requirements

Check cables and power cords. Make sure that:

1. Check that the system cables, power cords, and power plugs are not damaged, and pins are not loose. In case of any damage, remove it from use.
2. The insulation of patient cables and leadwires is not damaged, and connectors are not loose.



#### **WARNING**

- **Only power sockets with protective grounding can be used.**
- 

<b>Line voltage</b>	100 to 240 V AC
<b>Current</b>	1.1 to 0.5 A
<b>Frequency</b>	50/60 Hz

### 3.2.3 Monitor Installation

Refer to ***GCX Adapter Installation Guide (PN: 046-003424-00)***, ***Ambulance Mounting Installation Guide (iPM) (PN: 046-003425-00)***, ***iPM 8 Hook Assembly Installation Guide (PN: 046-003465-00)***.

### 3.2.4 Preparation for Power on

1. Before you start to make measurements, check the patient monitor for any mechanical damage and make sure that all external cables, plug-ins and accessories are properly connected.
2. Plug the power cord into the AC power source. If you run the patient monitor on battery power, ensure that the battery is sufficiently charged.
3. Press the power on/off switch on the monitor's front.

**FOR YOUR NOTES**

# 4 Hardware and Software Upgrade

## 4.1 Hardware Upgrade

iPM patient monitors supports upgrade of the following functions:

- 12-lead ECG measurement (only for monitors with Mindray ECG algorithm);
- IBP measurement;
- C.O. measurement;
- CO<sub>2</sub> measurement;
- AG measurement;
- O<sub>2</sub> measurement;
- Analog output and Sync Defib;
- Wireless network;
- Recorder; and,
- Hook.

### 4.1.1 Upgrade Package

Upgrade package	Monitor config. before upgrade	Description of upgrade package	PN of upgrade package
Parameter module	/	IBP_C.O. module kit	115-011829-00
	/	IBP_C.O._Sidestream CO <sub>2</sub> module kit	115-011830-00
	/	IBP_C.O._Microstream CO <sub>2</sub> module kit (English)	115-011831-00
	/	IBP_C.O._Microstream CO <sub>2</sub> module kit (Chinese)	115-011889-00
	/	IBP_C.O._Mainstream CO <sub>2</sub> module kit	115-011832-00
	/	IBP_Sidestream CO <sub>2</sub> module kit	115-021878-00
	/	IBP_Microstream CO <sub>2</sub> module kit (English)	115-021883-00
	/	IBP_Microstream CO <sub>2</sub> module kit (Chinese)	115-021879-00
	/	IBP_Mainstream CO <sub>2</sub> module kit	115-021880-00
	/	Sidestream CO <sub>2</sub> module kit	115-011833-00
	/	Microstream CO <sub>2</sub> module kit (English)	115-011834-00
	/	Microstream CO <sub>2</sub> module kit (Chinese)	115-011890-00
	/	Mainstream CO <sub>2</sub> module kit	115-011835-00
	/	IBP_C.O._AG module kit	115-011836-00
	/	IBP_AG module kit	115-021881-00
	/	IBP module kit	115-011837-00
	/	IBP_C.O._AG (w O <sub>2</sub> ) module kit	115-011838-00
/	IBP_AG (w O <sub>2</sub> ) module kit	115-021882-00	
12-Lead ECG	3/5-Lead ECG	iPM multi-parameter board PCBA (complete)	051-000952-00
Analog/Sync Defib output	/	iPM multi-parameter board PCBA (5-Lead, complete)	051-001063-00

Upgrade package	Monitor config. before upgrade	Description of upgrade package	PN of upgrade package
Wireless network	/	iPM 12 Wi-Fi module kit	115-010844-00
	/	iPM 8/10 Wi-Fi module kit	115-010801-00
Recorder	/	iPM recorder upgrade kit	115-012707-00
Hook	/	iPM 10/12 hook assembly kit	115-012698-00
	/	iPM 8 hook assembly kit	115-012697-00

Note: measurement accessories are not included in the above upgrade packages.

## 4.1.2 Hardware Upgrade Method

### 4.1.2.1 Upgrading the Parameter Modules

The external parameter modules are ready for use once properly installed into the module slot on the back of the patient monitor.

#### 4.1.2.2 Upgrading 12-Lead ECG Function

Replace the original parameter board with the multi-parameter board with 12-lead ECG monitoring function as described in **7.3.2 Disassembling Parameter Modules**.

#### 4.1.2.3 Upgrading Analog/Sync Defib Output Function

Replace the original parameter board with the multi-parameter board with analog/Sync Defib output function as described in **7.3.2 Disassembling Parameter Modules**.

#### 4.1.2.4 Upgrading Wireless Network Function

1. Install the Wi-Fi module onto the main board and then connect the Wi-Fi antennas as described in **7.4.2 Removing the Wi-Fi Module (Optional)**.
2. Select **[Main Menu]** → **[Maintenance >>]** → **[User Maintenance >>]** → enter the required password → **[Network Setup >>]**, and then set the **[Network Type]** to **[WLAN]**. Correctly set the patient monitor and connect to a nearby wireless network as described in **Network Connection** in **iPM 12/iPM 10/iPM 8/iPM 7/iPM 6/iPM 5 Patient Monitor Operator's Manual** to confirm that the Wi-Fi function is available on the patient monitor.

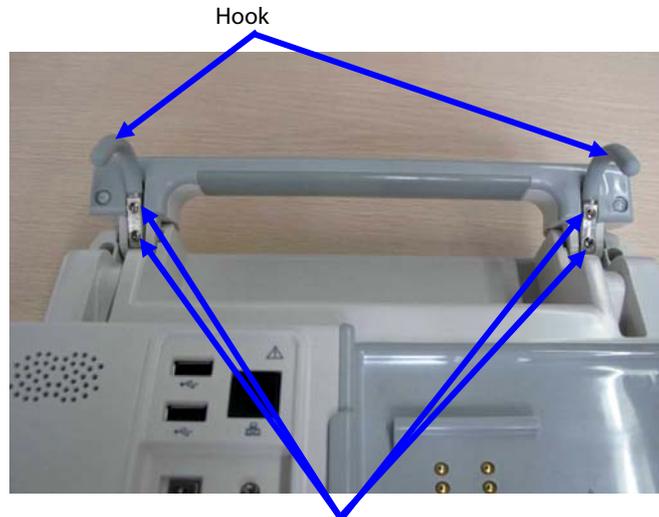
#### 4.1.2.5 Upgrading Recorder Function

1. Install a recorder onto the patient monitor as described in **7.3.6 Removing the Recorder (Optional)**.
2. Install paper into the recorder and perform printing task as described in **Recorder** in **iPM 12/iPM 10/iPM 8/iPM 7/iPM 6/iPM 5 Patient Monitor Operator's Manual** to confirm that the recorder works well on the patient monitor.

#### 4.1.2.6 Installing Hooks

##### For iPM 6/7/10/12 Patient Monitors

Fix the two hooks on to the handle with four M3×10 screws (torque force value: 4 to 6 kgf.cm) with the hook facing the ground, as shown below:



Screw, Pan head with washer, Phillips M3×10

##### For iPM 5/8 Patient Monitors

1. Remove the handle shield, and install the hook to the handle as shown below. Then insert the positioning pin into the corresponding hole on the hook assembly. Fix the hook with two M3×6 screws (torque force: 4 to 6 kgf.cm).
2. Install and fix the other hook onto the patient monitor as described.



Screw, Pan head w/washer, Phillips M3×6

## 4.2 Software Upgrade

You can upgrade system software and module software by installing and running the **Mindray Patient Monitor Software Upgrade Tool (PN: 110-000493-00)** on a PC with Windows operating system.

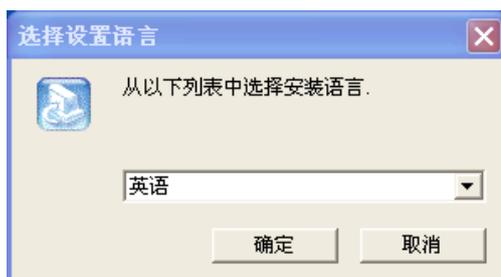
Connect the monitor to be upgraded and a PC running the upgrade tool to the same network, or directly connect the monitor and the PC via a crossover network cable. Then configure the IP address of the PC. You can upgrade the following software:

No.	Type	PN	Description
1.	System software package	/	System software package (language library: Simplified Chinese)
		/	System software package (language library: Traditional Chinese)
2.	Nios software for module converter	110-001994-00	Nios online upgrade program
3.	Module software	110-001987-00	MO software for power management board
4.		110-001839-00	DSP (BF512) software for M51A V2.0 module
5.		110-001978-00	DSP (Mortara algorithm) software for M51A V2.0 module
6.		110-000539-00	Software for 9008 SpO <sub>2</sub> module
7.		110-001838-00	STM32 software for M02C module
8.		M03B-30-86661	Software for M03B module (download online)

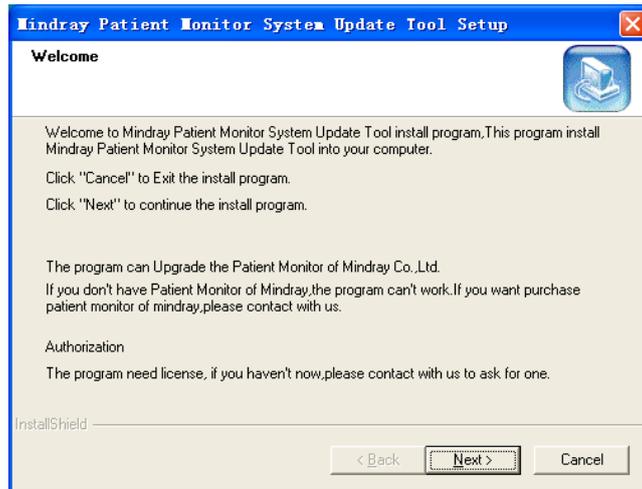
Note: No specific sequence is required for the upgrading of above software. For detailed information, please refer to **4.2.2 Software Upgrade Procedure**.

### 4.2.1 Installing Mindray Patient Monitor Software Upgrade Tool

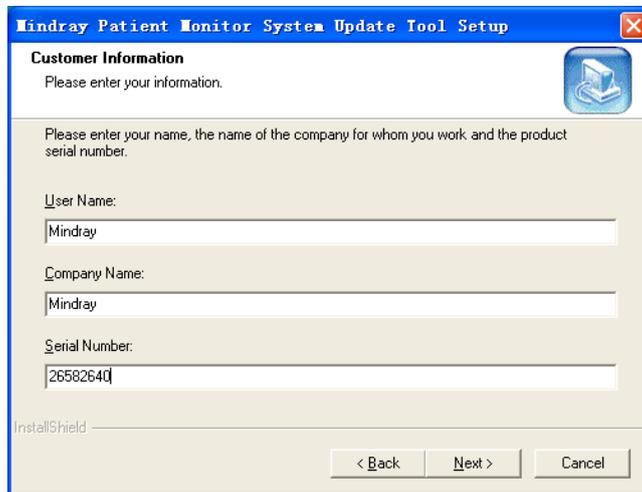
1. Find the installation program  **SystemUpdateTool.exe** and double click it to start installation.
2. Select [英语].



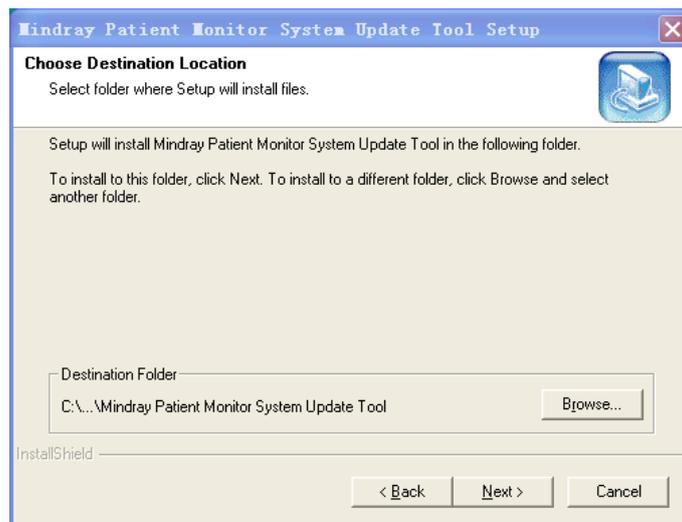
3. Click **[确定]** and the following screen is displayed. Click **[Next]** to go to the next step.



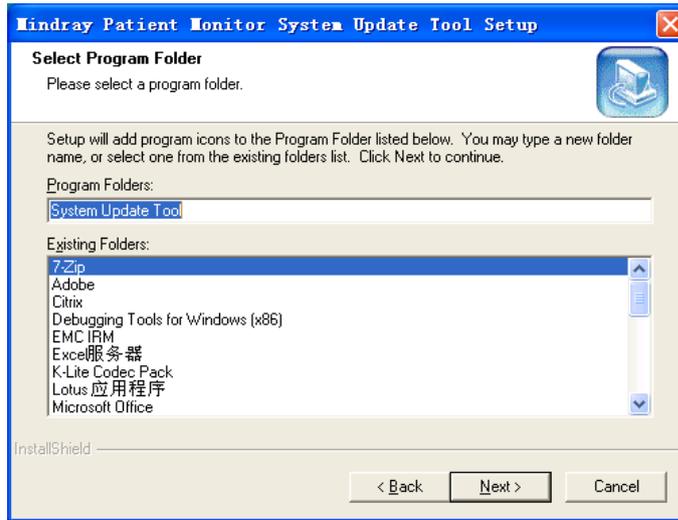
4. Enter User Name, Company name, and Serial Number "26582640". Then click **[Next]**.



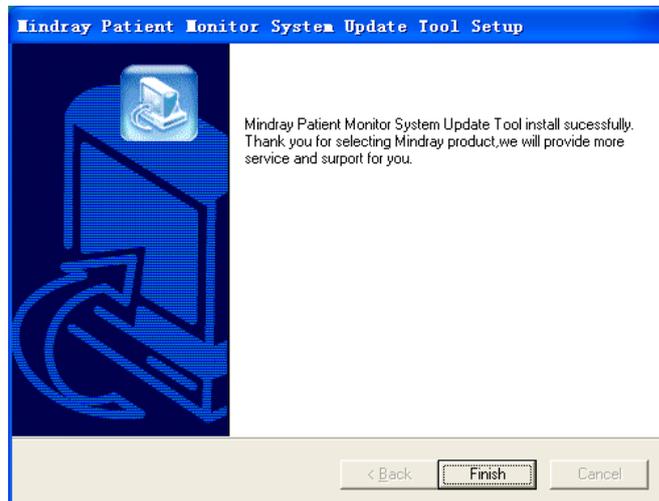
5. Specify the destination folder for installing this program. Then select **[Next]**.



6. Select Program Folder. Then select **[Next]**.



7. Click **[Finish]** to complete installation.

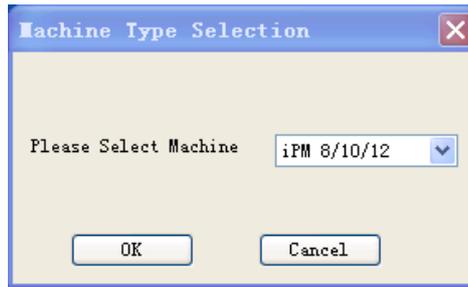


## 4.2.2 Software Upgrade Procedure

Before software upgrade, select **[Main Menu]** → **[Maintenance >>]** → **[Factory Maintenance >>]** → enter the required password → **[Software Version]** to check the current software version, as described in **5.11.4 Software version**.

1. Connect the monitor to be upgraded and a PC running the upgrade tool to the same network, or directly connect the monitor and the PC via a network cable (a crossover network cable is recommended).
2. Set the IP address of the PC to "77.77.1.XX" and subnet mask to "255.255.255.0".

3. Run Mindray Patient Monitor Software Upgrade Tool on the PC and set Machine to **[iPM 8/10/12]**.



4. On the Mindray Patient Monitor Software Upgrade Tool screen, select **[Select Package]** and then the packages you want to upgrade. Then select **[Start]**.
5. Turn on the patient monitor to be upgrade. Press and hold "Silence" and "Main Menu" buttons for 2 to 3 seconds, the patient monitor enters upgrade mode and starts software upgrade automatically, and corresponding prompt messages are displayed on both the patient monitor and PC.

When software upgrade is finished, restart the patient monitor and check if the software is correctly upgrade.

For details of software upgrade, please refer to ***help and instructions for use of Mindray Patient Monitor Software Upgrade Tool***.

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### CAUTION

- **Disconnect the equipment from the patient and make sure the important data are saved before upgrade.**
- **Do not shut down or power off the equipment when upgrading the system software. Otherwise, it may cause the equipment to break down.**
- **Software upgrade should be performed by qualified service personnel only.**
- **Crossover network cable is recommended when a PC is connected for software upgrade.**

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### NOTE

- **Make sure the version of the upgrade package is what you desired. To obtain the latest upgrade package, please contact Mindray Customer Service Department.**
-

**FOR YOUR NOTES**

# 5 Testing and Maintenance

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## 5.1 Introduction

To ensure the patient monitor always functions normally, qualified service personnel should perform regular inspection, maintenance and test. This chapter provides a checklist of the testing procedures for the patient monitor with recommended test equipments and frequency. The service personnel should perform the testing and maintenance procedures as required and use appropriate test equipments.

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 replacements must be done to correct the problem. If you have any question, contact our Customer Service Department.



- **All tests should be performed by qualified service personnel only.**
  - **Care should be taken to change the settings in [User Maintenance] and [Factory Maintenance] menus to avoid loss of data.**
  - **Service personnel should acquaint themselves with the test tools and make sure that test tools and cables are applicable.**
- 

### 5.1.1 Test Equipment

See the following sections.

### 5.1.2 Test Report

Upon the completion of the tests, the table of preventative maintenance test reports and the table of maintenance test reports in this chapter should be kept properly.

### 5.1.3 Preventative Maintenance

Below are preventative maintenance tests which need to be performed on the monitor. The recommended frequency of preventative maintenance is at least once per year. See the following sections for detailed maintenance procedures.

- Visual inspection
- NIBP test
- CO<sub>2</sub> test and calibration
- AG test and calibration

### 5.1.4 Recommended Frequency

Check/Maintenance Item		Frequency
Visual inspection		1. When first installed or reinstalled.
Power-on test		1. When first installed or reinstalled. 2. Following any repairs or replacement of any main unit parts.
ECG test	Performance Test	<ol style="list-style-type: none"> <li>If the user suspects that the measurement is incorrect.</li> <li>Following any repairs or replacement of relevant module.</li> <li>At least once every two years.</li> </ol> <p>Note: At least once a year is recommended for NIBP, CO<sub>2</sub>, and AG.</p>
	Module calibration	
Resp performance test		
SpO <sub>2</sub> test		
NIBP test	Pressure check	
	Leakage test	
TEMP test		
IBP test	Performance test	
	Pressure calibration	
C.O. test		
Mainstream CO <sub>2</sub> test		
Sidestream and Microstream CO <sub>2</sub> tests	Leakage test	
	Performance test	
	Calibration	
AG test	Leakage test	
	Performance test	
	Calibration	
Nurse call function test		If the user suspects that the nurse call or analog output does not work well.
Analog output performance test		
Electric Safety Tests	Refer to <b>A Electrical Safety Inspection.</b>	<ol style="list-style-type: none"> <li>Following any repair or replacement.</li> <li>After the monitor drops.</li> <li>At least once every two years.</li> </ol>
Touchscreen calibration		<ol style="list-style-type: none"> <li>When the touchscreen appears abnormal.</li> <li>After the touchscreen is replaced.</li> </ol>
Recorder check		Following any repair or replacement of the recorder.
Battery check	Functionality test	<ol style="list-style-type: none"> <li>When first installed.</li> <li>Whenever a battery is replaced.</li> </ol>
	Performance test	Once every six months or if the battery run time reduced significantly.

## 5.2 Visual Inspection

Inspect the equipment for obvious signs of damage. The test is passed if the equipment has no obvious signs of damage. Following these guidelines when inspecting the equipment:

- Carefully inspect the case, display screen, buttons, and knob for obvious signs of damage.
- Inspect the power cord, wall mount, and 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.

## 5.3 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 the battery in the battery compartment 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 monitor performs self-test as soon as the monitor is powered on. During the self-test, the alarm lamp turns yellow and red, and then turns off; the monitor gives a beep. This indicates that the visual and audible alarm indicators operate properly.

## 5.4 Module Performance Tests

### 5.4.1 ECG Tests and Calibration

#### ECG Performance Test

Tool required:

- Fluke Medsim 300B patient simulator recommended
1. Connect the patient simulator with the ECG connector using an ECG cable.
  2. Set the patient simulator as follows: ECG sinus rhythm, HR = 80 bpm with the amplitude as 1 mV.
  3. Check the ECG waves are displayed correctly without noise and the displayed HR value is within  $80 \pm 1$  bpm.
  4. Disconnect each of the leads in turn and observe the corresponding lead off message displayed on the screen.
  5. Set the simulator outputs paced signals and set **[Paced]** to **[Yes]** on the monitor. Check the pace pulse marks on the monitor screen.

## ECG Calibration

Tool required:

- Vernier caliper

1. Select the ECG parameter window or waveform area and set [Filter] to [Diagnostic].
2. Select [Main Menu] → [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%.
5. After completing the calibration, select [Stop Calibrating ECG].

You can print out the square wave and wave scale and then measure the difference between them if necessary.

### 5.4.2 Resp Test

Tool required:

- Fluke Medsim 300B patient simulator recommended

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  $\Omega$ , data impedance as 0.5  $\Omega$ , and respiration rate as 40 rpm.
3. Check the Resp wave is displayed without any distortion and the displayed Resp value is within  $40 \pm 2$  rpm.

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

Tool required:

- None

1. Connect SpO<sub>2</sub> sensor to the SpO<sub>2</sub> connector of the monitor. Set [Patient Cat.] to [Adu] and [PR Source] to [SpO2].
2. Apply the SpO<sub>2</sub> sensor to your ring finger (assume that you stay healthy).
3. Check the Pleth wave and PR reading on the screen and make sure that the displayed SpO<sub>2</sub> is within 95% and 100%.
4. Remove the SpO<sub>2</sub> sensor from your finger and make sure that an alarm of SpO<sub>2</sub> 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.**
-

## 5.4.4 NIBP Test

### NIBP Leakage Test

#### NOTE

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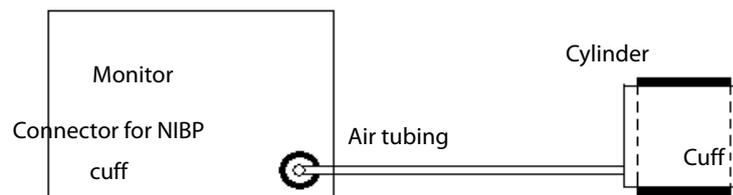
- **Perform NIBP leakage test before any other NIBP concerned test.**
- 

Tools required:

- NIBP cuff for adult patient
- Tubing
- Cylinder

Follow this procedure to perform the leakage test:

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



4. Select [**Main Menu**] → [**Maintenance >>**] → [**NIBP Leakage Test**]. The message [**Leakage Testing...**] is displayed in the NIBP parameter area.
5. The cuff automatically deflates after 20 s, which means NIBP leakage test is completed.
6. If no message is displayed in the NIBP parameter area, it indicates that the system has no leakage. If the message [**NIBP Pneumatic Leak**] is displayed, it indicates that the system may have a leakage. In this case, check if all connections are good and the cuff and tubing have no leakage. Perform the test again after making sure all connections are good and the cuff and tubing have no leakage.

You can either perform a manual leakage test:

1. Perform steps 1 to 4 in the **NIBP Accuracy Test** section.
2. Raise the pressure in the rigid vessel to 250 mmHg with the balloon pump. Then, wait for 5 seconds to let the measured values becoming stable.
3. Record the current pressure value, and meanwhile use a time counter to count the time. Then, record the pressure value after 60 s.
4. Compare the two pressure values and make sure the difference should not be greater than 6 mmHg.

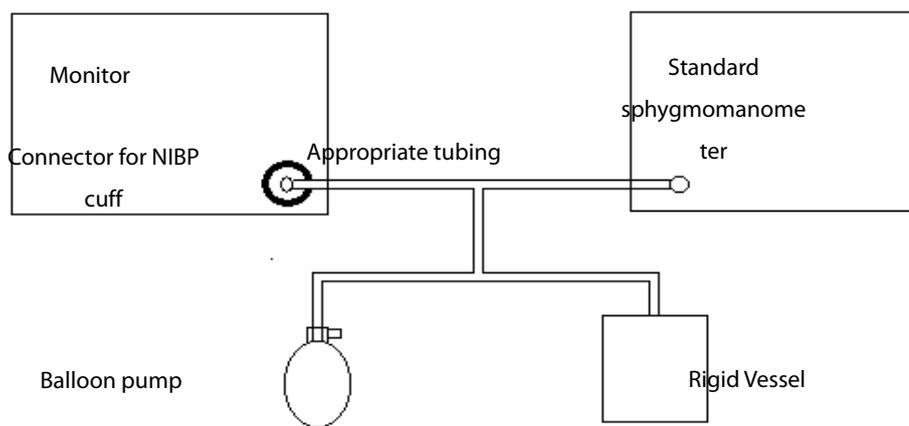
## NIBP Accuracy Test

Tool required:

- T-shape connector
- Appropriate tubing
- Balloon pump
- Rigid Vessel with volume  $500 \pm 25$  ml
- Reference manometer (calibrated with accuracy equal to or better than 0.75 mmHg)

Follow this procedure to perform the accuracy test:

1. Connect the equipments as shown below.



2. Before inflation, check that the reading of the manometer is 0. If not, turn off the balloon pump to let the whole airway open to the atmosphere. Turn on the balloon pump after the reading is 0.
3. Select [**Main Menu**] → [**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 balloon pump. Then, wait for 10 seconds to let the measured values become stable.
6. Compare the manometer values with the monitor values. The difference between the manometer and displayed values should be  $\pm 3$  mmHg.
7. Raise the pressure in the rigid vessel to 200 mmHg with the balloon pump. Then, wait for 10 seconds to let the measured values become stable. Repeat step 6.

## NOTE

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

## 5.4.5 Temp Test

Tool required:

- Resistance box (with accuracy above 0.1  $\Omega$ )
1. Connect the two pins of any Temp connector in the monitor to the two ends of the resistance box using 2 wires.
  2. Set the resistance box to 1354.9  $\Omega$  (corresponding temperature is 37 °C).
  3. Verify each Temp channel of the monitor and make sure that the displayed value is within  $37 \pm 0.1^\circ\text{C}$ .
  4. Repeat steps 1 to 3 and verify another temperature channel.

## 5.4.6 IBP Test and Calibration

### IBP Performance Test

Tools required:

- Medsim300B patient simulator, or MPS450, or equivalent equipments
  - IBP adapter cable for test (P/N 009-002199-00 for Medsim 300B, P/N 009-002198-00, for MPS450)
1. Connect the patient simulator through the monitor's IBP connector.
  2. Make the patient simulator outputs 0 mmHg to an IBP channel.
  3. Select IBP Zero in the IBP setup Menu to make a zero calibration.
  4. Set the patient simulator as P (static) = 200 mmHg.
  5. The displayed value should be within  $200 \pm 4$  mmHg.
  6. If the error is beyond  $\pm 4$  mmHg, calibrate the pressure module. If the IBP module was calibrated with a dedicated reusable IBP sensor, check the calibration together with this IBP sensor.
  7. Let the patient simulator output 120/80 mmHg ART signal and 120/0 mmHg LV signal to the IBP channel and check that the IBP wave is displayed correctly.
  8. Repeat the steps above to calibrate other IBP channels.

