

**iMEC12/iMEC10/iMEC8**

**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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**FOR YOUR NOTES**

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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.

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## 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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# 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, could result in death or serious injury.
- 

### **CAUTION**

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- 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.
-

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### 1.1.1 DANGER

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

### 1.1.2 Warnings

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#### WARNING

- 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.
  - When you disassemble/reassemble a parameter module, a patient leakage current test must be performed before it is used again for monitoring.
  - The equipment must be connected to a properly installed power outlet with protective earth contacts only. If the installation does not provide for a protective earth conductor, disconnect it from the power line and operate it on battery power, if possible.
  - Dispose of the package material, observing the applicable waste control regulations and keeping it out of children’s reach.
- 

### 1.1.3 Cautions

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#### CAUTION























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





## 1.1.4 Notes

### NOTE

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

## 1.2 Equipment Symbols

	Attention: Consult accompanying documents (this manual).		
	Power ON/OFF (for a part of the equipment)		Battery indicator
	Alternating current (AC)		Alarms paused
	Alarm silenced		Record
	Freeze/unfreeze waveforms		Main menu
	NIBP start/stop key		Multifunctional output
	Equipotential grounding		VGA output
	USB connector		Network connector
	Gas outlet		Serial number
	Inserted direction		Manufacture date
	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.		
	European community representative		
	ESD warning symbol for electrostatic sensitive devices.		

	Type CF applied part. Defibrillator-proof protection against electric shock.
	Type BF applied part. Defibrillator-proof protection against electric shock.
	<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>
	Classified by Underwriters Laboratories Inc. with respect to electric shock, fire and mechanical hazards, only in accordance with UL 60601-1, CAN/CSA C22.2 NO.601-1, IEC 60601-1-1, IEC 60601-2-27, IEC 60601-2-30, IEC 60601-2-34, IEC 60601-2-49.



# 2 Theory of Operation

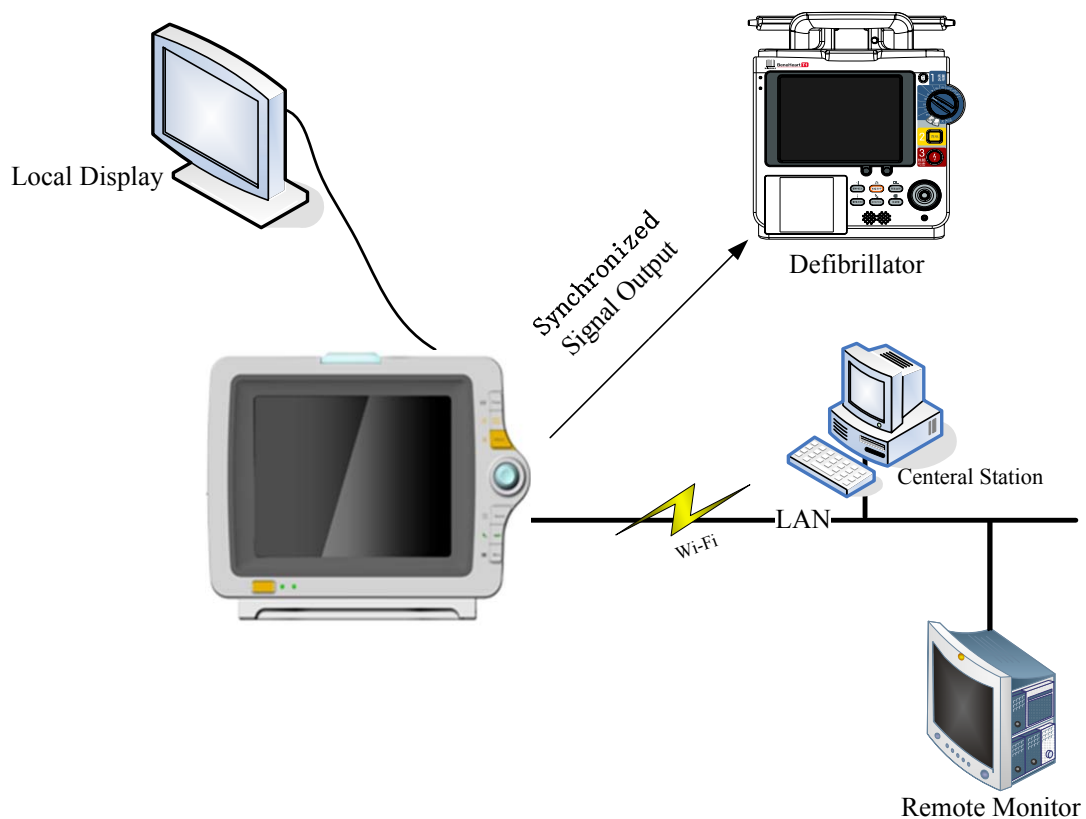
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## 2.1 Introduction

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.), and carbon dioxide (CO<sub>2</sub>).

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.



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The above figure shows a system consists of the iMEC patient monitor and its peripheral devices. The iMEC 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 Hyper Visor Central Monitoring System.
- Supports a secondary display.
- Supports external AC power source and an internal battery.
- 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 Mounting the Patient Monitor

The patient monitor can be mounted on a wall bracket or on a trolley support. The wall bracket or trolley support can be ordered 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.



#### **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.**
-

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## 2.2.2 Connectors for Peripheral Devices

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



Figure 1 iMEC Rear View

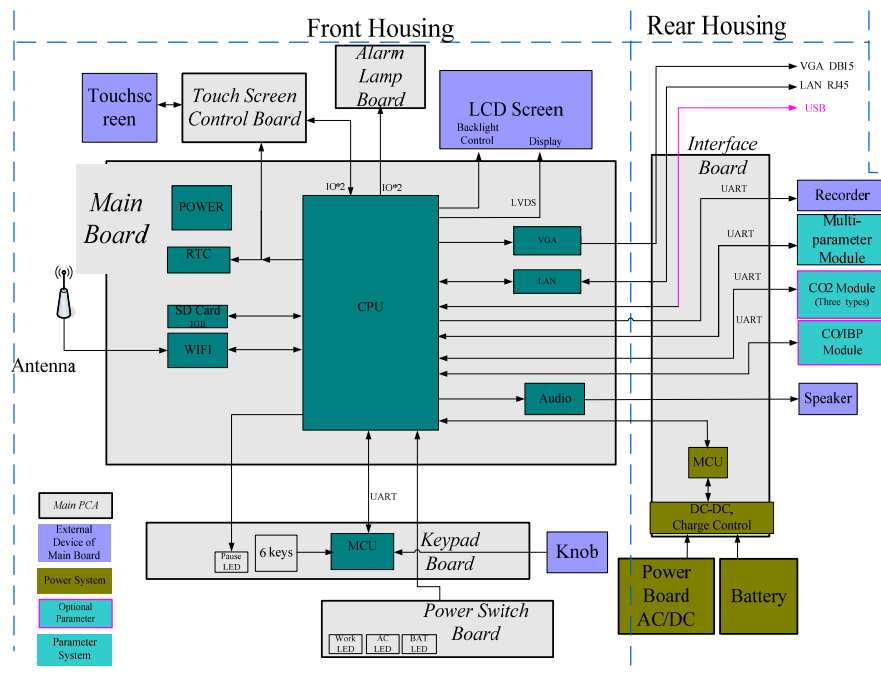
1. AC Power Connector: used to connect an AC power source (100 to 240 VAC, 50/60Hz).
2. Equipotential Terminal used to connect the equipotential terminal of other equipment, eliminating potential difference between different pieces of equipment.
3. VGA Connector: used to connect a secondary display.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