### IBP Pressure Calibration

Method 1:

Tools required:

- Medsim300B patient simulator, or MPS450, or equivalent equipments
  - IBP adapter cable for test (P/N 009-002199-00 for Medsim 300B, P/N 009-002198-00, for MPS450)
1. Connect the patient simulator through the monitor's IBP connector.
  2. Set the patient simulator to 0 for the desired IBP channel.
  3. Select IBP Zero in the IBP setup Menu to make a zero calibration.
  4. Set the patient simulator as P (static) = 200 mmHg.

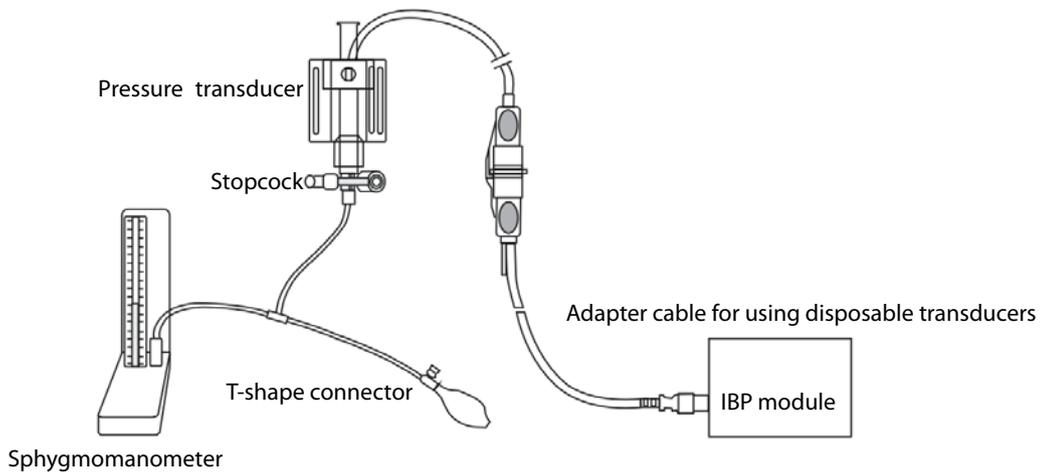
5. Select [**Main Menu**] → [**Maintenance >>**] → [**Cal. IBP Press. >>**]. In the [**Cal. IBP Press.**] menu, set the calibration value to 200 mmHg.
6. Select the [**Calibrate**] button next to the desired IBP channel to start calibration.
7. If the calibration is completed successfully, the message [**Calibration Completed!**] will be displayed. Otherwise, a corresponding message will be displayed.

Method 2:

Tools required:

- Standard sphygmomanometer
- Balloon pump
- Appropriate tubing
- T-shape connector

1. Connect the 3-way stopcock, the sphygmomanometer and the balloon pump through a T-shape connector, as shown below.



2. Vent the transducer to the atmospheric pressure by turning on the 3-way stopcock to the air. Zero the transducer, and then open the stopcock to the sphygmomanometer.
3. Select [**Main Menu**] → [**Maintenance >>**] → [**Cal. IBP Press. >>**]. In the [**Cal. IBP Press.**] menu, configure the IBP calibration value.
4. Inflate using the balloon pump until the reading of sphygmomanometer approximates the preset calibration value.
5. Adjust the preset calibration value until it equals to the reading of the sphygmomanometer.
6. Select the [**Calibrate**] button next to the desired IBP channel to start calibration.

When the calibration is completed, the message [**Calibration Completed!**] will be displayed. Otherwise, a corresponding message will be displayed.

### 5.4.7 C.O. Test

Tools required:

- Medsim300B patient simulator, or MPS450, or equivalent equipments
  - C.O. adapter box ( CI-3 module/cable, P/N: 3010-0289 for 300B; P/N: 5180500 for MPS450)
  - C.O. trunk cable (P/N: 0010-21-42716)
1. Connect the patient simulator to the C.O. connector on the patient monitor using a C.O. trunk cable and a C.O. adapter box.
  2. Set the blood pressure (BT) to 37 °C on the patient simulator and check that the temperature value displayed on the monitor is within  $37 \pm 0.2$  °C.
  3. In the **[C.O. Setup]** menu on the patient monitor, set **[Auto TI]** to **[Off]**, **[Manual TI (°C)]** to 2 °C, and **[Comp. Const.]** to 0.542. Select **[C.O. Measure]** to enter the C.O. measurement window.
  4. Select **[Start]** in the C.O. measurement window to start C.O. measurement.
  5. On the patient simulator, set C.O. to 5 L/min and wait for 3 to 10 seconds.
  6. Verify that the C.O. value displayed on the monitor is  $5 \pm 0.25$  L/min.

### 5.4.8 Mainstream CO<sub>2</sub> Tests

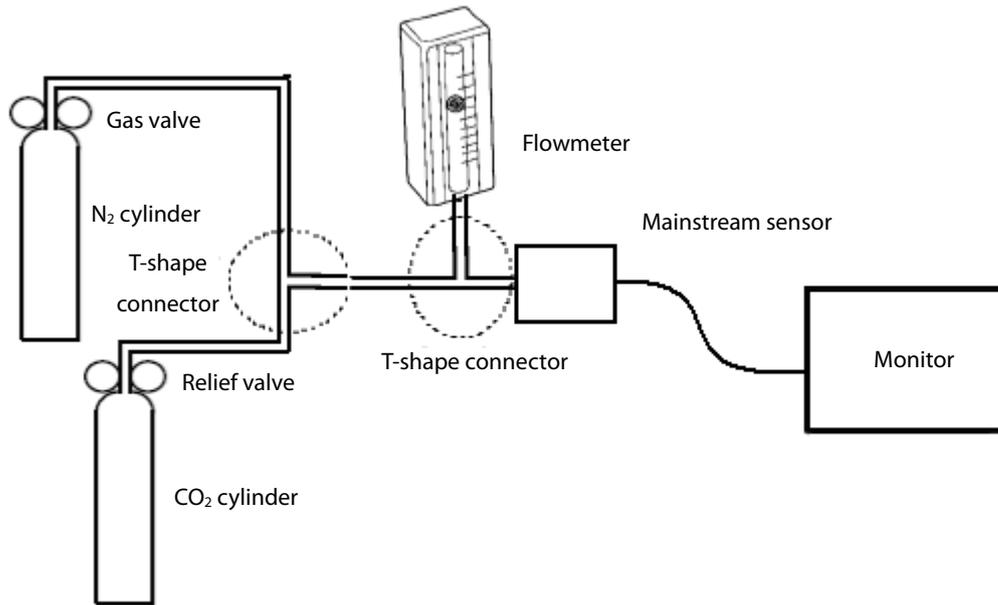
#### NOTE

- 
- **Before performing mainstream CO<sub>2</sub> tests, select [Main Menu] → [Maintenance >>] → [User Maintenance >>] → enter therequired password → [Maintain CO<sub>2</sub>], and make sure that the setting of [Barometric Pressure] is correct.**
- 

Tools required:

- A steel gas cylinder with  $6 \pm 0.05\%$  CO<sub>2</sub> and balance gas N<sub>2</sub>
  - A steel gas cylinder with 100% N<sub>2</sub>
  - T-shape connector
  - Appropriate tubing
  - Flowmeter
1. Connect the sensor.
  2. Wait for 10 minutes until the CO<sub>2</sub> warmup is finished and then select **[Start Zero Cal.]** from **[CO<sub>2</sub> Setup]** menu to start a zero calibration. If the calibration fails, the prompt message **[CO<sub>2</sub> Zero Failed!]** is displayed. Otherwise, the baseline of waveform recovers to zero.
  3. In the **[CO<sub>2</sub> Setup]** menu, set **[Apnea Delay]** to 10 s.
  4. Blow to the CO<sub>2</sub> sensor to generate a CO<sub>2</sub> waveform and then place the sensor in the air. Check if the alarm message **[CO<sub>2</sub> Apnea]** is displayed on the screen.

5. Connect the test system as follows:



6. Adjust the power supply and turn on/off 3-way valves to ensure that only one cylinder is connected to the Mainstream CO<sub>2</sub> sensor via the 3-way valves at one time.
7. Adjust the relief valve and make sure the flowmeter reading is stable and within 2 and 5 L/min.
8. Switch between the two cylinders to connect Mainstream CO<sub>2</sub> sensor at an intervals of 6 to 10s and check if the displayed CO<sub>2</sub> value is within  $45 \pm 2$  mmHg.

## 5.4.9 Sidestream and Microstream CO<sub>2</sub> Tests

### Leakage Test

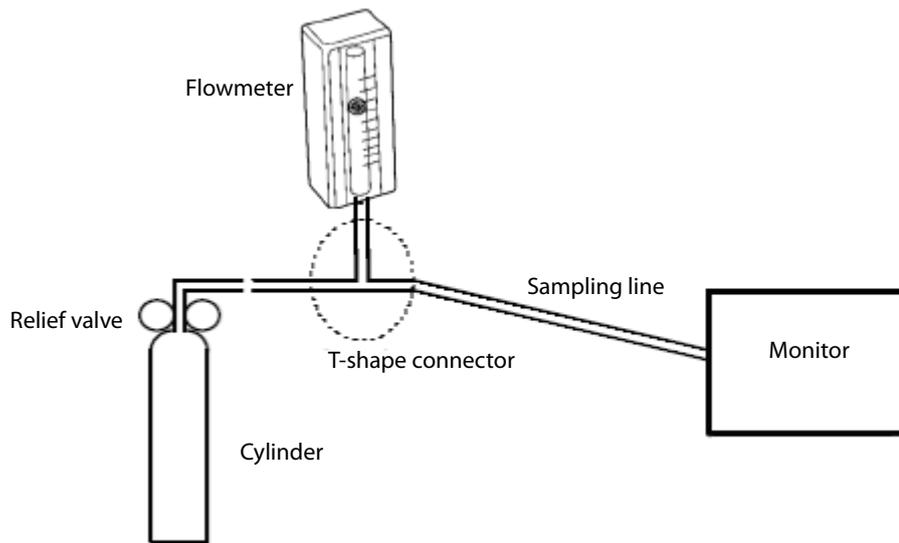
1. Connect the CO<sub>2</sub> module with the patient module.
2. Wait for 10 seconds until CO<sub>2</sub> warmup is finished, and then use your hand or other objects to completely block the gas inlet of the module or watertrap. The sidestream and microstream CO<sub>2</sub> modules will behave as follows:
  - ◆ Sidestream: The alarm message **[CO<sub>2</sub> Filter Line Err]** is displayed on the screen after 3 seconds. Block the gas inlet for another 60 seconds, and select **[User Maintenance >>]** → enter the required password → **[Maintain CO<sub>2</sub> >>]** → **[Calibrate CO<sub>2</sub> >>]** and check that the current CO<sub>2</sub> flow is less than 10 ml/min. If the alarm message does not disappear, it indicates that the module does not leak.
  - ◆ Microstream: The alarm message **[CO<sub>2</sub> Purging]** is displayed on the screen after 3 seconds. Block the gas inlet for another 40. If alarm message **[CO<sub>2</sub> Filter Line Err]** is displayed, it indicates that the module does not leak.

## Accuracy Test

Tools required:

- A steel gas cylinder with  $6 \pm 0.05\%$  CO<sub>2</sub> and balance gas N<sub>2</sub>
- T-shape connector
- Appropriate tubing
- Flowmeter

1. Connect the CO<sub>2</sub> module with the patient module.
2. Wait for 10 minutes until the CO<sub>2</sub> warmup is finished, and check the airway for leakage and perform a leakage test as well to make sure the airway has no leakage.
3. Select [**User Maintenance >>**] → enter the required password → [**Maintain CO2 >>**] → [**Calibrate CO2 >>**].
4. Connect the test system as follows:



5. Adjust the relief valve and make sure the flowmeter reading is stable and within 10 and 50 L/min.
6. Check the realtime CO<sub>2</sub> value is within  $6.0 \pm 0.3\%$  in the [**Calibrate CO2**] menu.

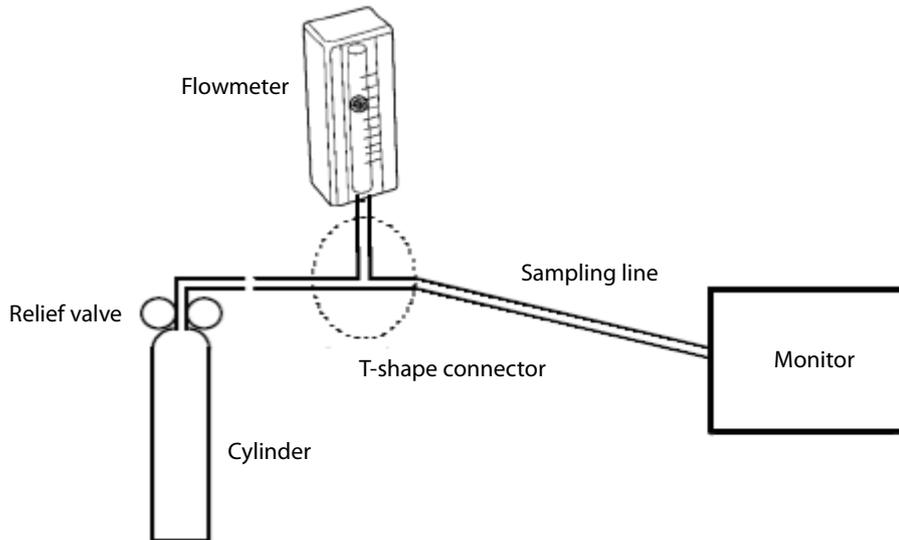
## Calibration

Tools required:

- A steel gas cylinder with  $6 \pm 0.05\%$  CO<sub>2</sub> and balance gas N<sub>2</sub>
- T-shape connector
- Appropriate tubing

1. Make sure that the sidestream CO<sub>2</sub> module or microstream CO<sub>2</sub> module has been warmed up or started up.
2. Check the airway for leakage and perform a leakage test as well to make sure the airway has no leakage.
3. Select [**Main Menu**] → [**Maintenance >>**] → [**User Maintenance >>**] → enter the required password → [**Maintain CO2 >>**] → [**Calibrate CO2 >>**] to enter the [**Calibrate CO2**] menu.

4. Then select [**Zero**].
5. After the zero calibration is finished successfully, connect the equipment as follows:



6. Adjust the relief valve and make sure the flowmeter reading is stable and within 10 and 50 L/min.
7. In the [**Calibrate CO2**] menu, enter the vented CO<sub>2</sub> concentration in the [**CO2**] field.
8. In the [**Calibrate CO2**], the measured CO<sub>2</sub> concentration is displayed. After the measured CO<sub>2</sub> concentration becomes stable, select [**Calibrate CO2**] to calibrate the CO<sub>2</sub> module.
9. If the calibration is finished successfully, the message [**Calibration Completed!**] is displayed in the [**Calibrate CO2**] menu. If the calibration failed, the message [**Calibration Failed**] is displayed. In this case, perform another calibration.

## 5.4.10 AG Tests and Calibration

### Leakage Test

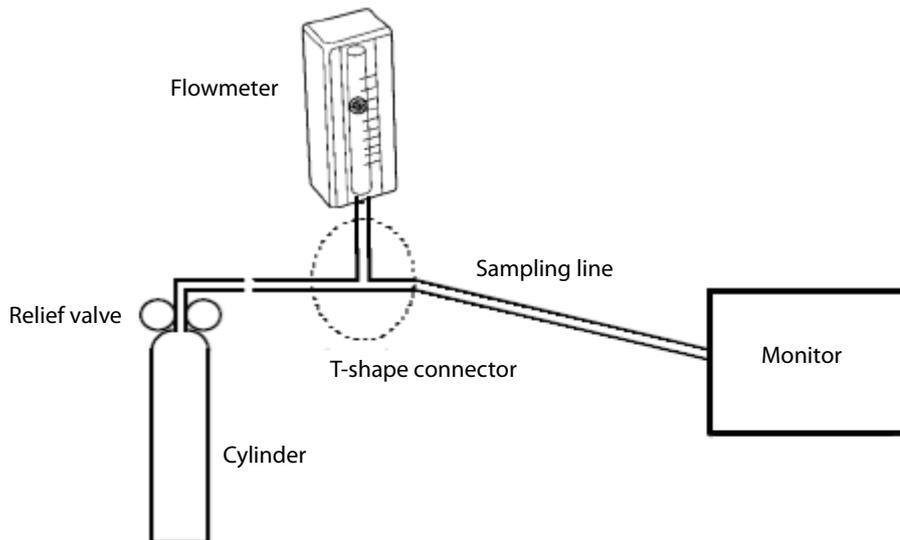
1. Plug the AG module into the module rack.
2. Wait for a minute until the AG module warmup is finished and then use your hand or other objects to completely block the gas inlet of the AG module. An alarm message [**AG Airway Occluded**] will be displayed.
3. Block the gas inlet for another 60 seconds, Then select [**User Maintenance >>**] → [**Maintain AG >>**] → [**Calibrate AG >>**] and check that 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.

### Accuracy Test

Tools required:

- Gas cylinder with a certain standard gas (such as  $6 \pm 0.05\%$  CO<sub>2</sub>, Bal N<sub>2</sub>), or standard gas mixture. Gas concentration should meet the following requirements : AA  $\geq 1.5\%$ , CO<sub>2</sub>  $\geq 1.5\%$ , N<sub>2</sub>O  $\geq 40\%$ , O<sub>2</sub>  $\geq 40\%$ , of which AA represents an anesthetic agent (Des, Sev, Enf, Iso, or Hal).  $a/c \leq 0.01$  (a is the gas absolute concentration accuracy; c is the gas concentration)
- T-shape connector
- Appropriate tubing

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



5. Adjust the relief valve and make sure the flowmeter reading is stable and within 10 and 50 L/min.
6. Check that the concentration of each composition meets the specification stated in the Operator's Manual.

## Calibration

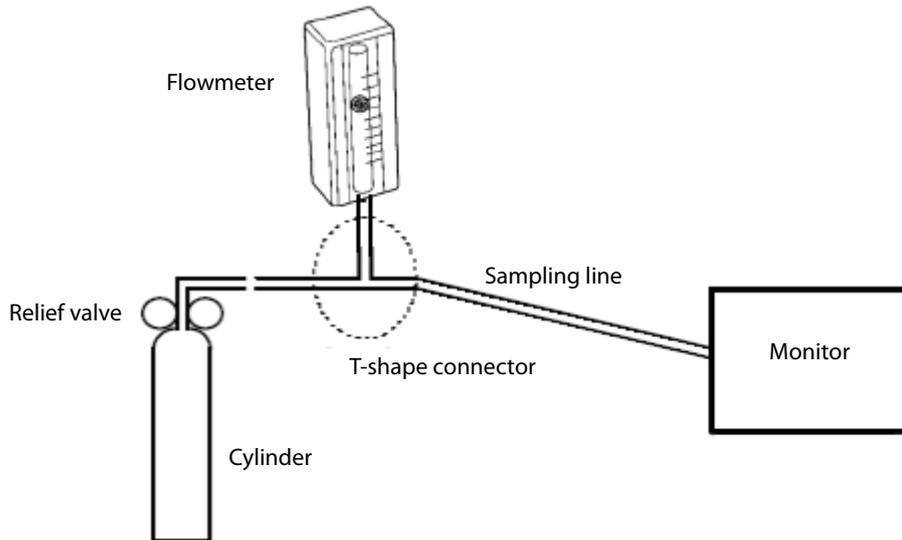
Tools required:

- Gas cylinder with a certain standard gas (such as  $6 \pm 0.05\%$  CO<sub>2</sub>, Bal N<sub>2</sub>), or standard gas mixture. Gas concentration should meet the following requirements: AA  $\geq 1.5\%$ , CO<sub>2</sub>  $\geq 1.5\%$ , N<sub>2</sub>O  $\geq 40\%$ , O<sub>2</sub>  $\geq 40\%$ , of which AA represents an anesthetic agent (Des, Sev, Enf, Iso, or Hal).  $a/c \leq 0.01$  (a is the gas absolute concentration accuracy; c is the gas concentration)
- T-shape connector
- Appropriate tubing

Follow this procedure to perform the pressure calibration:

1. Select **[Main Menu]** → **[Maintenance >>]** → **[User Maintenance >>]** → enter the required password → **[Calibrate AG >>]** to access the **[Calibrate AG]** menu.
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 Flow Rate]** and **[Set Flow Rate]** 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.
  - ◆ Check the airway and make sure that the airway has no leakage.

3. Connect the test system as follows:



4. Open the relief valve and vent a certain standard gas or gas mixture. Then adjust the relief valve and make sure the flowmeter reading is stable and within 10 and 50 L/min.
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 very small, a calibration is not needed.
  - ◆ If the difference is great, you should perform a calibration. 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 calibration.
8. If the calibration is finished successfully, the message [**Calibration Completed!**] is displayed. If the calibration failed, the message [**Calibration Failed**] is displayed. In this case, perform another calibration.

### CAUTION

- 
- **Calibrate the O<sub>2</sub> module, if it has been transported for long distance.**
-

## 5.5 Nurse Call Reply Performance Test

Tool required:

- Oscilloscope

1. Connect the nurse call cable to the Multifunctional Connector of the patient monitor.
2. Enter [**Demo**] mode. Then select [**Main Menu**] → [**Maintenance >>**] → [**User Maintenance >>**] → enter the required password → [**Others >>**].
3. In the [**Others >>**] menu, select [**Nurse Call Setup >>**] and then in the [**Nurse Call Setup**] menu, select all optional [**Alm Lev**] and [**Alm Cat.**], and set [**Contact Type**] to [**Normally Open**].
4. In [**Nurse Call Setup >>**] menu, set [**Signal Type**] to [**Pulse**]. Make the monitor to generate an alarm and check that the oscillograph displays positive pulses of 1s width when there is an alarm.
5. In [**Nurse Call Setup >>**] menu, set [**Signal Type**] to [**Continuous**]. Make the monitor to generate an alarm and check that the oscillograph outputs continuous high level when there is an alarm.

## 5.6 Analog Output Performance Test

Tools required:

- Medsim300B patient simulator, or MPS450, or equivalent equipments
- Oscilloscope

Connect the patient simulator to the monitor using an ECG or IBP cable and connect the oscillograph to the Multifunctional Connector of the patient monitor. Verify that the waves displayed on the oscillograph are identical with those displayed on the monitor.

## 5.7 Electric Safety Tests

See **A Electrical Safety Inspection** for electrical safety tests.

## 5.8 Touchscreen Calibration

Tool required:

- None

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

## 5.9 Recorder Check

Tool required:

- None

1. Print ECG waveforms. The recorder should print correctly and the printout should be clear.
2. Set the recorder to some problems such as out of paper, etc. the patient monitor should give corresponding prompt messages. After the problem is removed, the recorder should be able to work correctly.
3. Switch automatic alarm recording for each parameter ON and then set each parameter's limit outside set alarm limits. Corresponding alarm recordings should be triggered when parameter alarms occur.

## 5.10 Battery Check

Tool required:

- None

### Functional Test

1. If the patient monitor is installed with a battery, remove the battery first.
2. Verify that the patient monitor works correctly when running powered from an AC source.
3. Insert the battery per the procedures provided in the Operator's Manual.
4. Remove the AC power cord and verify that the patient monitor still works correctly.

### Performance Test

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

## 5.11 Factory Maintenance

### 5.11.1 Accessing Factory Maintenance Menu

Select **[Main Menu]** → **[Maintenance >>]** → **[Factory Maintenance >>]** → enter the required password to access the **[Factory Maintenance]** menu.

The screenshot shows the 'Factory Maintenance' menu with the following options:

- Draw Wave: **Mono** (selected), Device Config >>
- Recorder: Off
- HR Alarm Delay: Off
- Console Output: Diagnose
- Software Version >>
- Monitor Information >>
- VirtualRecordOnOFF
- TcpSpy Level Select >>
- Calibrate NIBP >>
- MPM SelfTest Info. >>
- MPM RealTime Info. >>

At the bottom, a note reads: "Select Mono to have wider viewing angle or Color to have smoother waveforms."

### 5.11.2 Drawing Waves

There are two methods to draw waves: **[Color]** and **[Mono]**.

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

### 5.11.3 Recorder

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

#### NOTE

- The recorder is disabled if **[Recorder]** is set to **[Off]** in the **[Factory Maintenance]** menu.

### 5.11.4 Software version

Selecting the [Software Version >>] will show software version information, as shown below:

Software Version

System Software Version	01.02.00	1
Power Software Version	N/A	2
UBoot	11.22.33	
Kernel	00.11.22	
Bios	66.77.88	
Keypad Module	N/A	

Software Version

Recorder Module	N/A	
MPM Version	0.0-0.0-0.0-0.0	3
MPM Type	ARR-ST.12L	4
MotherBoard FPGA Logic/Nios Software Version	N/A	
MotherBoard Audio Software Version	0.1	
IMR Nios Module FPGA Logic/Nios Software Version	N/A	

Software Version

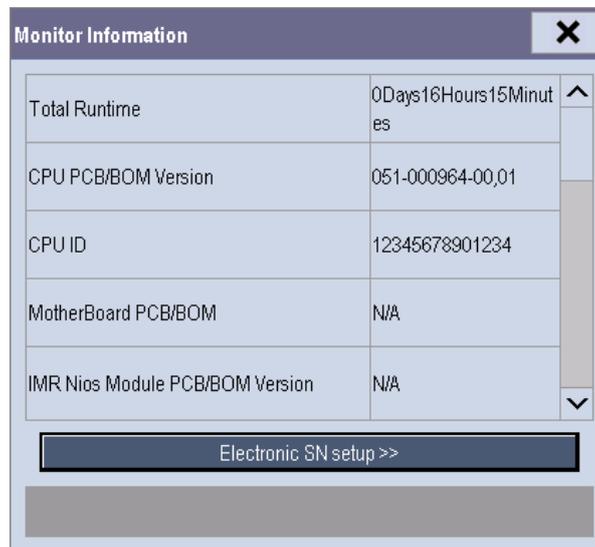
IMR Nios Module FPGA Logic/Nios Software Version	N/A	
SMR Nios Module FPGA Logic/Nios Software Version	N/A	
External Module Interface Board Version	N/A	5
Language Library Version	08.00.00	
Icon Library Version	08.00.00	
Logo Library Version	04.-0.0-	

In the above figure,

1. System software version
2. Power software version
3. SpO<sub>2</sub> software version (0.0 indicates that the monitor is equipped with Nellcor or Masimo SpO<sub>2</sub> board)
4. MPM software version
5. External module interface board version

### 5.11.5 Monitor information recording

Selecting [**Monitor Information >>**] will show the status of the patient monitor as shown below:



The screenshot shows a dialog box titled "Monitor Information" with a close button (X) in the top right corner. The dialog contains a table with the following data:

Total Runtime	0Days16Hours15Minutes
CPU PCB/BOM Version	051-000964-00,01
CPU ID	12345678901234
MotherBoard PCB/BOM	N/A
IMR Nios Module PCB/BOM Version	N/A

Below the table is a button labeled "Electronic SN setup >>".

#### NOTE

- **If the main board is replaced, you need to check the label on the main unit and reconfigure the serial number of the patient monitor.**



<b>SpO<sub>2</sub> test</b>		
Measure SpO <sub>2</sub> on a healthy person's finger and a Pleth wave and PR value are displayed. The displayed SpO <sub>2</sub> value is within 95% and 100%.		
<b>NIBP test</b>		
The difference is within $\pm 3$ mm when 0, 50 or 200 mmHg is set for NIBP accuracy test.		
There is no leakage with NIBP, or the manual leakage test result does not exceed 6 mmHg/min.		
<b>Temp test</b>		
The value displayed for each Temp channel of the monitor is within $37 \pm 0.1$ °C.		
<b>IBP test and calibration</b>		
The static pressure value displayed for each IBP channel is within $200 \pm 4$ mmHg.		
The ART and LV waves for each IBP channel are displayed correctly.		
<b>C.O. test</b>		
The TB value displayed on the monitor is within $37 \pm 0.2$ °C.		
The displayed C.O. value is within $5 \pm 0.25$ L/min.		
<b>Mainstream CO<sub>2</sub> tests</b>		
The mainstream CO <sub>2</sub> is zeroed successfully and the waveform baseline recovers to zero.		
CO <sub>2</sub> Apnea alarm behaves correctly.		
The displayed CO <sub>2</sub> value is within $6.0 \pm 0.3\%$ .		
<b>Mainstream CO<sub>2</sub> tests</b>		
Block the gas inlet of the module or watertrap. The sidestream CO <sub>2</sub> flowrate is slower than 10ml/min and an alarm of <b>CO<sub>2</sub> Filterline Err</b> is given. It indicates that there is no leakage.		
The displayed CO <sub>2</sub> value is within $6.0 \pm 0.3\%$ .		
<b>Mainstream CO<sub>2</sub> tests</b>		
Block the gas inlet of the module or watertrap for 40s. An alarm of CO <sub>2</sub> Filterline Err is given. It indicates that there is no leakage.		
The displayed CO <sub>2</sub> value is within $6.0 \pm 0.3\%$ .		
<b>AG tests and calibration</b>		
When AG flowrate is slower than 10ml/min, an alarm of AG Airway Occluded is given. It indicates that there is no leakage.		
The fan inside the AG module works properly.		
The measurement accuracy of CO <sub>2</sub> , N <sub>2</sub> O, O <sub>2</sub> and AA (AA represents an anaesthetic agent) meets the product specifications in the Operator's Manual.		
<b>Nurse call reply performance test</b>		
When an alarm is reported on the patient monitor, a nurse call is send out through the cable.		
<b>Analog output performance test</b>		
The waves displayed on the oscillograph are identical with those displayed on the monitor.		
<b>Electric safety tests</b>		
Refer to <b>A Electrical Safety Inspection</b> . All the electrical safety tests should be passed		

<b>Touchscreen calibration</b>		
The touchscreen is calibrated successfully.		
<b>Recorder check</b>		
The recorder can print ECG waves correctly and the printout is clear.		
Set the recorder to some problems such as out of paper, etc. the patient monitor gives corresponding prompt messages. After the problem is removed, the recorder is able to work correctly.		
Automatic alarm recording for each parameter functions correctly when parameter alarms occur.		
<b>Battery check</b>		
The monitor can operate correctly from battery power when an AC power failure accidentally occurs.		
The patient monitor can operate independently on a single battery.		

Test conclusion

Tested by:

Test date:

# 6 Troubleshooting

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## 6.1 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 the troubles.

The troubles we list here are frequently arisen difficulties and the actions we recommend can correct most problems, but not all of them. For more information on troubleshooting, contact our Customer Service Department.

## 6.2 Part Replacement

Printed circuit boards (PCBs), major parts and components in the patient monitor are replaceable. Once you isolate a PCB you suspect defective, follow the instructions in **7 Disassembly and Repair** to replace the PCB with a known good one and check that the trouble disappears or the patient monitor passes all performance tests. Defective PCB can be sent to us for repair. If the trouble remains, exchange the replacement PCB with the original suspicious PCB and continue troubleshooting as directed in this chapter.

To obtain information on replacement parts or order them, refer to **8 Parts**.

## 6.3 Checking Patient Monitor Status

Some troubleshooting tasks may require you to identify the hardware version and status of your monitor. To check equipment status,

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

## 6.4 Checking Software Version

Some troubleshooting may involve software compatibility. Thus it requires you to know your monitor configuration and software version. For detailed information on version compatibility, please contact our Customer Service Department. To view information on the system configuration and system software version,

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

## 6.5 Checking Technical Alarms

Before troubleshooting the patient monitor, check for technical alarm messages. If an alarm message is presented, eliminate the technical alarm first.

For detailed information on technical alarm message, possible cause and corrective action, refer to the patient monitor's Operation Manual.

## 6.6 Troubleshooting Guide

### 6.6.1 Power On/Off Failure

Symptoms	Possible Cause	Corrective Action
The patient monitor fails to start.	AC mains not connected or battery too low	Check that AC mains is properly connected or battery capacity is sufficient.
	Cable defective	1. Check that the cable between the keypad board and main board is correctly connected. 2. Check that the cable between the power board and power management board is correctly connected. 3. Check that the cable between the main board and power management board is correctly connected.
	Power board defective	Replace the power board.
	Power management board defective	Replace the power management board.
	The main board failed.	Replace the main board.

### 6.6.2 Display Failures

Symptoms	Possible Cause	Corrective Action
The display is blank or black.	Cable defective	1. Check if the cable between the display and main board and the backlight cable are correctly connected. 2. Check that the cables and connectors are not damaged.
	Main board defective	Replace the main board.
	Display defective	Replace the display.
Images overlapped or distorted	Main board error	Replace the main board, or upgrade the main board with the upgrade software.
	Cable defective	1. Check if the cable between the display and main board and the backlight cable are correctly connected.
Secondary display does not function or displays snows or flashing specks	Cable defective	1. Check that the cable between the secondary display and the monitor is correctly connected. 2. Check that the cable between the main board and power management board is correctly connected. 3. Check that the cable between power management board and interface board is correctly connected.

Symptoms	Possible Cause	Corrective Action
	The connector board failed.	Replace the connector board.
	Power management board defective	Replace the power management board.
	The main board failed.	Replace the main board.
Touchscreen does not respond.	Touchscreen disabled	Check if there is a  symbol displayed above the [Main Menu] quickkey. If yes, press and hold the [Main Menu] quickkey for more than 3 seconds to enable the touchscreen.
	Cable defective	1. Check that the cable between the touchscreen and touchscreen control board is correctly connected. 2. Check that the cable between the touchscreen control board and main board is correctly connected.
	Touchscreen control board defective	Replace the touchscreen control board
	Touchscreen defective	Replace the touchscreen.
	The main board failed.	Replace the main board.
Touch position invalid	Touchscreen not calibrated	Calibrate the touchscreen.

### 6.6.3 Alarm Lamp Failures

Symptoms	Possible Cause	Corrective Action
The alarm lamp is not light or extinguished, or the alarm lamp illuminates abnormally.	Cable defective	1. Check that the cable between the alarm lamp board and main board is correctly connected. 2. Check that the cables and connectors are not damaged.
	Alarm lamp board defective	Replace the alarm lamp board
	The main board failed.	Replace the main board.

### 6.6.4 Button and Knob Failures

Symptoms	Possible Cause	Corrective Action
Buttons do not work	Cable defective	1. Check that the cable between the keypad board and main board is correctly connected.
	Keypad board failure	Replace the keypad board.
Knob does not work	Cable defective	1. Check that the cable between the knob and keypad board is correctly connected. 2. Check that the cable between the keypad board and main board is correctly connected.
	Knob failure	Replace the knob encoder.
	Keypad board failure	Replace the keypad board.

### 6.6.5 Sound Failures

Symptoms	Possible Cause	Corrective Action
No hardkey or knob sound, or hardkey or knob sound abnormal	The key volume is set to zero.	1. Select <b>[Main Menu]</b> → <b>[Screen Setup &gt;&gt;]</b> → <b>[Key Volume &gt;&gt;]</b> and adjust the key volume to appropriate level.
	Cable defective	1. Check that the cable between the speaker and interface board is properly connected.
	Speaker defective	Replace the speaker.
	The main board failed.	Replace the main board.
	Power management board defective	Replace the power management board.
No alarm sound or alarm sound abnormal	The alarm sound is set to zero.	Select <b>[Main Menu]</b> → <b>[Maintenance &gt;&gt;]</b> → <b>[User Maintenance &gt;&gt;]</b> →enter the required password → <b>[Alarm Setup &gt;&gt;]</b> and set the <b>[Minimum Alarm Volume]</b> to appropriate level. Select <b>[Alarm Setup]</b> on the main menu to adjust the alarm volume.
	Cable defective	1. Check that the cable between the speaker and interface board is properly connected.
	Speaker defective	Replace the speaker.
	The main board failed.	Replace the main board.
	Power management board defective	Replace the power management board.

### 6.6.6 Battery Failures

Symptoms	Possible Cause	Corrective Action
Battery cannot be charged	Battery defective	Replace the battery.
	Cable defective	1. Check that the cable between the battery interface board and power management board is correctly connected.
	Power management board defective	Replace the power management board.
	Battery interface board defective	Replace the battery interface board.

#### NOTE

- **When the battery module has a failure, it may cause problems to other components, In this case, troubleshoot the battery module per the procedure described in the table above.**
- **Components of the main unit are powered by the power module. In the event that a component malfunctions, check if the operating voltage is correct.**

### 6.6.7 Recorder Failures

Symptoms	Possible Cause	Corrective Action
No printout	Recorder module disabled	1. Check if the recorder status indicator lights. 2. If yes, enable the module in the [ <b>Factory Maintenance</b> ] menu. Otherwise, check for other possible causes.
	Paper reversed	Re-install the paper roll.
	Cable defective	1. Check that the cable between the recorder and main board is correctly connected.
	Recorder defective	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. Check the thermal print head and the paper roller for foreign matter. 2. Clean the thermal print head with an appropriate clean solution.
	Recorder defective	Replace the recorder.

### 6.6.8 Output Interface Failure

Symptoms	Possible Cause	Corrective Action
No analog out signal	Cable defective	1. Check that the cable between the multi-parameter board and power management board is correctly connected. 2. Check that the cable between power management board and interface board is correctly connected.
	Multi-parameter board failure	Replace the multi-parameter board
	Power management board defective	Replace the power management board.
	The connector board failed.	Replace the connector board .
Unable to use the USB devices USB drive data transfer failure	Cable defective	1. Check that the cable between the power management board and main board is correctly connected. 2. Check that the cable between power management board and interface board is correctly connected.
	The connector board failed.	Replace the connector board.
	Power management board defective	Replace the power management board.
	The main board failed.	Replace the main board.
	Improper setup	Select [ <b>Main Menu</b> ]→[ <b>Maintenance &gt;&gt;</b> ]→[ <b>User Maintenance &gt;&gt;</b> ]→enter the required password→[ <b>Others &gt;&gt;</b> ] and set [ <b>Data Transfer Method</b> ] to [ <b>USB Device</b> ].

### 6.6.9 Data Storage Failure

Symptoms	Possible Cause	Corrective Action
Fails to review archived patient data	Abnormal patient admitting	Admit the patient properly.
	SD card full; unavailable for more patient data	Delete garbage patient data, remove the related alarm, and readmit the patient.
	The main board failed.	Replace the main board.
SD card failure	SD card not formatted	Format the SD card.
	SD card failure	Replace the SD card.
	SD card is locked	Unlock the SD card.
	Main board defective	Replace the main board.

### 6.6.10 Wired Network Related Problems

Symptoms	Possible Cause	Corrective Action
Unable to connect the wired network	Incorrect LAN cable connection	Check LAN cable connection. LAN cable shall not be longer than 50 m.
	Incorrect IP address configuration	Check for IP address conflict. If yes, reconfigure the IP address.
	Cable defective	1. Check that the cable between the power management board and main board is correctly connected. 2. Check that the cable between power management board and interface board is correctly connected.
	The connector board failed.	Replace the connector board.
	Power management board defective	Replace the power management board.
	The main board failed.	Replace the main board.
The monitor is frequently off line or disconnects from the network.	Incorrect LAN cable connection	Check LAN cable connection. LAN cable shall not be longer than 50 m.
The patient monitor is connected to a LAN but cannot view other patients under the View Others mode	Incorrect LAN cable connection	Check LAN cable connection. LAN cable shall not be longer than 50 m.
	Excessive requests for viewing the patient monitor at the same time	A patient monitor can only be viewed by 4 other patient monitors at the same time under the View Others mode. The excessive view requests system will be ignored.
	Incorrect IP address configuration	Check for IP address conflict. If yes, reconfigure the IP address.

### 6.6.11 Wi-Fi Related Problems

Symptoms	Possible Cause	Corrective Action
The monitor is frequently off line or disconnects from the Wi-Fi network.	The Wi-Fi signal is unstable in the operating area.	Check the signal quality of the hospital Wi-Fi network.
	The monitor's Wi-Fi antenna is detached from or not properly connected with the Wi-Fi module.	Disassemble the monitor and fix the Wi-Fi antenna.
	Wi-Fi antenna defective	Replace the Wi-Fi antenna.
	Wi-Fi module defective	Replace the Wi-Fi module.
Unable to connect the Wi-Fi network.	Incorrect IP address configuration	Check for IP address conflict. If yes, reconfigure the IP address.
	The Wi-Fi signal is unstable in the operating area.	Check the signal quality of the hospital Wi-Fi network.
	The monitor's Wi-Fi antenna is detached from or not connected with the Wi-Fi module.	Fix the Wi-Fi antenna.
	Wi-Fi antenna defective	Replace the Wi-Fi antenna.
	Wi-Fi module defective	Replace the Wi-Fi module.
	Main board defective	Replace the main board.

### 6.6.12 Module Failures

Symptoms	Possible Cause	Corrective Action
Failed to connect the external parameter modules	Module defective	1. Check that the cable between the external converter board inside the module and the converter board is correctly connected, 2. Replace the converter board.
	Main unit defective	1. Check that the cable between the main board and power management board is correctly connected. 2. Replace the power management board. 3. Replace the main board.
Module can be loaded, but "XX communication stopped" is reported or some parameters cannot be used	Cable defective inside the module	Check the cables connecting the converter board and corresponding parameter module.
	Parameter module defective	Replace the corresponding module.
	Converter board defective inside the module	Replace corresponding converter board.

### 6.6.13 Software Upgrade Problems

Symptoms	Possible Cause	Corrective Action
Boot file upgrade fails	Power failure or unintended power off during boot file upgrade	Replace the main board.
Program upgrade fails	Incorrect network connection	1. Check the network connector on the patient monitor. 2. Make sure that the hub or switch runs normally. Check that net twines are of the right type and have been connected correctly.
	Wrong upgrade package has been downloaded	Select package according to system requirement. Upgrade package shall be .pkg files.
	Incorrect IP address configuration	Configure a fixed IP address for the patient monitor. We recommend not to upgrade a program when the patient monitor is connected to a network with multiple PCs.
Battery abnormal after upgrading the power management program	Fails to power cycle the patient monitor after upgrading the power management program	Upgrade the power management software again and then power cycle the patient monitor.

### 6.6.14 Technical Alarm Messages

Refer to the Operator's Manual.

# 7 Disassembly and Repair

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## 7.1 Tools Required

To disassemble and replace the parts and components, the following tools may be required:

- Philips screwdrivers
- Tweezers
- Sharp nose pliers
- Clamp

## 7.2 Preparations for Disassembly

Before disassembling the equipment, finish the following preparations:

- Stop patient monitoring, turn off the equipment, and disconnect all the accessories and peripheral devices.
- Disconnect the AC power source and remove the battery.



### WARNING

- **Before disassembling the equipment, be sure to eliminate the static charges first. When disassembling the parts labeled with static-sensitive symbols, make sure you are wearing electrostatic discharge protection such as antistatic wristband or gloves to avoid damaging the equipment.**
  - **Properly connect and route the cables and wires when reassembling the equipment to avoid short circuit.**
  - **Select appropriate screws to assemble the equipment. If unfit screws are tightened by force, 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 disassembly the equipment. Otherwise, the equipment may be damaged permanently.**
  - **Be sure to disconnect all the cables before disassembling any parts. Be sure not to damage any cables or connectors.**
  - **Be sure to place removed screws and disassembled parts properly, preventing them from being lost or contaminated.**
  - **Place the screws and parts from the same module together to facilitate reassembling.**
  - **To reassemble the equipment, first assemble the assemblies, and then the main unit. Carefully route the cables.**
  - **Make sure that the waterproof material is properly applied during reassembling.**
-

## 7.3 Disassembling the Main Unit

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### NOTE

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- The recorder can be disassembled separately.
  - To disassemble the equipment, place the equipment on a work surface free from foreign material, avoiding damaging the antiglare screen, touchscreen and the knob. Be careful not to break the two cotters on the front ends of rear housing.
  - All the operations should be performed by qualified service personnel only. Make sure to put on the insulating gloves during service operations.
  - Operations relating to optional parts may not apply to your equipment.
- 

### 7.3.1 Separating the Front and Rear Half of the Monitor

1. Lay the monitor on a flat platform with the knob overhanging as shown below. Then unscrew the two M3×10 screws on the rear panel and the two M3×6 screws on the bottom of the patient monitor.



2. Stand the patient monitor and separate the front housing assembly and rear housing assembly with caution. Disconnect the cable between the main board and keypad board and then take off the front panel.



Cable between the main board and keypad board

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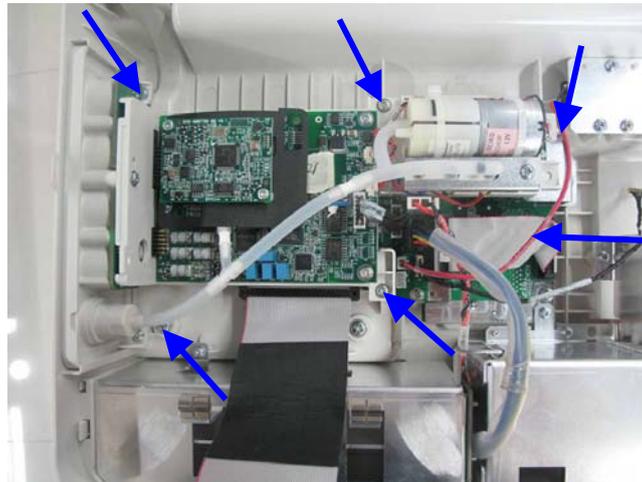
### NOTE

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- When reassembling the equipment, be sure to check if the front housing waterproof strip is correctly placed.
-

### 7.3.2 Disassembling Parameter Modules

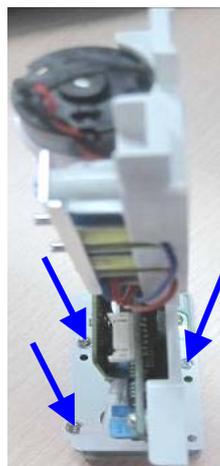
Lay the patient monitor on a flat platform and unscrew the five M3×5 screws as shown below. Disconnect the cable between the power management board and multi-parameter board, and then take out the parameter module.



Cable between the power management board and multi-parameter board

### 7.3.3 Removing the Parameter Connector Panel Assembly

Unscrew the three M3×6 screws as shown below and separate the parameter connector panel assembly and parameter board assembly.

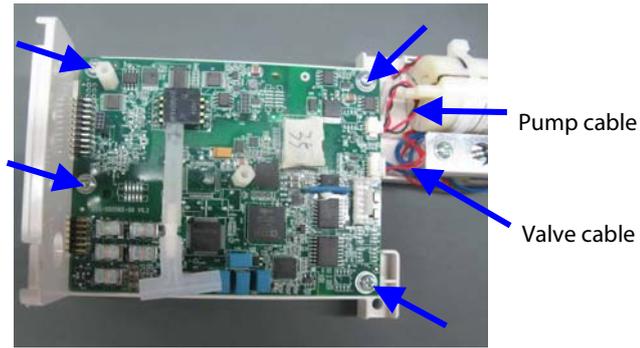


### 7.3.4 Removing the SpO<sub>2</sub> Board and Parameter Board

1. Unscrew the two M3×4 screws and take out the SpO<sub>2</sub> board and insulation plate.

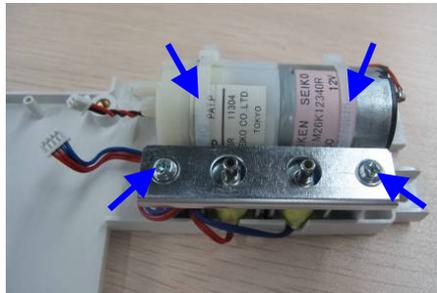


2. Unscrew the four M3×6 screws, disconnect the pump cable and valve cable, and then take out the SpO<sub>2</sub> board.



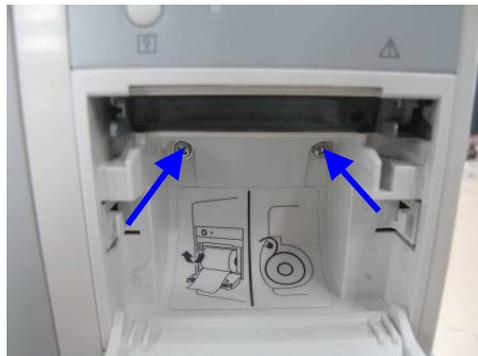
### 7.3.5 Removing Pump and Valve

Unscrew the two M3×6 screws and take out the valve. Then cut the two fixing strips to take out the pump.



### 7.3.6 Removing the Recorder (Optional)

Unscrew the four M3×6 screws and disconnect the recorder cable to remove the recorder.



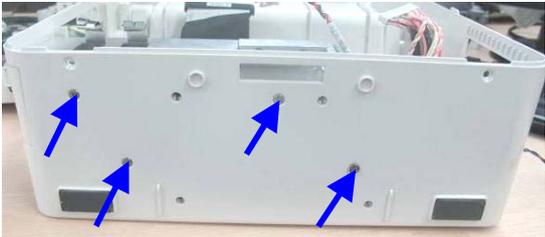
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#### NOTE

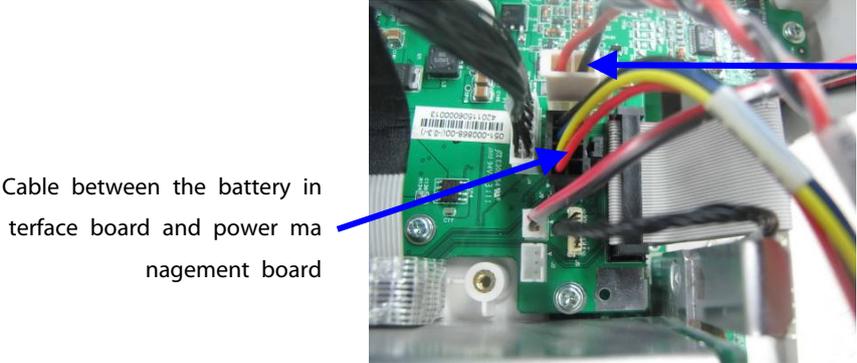
- The recorder can be disassembled separately.
-

### 7.3.7 Removing Battery Interface Board and Power Board (iPM 5/iPM 6/iPM 8/iPM 10)

1. Unscrew the three M3×6 screws inside the patient monitor and the four M3×6 screws on the bottom as shown below:



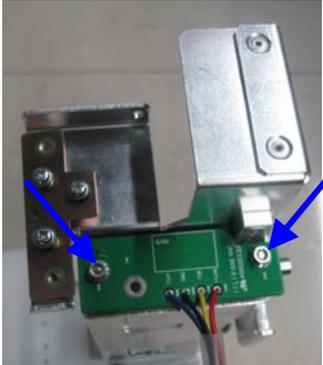
2. Disconnect the cable between battery interface board and power management board, and the cable between the power management board and AC/DC power board. Then take out the battery compartment assembly.



Cable between the battery interface board and power management board

Cable between the power management board and AC/DC power board

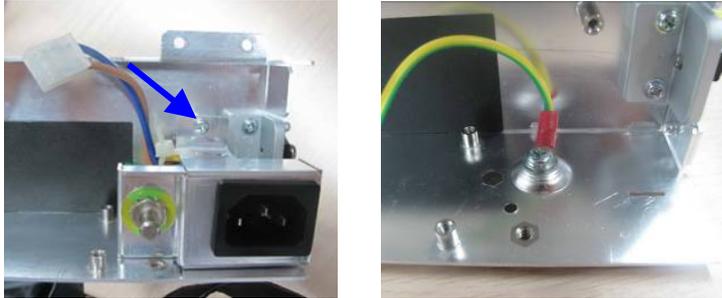
3. Unscrew the two M3 nuts to take out the battery interface board.



4. Unscrew the three M3×6 screws to remove the AC/DC power board.



5. Unscrew the M3×6 screw and the flat head screw fixing the AC input receptacle assembly, then loose the screw that fixes the grounding cable to take out the AC input receptacle assembly.

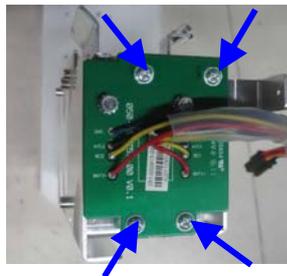


### 7.3.8 Removing the Battery Interface Board and Power Board (iPM 7/iPM 12)

1. Unscrew the two M3×6 screw inside the patient monitor and then the two M3×6 screws on the bottom. Then disconnect the cable between the battery interface board and power management board to remove the battery compartment assembly.



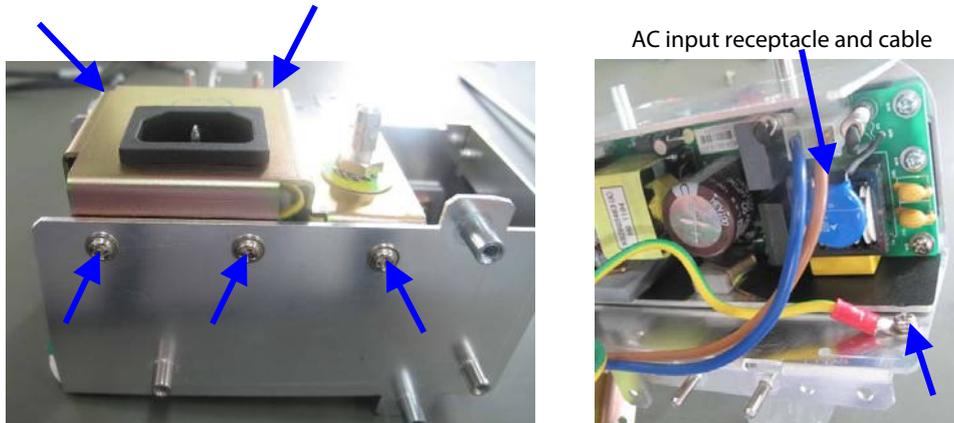
2. Unscrew the four M3×6 screws to take out the battery interface board assembly.



3. Unscrew the two M3×6 screws inside the patient monitor and then the two M3×6 screws on the bottom. Then disconnect the cable between the battery interface board and the power management board to remove the power board assembly.



4. Unscrew the five M3×6 screws that fix the AC input receptacle assembly and then the screw that fixes the grounding cable. Unplug the AC input receptacle and cable from the board to remove the AC input receptacle assembly.



5. Unscrew the three M3×6 screws to remove the AC/DC power board.



### 7.3.9 Removing the Power Management Board

Unscrew the seven M3×6 screws inside the patient monitor, disconnect all the cables, and then take out the power management board.



### 7.3.10 Removing the Interface Board (iPM 5/iPM 8)

Unscrew the three M3×6 screws inside the patient monitor and take out the interface board.



### 7.3.11 Removing the Interface Board (iPM 6/iPM 7/iPM 10/iPM 12)

Unscrew the three M3×6 screws inside the patient monitor and take out the interface board.