## 2.3 Main Unit

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

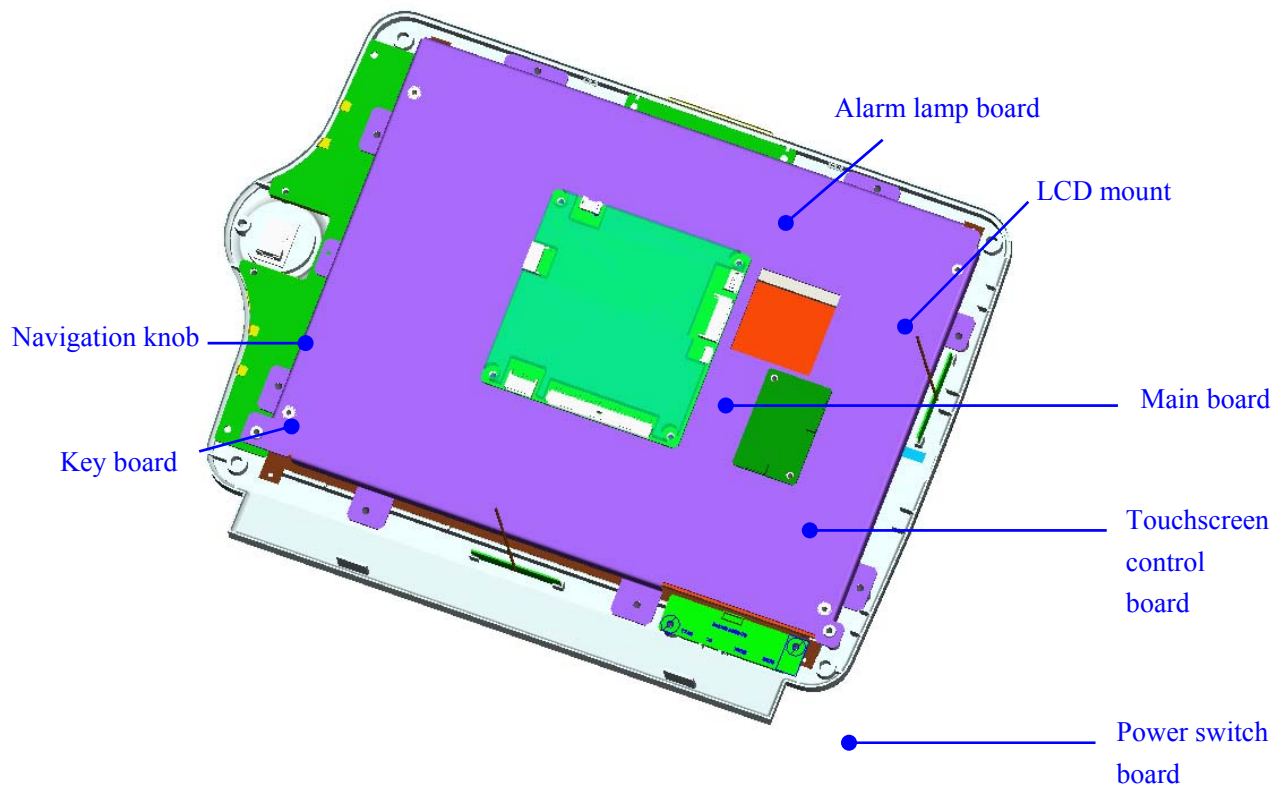
- Front housing assembly: main board, keypad board assembly (knob), display, touchscreen, alarm lamp board, power switch and indicator board.
- Rear housing assembly: power board (AC/DC), battery pad, interface board, recorder, speaker, multi-parameter module which includes three types of SpO<sub>2</sub>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

The following diagram illustrates the structure of the patient monitor.



---

## 2.4 Front Housing Assembly



### 2.4.1 Main Board

The main board is located at the center of the front housing assembly's LCD metal sheet. It is the heart of the patient monitor. It has the function of communication, display and data storage, including

- Display drive and backlight control
- Wired and wireless network
- Data storage (DDR + NOR flash + SD storage card)
- Printing
- Serial port: there are 7 serial ports, respectively for multi-parameter module, C.O./IBP module, sidestream/mainstream CO<sub>2</sub> module, recorder, power board, and key board. The seventh serial board is for future use.
- Connection of touchscreen board
- Audio drive
- EEPROM
- USB

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The main board has the following interfaces to connect other PCBAs:

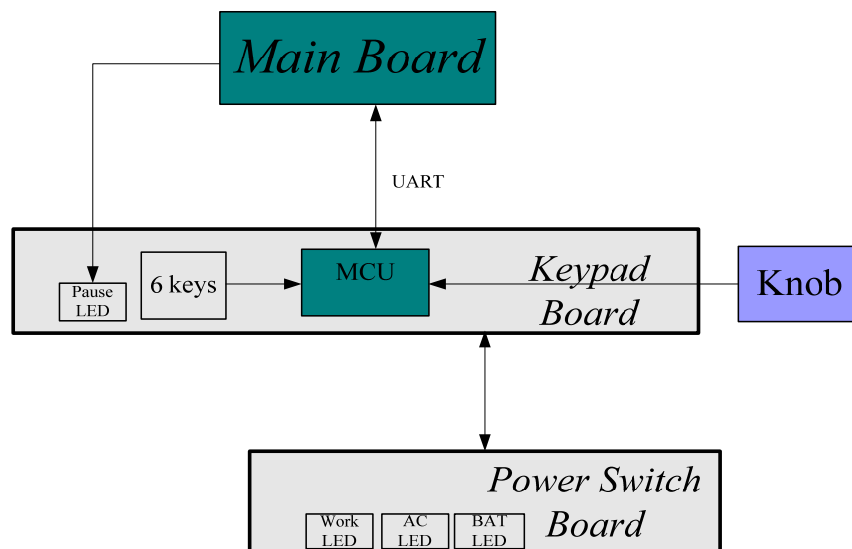
- Display signal interface
- Backlight control interface
- Key board interface
- Alarm light interface
- WIFI interface
- SD storage card interface
- Interface board interface (for external output, module communication, power supply, and etc)

## 2.4.2 Key Board and the Navigation Knob

The key board and navigation knob are located at the right side of the front housing assembly. The navigation knob can be rotated both clockwise and counterclockwise. It can also be pressed down. The navigation knob is connected with the key board.

- The key board has the following functions: It
- Scans and detects the input of the six keys.
- Integrates the power on/off hardkey.
- Integrates the rotary encoder.
- Connects and forwards the status of power switch and LED board to the main board.
- Communicates the main board through a serial port.

The follow figure shows the connection of key board.



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### **2.4.3 Power Switch and Indicator Board**

The power switch and indicator board controls the patient monitor's power switch. It has 3 groups of indicators which are used to indicate the status of AC mains and battery, as well as the monitor's power on/off status. The power switch and indicator board is connected with the key board.