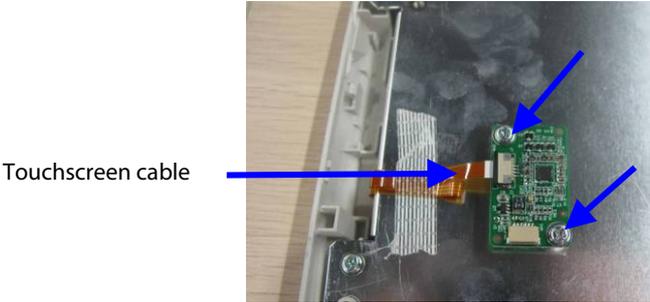
## 7.4 Disassembling the Front Housing Assembly

### NOTE

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- To disassemble the equipment, place the equipment on a work surface free from foreign material, avoiding damaging the antiglare screen, touchscreen and the knob.
  - Remember to install the screen support pad properly during reassembly.
  - Operations relating to optional parts may not apply to your equipment.
  - Position the touchscreen properly with the flexible cable facing down.
-

### 7.4.1 Removing Touchscreen Control Board (Optional)

Loose and unscrew the two M3x6 screws as shown below. Disconnect the touchscreen cable and cable for touchscreen control board, and then remove the touchscreen control board.

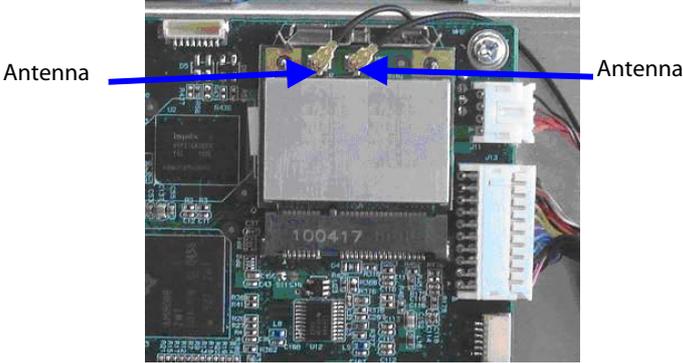


### 7.4.2 Removing the Wi-Fi Module (Optional)

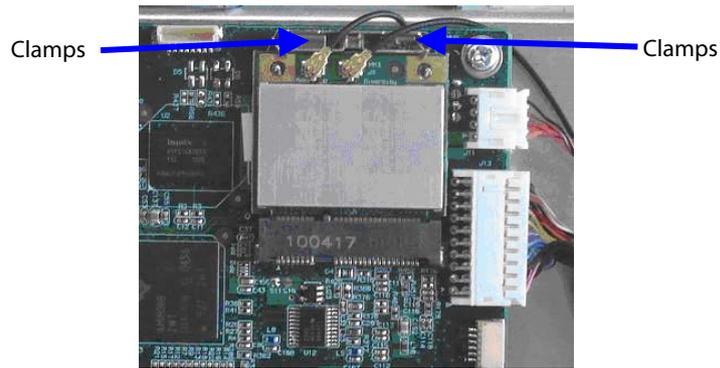
1. Take out the two antennas on the front panel from the slots as shown below:



2. Remove the antennas from the Wi-Fi module PCBA.



3. Push the clamps aside to remove the Wi-Fi module.



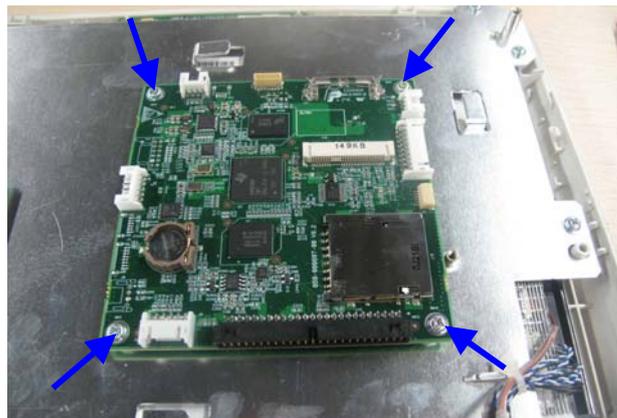
### 7.4.3 Removing SD Card (Optional)

Unscrew the M3x6 screw, and push the SD card as indicated below to take out the SD card.



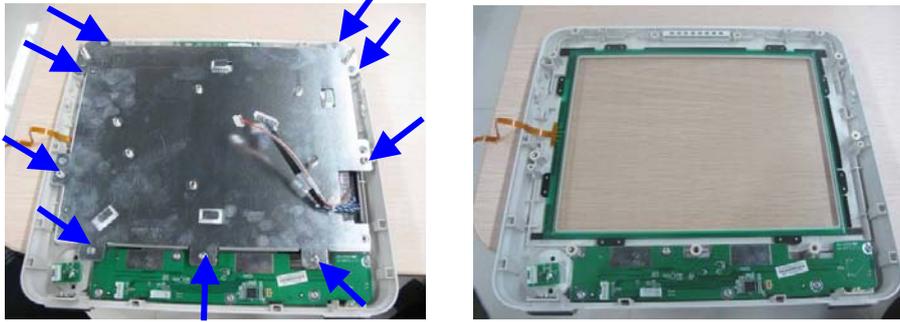
### 7.4.4 Removing the Main Control Board

Disconnect the alarm lamp cable, cable for display backlight, display cable, and the cable between the main board and keypad board respectively. Unscrew the four M3x8 screws and take out the main board, as shown below:



### 7.4.5 Removing the Touchscreen (Optional)

Unscrew the nine M3×6 screws as indicated below. Take out the touchscreen assembly and then the touchscreen.



### 7.4.6 Disassembling the Screen

Unscrew the four M3×6 screws indicated below to remove the screen.



### 7.4.7 Removing the Keypad

Unplug the encoder cable and unscrew the five PT3×8 screws indicated below. Take out the keypad.



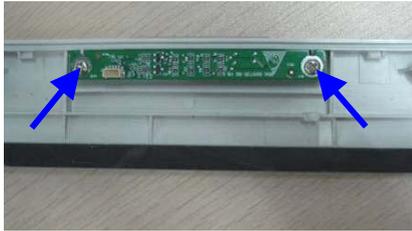
### 7.4.8 Removing the Encoder

Poke the encoder knob out from the slot and loose the nut with a sharp nose plier. Take out the encoder.



### 7.4.9 Removing the Alarm Lamp Board

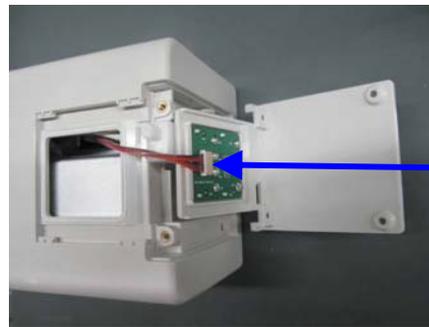
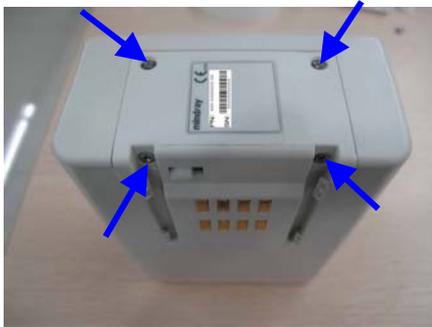
Unscrew the two M3×6 screws indicated below and take out the alarm lamp board.



## 7.5 Disassembling Modules

### 7.5.1 Removing the External Converter Board

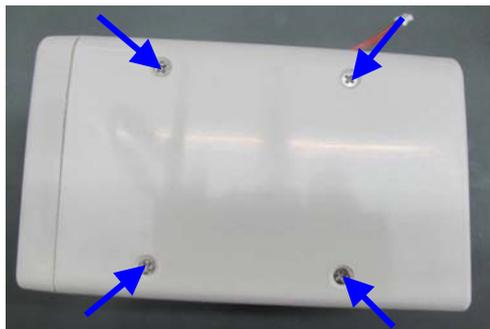
Unscrew the four M3×8 screws and disconnect the cable between the converter board and copper board to remove the converter board.



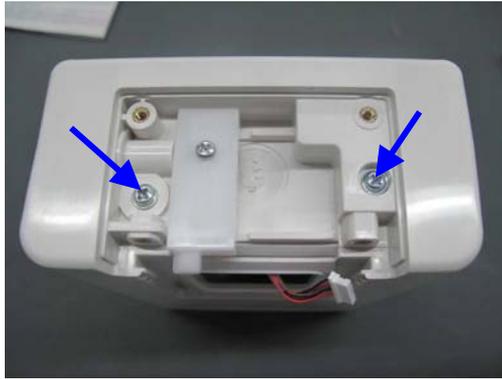
Cable between the  
converter board and  
copper board

### 7.5.2 Separating the Front and Rear Housing of Modules

1. For AG modules, unscrew the four M3×8 screws on the bottom before separating the front and rear housing.



- For other modules, unscrew the two M3×6 screws on the back to separate the front and rear housing.



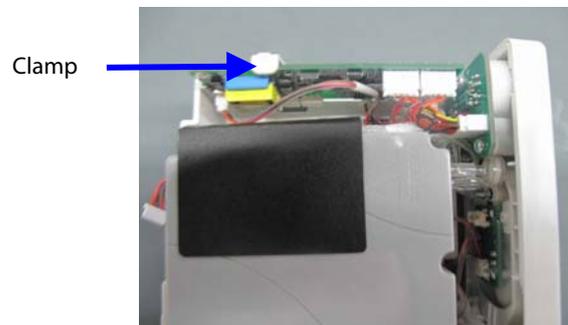
### 7.5.3 Removing the External Module Interface Board

Unscrew the two M3×6 screws, disconnect all the cables from the board, and then remove the module interface board.



### 7.5.4 Removing M03B Module

Disconnect all the cables from the M03B module and push the clamp on the bracket to remove the M03B module.



### 7.5.5 Removing Sidestream CO<sub>2</sub> Module

1. Unscrew the 3 screws that fix the bracket and connector panel. Disconnect all the cables and tubes that connect the bracket and connector panel. Then separate the connector panel and bracket.



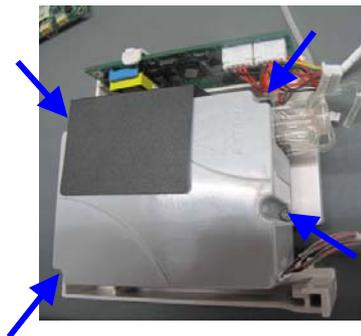
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#### NOTE

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- **Manage the tubes properly during reassembly and make sure the tubes shaping smooth.**
- 

2. Unscrew the four screws that fix the M02C module, and then take out the M02C module.

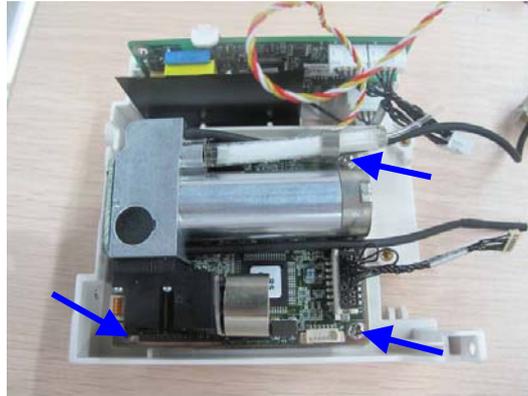


### 7.5.6 Removing Microstream CO<sub>2</sub> Module

1. Unscrew the 3 screws that fix the bracket and connector panel. Disconnect all the cables and tubes that connect the bracket and connector panel. Then separate the connector panel and bracket.

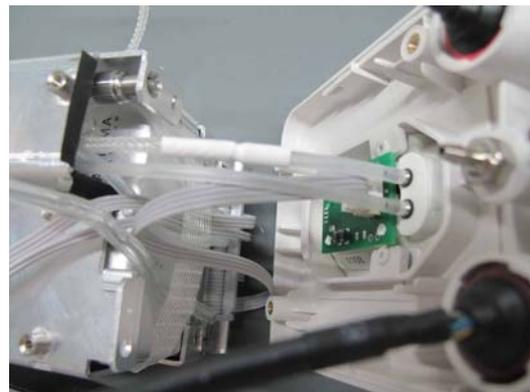


2. Unscrew the three M3×8 screws that fix the microstream CO<sub>2</sub> module, and then remove the microstream CO<sub>2</sub> module.

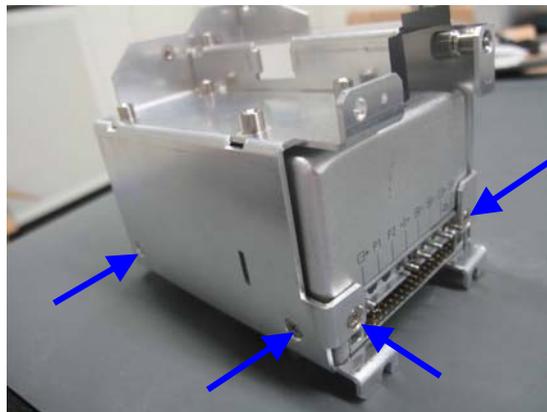


### 7.5.7 Removing AG Module

1. Unscrew the three M3×6 screws and the captive screw that fix the AG module bracket and connector panel. Then disconnect all the cables and tubes connecting the connector panel and the AG module to separate the connector panel and bracket.



2. Unscrew the six M3×6 screws that fix the AG module and remove AG module.



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#### NOTE

- Manage the tubes properly during reassembly and make sure the tubes shaping smooth.
-

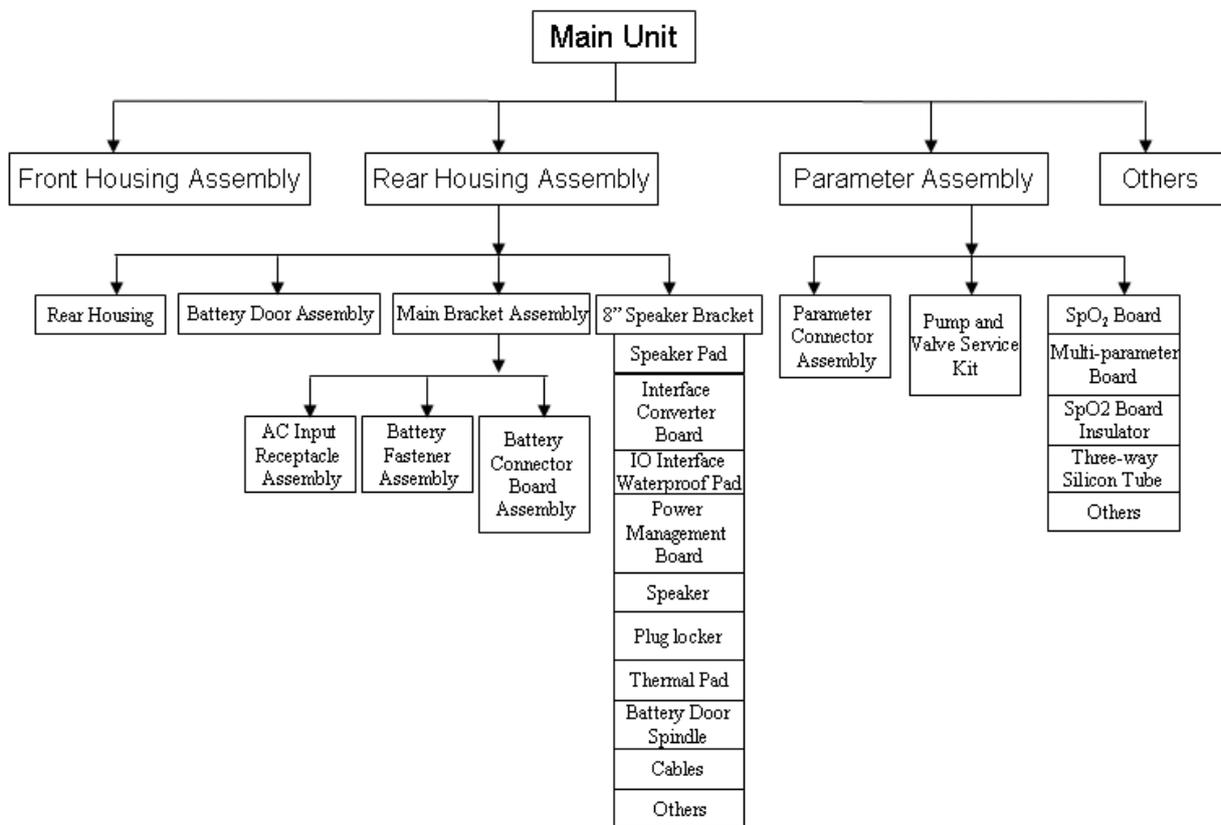
**FOR YOUR NOTES**

# 8 Parts

## 8.1 Introduction

This section contains the exploded views and parts lists of the main unit. It helps the engineer to identify the parts during disassembling the patient monitor and replacing the parts. This manual is based on the maximum configuration. Your equipment may not have same parts and the quantity of the screws or stacking sleeves etc. may be different with those included in the parts lists.

Hardware architecture of the main unit is shown below:



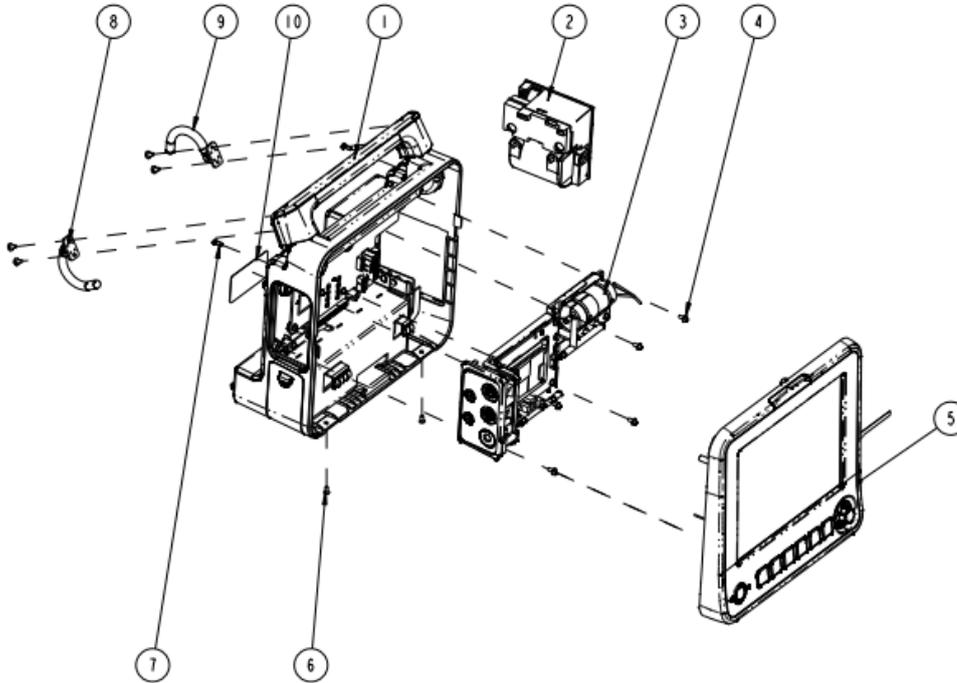
### NOTE

- The part number listed in the Parts List is only for checking the FRU part number which is also included in the Parts List. Please provide the FRU parts number if you want to purchase the spare parts.

## 8.2 iPM 8/iPM 5

### 8.2.1 Main Unit

#### 8.2.1.1 Exploded View

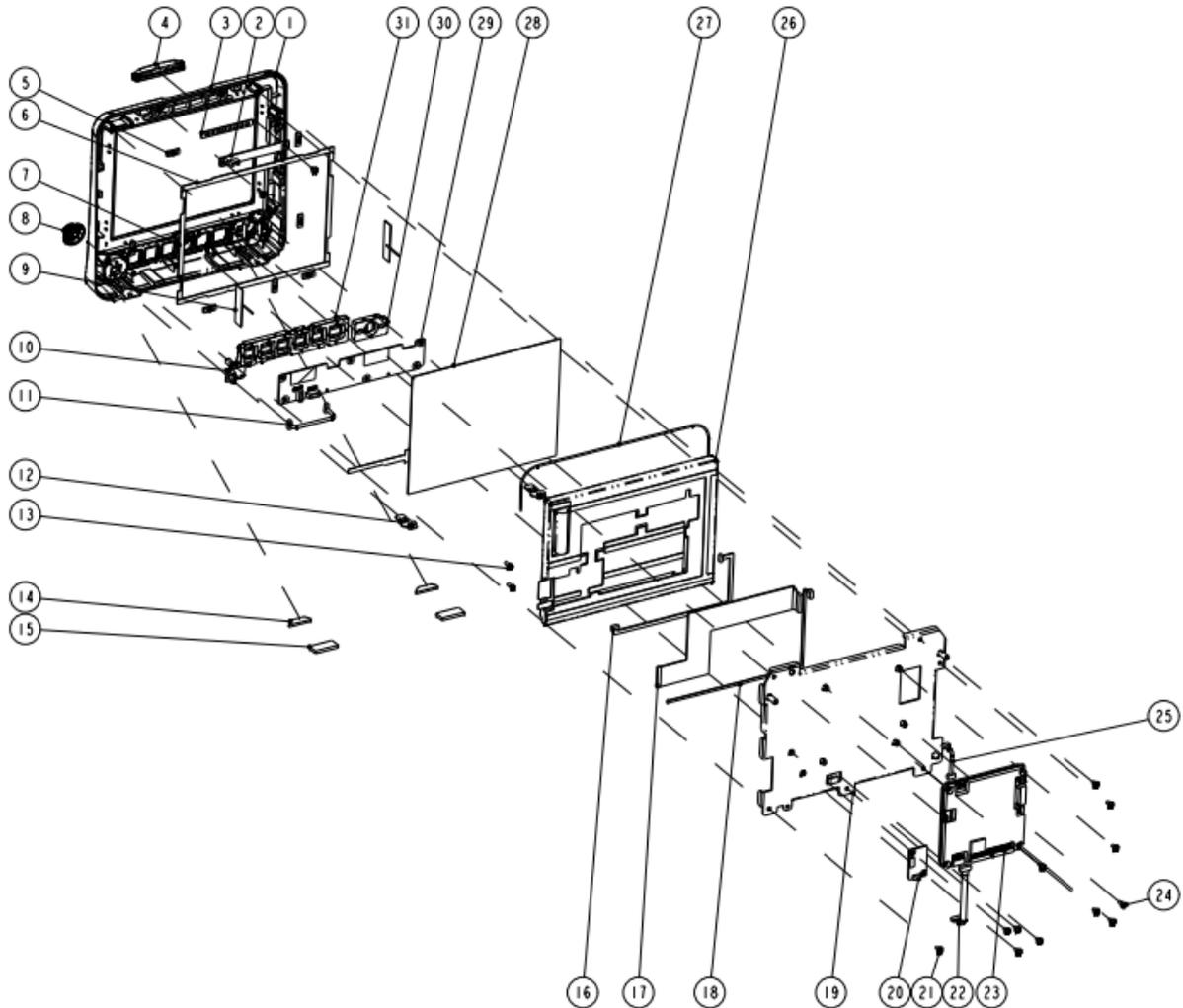


#### 8.2.1.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	/	Rear housing assembly (iPM 8)	/	Only for iPM 8
	/	Rear housing assembly (iPM5)		Only for iPM 5
2	115-001290-00	TR6F recorder (Datascope)	115-001290-00	/
	043-000184-00	Recorder door (MR-DS193)	043-000184-00	For monitors without recorder
3	/	Multi-parameter assembly (3-/5-lead, Nellcor SpO <sub>2</sub> )	/	/
4	/	Screw, Pan head with washer, Phillips M3×6	/	/
5	/	Front housing assembly (iPM 8, touchscreen)	/	Only for iPM 8
	/	Front housing assembly (iPM 5, touchscreen)	/	Only for iPM 5
6	/	Screw, pan head, Phillips, M3×6	/	/
7	/	Screw, pan head Phillips, M3×8	/	/
8	115-011534-00	Hook assembly (iPM 8, right)	115-010924-00	/
9	115-011533-00	Hook assembly (iPM 8, left)		/
10	/	Main unit label	/	/

## 8.2.2 Front Housing Subassembly (Touchscreen)

### 8.2.2.1 Exploded View



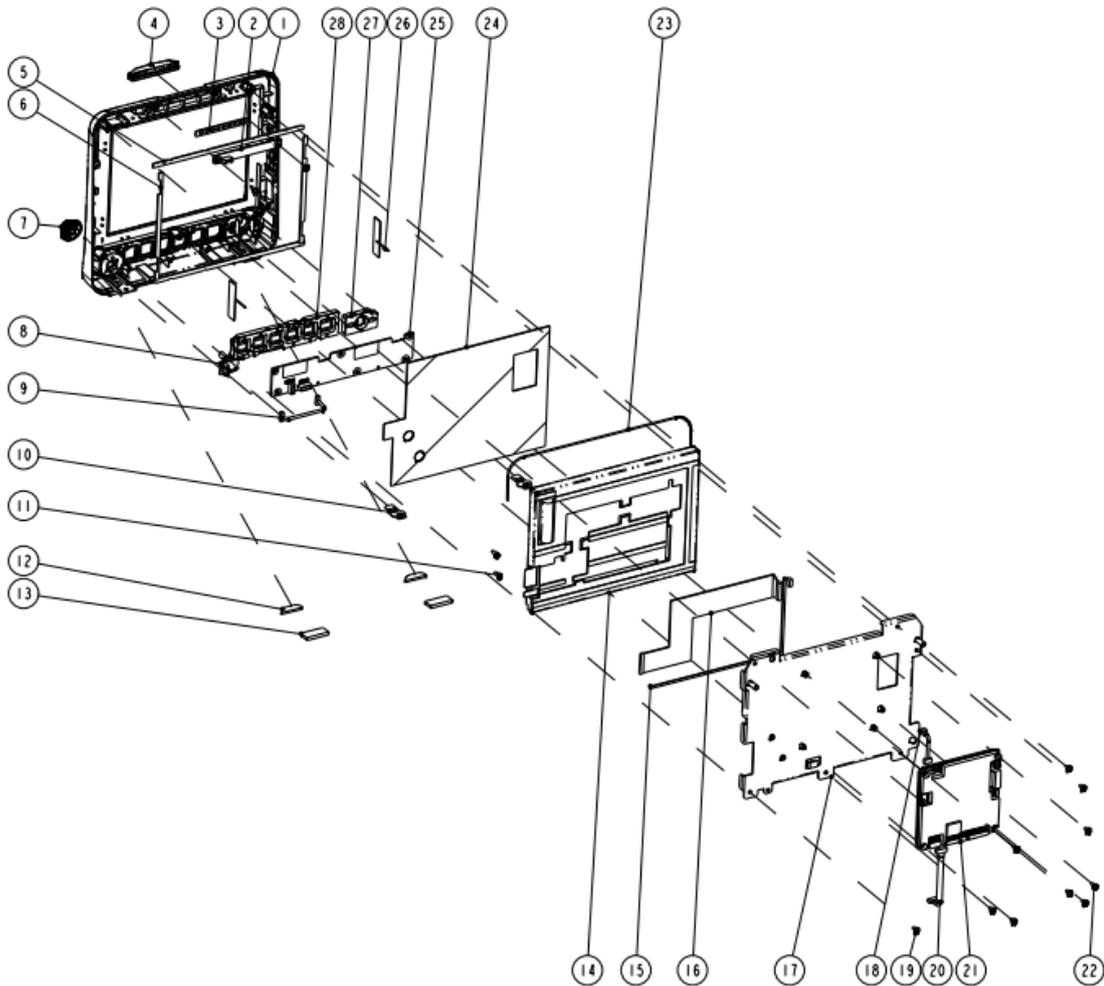
### 8.2.2.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	043-002066-02	8" front panel (iPM 8)	801-9261-00005-01	Only for iPM 8; The color of both the front panel and rear panel has been changed. Color difference may result if either is replaced separately.
3	/	Alarm lamp gasket		
4	/	Alarm lamp shade		
5	/	Touchscreen position pad (8")		
6	/	Long gasket, iPM 8, touchscreen		
7	/	Short gasket, iPM 8, touchscreen		
12	/	Locking plate		
14	/	Semicircle foot pad		
15	/	Square foot pad		
27	/	Tube, white, 1.6 mm OD × 0.8 mm	115-023577-00	Only for iPM 5
1	043-002067-02	8" front panel (iPM 5)		
3	/	Alarm lamp gasket		