### **2.4.4 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.

### **2.4.5 Display**

iMEC8, iMEC10 and iMEC12 respectively supports 8-inch, 10-inch, and 12-inch color LED backlight LCD. The display connects the main board through a display signal cable and a backlight cable. The interface cables for the three types of patient monitors are different and cannot be mixed.

The reliability of display signal cable is relatively poor. If display problem occurs, consider first to replaced the display signal cable.

### **2.4.6 Touchscreen and Touchscreen Control Board**

The fully configured iMEC patient monitor supports touchscreen.

The touchscreen can be controlled by touch and can be calibrated. The touchscreen is connected with the touchscreen control board and the main board.

The touchscreen control board drives the touchscreen and implements communication with the patient monitor. The touchscreen control board communicates with the main board via an I2C interface and connects the touchscreen via FPC.

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## 2.5 Back Housing Assembly

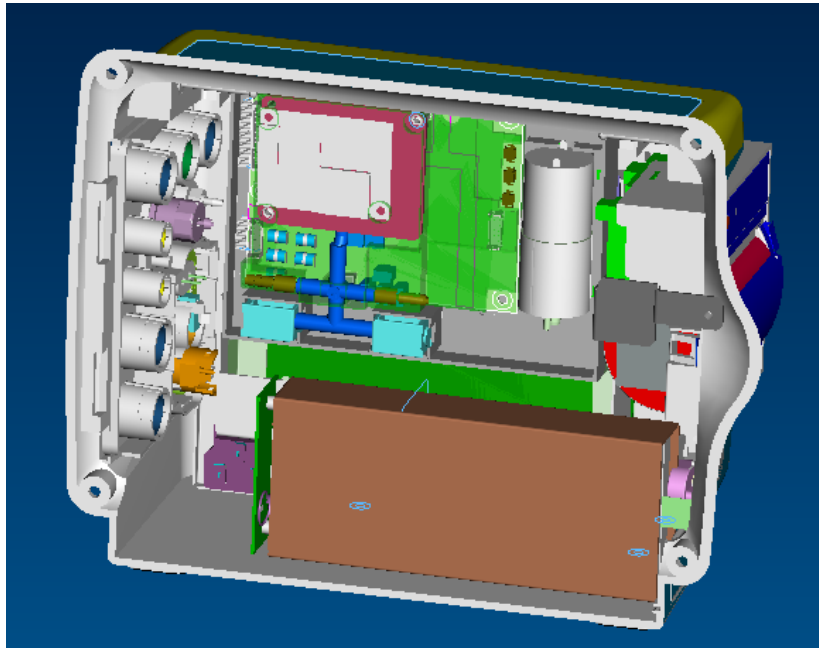
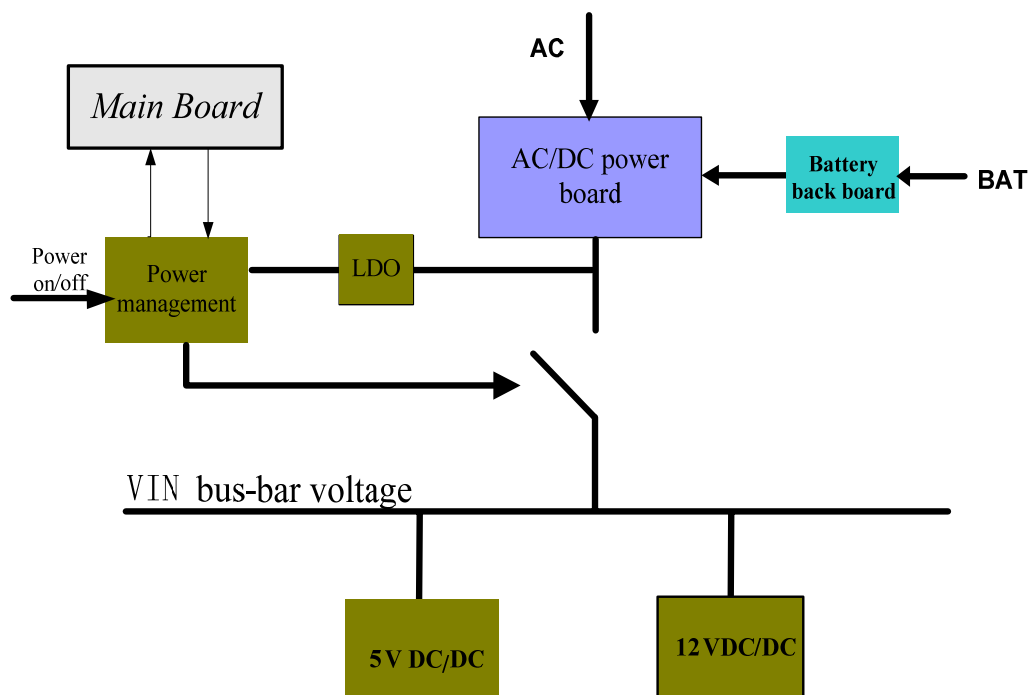


Figure 2 iMEC8 Back Housing Assembly Layout

The back housing assembly mainly includes power management system, multi-parameter collecting and processing system, recorder and speaker.

The power management system consists of three key components: AC/DC power board, DC/DC and power management, battery and battery back board. The structure is shown as below:





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The brown circuits are placed on the connector board. The three boards will be introduced respectively in the following:

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

The power board is located at the metal sheet of battery compartment at the lower part of patient monitor. The power board transforms the input AC (100~240 VAC、50/60 Hz) into 15.2V bus voltage VIN which is the power source for all voltages in patient monitor. AC/DC power board supplies power for all modules through the two-pin power cord connecting to the connector board.

### **2.5.2 Connector Board (DC/DC, power management circuit)**

The connector board is used to transfer the signal coming from external connectors and DC/DC, power management circuit.

- DC-DC: Output 12V (10.8~12.6V), 5V+/-5%
- Power management and connector
- DC/DC conversion circuit
- Single lithium battery charging and discharging management
- Power on/off control: no power-on delay, and power-off delay
- Battery type detection (current high-capacity and low-capacity lithium batteries)
- Battery on-site detection
- Battery voltage (capacity) detection
- AC or battery power supply detection
- Temperature check
- Communication with main board
- External connector signal transfer (RJ45, USB, multi-functional connector, VGA)

The connector board is the signal center of the whole system. All boards in back housing assembly needs to communicate with main board through the transfer of connector board. The connector definitions are:

- Multi-parameter module connector (2\*7pin)
- CO<sub>2</sub> connector (5pin)
- M03B-C.O. module connector (4pin)
- Recorder (6pin)
- AC-DC power board (2pin)

- 
- Battery back board (2\*4pin)
  - Speaker (2pin)
  - External connector (directly welt on the board): network, USB, VGA, multi functional connector
  - Main board connector (2\*25pin)
  - Preformed serial

All connectors are designed fool-proof to prevent mis-operations in production or maintenance. The connector board has two types of configuration:

NO.	Configuration Type	Common Requirement	Difference
1.	Standard (support standard patient monitor)	RJ45	No other ports
2.	Extended (support other patient monitors expect standard ones)		USB, VGA, multi-functional connector

### 2.5.3 Battery Back Board

The patient monitor consumes low power thanks to the better system design. One lithium battery is capable to supply the power for the whole system.