SN	PN	Description	FRU part number	Remarks
4	/	Alarm lamp shade		
5	/	Touchscreen position pad (8")		
6	/	Long gasket, iPM 8, touchscreen		
7	/	Short gasket, iPM 8, touchscreen		
12	/	Locking plate		
14	/	Semicircle foot pad		
15	/	Square foot pad		
27	/	Tube, white, 1.6 mm OD × 0.8 mm		
2	051-000879-00	Alarm lamp board PCBA	051-000879-00	/
8	043-004502-00	Knob for iPM 5	043-004502-00	Only for iPM 5
	043-001896-01	Knob for iPM 8	043-001896-01	Only for iPM 8
9	/	iPM Wi-Fi module kit	115-010801-00	The two parts below are included in this kit
	051-000811-00	Cyberlink module PCBA	051-000811-00	
	0012-00-1730-01	Antenna cable	0012-00-1730-01	
10	0010-30-43089	Encoder board	0010-30-43089	/
11	9200-21-10460	Encoder cable	9200-21-10460	/
13	/	Screw, self-tapping, PT3×8	/	/
16	009-001981-00	Cable between the touchscreen control board and the main board	009-001981-00	/
17	009-001983-00	Signal cable for 8" screen	009-001983-00	/
18	009-001986-00	Cable between the main board and backlight board (8")	009-001986-00	/
19	/	Bracket for 8" screen	/	/
20	051-000881-00	Touchscreen control board PCBA	051-000881-00	/
21	/	Screw, Pan head with washer, Phillips M3×6	/	/
22	009-001982-00	Cable between main board and keypad board	009-001982-00	/
23	051-000829-00	Main board PCBA	801-9261-00009-00	/
24	/	Inner hexagon screw, M3×6	/	/
25	009-001980-00	Cable between mother board and alarm lamp	009-001980-00	/
26	021-000060-00	AU LCD (iPM 8)	021-000060-00	/
28	021-000058-00	Touchscreen, resistive-type, 8.4" 4-line	021-000058-00	/
29	051-000887-00	Keypad board PCBA, 8.4 inch	051-000887-00	/
30	049-000366-00	Power button	049-000366-00	/
31	049-000364-01	8" button (English)	049-000364-01	/
	049-000390-01	8" button (Chinese)	049-000390-01	/
32	023-000755-00	Industrial SD card (SLC), 1G	023-000755-00	/

## 8.2.3 Front Housing Assembly (Nakescreen)

### 8.2.3.1 Exploded View



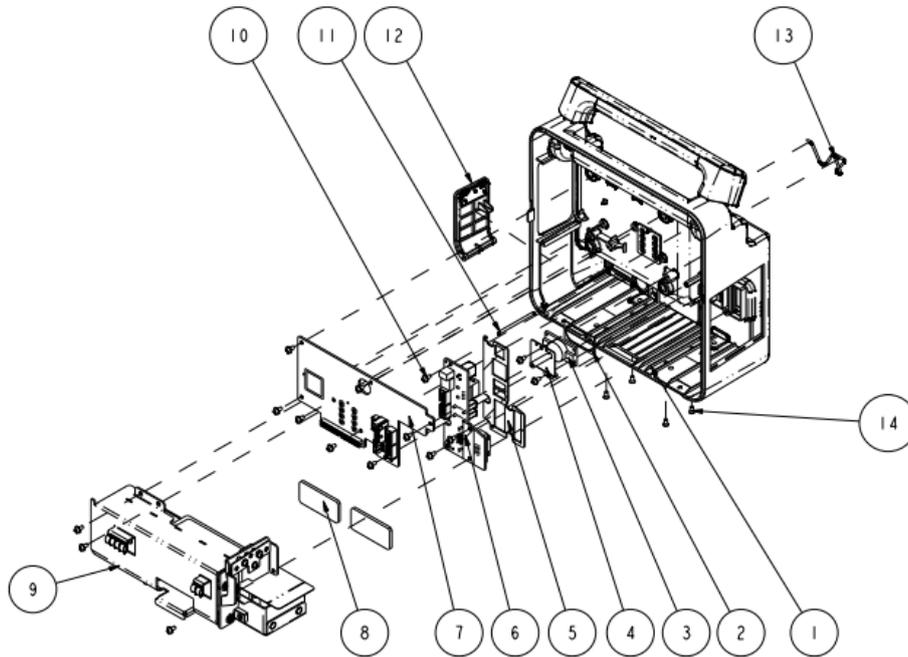
### 8.2.3.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	043-002066-02	8" front panel (iPM 8)	801-9261-00006-01	Only for iPM 8; The color of both the front panel and rear panel has been changed. Color difference may result if either is replaced separately.
3	/	Alarm lamp gasket		
4	/	Alarm lamp shade		
5	/	Long gasket, iPM 8, nakescreen		
6	/	Short gasket, iPM 8, nakescreen		
10	/	Locking plate		
12	/	Semicircle foot pad		
13	/	Square foot pad		
23	/	Tube, white, 1.6 mm OD x 0.8 mm		
1	043-002067-02	8" front panel (iPM 5)	115-023578-00	Only for iPM 5
3	/	Alarm lamp gasket		
4	/	Alarm lamp shade		

SN	PN	Description	FRU part number	Remarks
5	/	Long gasket, iPM 8, nakescreen		
6	/	Short gasket, iPM 8, nakescreen		
10	/	Locking plate		
12	/	Semicircle foot pad		
13	/	Square foot pad		
23	/	Tube, white, 1.6 mm OD × 0.8 mm		
2	051-000879-00	Alarm lamp board PCBA	051-000879-00	/
7	043-004502-00	Knob for iPM 5	043-004502-00	Only for iPM 5
	043-001896-01	Knob for iPM 8	043-001896-01	Only for iPM 8
8	0010-30-43089	Encoder board	0010-30-43089	/
9	9200-21-10460	Encoder cable	9200-21-10460	/
11	/	Screw, self-tapping, PT3×8	/	/
14	021-000060-00	8" AU LCD	021-000060-00	/
15	009-001986-00	Cable between the main board and backlight board (8")	009-001986-00	/
16	009-001983-00	Signal cable for 8" screen	009-001983-00	/
17	/	Bracket for 8" screen	/	/
18	009-001980-00	Cable between main board and alarm lamp	009-001980-00	/
19	/	Screw, Pan head with washer, Phillips M3×6	/	/
20	009-001982-00	Cable between main board and keypad board	009-001982-00	/
21	051-000829-00	Main board PCBA	801-9261-00009-00	/
22	/	Inner hexagon screw, M3×6	/	/
24	/	Plate	/	/
25	051-000887-00	Keypad board PCBA, 8.4 inch	051-000887-00	/
26	/	iPM 8/10 Wi-Fi module kit	115-010801-00	The two parts below are included in this kit
	051-000811-00	Cyberlink module PCBA	051-000811-00	
	0012-00-1730-01	Antenna cable	0012-00-1730-01	
27	049-000366-00	Power button	049-000366-00	/
28	049-000364-01	8" button (English)	049-000364-01	/
	049-000390-01	8" button (Chinese)	049-000390-01	/
29	023-000755-00	Industrial SD card (SLC), 1G	023-000755-00	/

## 8.2.4 Rear Housing Assembly

### 8.2.4.1 Exploded View



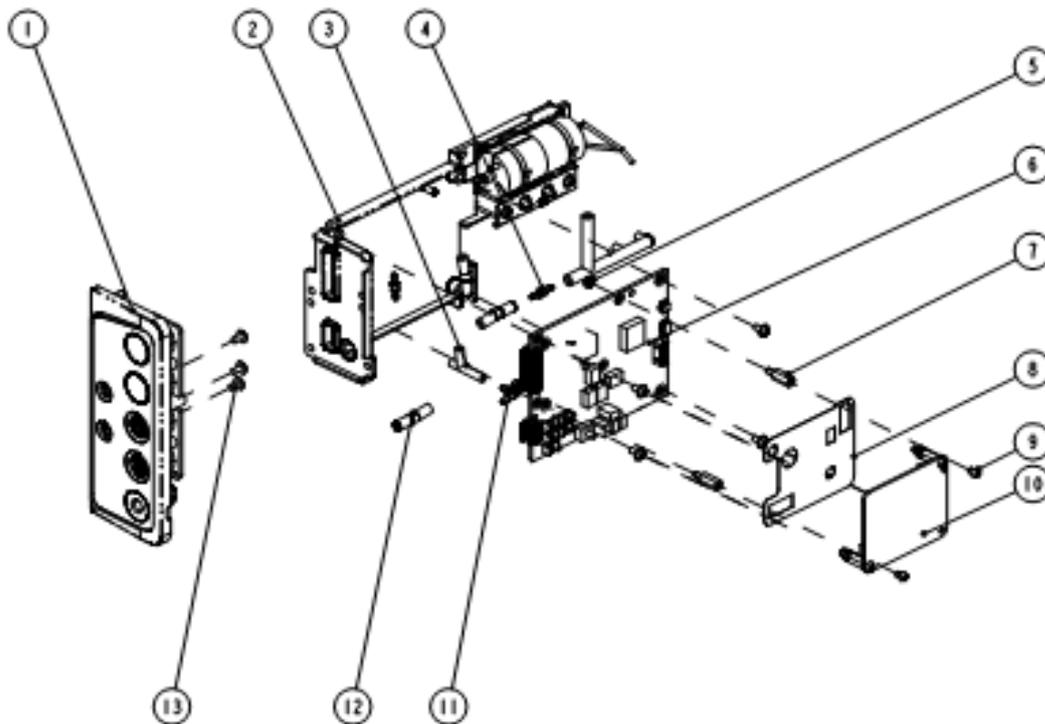
### 8.2.4.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	/	Rear housing assembly (iPM 8)	115-010811-01	Only for iPM 8; The color of both the front panel and rear panel has been changed. Color difference may result if either is replaced separately.
	/	Rear housing assembly (iPM 5)	115-023569-00	Only for iPM 5
2	/	Speaker pad	801-9261-00010-00	/
3	/	Speaker, 2W, 4ohm, 500 Hz		/
4	/	Speaker bracket (iPM 8)	/	/
6	051-001010-00	Interface converter kit (iPM 8, full config)	801-9261-00013-00	3 different configuration
	051-001009-00	Interface converter kit (iPM 8, USB, no DC_IN)	801-9261-00014-00	
	051-000885-00	Interface converter kit (iPM 8, no USB, no DC_IN)	801-9261-00015-00	
7	051-001007-00	Power management and interface board (full config, USB)	051-001007-00	3 different configuration
	051-001008-00	Power management and interface board (full config, USB, DC_IN)	051-001009-00	
	051-000868-00	Power management and interface board	051-000868-00	
8	/	Thermal gel	/	/
9	/	Main bracket assembly (iPM 8)	/	/

SN	PN	Description	FRU part number	Remarks
10	/	Screw, Pan head with washer, Phillips M3×6	/	/
11	/	Door spindle (iPM 8)	/	/
12	/	Battery door assembly (iPM 8/iPM 10)	115-010919-00	/
13	9211-20-87369	AC Inlet Hook	9211-20-87369	/
14	/	Screw, pan head, Phillips, M3×6	/	/
15	9211-20-87225	Cable between the interface board and main board	9211-20-87225	/
16	009-002235-00	Cable between power management board and I/O interface board	009-002235-00	/
17	009-001989-00	Cable between the power management board and parameter board	009-001989-00	/
18	009-001969-00	Recorder cables	009-001969-00	/
19	/	Fixing strip	/	/
20	049-000355-01	USB plug	049-000355-01	/
21	049-000356-01	DC plug	049-000356-01	/

## 8.2.5 Multi-parameter Assembly

### 8.2.5.1 Exploded View

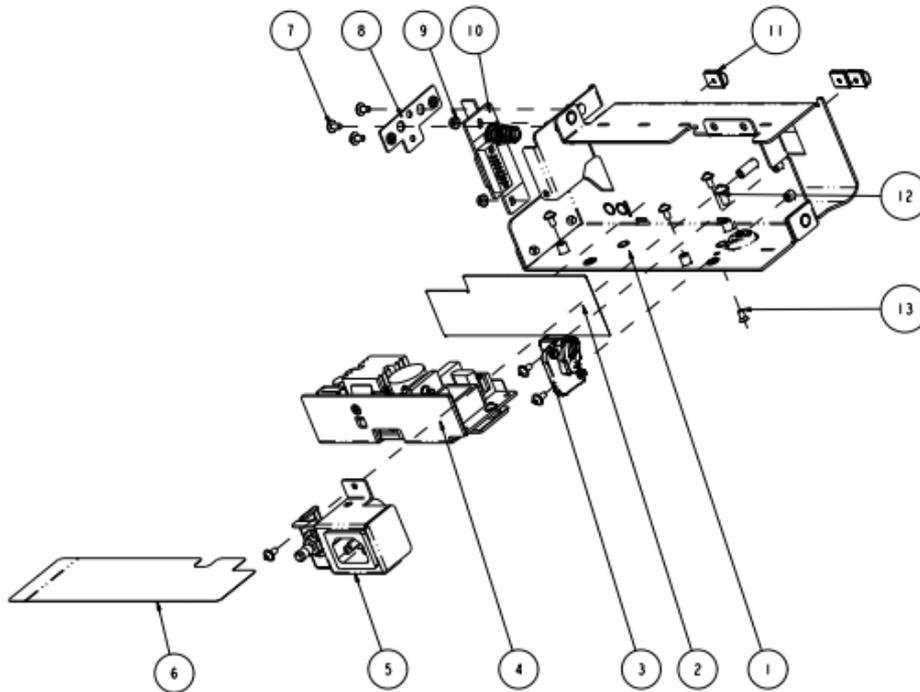


### 8.2.5.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	/	Parameter connector assembly (Mindray SpO <sub>2</sub> )	115-010793-00	iPM 5/6/8/ 10
	/	Parameter connector assembly (Nellcor SpO <sub>2</sub> )	115-010794-00	3 different
	/	Parameter connector assembly (Masimo SpO <sub>2</sub> )	115-010795-00	configuration
	/	Parameter connector assembly (iPM 12, Mindray SpO <sub>2</sub> )	115-010831-00	iPM 7/12 6 different configuration
	/	Parameter connector assembly (iPM 12, Nellcor SpO <sub>2</sub> )	115-010832-00	
	/	Parameter connector assembly (iPM 12, Masimo SpO <sub>2</sub> )	115-010833-00	
	/	Parameter connector assembly (iPM 12, Mindray SpO <sub>2</sub> , IBP)	115-010834-00	
	/	Parameter connector assembly (iPM 12, Nellcor SpO <sub>2</sub> , IBP)	115-010835-00	
	/	Parameter connector assembly (iPM 12, Masimo SpO <sub>2</sub> , IBP)	115-010836-00	
2	/	NIBP pump and valve kit	/	/
3	/	3-way silicone tube	/	/
4	/	Plastic connector	/	/
5	/	Hexagon plastic nut, M3×0.5P, PC	/	/
6	051-000951-00	iPM multi-parameter board PCBA (full config)	051-000951-00	3 kinds of parameter board
	051-001063-00	iPM multi-parameter board PCBA (5-Lead, complete)	051-001063-00	
	051-000952-00	iPM multi-parameter board PCBA (complete)	051-000952-00	
7	/	Plastic hexagon bolt	/	/
8	/	SpO <sub>2</sub> board insulator	/	/
9	/	Screw, pan head Phillips, M3×4	/	/
10	051-000943-00	9008 V2.0 SpO <sub>2</sub> board PCBA	051-000943-00	3 kinds of SpO <sub>2</sub> board
	0671-00-0102-01	Nellcor SpO <sub>2</sub> board (MDU)	0671-00-0102-01	
	040-001149-00	Masimo MS-2013 SpO <sub>2</sub> board (For Shenzhen Mindray only)	040-001149-00	
11	/	Connector	/	/
12	/	Silicon tube, 3/32" × 7/32" × 100 ft	/	/
13	/	Screw, Pan head with washer, Phillips M3×6	/	/

## 8.2.6 Battery Compartment Assembly

### 8.2.6.1 Exploded View

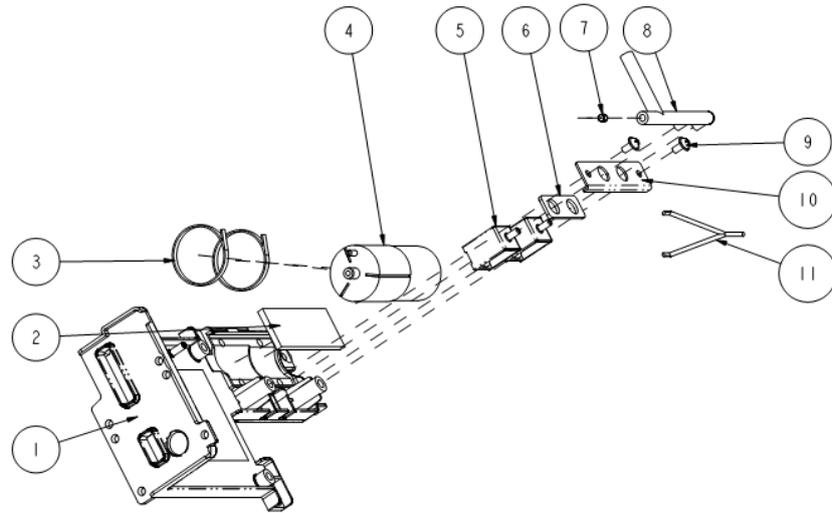


### 8.2.6.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	/	Main bracket (iPM 8)	/	/
2	/	Power bracket sheet	/	/
3	/	Battery fastener (iPM 8/iPM 10)	115-010921-00	/
4	051-001064-00	AC/DC power board	051-001064-00	/
5	/	AC input receptacle assembly (iPM 8/iPM 10)	115-010920-00	/
6	/	Power sheet (iPM 8)	/	/
7	/	Screw, Pan head with washer, Phillips M3×6	/	/
8	/	Recorder adjustment bracket	/	/
9	/	M3 nut with spring washer	/	/
10	/	Battery connector board (iPM 8/iPM 10)	115-010799-00	/
11	/	Spring, EMI	/	/
12	/	Screw, Pan head with washer, Phillips M4×8	/	/
13	/	Screw, pan head, Phillips, M3×6	/	/
14	009-001991-00	Cable between the power management board and AC/DC power board	009-001991-00	/

## 8.2.7 NIBP Pump and Valve Kit

### 8.2.7.1 Exploded View

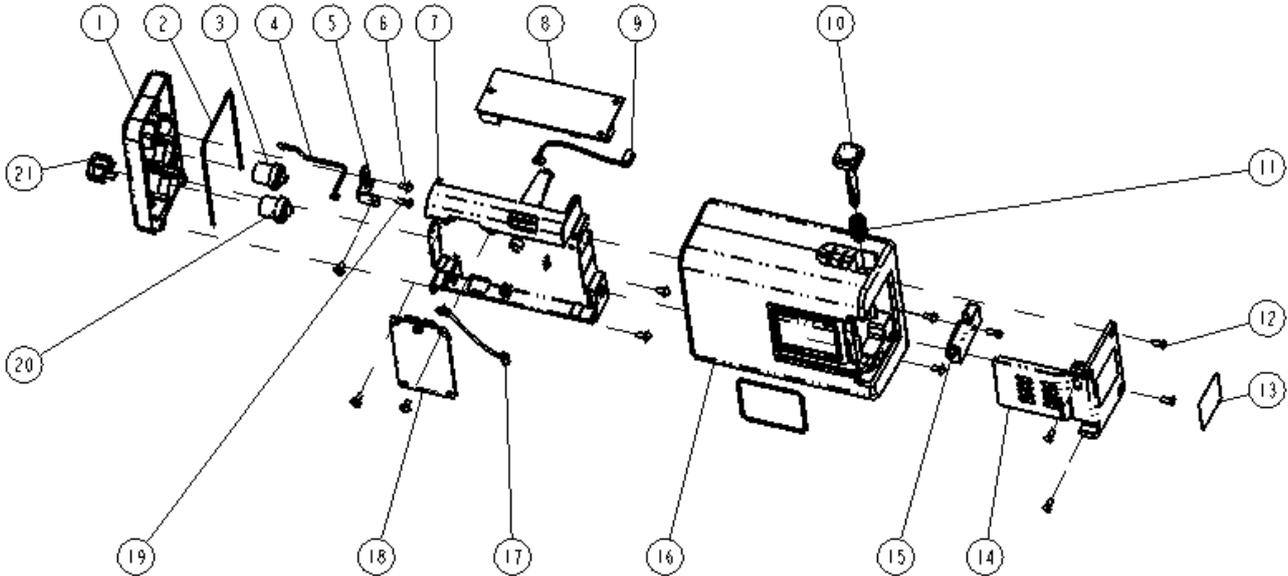


### 8.2.7.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	/	Multi-parameter board bracket	/	/
2	/	Shock absorption cushion for pump	/	/
3	/	Nylon fixing strip	/	/
4	/	Pump, P54C06R	801-6800-00211-00	/
6	/	Valve cushion		/
11	/	Cable between the pump and multi-parameter board		/
5	082-000864-00	Gas valve, CJV13-A12B2	082-000864-00	/
7	/	630F reducer	/	/
8	/	NIBP pipe	/	/
9	/	Screw, Pan head with washer, Phillips M3×6	/	/
10	/	Valve bracket	/	/

## 8.2.8 IBP\_C.O. Module Assembly

### 8.2.8.1 Exploded View



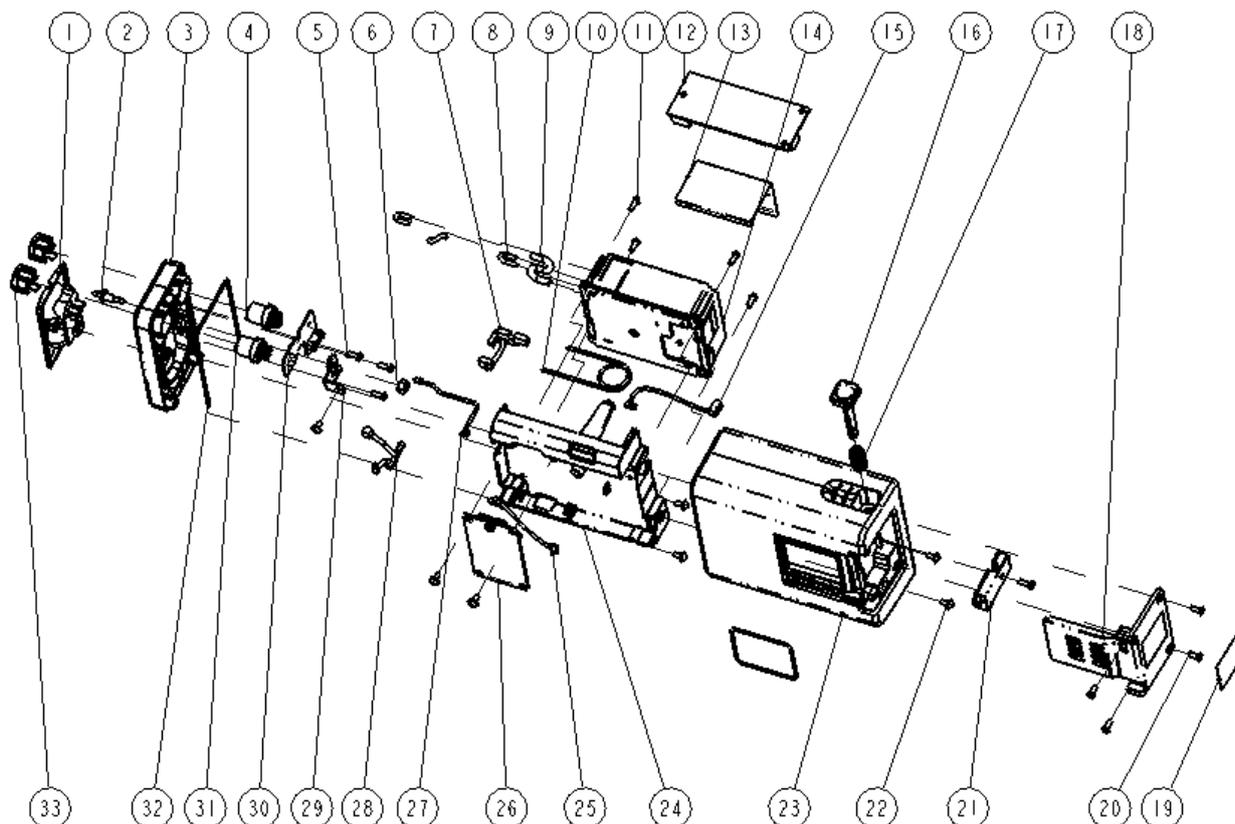
### 8.2.8.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	/	Front housing of A1 module	801-9261-00025-00	/
4	009-002213-00	Module indicator and cable		/
2	/	Silicone tube		/
3	009-001972-00	IBP signal cable (3-way)	009-001972-00	/
5	/	Connecting sheet for A1 module bracket	/	/
6	/	Screw, Pan head with washer, Phillips M3×6	/	/
7	043-001890-01	Bracket for A module	043-001890-01	/
8	M03B-30-26064	CO/IBP (M03B) module	M03B-30-26064	/
9	009-001971-00	Cable between the converter board and M03B module	009-001971-00	/
10	043-001891-01	A module button	043-001891-01	/
11	/	Spring washer	/	/
12	/	Screw, pan head, Phillips, M3×8	/	/
13	/	Module label (no manufacturer information)	/	/
14	051-000874-00	External converter board (plug-in modules)	051-000874-00	/
15	043-001892-01	Lock for A module	043-001892-01	/
16	043-002103-01	Rear housing of A modules	043-002103-01	/
17	009-001970-00	Cable between the converter board and copper board	009-001970-00	/
18	051-001033-00	External module interface board (IBP_C.O.)	801-9261-00016-00	/
	051-001033-00	External module interface board (IBP)	801-9261-00017-00	/
19	/	Screw, self-tapping, PT3×8	/	/

SN	PN	Description	FRU part number	Remarks
20	009-001973-00	C.O. signal cable	009-001973-00	/
21	043-001893-01	Decorative IBP socket	043-001893-01	/
22	/	DP 105 epoxy resins	/	/

## 8.2.9 IBP\_C.O.\_Sidestream CO<sub>2</sub> Module Assembly/ IBP\_Sidestream CO<sub>2</sub> Module Assembly

### 8.2.9.1 Exploded View



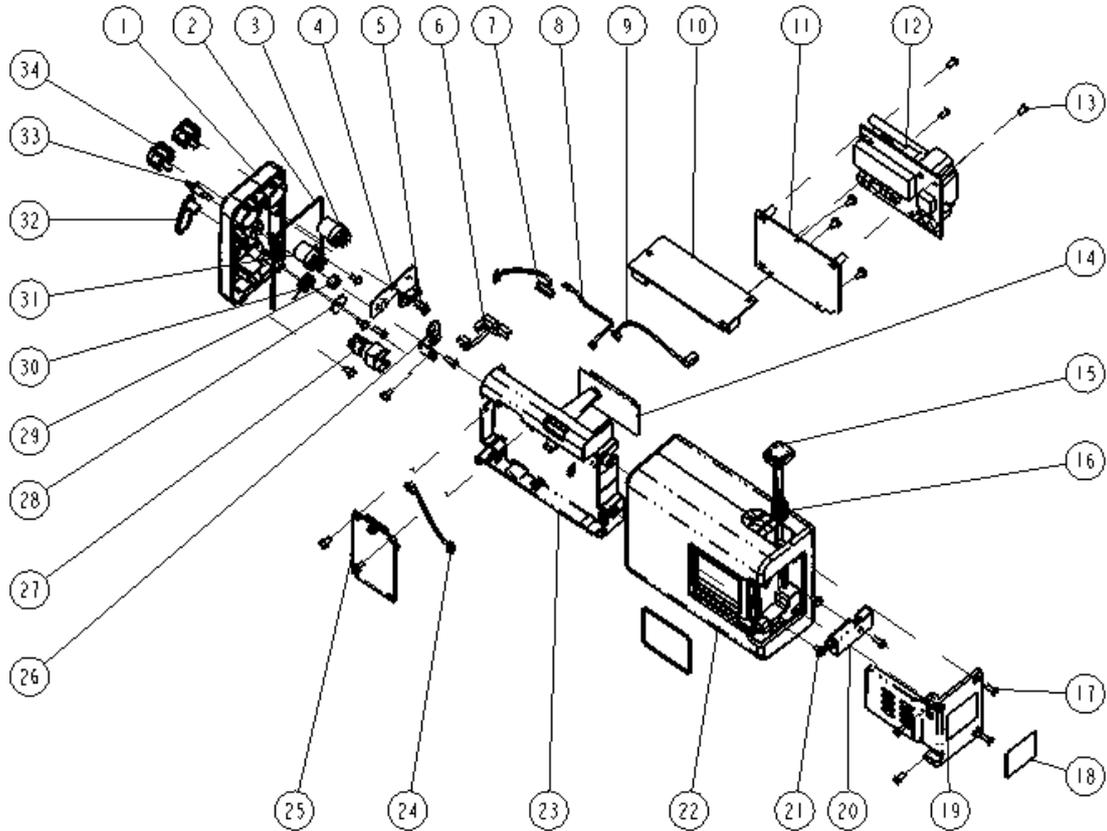
### 8.2.9.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	040-000119-00	AG watertrap receptacle (no pipe, 60-13510-01)	040-000119-00	/
2	/	Gas outlet	/	/
3	/	Front housing of A2 module (2ch-IBP + C.O. + Mindray CO <sub>2</sub> )	801-9261-00026-00	/
4	/	Double IBP receptacle (9281)		/
30	/	C.O._IBP interface board (iPM)		/
31	/	C.O. module, single receptacle		/
32	/	Silicone tube		/
27	009-002213-00	Module indicator and cable		/
5	/	Screw, self-tapping, PT3×8		/

SN	PN	Description	FRU part number	Remarks
6	/	Nut, Stainless Steel M5 GB6170	/	/
7	009-002214-00	IBP/C.O. signal cable (4-way)	009-002214-00	/
8	/	AG airway sampling line (1.4/2.8)	/	/
9	/	AG airway sampling line (2.2/4.4)	/	/
10	/	Moisture exchanger (Nafion Tube for Mindray CO <sub>2</sub> )	/	/
11	/	Screw, pan head Phillips, M3×8	/	/
12	M03B-30-26064	C.O./IBP (M03B) module	M03B-30-26064	/
13	/	Sampling line insulator for A module	/	/
14	/	CO <sub>2</sub> module unit (M02C)	/	/
15	009-001971-00	Cable between converter board and M03B module	009-001971-00	/
16	043-001891-01	A module button	043-001891-01	/
17	/	Spring washer	/	/
18	051-000874-00	External converter board (plug-in modules)	051-000874-00	/
19	/	Module label (no manufacturer information)	/	/
20	/	Screw, pan head, Phillips, M3×8	/	/
21	043-001892-01	Lock for A module	043-001892-01	/
22	/	Screw, Pan head with washer, Phillips M3×6	/	/
23	043-002103-01	Rear housing of A modules	043-002103-01	/
24	043-001890-01	Bracket for A module	043-001890-01	/
25	009-001970-00	Cable between the converter board and copper board	009-001970-00	/
26	051-000856-00	External module interface board (IBP_C.O._Sidestream CO <sub>2</sub> )	801-9261-00018-00	/
	051-000856-00	External module interface board (Sidestream CO <sub>2</sub> )	801-9261-00019-00	/
28	009-002309-00	M02C module cable	009-002309-00	/
29	/	Connecting sheet for A1 module bracket	/	/
33	043-001893-01	Decorative IBP socket	043-001893-01	/
34	/	DP 105 epoxy resins	/	/
35	/	Silicone tube	/	/
36	/	Air filter	/	/

## 8.2.10 IBP\_C.O.\_Microstream CO<sub>2</sub> Module Assembly/IBP\_Microstream CO<sub>2</sub> Module Assembly

### 8.2.10.1 Exploded View



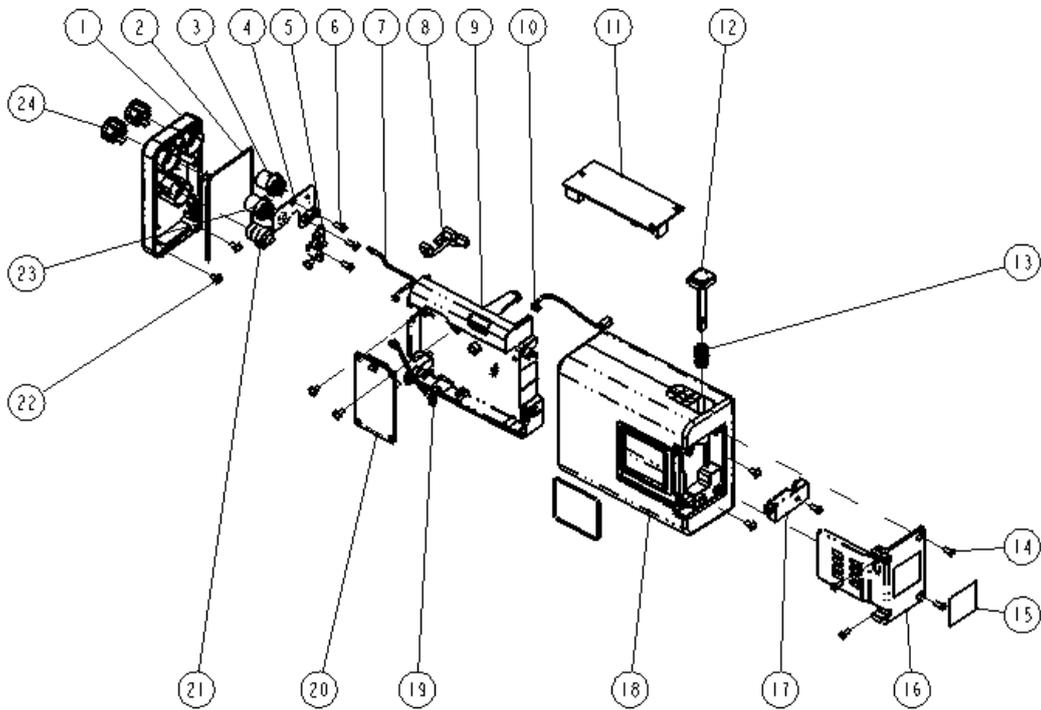
### 8.2.10.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	/	Front housing of A3 module (2ch-IBP + C.O. + Microstream CO <sub>2</sub> )	801-9261-00028-00	/
2	/	Silicone tube		/
3	/	Double IBP receptacle (9281)		/
4	/	C.O._IBP interface board (iPM)		/
8	009-002213-00	Module indicator and cable		/
31	/	C.O. module, single receptacle		/
5	/	Screw, self-tapping, PT3×8	/	/
6	009-002214-00	IBP/C.O. signal cable (4-way)	009-002214-00	/
7	009-001992-00	Cable between the Microstream CO <sub>2</sub> module and converter board	009-001992-00	/
9	009-001971-00	Cable between the converter board and M03B module	009-001971-00	/
10	M03B-30-26064	C.O./IBP (M03B) module	M03B-30-26064	/
11	/	CO <sub>2</sub> bracket for A module	/	/
12	/	Microstream CO <sub>2</sub> module;	/	/

SN	PN	Description	FRU part number	Remarks
13	/	Screw, pan head Phillips, M3×6	/	/
14	/	IBP insulator for A module	/	/
15	043-001891-01	A module button	043-001891-01	/
16	/	Spring washer	/	/
17	/	Screw, pan head, Phillips, M3×8	/	/
18	/	Module label (no manufacturer information)	/	/
19	051-000874-00	External converter board (plug-in modules)	051-000874-00	/
20	043-001892-01	Lock for A module	043-001892-01	/
21	/	Screw, Pan head with washer, Phillips M3×6	/	/
22	043-002103-01	Rear housing of A modules	043-002103-01	/
23	043-001890-01	Bracket for A module	043-001890-01	/
24	009-001970-00	Cable between the converter board and copper board	009-001970-00	/
25	051-001033-00	External module interface board (IBP_C.O._Microstream CO <sub>2</sub> )	801-9261-00020-00	/
	051-001033-00	External module interface board (Microstream CO <sub>2</sub> )	801-9261-00021-00	/
26	/	Connecting sheet for A1 module bracket	/	/
27	/	Microstream CO <sub>2</sub> module connector	/	/
28	/	Spring washer	/	/
29	/	Nut, Stainless Steel M5 GB6170	/	/
30	/	Microstream CO <sub>2</sub> connector fixing spring	/	/
32	/	Microstream CO <sub>2</sub> connector baffle	/	/
33	/	Gas outlet	/	/
34	043-001893-01	Decorative IBP socket	043-001893-01	/
35	/	DP 105 epoxy resins	/	/

## 8.2.11 IBP\_C.O.\_Mainstream CO<sub>2</sub> Module Assembly/IBP\_Mainstream CO<sub>2</sub> Module Assembly

### 8.2.11.1 Exploded View



### 8.2.11.2 Parts List

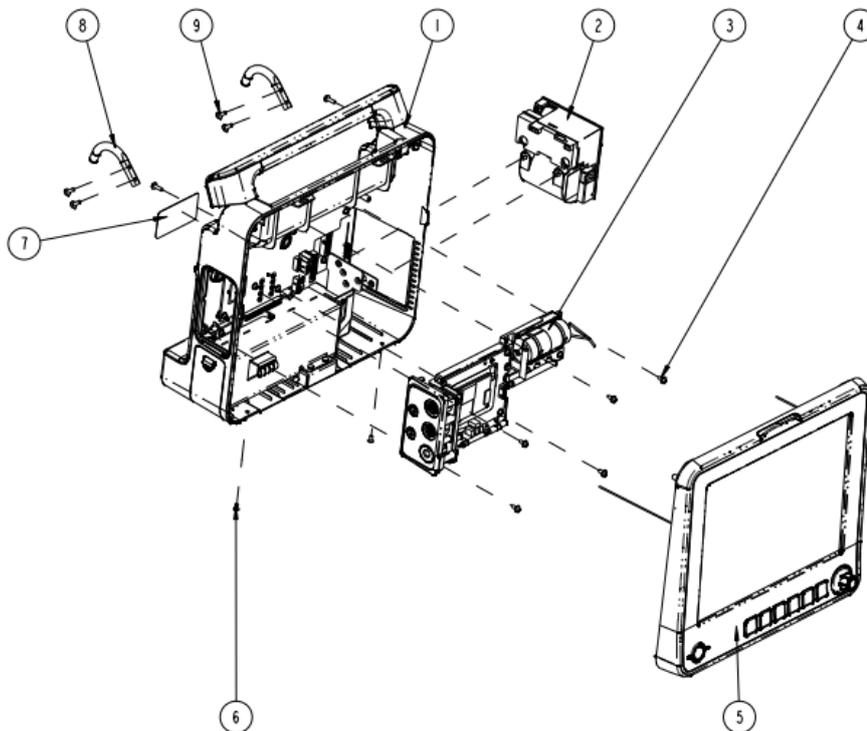
SN	PN	Description	FRU part number	Remarks
1	/	Front housing of A4 module (2ch-IBP + C.O. + Mainstream CO <sub>2</sub> )	801-9261-00030-00	/
2	/	Silicone tube		/
3	/	Double IBP receptacle (9281)		/
4	/	C.O._IBP interface board (iPM)		/
7	009-002213-00	Module indicator and cable		/
23	/	C.O. module, single receptacle		/
5	/	Connecting sheet for A1 module bracket	/	/
6	/	Screw, self-tapping, PT3×8	/	/
8	009-002214-00	IBP/C.O. signal cable (4-way)	009-002214-00	/
9	043-001890-00	Bracket for A module	043-001890-01	/
10	009-001971-00	Cable between the converter board and M03B module	009-001971-00	/
11	M03B-30-26064	C.O./IBP (M03B) module	M03B-30-26064	/
12	043-001891-01	A module button	043-001891-01	/
13	/	Spring washer	/	/
14	/	Screw, pan head, Phillips, M3×8	/	/

SN	PN	Description	FRU part number	Remarks
15	/	Module label (no manufacturer information)	/	/
16	051-000874-00	External converter board (plug-in modules)	051-000874-00	/
17	043-001892-01	Lock for A module	043-000184-00	/
18	043-002103-01	Rear housing of A modules	043-002103-01	/
19	009-001970-00	Cable between the converter board and copper board	/	/
20	051-001033-00	External module interface board (IBP_C.O._Mainstream CO <sub>2</sub> )	801-9261-00022-00	/
	051-001033-00	External module interface board (Mainstream CO <sub>2</sub> )	801-9261-00023-00	/
21	009-001975-00	Mainstream CO <sub>2</sub> signal cable	009-001975-00	/
22	/	Screw, Pan head with washer, Phillips M3×6	/	/
24	043-001893-01	Decorative IBP socket	043-001893-01	/
25	/	DP 105 epoxy resins	/	/

## 8.3 iPM 10/iPM 6

### 8.3.1 Main Unit

#### 8.3.1.1 Exploded View

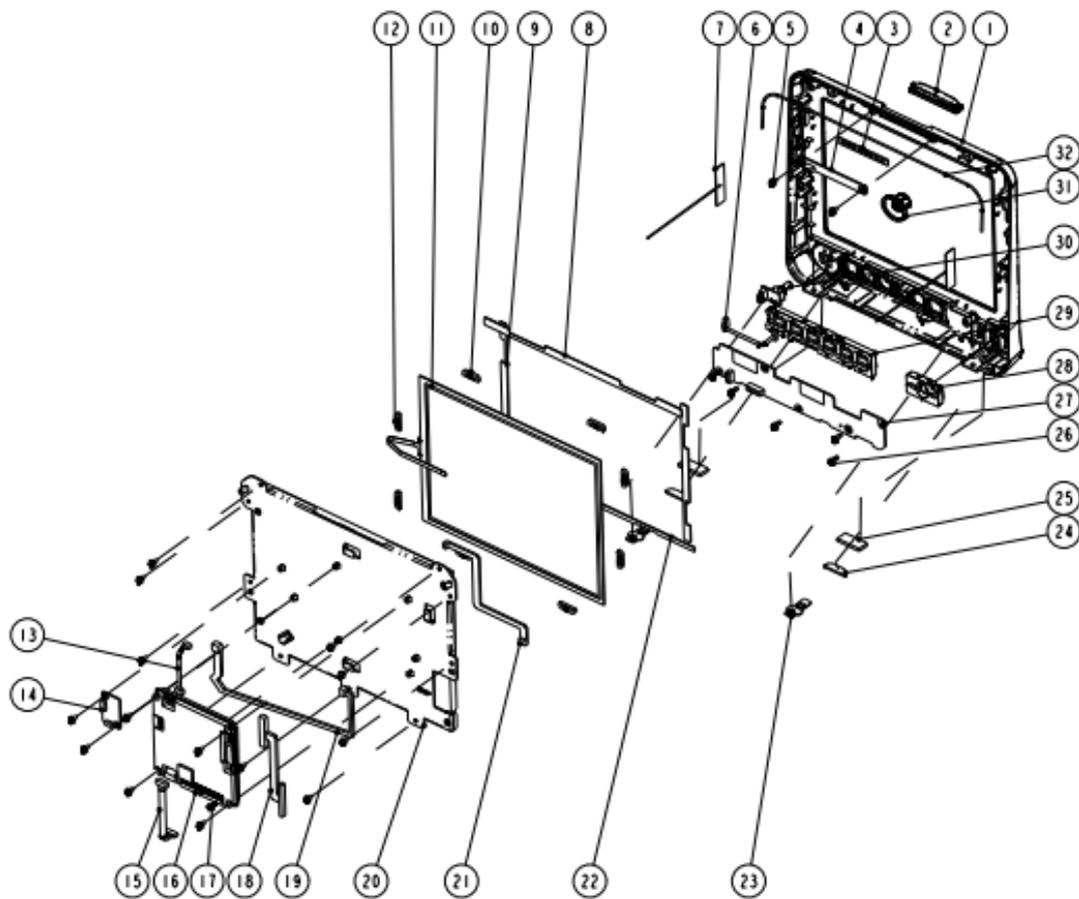


### 8.3.1.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	/	Rear housing assembly (iPM 10)	/	/
2	115-001290-00	TR6F recorder (Datascopes)	115-001290-00	/
	043-000184-00	Recording cover (MR-DS193)	043-000184-00	For monitors without recorder
3	/	Multi-parameter assembly (3-/5-lead, Nellcor SpO <sub>2</sub> )	/	/
4	/	Screw, Pan head with washer, Phillips M3×6	/	/
5	/	Front housing assembly (iPM 10, touchscreen)	/	Only for iPM 10
	/	Front housing assembly (iPM 6, touchscreen)	/	Only for iPM 6
6	/	Screw, pan head, Phillips, M3×6	/	/
7	/	iMEC12 rear label (CN)	/	/
8	/	Hook (iPM 10)	115-010922-00	/
9	/	Screw, Pan head with washer, Phillips M3×10	/	/

### 8.3.2 Front Housing Subassembly (Touchscreen)

#### 8.3.2.1 Exploded View



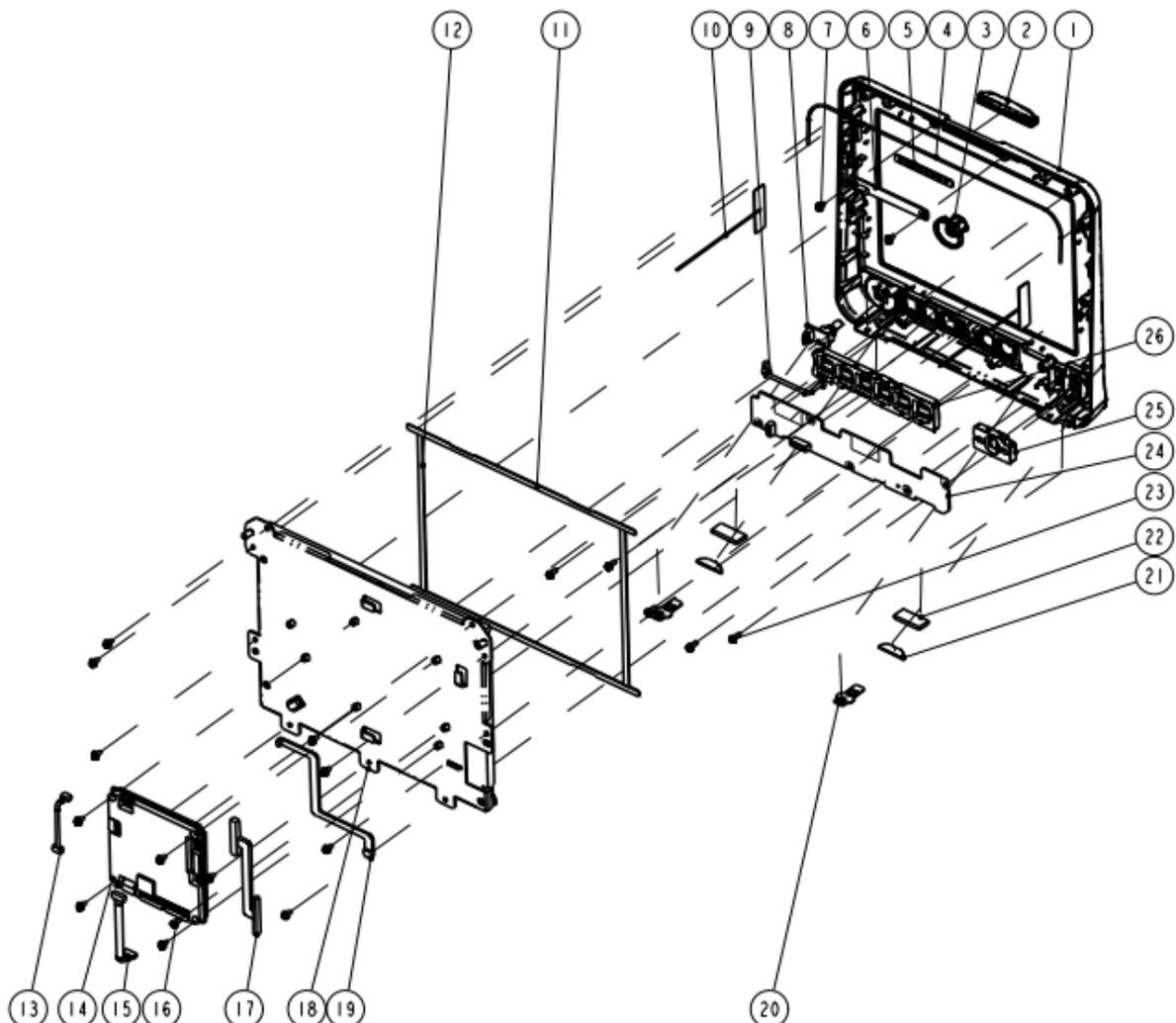
### 8.3.2.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	043-002068-01	10" front panel (iPM 10)	801-9241-00001-00	Only for iPM 10; The color of both the front panel and rear panel has been changed. Color difference may result if either is replaced separately.
2	/	Alarm lamp shade		
3	/	Alarm lamp gasket		
8	/	Gasket 1, iPM 10, touchscreen		
9	/	Gasket 2, iPM 10, touchscreen		
10	/	Touchscreen position pad (iPM 12)		
12	/	Touchscreen position pad (iPM 10/iPM 12)		
22	/	Gasket 3, iPM 10, touchscreen		
23	/	Locking plate		
24	/	Semicircle foot pad		
25	/	Square foot pad		
32	/	Tube, white, 1.6 mm OD × 0.8 mm		
1	043-002069-01	10" front panel (iPM 6)		
2	/	Alarm lamp shade		
3	/	Alarm lamp gasket		
8	/	Gasket 1, iPM 10, touchscreen		
9	/	Gasket 2, iPM 10, touchscreen		
10	/	Touchscreen position pad (iPM 12)		
12	/	Touchscreen position pad (iPM 10/iPM 12)		
22	/	Gasket 3, iPM 10, touchscreen		
23	/	Locking plate		
24	/	Semicircle foot pad		
25	/	Square foot pad		
32	/	Tube, white, 1.6 mm OD × 0.8 mm		
4	051-000879-00	Alarm lamp board PCBA	051-000879-00	/
5	/	Screw, Pan head with washer, Phillips M3×6	/	/
6	9200-21-10460	Encoder cable	9200-21-10460	/
7	/	iPM Wi-Fi module kit	115-010801-00	The two parts below are included in this kit
	051-000811-00	Cyberlink module PCBA	051-000811-00	
	0012-00-1730-01	Antenna cable	0012-00-1730-01	
11	021-000005-00	Touch panel, resistive-type, 10.4" 4-line	021-000005-00	/
13	009-002203-00	Cable between main board and alarm lamp board	009-002203-00	/
14	051-000881-00	Touchscreen control board PCBA	051-000881-00	/
15	009-001982-00	Cable between main board and keypad board	009-001982-00	/
16	051-000829-00	Main board PCBA	801-9241-00003-00	/
17	/	Inner hexagon screw, M3×6	/	/
18	009-001984-00	Signal cable for 10" screen	009-001984-00	/

SN	PN	Description	FRU part number	Remarks
19	009-001981-00	Cable between the touchscreen control board and the main board	009-001981-00	/
20	/	10" AU LCD service kit	801-9241-00006-00	/
21	009-001988-00	Cable between the main board and backlight board (12")	009-001988-00	/
26	/	Screw, self-tapping, PT3×8	/	/
27	051-000888-00	Keypad board PCBA, 10.4 inch	051-000888-00	/
28	049-000366-00	Power button	049-000366-00	/
29	049-000364-01	Button (for iPM 8)	049-000364-01	/
30	0010-30-43089	Encoder board	0010-30-43089	/
31	043-004113-00	Knob	043-004113-00	For iPM 10/12
	043-004500-00	Knob	043-004500-00	For iPM 6/7
33	023-000278-00	Industrial SD card (SLC), 1G	023-000278-00	/

### 8.3.3 Front Housing Assembly (Nakescreen)

#### 8.3.3.1 Exploded View



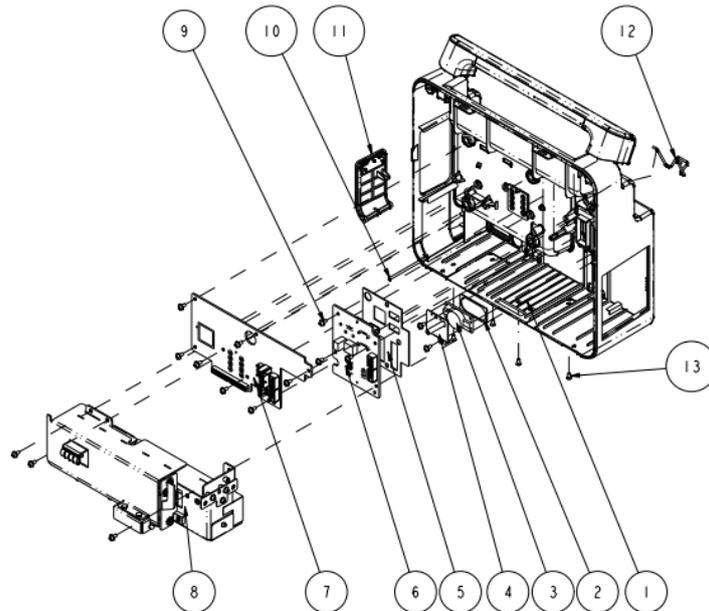
### 8.3.3.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	043-002068-01	10" front panel	801-9241-00002-00	Only for iPM 10; The color of both the front panel and rear panel has been changed. Color difference may result if either is replaced separately.
2	/	Alarm lamp shade		
4	/	Tube, white, 1.6 mm OD × 0.8 mm		
11	/	Gasket 3, iPM 10, touchscreen		
12	/	Gasket 4, iPM 10, touchscreen		
20	/	Locking plate		
21	/	Semicircle foot pad		
22	/	Square foot pad		
5	/	Alarm lamp gasket		
1	043-002069-01	10" front panel (iPM 6)	043-004500-00	Only for iPM 6
2	/	Alarm lamp shade		
4	/	Tube, white, 1.6 mm OD × 0.8 mm		
11	/	Gasket 3, iPM 10, touchscreen		
12	/	Gasket 4, iPM 10, touchscreen		
20	/	Locking plate		
21	/	Semicircle foot pad		
22	/	Square foot pad		
5	/	Alarm lamp gasket		
3	043-004113-00	Knob	043-004113-00	For iPM 10/12
	043-004500-00		043-004500-00	For iPM 6/7
6	051-000879-00	Alarm lamp board PCBA	051-000879-00	/
7	/	Screw, Pan head with washer, Phillips M3×6	/	/
8	0010-30-43089	Encoder board	0010-30-43089	/
9	9200-21-10460	Encoder cable	9200-21-10460	/
10	/	iPM Wi-Fi module kit	115-010801-00	The two parts below are included in this kit
	051-000811-00	Cyberlink module PCBA	051-000811-00	
	0012-00-1730-01	Antenna cable	0012-00-1730-01	
13	009-002203-00	Cable between main board and alarm lamp board	009-002203-00	/
14	051-000829-00	Main board PCBA	801-9241-00003-00	/
15	009-001982-00	Cable between main board and keypad board	009-001982-00	/
16	/	Inner hexagon screw, M3×6	/	/
17	009-001984-00	Signal cable for 10" screen	009-001984-00	/
18	/	10" AU LCD service kit	801-9241-00004-00	/
19	009-001988-00	Cable between the main board and backlight board (12")	009-001988-00	/
23	/	Screw, self-tapping, PT3×8	/	/
24	051-000888-00	Keypad board PCBA, 10.4 inch	051-000888-00	/