The battery back board transmits the signal of battery capacity and status into the internal system. This patient monitor only supports lithium battery. The on-site detection of lithium battery is achieved by the resistance inside the battery.

A new battery provides two types of information by 2 pins.

- Battery on-site information
- Battery low/high capacity information

The patient monitor supports 11.1V lithium chargeable battery. The battery is located at the base of patient monitor. The battery power is input into power module through battery connector board, and then power module processes and forwards the power into each components of the patient monitor. Two types of batteries are supported:

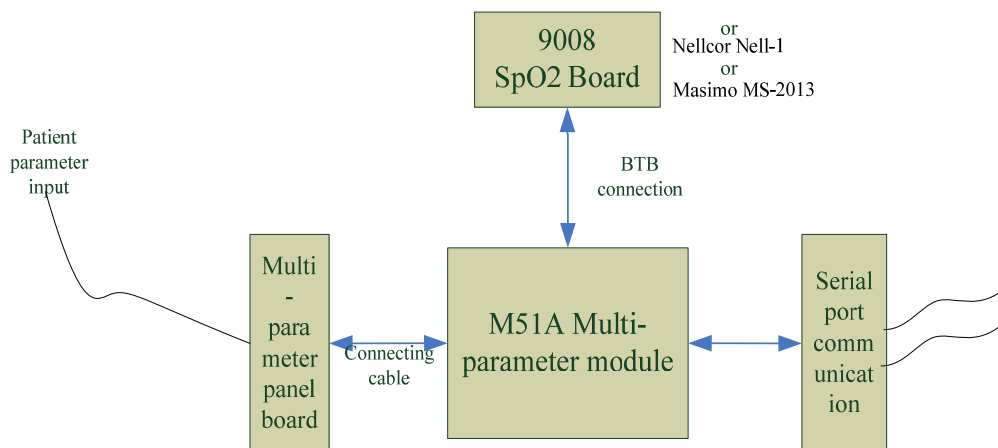
- Current high-end lithium battery 4500mAh
- New developed low capacity lithium battery 2600mAh

---

The battery is fool-proof for type and insertion. The patient monitor requires a battery of correct type to be inserted in correct direction. Otherwise, the battery can not be loaded.

## 2.5.4 Parameter Module

The parameter module is a relatively independent system, which consists of a multi-parameter module and a SpO2 board, as shown below:



## 2.5.5 Multi-parameter Module

The multi-parameter module, as well as the NIBP pump and electromagnetic valve, are located on the bracket of the multi-parameter module, which is fixed to the rear housing with 4 screws.

The multi-parameter module is connected to the connector board with a 2 x 7 pin cable to supply power for the parameter module, communicate with the main board, and realize analog output and Defib sync output. It adopts the DSP processor as the core. For ECG applications, the self-developed Mindray ECG\_ASIC chip is used to realize 3/5/12-lead ECG, and RESP (I/II lead selectable) measurement, which greatly simplifies the sampling and control of ECG signals for the DSP.

As for NIBP, IBP, and TEMP measurement, the high-precision  $\Sigma - \Delta$  ADC is used to realize a direct sampling of corresponding parameter signals. Mindray SpO<sub>2</sub> measurement is realized by a stacking connector. The Nellcor and Masimo SpO<sub>2</sub> boards are also compatible with the multi-parameter module, being connected through a BTB socket.

- 
- 2-channel 3/5-lead ECG parameter (12-lead will be developed in the future), with selectable I/II resp lead;
  - Mindray/Nellcor/Masimo SpO<sub>2</sub> powering and communication;
  - 2-channel TEMP;
  - 2-channel IBP;
  - NIBP parameter;
  - Algorithms for all parameters, communicating with the main board through UART serial port; and,
  - 4 parallel output interfaces: (1 for ECG, 2 for IBP, and the other for Defib sync output)

The ECG parameter is isolated separately while the others are protected from earth.

### **2.5.6 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.

### **2.5.7 C.O. Module**

The C.O. module is located on the back of the bracket of the multi-parameter module, facing the multi-parameter module with the bracket in between. The current on-line M03B module is used for C.O. measurement. The C.O. module is an independent subsystem. It is connected with the main board through the serial port and interface board.

### **2.5.8 CO<sub>2</sub> Module**

The CO<sub>2</sub> module is also located on the back of the bracket of the multi-parameter module, next to the C.O. module. The CO<sub>2</sub> module is an independent subsystem. It is connected with the main board through the serial port and interface board. The socket for CO<sub>2</sub> module on the interface board is 5-pin, different from that for C.O. module, which avoids misoperation.

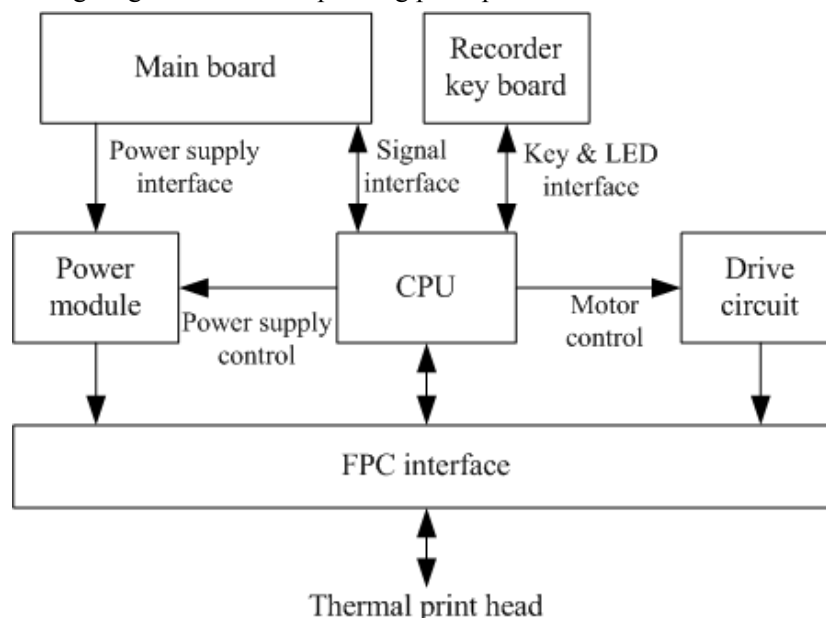
Three gas modules, which can be selected in corresponding menu, are supported on the patient monitor:

- M02C sidestream module;
- Capnostat mainstream CO<sub>2</sub> module; and,
- Ordion microstream CO<sub>2</sub> module.

## 2.5.9 Recorder

The recorder receives data from the main board and then sends them to the thermal printhead for printing. The recorder has a hardkey (starting/stopping recordings) and a green LED on its front. It is connected with the main board.

The following diagram shows its operating principle:



Module	Description
Power interface	Introduces a DC from the main board.
Power module	Converts the input power into voltages that fit each module and then forwards them to each module.
CPU	Control the communications between modules.
Signal interface	Control the communications between the main board and the recorder CPU.
Motor drive circuit	Receives the control signals from the CPU and then forwards them to the step engines.
Key&LED interface	Includes a button and an LED which are directly controlled by the CPU.

---

## 2.6 Speaker

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

# 3 Unpacking and Installation

---

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

## 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.

- 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.

Accessory packing



Main unit

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 defibrillator/monitor needs to be connected to network.



#### **WARNING**

- 
- Only power cables provided with the system may be used. For reasons of safety, power (mains) extension cables or adapters shall not be used.
- 

### Environmental Requirements



#### **WARNING**

- 
- To avoid explosion hazard, do not use the equipment in the presence of flammable anaesthetics, vapours or liquids.
- 



#### **CAUTION**

- 
- 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 accuracy of the system may be affected and damage may occur.
-



---

The environmental specification is as follows:

Main unit		
Item	Operating conditions	Storage conditions
Temperature (°C)	0 to 40	-20 to 60
Relative humidity (noncondensing)	15% to 95%	10% to 95%
Barometric (mmHg)	427.5 to 805.5	120 to 805.5

Microstream CO <sub>2</sub> module		
Item	Operating conditions	Storage conditions
Temperature (°C)	0 to 40	-20 to 60
Relative humidity (noncondensing)	15% to 95%	10% to 95%
Barometric (mmHg)	430 to 790	430 to 790

Sidestream CO <sub>2</sub> module		
Item	Operating conditions	Storage conditions
Temperature (°C)	5 to 40	-20 to 60
Relative humidity (noncondensing)	15% to 95%	10% to 95%
Barometric (mmHg)	430 to 790	430 to 790

Mainstream CO <sub>2</sub> module		
Item	Operating conditions	Storage conditions
Temperature (°C)	0 to 40	-20 to 60
Relative humidity (noncondensing)	15% to 90%	10% to 90%
Barometric (mmHg)	427.5 to 805.5	400 to 805.5

## NOTE

- 
- The environmental specifications of unspecified parameters are the same as those of the main unit.
-

---

### 3.2.2 Electrical Requirements

Check cables and power cords. Make sure that:

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



#### **WARNING**

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

The electrical specification is as follows:

Line voltage	100 to 240VAC
Current	1.1 to 0.5 A
Frequency	50/60Hz

### 3.3 Monitor Installation

Refer to *3.1 Installation, iMEC 12/ iMEC 10/ iMEC 8 Patient Monitor Operator's Manual..*

### 3.4 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.

# 4 Testing and Maintenance

---

## 4.1 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 equipment and frequency. The service personnel should perform the testing and maintenance procedures as required and use appropriate test equipment.

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



### CAUTION

- 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.
- 

### 4.1.1 Test Equipment

See the following sections.

### 4.1.2 Test Report

Upon 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.

---

### 4.1.3 Preventative Maintenance

Below are preventative maintenance tests which need to be performed on the monitor. See the following sections for detailed maintenance procedures.

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

### 4.1.4 Recommended Frequency

Check/Maintenance Item		Frequency
Preventative Maintenance Tests		
Visual inspection		1. When first installed or reinstalled.
NIBP test	Pressure check	1. If the user suspects that the measurement is incorrect. 2. Following any repairs or replacement of relevant module. 3. At least once a year is recommended for NIBP and CO <sub>2</sub> .
	Leakage test	
	Calibration	
Sidestream and Microstream CO <sub>2</sub> tests	Leakage test	
	Performance test	
	Calibration	
Performance Tests		
ECG test	Performance test	1. If the user suspects that the measurement is incorrect. 2. Following any repairs or replacement of relevant module. 3. At least once every two years. Note: At least once a year is recommended for NIBP and CO <sub>2</sub> .
	Calibration	
Resp performance test		
SpO <sub>2</sub> test		
NIBP test	Pressure check	
	Leakage test	
	Calibration	
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	
Nurse call relay performance test		If the user suspects that the nurse call or analog output does not work well.
Analog output performance test		
<b>Electrical Safety Tests</b>		
Electrical safety tests	Refer to <i>A <b>Electrical Safety Inspection</b></i> .	<ol style="list-style-type: none"><li>1. Following any repair or replacement</li><li>2. After the monitor drops.</li><li>3. At least once every two years.</li></ol>
<b>Other Tests</b>		
Power on test		<ol style="list-style-type: none"><li>1. When first installed or reinstalled.</li><li>2. Following any maintenance or the replacement of any main unit parts.</li></ol>
Touchscreen calibration		<ol style="list-style-type: none"><li>1. When the touchscreen appears abnormal.</li><li>2. 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>1. When first installed.</li><li>2. Whenever a battery is replaced.</li></ol>

## 4.2 Preventative Maintenance Procedures

### 4.2.1 Visual Inspection

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

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

---

## 4.2.2 NIBP Tests and Calibration

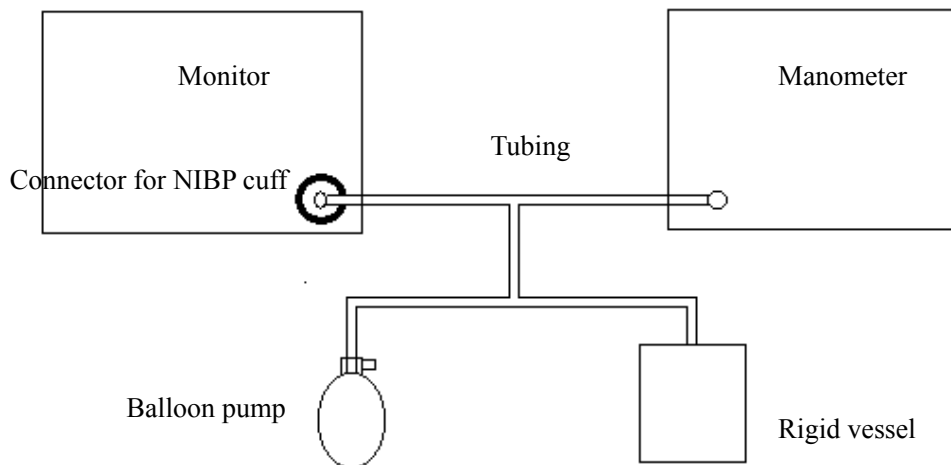
### NIBP Accuracy Test

Tools required:

- T-shape connector
- Appropriate tubing
- Balloon pump
- Rigid Vessel with volume  $500 \pm 25$  ml
- Reference manometer (calibrated with accuracy equal to or greater than 1 mmHg)

Follow this procedure to perform the test:

1. Connect the equipment as shown below.



2. Before inflation, the reading of the manometer should be 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 0mmHg.
5. Raise the pressure in the rigid vessel to 50 mmHg with the balloon pump. Then, wait for 10 seconds until the measured values become stable.
6. Compare the manometer values with the monitor values. The difference should be 3 mmHg. If it is greater than 3 mmHg, calibrate the monitor by referring to the **NIBP Calibration** section.
7. Raise the pressure in the rigid vessel to 200 mmHg with the balloon pump. Then, wait for 10 seconds until the measured values become stable and repeat step 6.