SN	PN	Description	FRU part number	Remarks
25	049-000366-00	Power button	049-000366-00	/
26	049-000364-01	8" button (English)	049-000364-01	/
	049-000390-01	8" button (Chinese)	049-000390-01	/
27	023-000755-00	Industrial SD card (SLC), 1G	023-000755-00	/

### 8.3.4 Rear Housing Assembly

#### 8.3.4.1 Exploded View



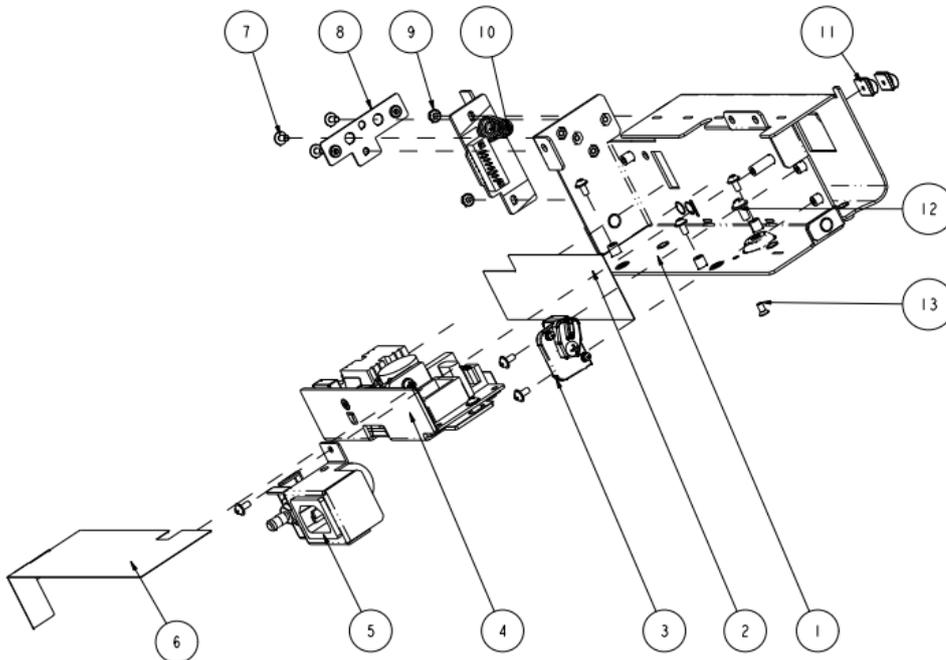
#### 8.3.4.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	/	Rear housing assembly (iPM 10)	115-010800-00	Only for iPM 10; The color of both the front panel and rear panel has been changed. Color difference may result if either is replaced separately.
	/	Rear housing assembly (iPM 6)	115-023561-00	Only for iPM 6
2	/	Speaker pad	801-9261-00010-00	/
3	/	Speaker, 2W, 4ohm, 500 Hz		/
4	/	Speaker bracket (iPM 8)	/	/
5	/	I/O interface waterproof pad (iPM 10)	/	/
6	051-001011-00	Interface converter board (iPM 10, full config, USB)	801-9261-00005-00	2 different configuration
	051-000886-00	Interface converter board (iPM 10)	801-9261-00006-00	
7	051-001007-00	Power management and interface board (full config, USB)	051-001007-00	2 different configuration
	051-000868-00	Power management and interface board	051-000868-00	

SN	PN	Description	FRU part number	Remarks
8	/	Battery compartment assembly (iPM 10)	/	/
9	/	Screw, Pan head with washer, Phillips M3×6	/	/
10	/	Door spindle (iPM 8)	/	/
11	/	Battery door assembly (iPM 8/iPM 10)	115-010919-00	/
12	9211-20-87369	AC Inlet Hook	9211-20-87369	/
13	/	Screw, pan head, Phillips, M3×6	/	/
14	009-002235-00	Cable between the power management board and recorder	009-002235-00	/
15	009-001969-00	Cable between the interface board and main board	009-001969-00	/
16	9211-20-87225	Cable between the interface board and main board	9211-20-87225	/
17	009-001989-00	Cable between the power management board and parameter board	009-001989-00	/
18	/	Fixing strip	/	/
19	049-000355-01	USB plug	049-000355-01	/

## 8.3.5 Battery Compartment Assembly

### 8.3.5.1 Exploded View



### 8.3.5.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	/	Main bracket (iPM 10)	/	/
2	/	Power bracket sheet	/	/

SN	PN	Description	FRU part number	Remarks
3	/	Battery fastener (iPM 8/iPM 10)	115-010921-00	/
4	051-001064-00	AC/DC power board	051-001064-00	/
5	/	AC input receptacle assembly (iPM 8/iPM 10)	115-010920-00	/
6	/	Power sheet (iPM 10)	/	/
7	/	Screw, Pan head with washer, Phillips M3×6	/	/
8	/	Recorder adjustment bracket	/	/
9	/	M3 nut with spring washer	/	/
10	/	Battery connector board (iPM 8/iPM 10)	115-010799-00	/
11	/	Spring, EMI	/	/
12	/	Screw, Pan head with washer, Phillips M4×8	/	/
13	/	Screw, pan head, Phillips, M3×6	/	/
14	009-001991-00	Cable between the power management board and AC/DC power board	009-001991-00	/

### 8.3.6 Multi-parameter Assembly

For the exploded view and parts list of the multi-parameter assembly, refer to Section **8.2.5 Multi-parameter Assembly**.

### 8.3.7 NIBP Pump and Valve Kit

For the exploded view and parts list of the NIBP pump and valve kit, refer to Section **8.2.7 NIBP Pump and Valve Kit**.

### 8.3.8 IBP\_C.O. Module Assembly

For the exploded view and parts list of the IBP\_C.O. module assembly, refer to Section **8.2.8 IBP\_C.O. Module Assembly**.

### 8.3.9 IBP\_C.O.\_Sidestream CO<sub>2</sub> Module Assembly/IBP\_Sidestream CO<sub>2</sub> Module Assembly

For the exploded view and parts list of the IBP\_C.O.\_Sidestream CO<sub>2</sub> module assembly and IBP\_Sidestream CO<sub>2</sub> module assembly, refer to Section **8.2.9 IBP\_C.O.\_Sidestream CO<sub>2</sub> Module Assembly/IBP\_Sidestream CO<sub>2</sub> Module Assembly**.

### 8.3.10 IBP\_C.O.\_Microstream CO<sub>2</sub> Module Assembly/IBP\_Microstream CO<sub>2</sub> Module Assembly

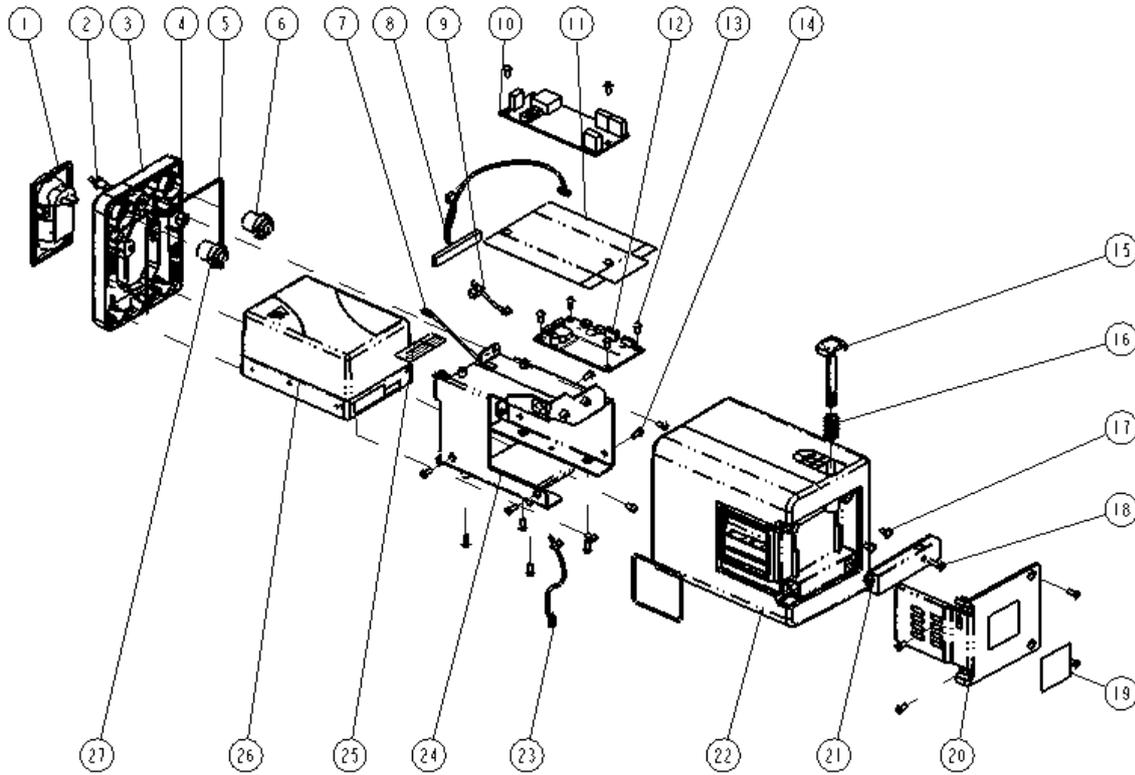
For the exploded view and parts list of the IBP\_C.O.\_Microstream CO<sub>2</sub> module assembly and IBP\_Microstream CO<sub>2</sub> module assembly, refer to Section **8.2.10 IBP\_C.O.\_Microstream CO<sub>2</sub> Module Assembly/IBP\_Microstream CO<sub>2</sub> Module Assembly**.

### 8.3.11 IBP\_C.O.\_Mainstream CO<sub>2</sub> Module Assembly/IBP\_Mainstream CO<sub>2</sub> Module Assembly

For the exploded view and parts list of the IBP\_C.O.\_Mainstream CO<sub>2</sub> module assembly and IBP\_Mainstream CO<sub>2</sub> module assembly, refer to Section **8.2.11 IBP\_C.O.\_Mainstream CO<sub>2</sub> Module Assembly/IBP\_Mainstream CO<sub>2</sub> Module Assembly**IBP\_C.O.\_Mainstream CO<sub>2</sub> Module Assembly.

### 8.3.12 IBP\_C.O.\_AG Module Assembly/ IBP\_AG Module Assembly

#### 8.3.12.1 Exploded View



#### 8.3.12.2 Parts List

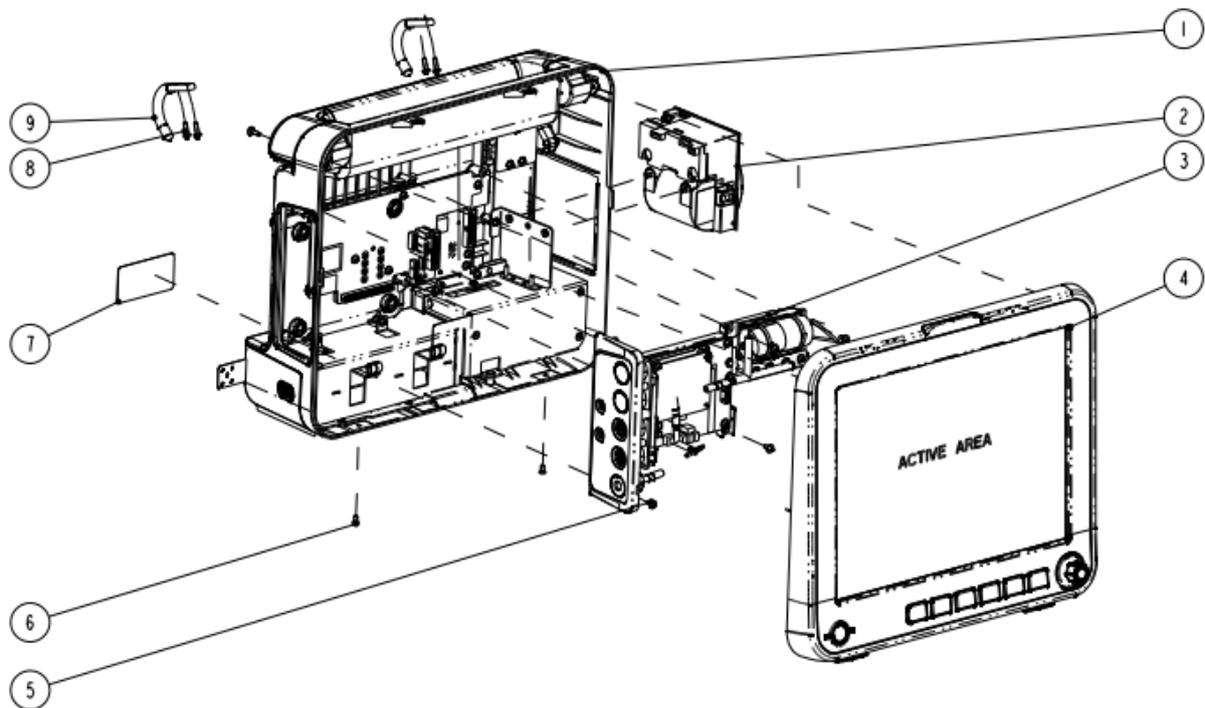
SN	PN	Description	FRU part number	Remarks
1	9200-10-10560	AG watertrap receptacle	/	/
2	/	Gas outlet	/	/
3	/	Front housing of B1 module	801-9261-00032-00	/
5	/	Silicone tube		/
7	/	Module indicator and cable		/
4	/	Nut, Stainless Steel M5 GB6170	/	/
6	009-001972-00	IBP signal cable (3-way)	009-001972-00	/
8	009-001976-00	Cable between the AG module and converter board	009-001976-00	/
9	009-001971-00	Cable between the converter board and M03B module	009-001971-00	/
10	M03B-30-26064	C.O./IBP (M03B) module	M03B-30-26064	/
11	/	IBP insulator for B module	/	/
12	051-001033-00	External module interface board (RS232)	801-9261-00024-00	/
13	/	Screw, pan head Phillips, M3×6	/	/
14	/	Screw, pan head, Phillips, M3×8	/	/
15	043-001891-01	A module button	043-001891-01	/
16	/	Spring washer	/	/

SN	PN	Description	FRU part number	Remarks
17	/	Screw, Pan head with washer, Phillips M3×6	/	/
18	/	Screw, self-tapping, PT3×10	/	/
19	/	Module label (no manufacturer information)	/	/
20	051-001036-00	External converter board (B modules)	051-001036-00	/
21	043-001899-01	Lock for B module	043-001899-01	/
22	043-001898-00	Rear housing of B modules	/	/
23	009-001970-00	Cable between the converter board and copper board	/	/
24	/	Bracket for B1 module	/	/
25	/	B module pipe shield	/	/
26	/	AION 2.5G AG module (AG + O <sub>2</sub> + SPM)	/	/
27	009-001973-00	C.O. signal cable	009-001973-00	/
28	/	AG airway sampling line (1.4/2.8)	/	/
29	/	AG airway sampling line (2.2/4.4)	/	/
30	/	DP 105 epoxy resins	/	/

## 8.4 iPM 12/iPM 7

### 8.4.1 Main Unit

#### 8.4.1.1 Exploded View

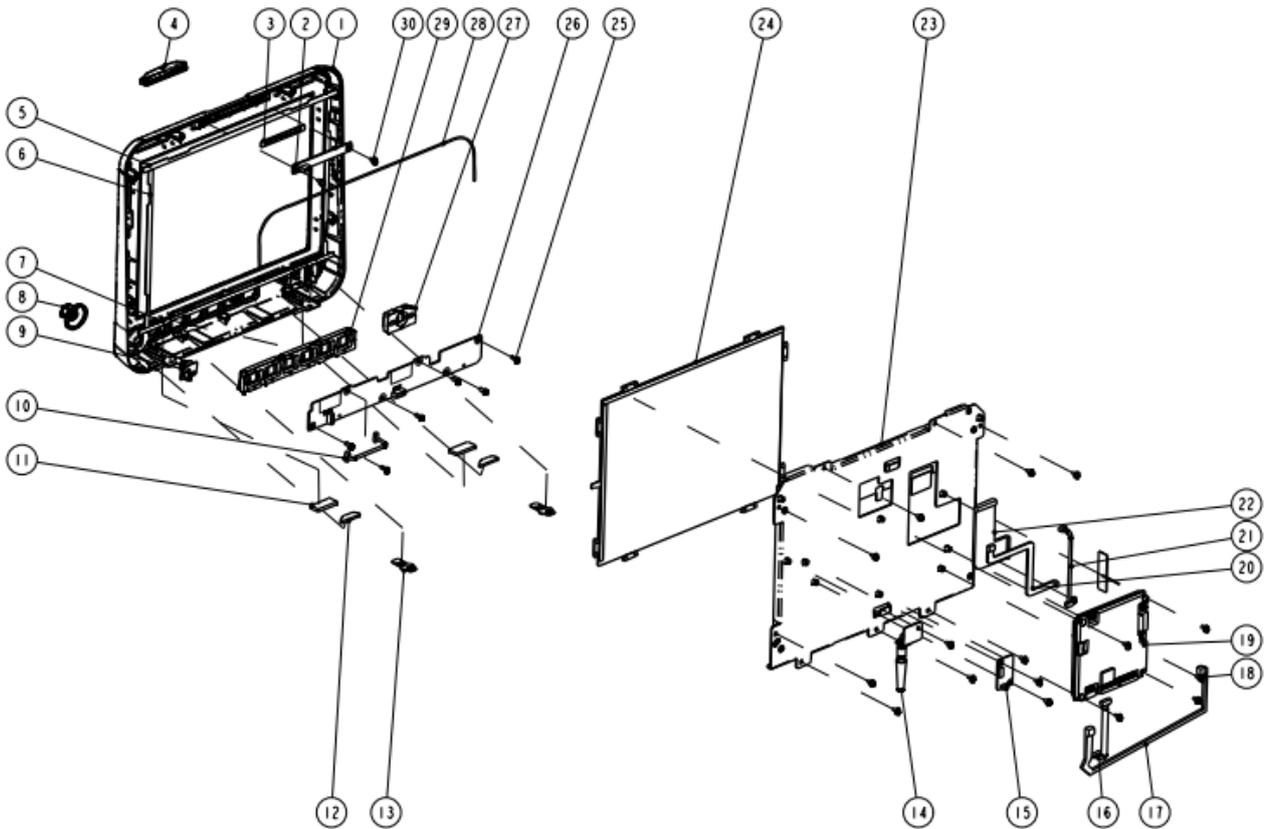


### 8.4.1.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	/	Rear housing assembly (iPM 12)	/	Only for iPM 12
	/	Rear housing assembly (iPM 7)	/	Only for iPM 7
2	115-001290-00	TR6F recorder (Datascope)	115-001290-00	/
	043-000184-00	Recording cover (MR-DS193)	043-000184-00	For monitors without recorder
3	/	Multi-parameter assembly (iPM 12, 3-/5-lead, Mindray SpO <sub>2</sub> )	/	/
4	/	Front housing assembly (iPM 12, touchscreen)	/	/
5	/	Screw, Pan head with washer, Phillips M3×6	/	/
6	/	Screw, pan head, Phillips, M3×6	/	/
7	/	iMEC12 rear label (CN)	/	/
8	/	Screw, Pan head with washer, Phillips M3×10	/	/
9	/	Hook (iPM 10)	115-010922-00	/

### 8.4.2 Front Housing Subassembly (Touchscreen)

#### 8.4.2.1 Exploded View



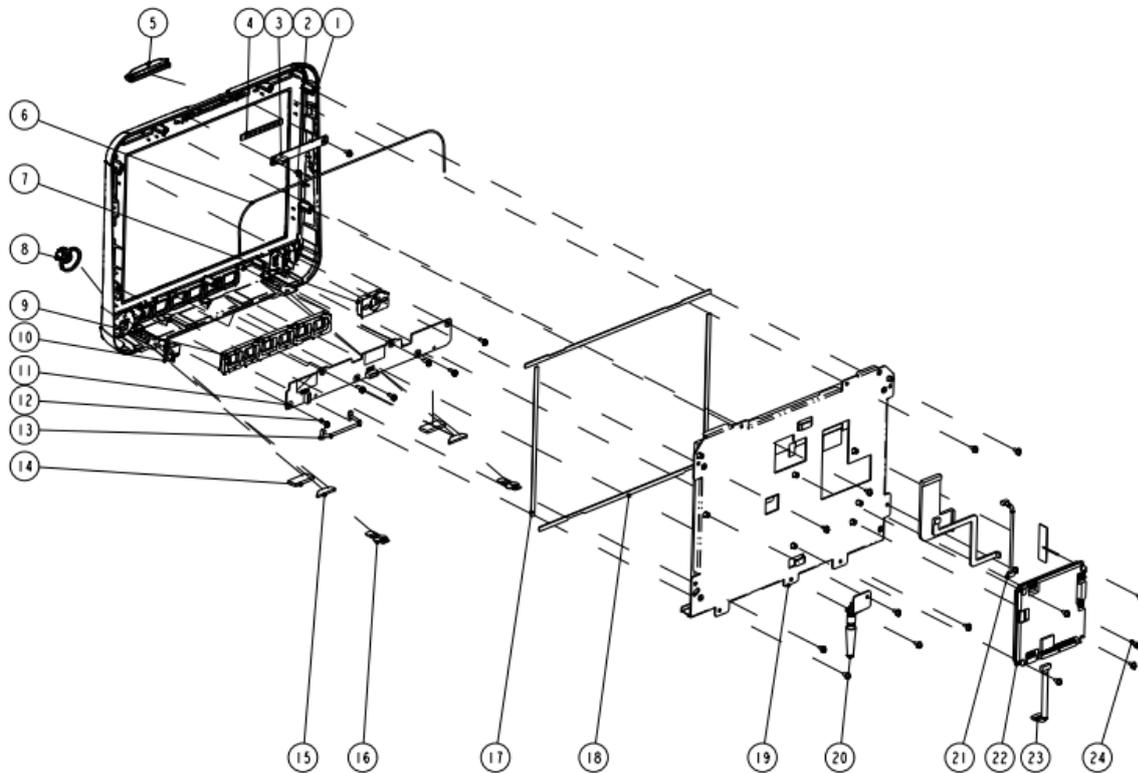
### 8.4.2.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	043-002070-01	12" front panel	801-9221-00001-00	Only for iPM 12; The color of both the front panel and rear panel has been changed. Color difference may result if either is replaced separately.
3	/	Alarm lamp gasket		
4	/	Alarm lamp shade		
5	/	Long gasket, iPM 12, touchscreen		
6	/	Short gasket, iPM 12, touchscreen		
7	/	Long gasket, iPM 12, nakescreen		
11	/	Square foot pad		
12	/	Semicircle foot pad		
13	/	Locking plate		
28	/	Tube, white, 1.6 mm OD × 0.8 mmID		
1	043-002071-01	12" front panel (iPM 7)	115-023574-00	Only for iPM 7
3	/	Alarm lamp gasket		
4	/	Alarm lamp shade		
5	/	Long gasket, iPM 12, touchscreen		
6	/	Short gasket, iPM 12, touchscreen		
7	/	Long gasket, iPM 12, nakescreen		
11	/	Square foot pad		
12	/	Semicircle foot pad		
13	/	Locking plate		
28	/	Tube, white, 1.6 mm OD × 0.8 mmID		
2	051-000879-00	Alarm lamp board PCBA	051-000879-00	/
8	043-004113-00	Knob	043-004113-00	For iPM 10/12
	043-004500-00		043-004500-00	For iPM 6/7
9	0010-30-43089	Encoder board	0010-30-43089	/
10	9200-21-10460	Encoder cable	9200-21-10460	/
14	/	iPM12 Wi-Fi module kit	115-010844-00	The parts listed below is included in the kit
	051-000811-00	Cyberlink module PCBA	051-000811-00	
	0012-00-1730-01	Antenna cable	0012-00-1730-01	
	/	Antenna service kit (iPM 12)	801-9221-00006-00	
15	051-000881-00	Touchscreen control board PCBA	051-000881-00	/
16	009-001982-00	Cable between main board and keypad board	009-001982-00	/
17	009-001981-00	Cable between the touchscreen control board and the main board	009-001981-00	/
18	/	Inner hexagon screw, M3×6	/	/
19	051-000829-00	Main board PCBA	801-9221-00004-00	/
20	009-001988-00	Cable between the main board and backlight board (12")	009-001988-00	/
21	009-002203-00	Cable between main board and alarm lamp board	009-002203-00	/
22	009-001985-00	Signal cable for 12" screen	009-001985-00	/

SN	PN	Description	FRU part number	Remarks
23	021-000061-00	12" AU LCD service kit	801-9221-00003-00	/
24	021-000059-00	Touch-panel, resistive-type, 12.1" 4-line	021-000059-00	/
25	/	Screw, self-tapping, PT3x8	/	/
26	051-000889-00	Keypad board PCBA, 12 inch	051-000889-00	/
27	049-000366-00	Power button	049-000366-00	/
29	049-000365-01	12" button (English)	049-000365-01	/
	049-000391-01	12" button (Chinese)	049-000391-01	/
30	/	Screw, Pan head with washer, Phillips M3x6	/	/
31	023-000755-00	Industrial SD card (SLC), 1G	023-000755-00	/