---

## NOTE

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

## NIBP Leakage Test

### NOTE

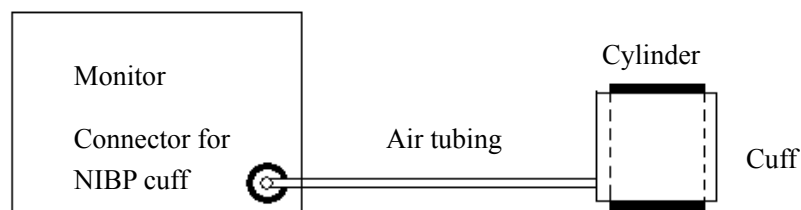
- You should perform NIBP accuracy test and make sure the test result is pass prior to NIBP leakage test.
- 

Tools required:

- NIBP cuff for adult patient
- Appropriate tubing
- Cylinder

Follow this procedure to perform the test:

1. Set **[Patient Cat.]** to **[Adu]**.
2. Connect the NIBP cuff with 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 20s, which means NIBP leakage test is completed.

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 procedures 1-4 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 time. Then, record the pressure value after counting to 60s.
4. Compare the two values and make sure the difference should not be greater than 6 mmHg.

## NIBP Calibration

Tools required:

- T-shape connector
- Appropriating tubing
- Balloon pump
- Metal Vessel with volume  $500 \pm 25$  ml
- Reference manometer (calibrated with accuracy equal to or greater than 1 mmHg)

Follow this procedure to perform a NIBP calibration:

1. Perform procedures 1-4 in the **NIBP Accuracy Test** section.
2. Select [**Main Menu**] → [**Maintenance >>**] → [**Factory Maintenance >>**] → enter the required password → [**Calibrate NIBP >>**].
3. Set [**NIBP Pressure**] to 150 mmHg in the [**NIBP Measurement Circuit**]. Raise the pump pressure to 150 mmHg. After the pressure value is stabilized, select the [**Calibrate**] button to start a calibration.
4. Set patient category to [**Adu/Ped**] in the [**Overpressure Protection Circuit**], and raise the pressure to 330 mmHg. After the pressure value is stabilized, select [**Calibrate**] to start a calibration.
5. Set the patient category to [**Neo**] in the [**Overpressure Protection Circuit**], and raise the pressure to 165 mmHg. After the pressure value is stabilized, select [**Calibrate**] to start a calibration.

All calibration results are displayed in the [**Calibrate NIBP**] menu. If the calibration fails, check the test system for leakage and perform another calibration.



---

## 4.2.3 Sidestream and Microstream CO<sub>2</sub> Module Tests and Calibration

### Leakage test

Follow this procedure to perform the test:

1. Turn on the patient monitor.
2. Wait 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> FilterLine Err**] is displayed on the screen after certain time. Block the gas inlet for another 30 s. 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 certain time. Block the gas inlet for another 30s. If alarm message [**CO<sub>2</sub> FilterLine Err**] is shown, it indicates that the module does not leak.

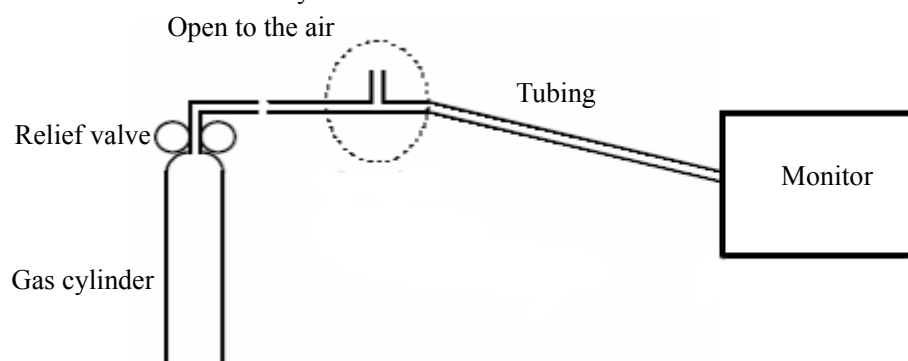
### Accuracy Test

Tools required:

- A steel gas cylinder with  $6\pm0.05\%$  CO<sub>2</sub> and balance gas N<sub>2</sub>
- T-shape connector
- Tubing

Follow this procedure to perform the test:

1. Turn on the patient monitor.
2. Wait until the CO<sub>2</sub> module 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. Enter [**User Maintenance**] → enter the required password → [**Maintain CO<sub>2</sub> Purging**] → [**Calibrate CO<sub>2</sub>>>**].
4. Connect the test system as follows:



- 
5. Open the relief valve to vent standard CO<sub>2</sub> and make sure that there is an excess gas flow through the T-shape connector to air..
  6. Check the realtime CO<sub>2</sub> value is within  $6 \pm 0.3\%$  in the [**Calibrate CO<sub>2</sub>**] menu.

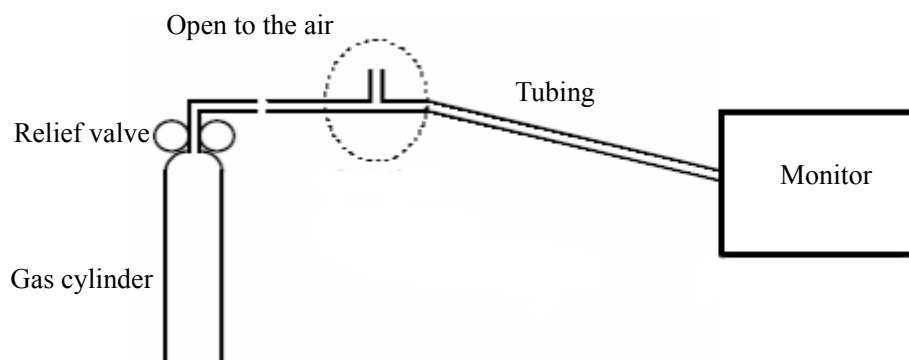
## Calibration

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
- Tubing

Follow this procedure to perform a calibration:

1. Make sure that the sidestream 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 CO<sub>2</sub> >>**]→ [**Calibrate CO<sub>2</sub> >>**].
4. In the [**Calibrate CO<sub>2</sub>**] menu, select [**Zero**].
5. After the zero calibration is finished successfully, connect the equipment as follows:



6. Open the relief valve to vent standard CO<sub>2</sub> and make sure that there is an excess gas flow through the T-shape connector to air.
7. In the [**Calibrate CO<sub>2</sub>**] menu, enter the vented CO<sub>2</sub> concentration in the [**CO<sub>2</sub>**] field.
8. In the [**Calibrate CO<sub>2</sub>**] menu, the measured CO<sub>2</sub> concentration is displayed. After the measured CO<sub>2</sub> concentration becomes stable, select [**Calibrate CO<sub>2</sub>**] to calibrate the CO<sub>2</sub> module.

---

If the calibration is finished successfully, the message [**Calibration Completed!**] is displayed in the [**Calibrate CO<sub>2</sub>**] menu. If the calibration failed, the message [**Calibration Failed!**] is displayed. In this case, perform another calibration.

#### 4.2.4 Preventative maintenance test report

<b>Customer name</b>		
<b>Customer address</b>		
<b>Servicing person</b>		
<b>Servicing company</b>		
<b>Equipment under test (EUT)</b>		
<b>Model of EUT</b>		
<b>SN of EUT</b>		
<b>Hardware version</b>		
<b>Software version</b>		
<b>Test equipment</b>	<b>Model/No.</b>	<b>Effective date of calibration</b>
<b>Test items</b>	<b>Test records</b>	<b>Test results(Pass/Fail)</b>
<b>Visual inspection</b>		
The case, display screen, buttons, knob, SMR, modules, power cord, wall-mount bracket and accessories have no obvious signs of damage.		
The external connecting cables are not frayed and the connector pins are not loose and bent.		
The external connectors are not loose or their pins are not bent.		
The safety labels and data plate are clearly legible.		