### 8.4.3 Front Housing Assembly (Nakescreen)

#### 8.4.3.1 Exploded View



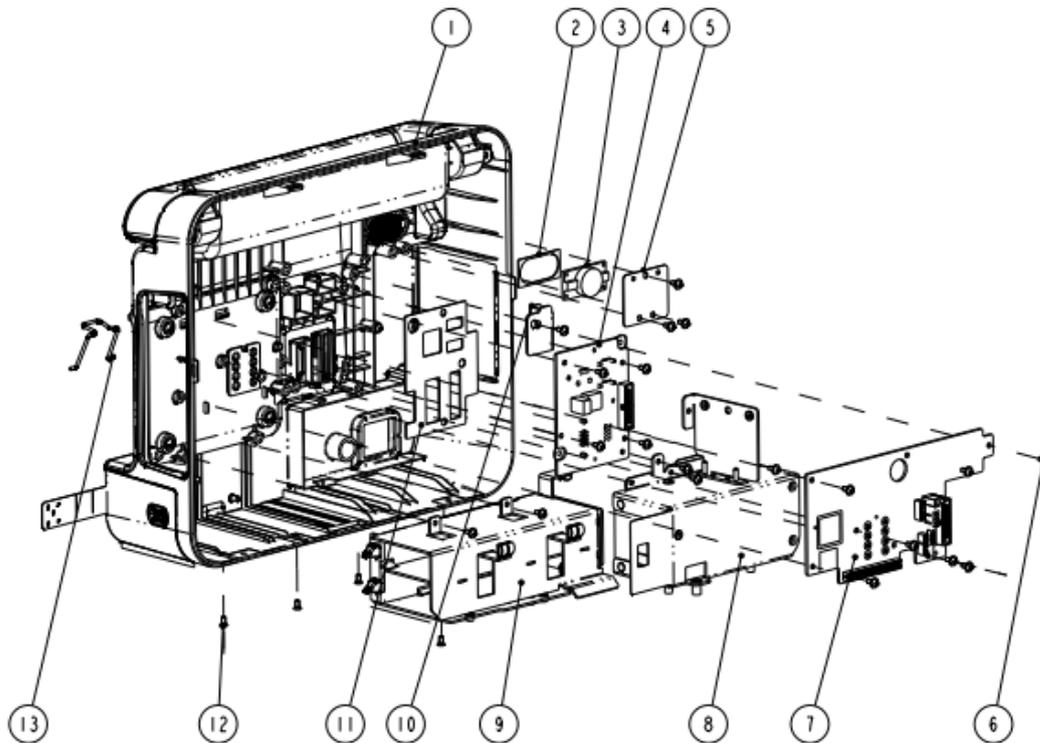
#### 8.4.3.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	043-002070-01	12" front panel	801-9221-00002-00	Only for iPM 12; The color of both the front panel and rear panel has been changed. Color difference may result if either is
14	/	Square foot pad		
15	/	Semicircle foot pad		
16	/	Locking plate		
17	/	Short gasket, iPM 12, nakescreen		
18	/	Long gasket, iPM 12, nakescreen		
4	/	Alarm lamp gasket		

SN	PN	Description	FRU part number	Remarks
5	/	Alarm lamp shade		replaced separately.
6	/	Tube, white, 1.6 mm OD × 0.8 mmID		
1	043-002071-01	12" front panel (iPM 7)		Only for iPM 7
14	/	Square foot pad		
15	/	Semicircle foot pad		
16	/	Locking plate		
17	/	Short gasket, iPM 12, nakescreen	115-023575-00	
18	/	Long gasket, iPM 12, nakescreen		
4	/	Alarm lamp gasket		
5	/	Alarm lamp shade		
6	/	Tube, white, 1.6 mm OD × 0.8 mmID		
7	049-000366-00	Power button	049-000366-00	
8	043-004113-00	Knob	043-004113-00	For iPM 10/12
	043-004500-00		043-004500-00	For iPM 6/7
9	049-000365-01	12" button (English)	049-000365-01	/
	049-000391-01	12" button (Chinese)	049-000391-01	/
10	0010-30-43089	Encoder board	0010-30-43089	/
2	/	Screw, Pan head with washer, Phillips M3×6	/	/
3	051-000879-00	Alarm lamp board PCBA	051-000879-00	/
11	051-000889-00	Keypad board PCBA, 12 inch	051-000889-00	/
12	/	Screw, self-tapping, PT3×8	/	/
13	9200-21-10460	Encoder cable	9200-21-10460	/
19	/	12" AU LCD service kit	801-9221-00003-00	/
20	/	iPM12 Wi-Fi module kit	115-010844-00	The parts listed below is included in the kit
	051-000811-00	Cyberlink module PCBA	051-000811-00	
	0012-00-1730-01	Antenna cable	0012-00-1730-01	
	/	Antenna service kit (iPM 12)	801-9221-00006-00	
21	009-002203-00	Cable between main board and alarm lamp board	009-002203-00	/
22	051-000829-00	Main board PCBA	801-9221-00004-00	/
23	009-001982-00	Cable between main board and keypad board	009-001982-00	/
24	/	Inner hexagon screw, M3×6	/	/
25	009-001985-00	Signal cable for 12" screen	009-001985-00	/
26	009-001988-00	Cable between the main board and backlight board (12")	009-001988-00	/
27	023-000755-00	Industrial SD card (SLC), 1G	023-000755-00	/

## 8.4.4 Rear Housing Assembly

### 8.4.4.1 Exploded View



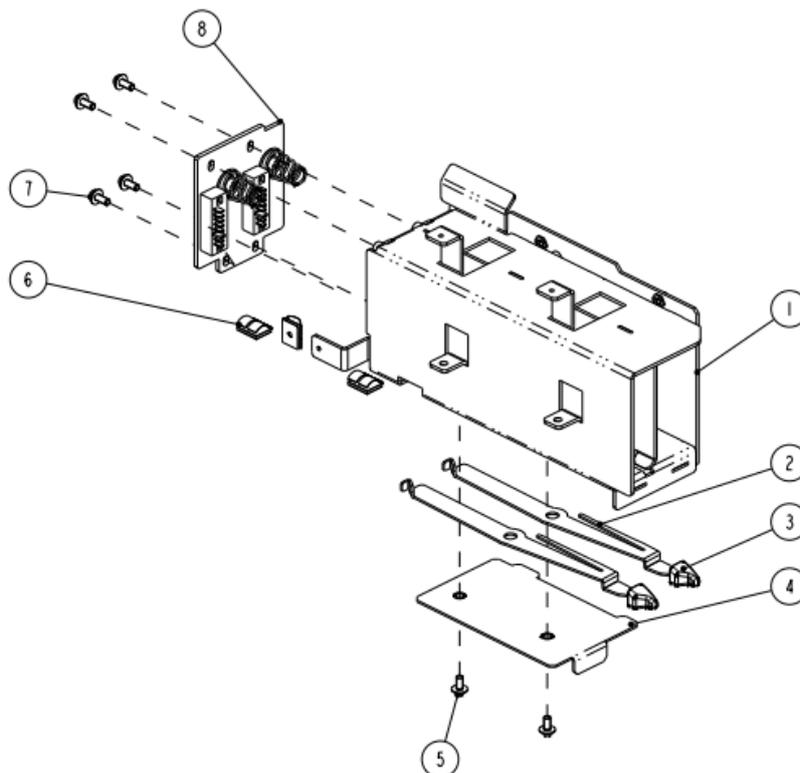
### 8.4.4.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	/	Rear housing assembly (iPM 12)	115-010843-00	Only for iPM 12; The color of both the front panel and rear panel has been changed. Color difference may result if either is replaced separately.
	/	Rear housing assembly (iPM 7)		Only for iPM 7
2	/	Speaker pad	801-9261-00010-00	/
3	/	Speaker, 2W, 4ohm, 500 Hz		/
4	051-001011-00	Interface converter board (iPM 10, full config, USB)	801-9261-00005-00	2 different configuration
	051-000886-00	Interface converter board (iPM 10)	801-9261-00006-00	
5	/	Speaker pad	/	/
6	/	Screw, Pan head with washer, Phillips M3×6	/	/
7	051-001007-00	Power management and interface board (full config, USB)	051-001007-00	2 different configuration
	051-000868-00	Power management and interface board	051-000868-00	
8	/	Power board PCBA (iPM 12)	/	/
9	/	Battery compartment subassembly (12 inch)	/	/
10	/	Parameter board bracket (iPM 12)	/	/

SN	PN	Description	FRU part number	Remarks
11	/	I/O interface waterproof pad (iPM 10)	/	/
12	/	Screw, pan head, Phillips, M3×6	/	/
13	9211-20-87369	AC Inlet Hook	9211-20-87369	/
14	009-002235-00	Cable between power management board and I/O interface board	009-002235-00	/
15	9211-20-87225	Cable between the interface board and main board	9211-20-87225	/
16	009-001989-00	Cable between the power management board and parameter board	009-001989-00	/
17	009-001969-00	Recorder cable	009-001969-00	/
18	/	Fixing strip, CHS-3 × 100 mm	/	/
19	049-000355-01	USB plug	049-000355-01	/
20	/	Battery door assembly service kit (iPM 12)	801-9221-00005-00	/

## 8.4.5 Battery Compartment Assembly

### 8.4.5.1 Exploded View



### 8.4.5.2 Parts List

SN	PN	Description	FRU part number	Remarks
1	/	Battery compartment (iPM 12)	/	/
2	/	Battery latch (iPM 12)	/	/
3	0380-00-0593	Knob, Battery latch 2	0380-00-0593	/

SN	PN	Description	FRU part number	Remarks
4	/	Batteyr spring (iPM 12)	/	/
5	/	Screw, Pan head with washer, Phillips M3×6	/	/
6	/	Spring, EMI	/	/
7	/	M4×8 combined screw	/	/
8	/	Battery connector board assembly (iPM 12)	115-010841-00	/

#### 8.4.6 Multi-parameter Assembly

For the exploded view and parts list of the multi-parameter assembly, refer to Section **8.2.5 Multi-parameter Assembly**.

#### 8.4.7 NIBP Pump and Valve Kit

For the exploded view and parts list of the NIBP pump and valve kit, refer to Section **8.2.7 NIBP Pump and Valve Kit**.

#### 8.4.8 IBP\_C.O. Module Assembly

For the exploded view and parts list of the IBP\_C.O. module assembly, refer to Section **8.2.8 IBP\_C.O. Module Assembly**.

#### 8.4.9 IBP\_C.O.\_Sidestream CO<sub>2</sub> Module Assembly/IBP\_Sidestream CO<sub>2</sub> Module Assembly

For the exploded view and parts list of the IBP\_C.O.\_Sidestream CO<sub>2</sub> module assembly and IBP\_Sidestream CO<sub>2</sub> module assembly, refer to Section **8.2.9 IBP\_C.O.\_Sidestream CO<sub>2</sub> Module Assembly/ IBP\_Sidestream CO<sub>2</sub> Module Assembly**.

#### 8.4.10 IBP\_C.O.\_Microstream CO<sub>2</sub> Module Assembly/IBP\_Microstream CO<sub>2</sub> Module Assembly

For the exploded view and parts list of the IBP\_C.O.\_Microstream CO<sub>2</sub> module assembly and IBP\_Microstream CO<sub>2</sub> module assembly, refer to Section **8.2.10 IBP\_C.O.\_Microstream CO<sub>2</sub> Module Assembly/IBP\_Microstream CO<sub>2</sub> Module Assembly**.

#### 8.4.11 IBP\_C.O.\_Mainstream CO<sub>2</sub> Module Assembly/IBP\_Mainstream CO<sub>2</sub> Module Assembly

For the exploded view and parts list of the IBP\_C.O.\_Mainstream CO<sub>2</sub> module assembly and IBP\_Mainstream CO<sub>2</sub> Module Assembly, refer to Section **8.2.11 IBP\_C.O.\_Mainstream CO<sub>2</sub> Module Assembly/IBP\_Mainstream CO<sub>2</sub> Module Assembly**.

#### 8.4.12 IBP\_C.O.\_AG Module Assembly/IBP\_AG Module Assembly

For the exploded view and parts list of the IBP\_C.O.\_AG module assembly and IBP\_AG Module Assembly, refer to Section **8.3.12 IBP\_C.O.\_AG Module Assembly/ IBP\_AG Module Assembly**.

# A Electrical Safety Inspection

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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 smells (e.g., burning or smoky smells, particularly from ventilation holes).
	No taped notes that may suggest device deficiencies or operator concerns.

## A.3 Device Labeling

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

- Main unit label
- Integrated warning labels

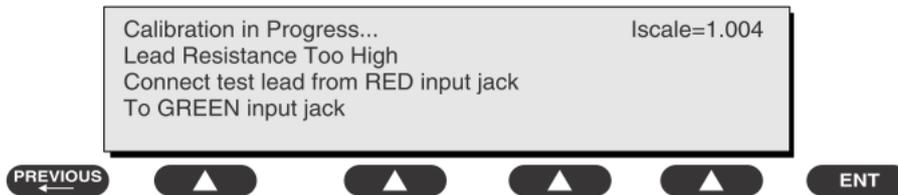
## A.4 Protective Earth Resistance

Protective Earth Resistance is measured using the RED test lead attached to the DUT Protective Earth terminal or enclosure. Select the test current (25 amp) by pressing SOFT KEY 3. The front panel outlet power is turned off for this test.

The following conditions apply: L1 and L2 Open.

### Preparation

1. First select the test current that will be used for performing the Protective Earth Resistance test by pressing AMPERES (SOFT KEY 3).
2. Connect the test lead(s) between the RED input jack and the GREEN input jack.
3. Press CAL LEADS. The 601PRO will measure the lead resistance, and if less than 0.150 Ohms, it will store the reading and subtract it from all earth resistance readings taken at the calibrated current.



If the calibration fails, the previously stored readings will be used until a passing calibration has occurred.

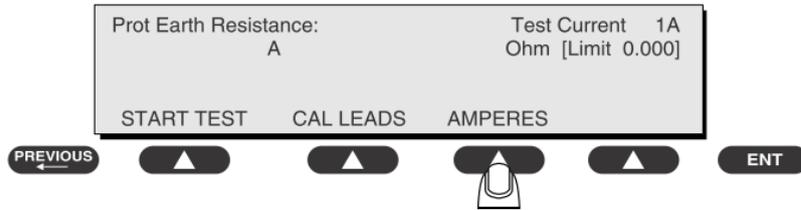
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### WARNING

- **During Earth Resistance testing, the DUT must be plugged into the 601PRO front outlet. If the DUT fails Earth Resistance, discontinue tests and label the device defective.**
- 

### To Perform the Test

1. From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet.
2. Attach the 601PRO RED input lead to the device's Protective Earth terminal or an exposed metal area.
3. Press shortcut key 3. The Protective Earth Resistance test is displayed.
4. Press SOFT KEY 3 to select a test current (25 amp). The selected test current is displayed in the upper right corner of the display.



5. Press START TEST to start the test. The test current is applied while resistance and current readings are taken. This takes approximately 5 seconds.
6. Press the print data key at any time to generate a printout of the latest measurement(s).

## NOTE

- **When "Over" is displayed for Ohms, this signifies that a valid measurement was not obtained because either an open connection was detected or that the measurement was not within range. Readings greater than 9.999 Ohms will be displayed as Over.**

### In Case of Failure

Once it reaches the limitation, stop using and inform the Customer Service Engineer for analysis and disposal.

### LIMITS

ALL COUNTRIES R = 0.2  $\Omega$  Maximum

## A.5 Earth Leakage Test

Run an Earth Leakage test on the device being tested before performing any other leakage tests.

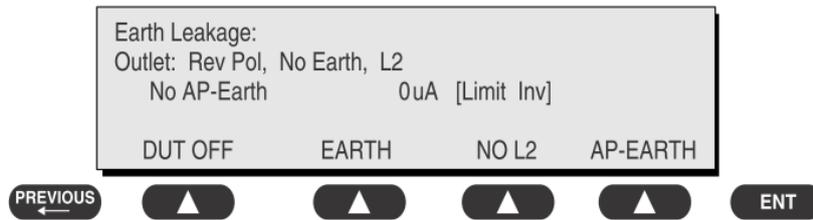
Leakage current is measured the following ways:

- Earth Leakage Current, leakage current measured through DUT outlet Earth
- Earth Leakage Current AP-EARTH (ALL Applied Parts connected to Earth), leakage current measured through DUT outlet Earth

There is no need to attach a test lead; the 601PRO automatically connects the measuring device internally.

### To Perform the Test

1. From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
2. Attach the device's applied parts to the 601PRO applied part terminals if applicable.
3. Press shortcut key 4. The Earth Leakage test appears on the display, and the test begins immediately:



- SOFT KEY 1 toggles the DUT outlet Polarity from Normal to Off to Reverse.
  - SOFT KEY 2 toggles the DUT outlet from Earth to No Earth.
  - SOFT KEY 3 toggles the DUT outlet from L2 to No L2.
  - SOFT KEY 4 toggles the AP to Earth to No AP to Earth.
4. Press the print data key at any time to generate a printout of the latest measurement.

### In Case of Failure

- Check any broken of the enclosure. Replace any defective part.
- Inspect wiring for bad crimps, poor connections, or damage.
- Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.
- Change another probe to confirm if the fail is caused by console.
- If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.
- If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

### LIMITS

For UL60601-1,

- ◆ 300  $\mu$ A in Normal Condition
- ◆ 1000  $\mu$ A in Single Fault Condition

For IEC60601-1,

- ◆ 500  $\mu$ A in Normal Condition
- ◆ 1000  $\mu$ A in Single Fault Condition

## A.6 Patient Leakage Current

Patient leakage currents are measured between a selected applied part and mains earth. All measurements have a true RMS only response.

## Preparation

Perform a calibration from the Mains on Applied Part menu.

The following outlet conditions apply when performing this test:

- Normal Polarity, Earth Open, Outlet ON Normal Polarity, Outlet ON
- Normal Polarity, L2 Open, Outlet ON Reversed Polarity, Outlet ON
- Reversed Polarity, Earth Open, Outlet ON Reversed Polarity, L2 Open, Outlet ON

---

## WARNING

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- **If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and Step modes only.**
- 

## To Perform the Test

1. From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
2. Attach the applied parts to the 601PRO's applied part terminals.
3. Press shortcut key 6. The Patient Leakage test is displayed, and the test begins immediately.



4. Press APPLIED PART (SOFT KEY 4) at any time to select the desired applied part leakage current.
5. Modify the configuration of the front panel outlet by pressing the appropriate SOFT KEY on the 601PRO.
6. Press the print data key at any time to generate a printout of the latest measurement.

## In Case of Failure

- Check any broken of the enclosure. Replace any defective part.
- Inspect wiring for bad crimps, poor connections, or damage.
- Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.
- Change another probe to confirm if the fail is caused by console.
- If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.
- If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

## LIMITS

For CF  applied parts

- ◆ 10µA in Normal Condition
- ◆ 50µA in Single Fault Condition

For BF  applied parts

- ◆ 100µA in Normal Condition
- ◆ 500µA in Single Fault Condition

## A.7 Mains on Applied Part Leakage

The Mains on Applied Part test applies a test voltage, which is 110% of the mains voltage, through a limiting resistance, to selected applied part terminals. Current measurements are then taken between the selected applied part and earth. Measurements are taken with the test voltage (110% of mains) to applied parts in the normal and reverse polarity conditions as indicated on the display.

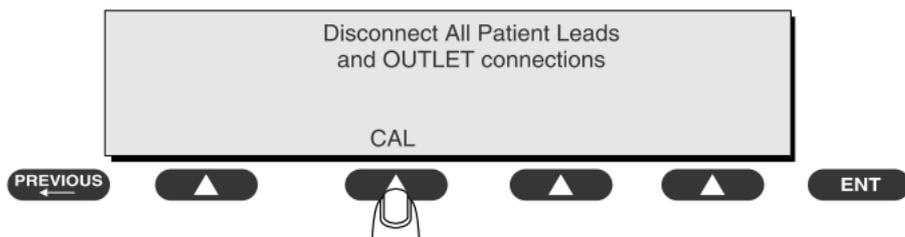
The following outlet conditions apply when performing the Mains on Applied Part test.

- Normal Polarity;
- Reversed Polarity

### Preparation

To perform a calibration from the Mains on Applied Part test, press CAL (SOFT KEY 2).

1. Disconnect ALL patient leads, test leads, and DUT outlet connections.
2. Press CAL to begin calibration, as shown:



If the calibration fails, the previously stored readings will be used until a passing calibration has occurred. Also, the esc/stop key has no effect during calibration.

3. When the calibration is finished, the Mains on Applied Part test will reappear.

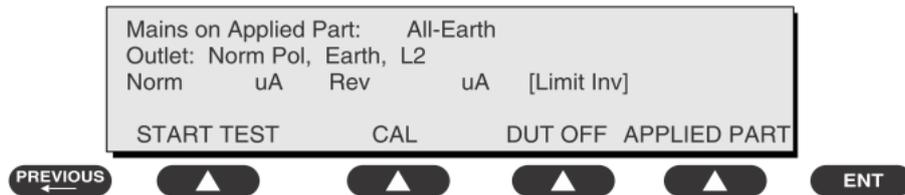
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## WARNING

- A 2-beep-per-second signal indicates high voltage present at the applied part terminals while a calibration is being performed.
  - High voltage is present at applied part terminals while measurements are being taken.
-

## To Perform the Test

1. From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601
2. Attach the applied parts to the 601PRO applied part terminals.
3. Attach the red terminal lead to a conductive part on the DUT enclosure.
4. Press shortcut key 7. The Mains on Applied Part test is displayed.



5. Select the desired outlet configuration and applied part to test using the appropriate SOFT KEYS:
6. Press START TEST (SOFT KEY 1) to begin the test.
7. Press the print data key to generate a printout of the latest measurement.

## NOTE

- 
- **If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and Step modes only.**
- 

## In Case of Failure

- Check any broken of the enclosure. Replace any defective part.
- Inspect wiring for bad crimps, poor connections, or damage.
- Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.
- Change another probe to confirm if the fail is caused by console.
- If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.
- If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

## LIMITS

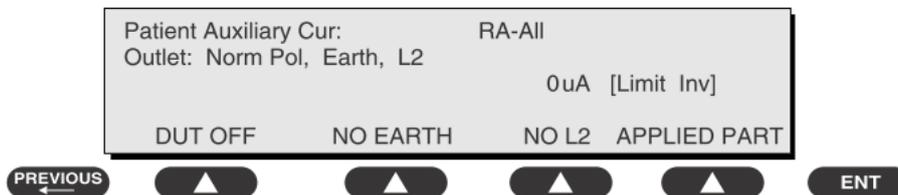
- For CF  applied parts: 50  $\mu$ A
- For BF  applied parts: 5000  $\mu$ A

## A.8 Patient Auxiliary Current

Patient Auxiliary currents are measured between any selected ECG jack and the remaining selected ECG jacks. All measurements may have a true RMS only response.

### Preparation

1. From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
2. Attach the patient leads to the 601PRO ECG jacks.
3. Define the Lead Types from the View Settings Option (refer to: Lead Type Definitions in Section 5 of this chapter).
4. Press shortcut key 8. The Patient Auxiliary Current test is displayed, and the test begins immediately. Display values are continuously updated until another test is selected.



5. Press SOFT KEYS 1-4 to select leakage tests
6. Press APPLIED PART (SOFT KEY 4) at any time to select the desired applied part leakage current:
7. Modify the configuration of the front panel outlet by pressing the appropriate SOFT KEY on the 601PRO:
8. Press the print data key at any time to generate a printout of the latest measurement.

### In Case of Failure

- Check any broken of the enclosure. Replace any defective part.
- Inspect wiring for bad crimps, poor connections, or damage.
- Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.
- Change another probe to confirm if the fail is caused by console.
- If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.
- If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

### LIMITS

For CF  applied parts,

- ◆ 10 $\mu$ A in Normal Condition
- ◆ 50 $\mu$ A in Single Fault Condition

For BF  applied parts,

- ◆ 100 $\mu$ A in Normal Condition
- ◆ 500 $\mu$ A in Single Fault Condition

## A.9 Scheduled Electrical Safety Inspection

For scheduled electrical safety inspection, test items 1, 2, 3, 4, 5, 6, 7, and 8 included in the **ELECTRICAL SAFETY INSPECTION FORM** shall be performed.

### ELECTRICAL SAFETY INSPECTION FORM

<b>Location:</b>			<b>Technician:</b>	
<b>Equipment:</b>			<b>Control Number:</b>	
<b>Manufacturer:</b>		<b>Model:</b>	<b>SN:</b>	
<b>Measurement equipment /SN:</b>			<b>Date of Calibration:</b>	
<b>INSPECTION AND TESTING</b>			<b>Pass/Fail</b>	<b>Limit</b>
1	Power Cord Plug			
2	Device Enclosure and Accessories			
3	Device Labeling			
4	Protective Earth Resistance		___Ω	Max 0.2 Ω
5	Earth Leakage	Normal condition (NC)	___μA	Max: NC: 300μA(refer to UL60601-1) * NC: 500μA(refer to IEC60601-1) * SFC: 1000μA
		Single Fault condition (SFC)	___μA	
6	Patient Leakage Current	Normal condition (NC)	<input type="checkbox"/> BF ___μA	Max: CF applied part: NC:10μA, SFC: 50μA BF applied part: NC:100μA, SFC: 500μA
			<input type="checkbox"/> CF ___μA	
		Single Fault condition (SFC)	<input type="checkbox"/> BF ___μA	
			<input type="checkbox"/> CF ___μA	
7	Mains on Applied Part Leakage		<input type="checkbox"/> BF ___μA	Max: CF applied part: 50μA BF applied part: 5000μA
			<input type="checkbox"/> CF ___μA	
8	Patient Auxiliary Current	Normal condition (NC)	<input type="checkbox"/> BF ___μA	Max: CF applied part: NC:10μA, SFC: 50μA BF applied part: NC:100μA, SFC: 500μA
			<input type="checkbox"/> CF ___μA	
		Single Fault condition (SFC)	<input type="checkbox"/> BF ___μA	
			<input type="checkbox"/> CF ___μA	

Note: The equipment sold to the United States shall comply with the requirement of UL60601-1; others shall comply with the requirement of IEC60601-1.

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

## A.10 Electrical Safety Inspection after Repair

The following table specifies test items to be performed after the equipment is repaired.

<b>Repair with main unit not disassembled</b>		Test items: 1, 2, 3
<b>Repair with main unit disassembled</b>	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

## ELECTRICAL SAFETY INSPECTION FORM

<b>Location:</b>			<b>Technician:</b>		
<b>Equipment:</b>			<b>Control Number:</b>		
<b>Manufacturer:</b>		<b>Model:</b>		<b>SN:</b>	
<b>Measurement equipment /SN:</b>			<b>Date of Calibration:</b>		
INSPECTION AND TESTING				Pass/Fail	Limit
1	Power Cord Plug				
2	Device Enclosure and Accessories				
3	Device Labeling				
4	Protective Earth Resistance		Ω		Max 0.2 Ω
5	Earth Leakage	Normal condition(NC)	____μA		Max: NC: 300μA(refer to UL60601-1) * NC: 500μA(refer to IEC60601-1) * SFC: 1000μA
		Single Fault condition(SFC)	____μA		
6	Patient Leakage Current	Normal condition(NC)	<input type="checkbox"/> BF ____μA		Max: CF applied part: NC:10μA, SFC: 50μA BF applied part: NC:100μA, SFC: 500μA
			<input type="checkbox"/> CF ____μA		
		Single Fault condition(SFC)	<input type="checkbox"/> BF ____μA		
			<input type="checkbox"/> CF ____μA		
7	Mains on Applied Part Leakage		<input type="checkbox"/> BF ____μA		Max: CF applied part: 50μA BF applied part: 5000μA
			<input type="checkbox"/> CF ____μA		
8	Patient Auxiliary Current	Normal condition(NC)	<input type="checkbox"/> BF ____μA		Max: CF applied part: NC:10μA, SFC: 50μA BF applied part: NC:100μA, SFC: 500μA
			<input type="checkbox"/> CF ____μA		
		Single Fault condition(SFC)	<input type="checkbox"/> BF ____μA		
			<input type="checkbox"/> CF ____μA		

Note: The equipment sold to the United States shall comply with the requirement of UL60601-1; others shall comply with the requirement of IEC60601-1.

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

**FOR YOUR NOTES**