---

<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 6mmHg/min.		
<b>Sidestream CO<sub>2</sub> test</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 CO <sub>2</sub> Filterline Err is given. It indicates that there is no leakage.		
The displayed CO <sub>2</sub> value is within $6\pm 0.05\%$ .		
<b>Microstream CO<sub>2</sub> test</b>		
Block the gas inlet of the module or watertrap. 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 $6\pm 0.05\%$ .		

## 4.3 Power On Test

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

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

---

## 4.4 Module Performance Tests

### 4.4.1 ECG Tests and Calibration

#### ECG Performance Test

Tool required:

- Fluke Medsim 300B patient simulator recommended

Follow this procedure to perform the test:

1. Connect the patient simulator with the ECG module using an ECG cable.
2. Set the patient simulator as follows: ECG sinus rhythm, HR=80 bpm with the amplitude as 1mV.
3. Check the ECG waves are displayed correctly without noise and the displayed HR value is within  $80 \pm 1$  bpm.
4. Disconnect each of the leads in turn and observe the corresponding lead off message displayed on the screen.
5. Set that 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

Follow this procedure to perform a calibration:

1. Select the ECG parameter window or waveform area → **[Filter]** → **[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]**.

If necessary, you can print out the square wave and wave scale through the recorder and then measure the difference.

---

## 4.4.2 Resp Performance Test

Tool required:

- Fluke Medsim 300B patient simulator recommended

Follow this procedure to perform the test:

1. Connect the patient simulator to the module using a non ESU-proof cable and set lead II as the respiration lead.
2. Configure the simulator as follows: lead II as the respiration lead, base impedance line as 1500  $\Omega$ ; delta impedance as 0.5  $\Omega$ , 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.

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

Tool Required:

- None.

Follow this procedure to perform the test:

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 [**SpO<sub>2</sub>**] on the monitor.
2. Measure SpO<sub>2</sub> on your 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%-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.**
-

---

#### 4.4.4 NIBP Tests

See section *1.2.2 NIBP Tests*.

#### 4.4.5 Temp Test

Tool required:

- Resistance box (with accuracy above  $0.1\Omega$ )

Follow this procedure to perform the test:

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  $37^{\circ}\text{C}$ ).
3. Verify each Temp channel of the monitor and make sure that the displayed value is within  $37 \pm 0.1^{\circ}\text{C}$ .

You can also use a patient simulator to perform the Temp test.

#### 4.4.6 IBP Tests and Calibration

##### IBP Performance Test

Tool required:

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

Follow this procedure to perform the test:

1. Connect the patient simulator with the pressure connector.
2. Make the patient simulator outputs 0 to each IBP channel.
3. Make a zero calibration.
4. Configure the patient simulator as P (static) = 200 mmHg.
5. The displayed value should be within  $200 \pm 2$  mmHg.
6. If the value is outside of these tolerances, 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. Make that the patient simulator outputs 120/80 mmHg ART signals and 120/0 mmHg LV signals respectively to each IBP channel and check that the IBP wave is displayed correctly.
8. Repeat the steps above for all the IBP channels.

---

## IBP Pressure Calibration

Method 1:

Tools required:

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

Follow this procedure to perform the test:

1. Connect the patient simulator to the pressure connector.
2. Set the patient simulator to 0 pressure for the desired IBP channel.
3. Make a zero calibration.
4. Configure 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 a calibration.
7. If the calibration is completed successfully, the message [**Calibration Completed!**] will be displayed. Otherwise, a corresponding message will be displayed.

Method 2:

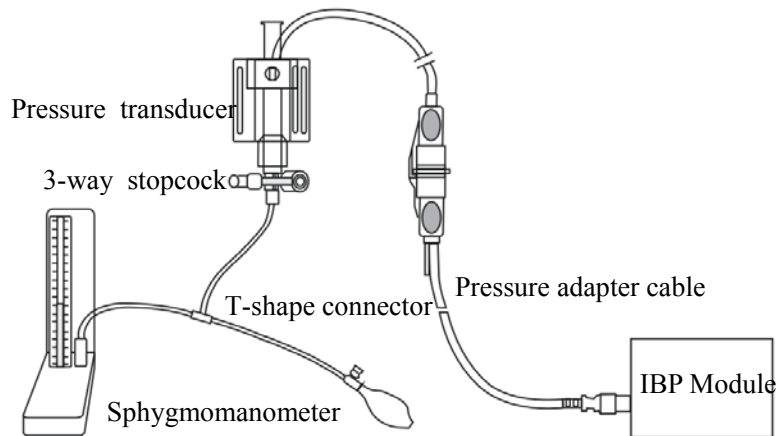
Tools required:

- Standard sphygmomanometer
- Balloon pump
- Tubing
- T-shape connector

To perform a calibration:

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





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

#### 4.4.7 C.O. Test

Tools required:

- Medsim300B Patient simulator
- C.O. adapter box

Follow this procedure to perform the test:

1. Connect the patient simulator to the C.O. connector using a C.O. main cable.
2. Set the blood temperature (BT) to 37°C on the patient simulator and check the temperature value is  $37 \pm 0.1^\circ\text{C}$ .
3. Set [**Auto IT**] to [**Off**] and adjust [**IT**] to 24°C. Select [**C.O. Measure**] to enter the C.O. measurement window and set [**Comp. Const.**] to 0.542.
4. Set the injectate temperature to 24°C and the C.O. to 5L/min on the C.O. simulator. Select [**Start**] in the C.O. measurement window to start C.O. measurements and after 3-10 seconds press the run key on the simulator.
5. Check the C.O. value is  $5 \pm 0.25\text{L/min}$ .

---

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

### NOTE

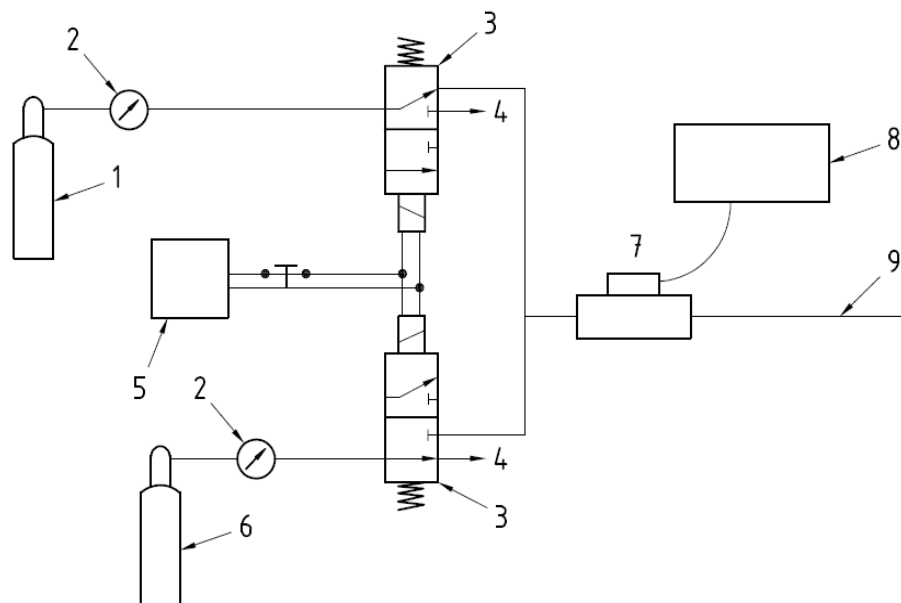
- Make sure that the barometric pressure set in [Maintain CO<sub>2</sub>] of [User Maintenance] accords with the local barometric pressure before performing mainstream CO<sub>2</sub> tests.
- 

Tools required:

- A steel gas cylinder with  $6\pm0.05\%$  CO<sub>2</sub>
- A steel gas cylinder with compressed air or N<sub>2</sub> (with standard concentration)
- Two 3-way valves (power supply controlled)
- Flowmeter
- Power supply
- Tube

Follow this procedure to perform the test:

1. Wait until 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 zero calibration fails, the prompt message [CO<sub>2</sub> **Zero Failed**] is displayed. Otherwise, the baseline of waveform recovers to zero.
2. Set [Apnea Time] to 10 s in the [Adjust CO<sub>2</sub> Limits] menu.
3. 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.
4. Connect the test system as follows.



---

Indication of numbers in the figure above:

- 1 A steel gas cylinder with  $6 \pm 0.05\%$  CO<sub>2</sub>
  - 2 Flowmeter
  - 3 3-way valve (power supply controlled)
  - 4 Open to air
  - 5 Power supply (controlling two 3-way valves)
  - 6 Compressed air or N<sub>2</sub> with standard concentration
  - 7 Mainstream CO<sub>2</sub> sensor
  - 8 Patient monitor
  - 9 Tube (preventing back flow)
- 
- 5 Adjust the power supply and turn on/off 3-way valves to ensure that that only one cylinder is connected to Mainstream CO<sub>2</sub> sensor via 3-way valves at one time and the flowmeter reading is stable and within 2-5L/min.
  - 6 Switch between the two cylinders to connect Mainstream CO<sub>2</sub> sensor at intervals of 6-10s and check if the displayed CO<sub>2</sub> value is within  $6 \pm 0.05\%$ .

#### 4.4.9 Sidestream and Microstream CO<sub>2</sub> Module Tests

See section 3.2.3 Sidestream and Microstream CO<sub>2</sub> Module Tests.

### 4.5 Nurse Call Relay Performance Test

Tools 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 select all options of [**Alm Lev**] and [**Alarm Cat.**] and set [**Contact Type**] to [**Normally Open**]
4. In [**Nurse Call Setup >>**] setup menu, set [**Signal Type**] to [**Pulse**]. Make the monitor to generate an alarm and check that the oscilloscope displays positive pulses of 1s width when there is an alarm.
5. In [**Nurse Call Setup >>**] setup menu, set [**Signal Type**] to [**Continuous**]. Make the monitor to generate an alarm and check that the oscilloscope outputs continuous high level when there is an alarm.

---

## 4.6 Analog Output Performance Test

Tool required:



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

## 4.7 Electrical Safety Test

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

## 4.8 Touchscreen Calibration

Tools 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.

## 4.9 Recorder Check

Tools 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.

## 4.10 Battery Check

Tools required:

- None.

### Function 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.

## 4.11 Factory Maintenance

### 4.11.1 Accessing Factory Maintenance Menu

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

### 4.11.2 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.

---

### 4.11.3 Recorder

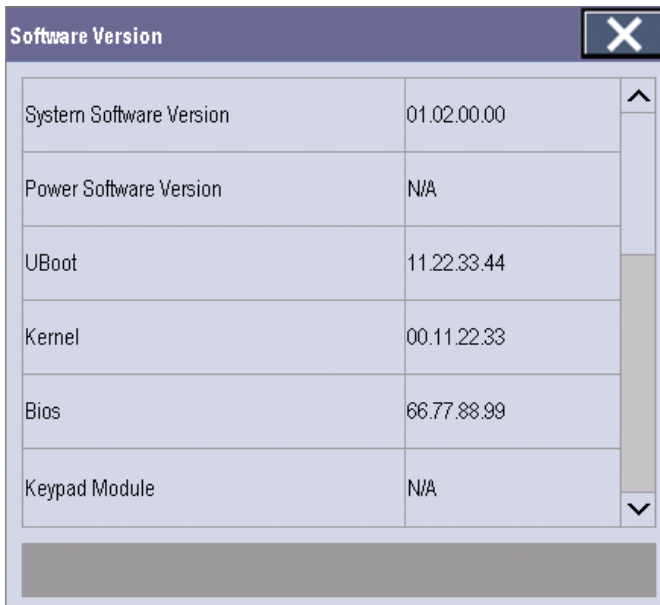
To enable/disable the recorder, select [**Recorder**] and toggle between [**On**] and [**Off**].

#### CAUTION

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

### 4.11.4 Software Version

Selecting [**Software Version**] will show software version information. The [**Software Version**] menu is as follows:



System Software Version	01.02.00.00
Power Software Version	N/A
UBoot	11.22.33.44
Kernel	00.11.22.33
Bios	66.77.88.99
Keypad Module	N/A

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### 4.11.5 Monitor Information

Selecting [**Monitor Information**] will show the status of the patient monitor. Monitor information is displayed as follows:

Monitor Information	
Total Runtime	0Days0Hours5Minutes
CPU PCB/BOM Version	051-000964-00,01
CPU ID	12345678901234
MotherBoard PCB/BOM	N/A
IMR Nios Module PCB/BOM Version	N/A

Electronic SN setup >>

### 4.11.6 Calibrate NIBP

For details, refer to section **3.4.4 NIBP Tests**.

---

## Maintenance and Test Report

(See the above sections for detailed test procedures and contents)

Customer name			
Customer address			
Servicing person			
Servicing company			
Equipment under test (EUT)			
Model of EUT			
SN of EUT			
Hardware version			
Software version			
Test equipment	Model/No.	Effective date of calibration	
Test items	Test records		Test results(Pass/Fail)
<b>Visual inspection</b>			
The case, display screen, buttons, knob, power cord, wall-mount bracket and accessories have no obvious signs of damage.			
The external connecting cables are not frayed and the connector pins are not loose and bent.			
The external connectors are not loose or their pins are not bent.			
The safety labels and data plate are clearly legible.			
<b>Power-on test</b>			
The power-on test is passed. The power indicator and alarm system work correctly and the monitor start up properly.			
<b>Performance test</b>			



<b>ECG performance test</b>		
ECG waves are displayed correctly without noise and the HR value is within $80 \pm 1$ bpm.		
ECG Lead Off alarm behaves correctly.		
Paced signals are detected and pace pulse marks are displayed when [Paced] is set to [Yes]		
The difference between the amplitude of the ECG calibration square wave and that of the wave scale is not greater than 5%.		
<b>Resp test</b>		
The Resp wave is not distorted and the Resp value is within $40 \pm 2$ rpm.		
<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%-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 6mmHg/min.		
<b>Temp test</b>		
The value displayed for each Temp channel of the monitor is within $37 \pm 0.1^\circ\text{C}$ .		
<b>IBP test</b>		
The static pressure value displayed for each IBP channel is within $200 \pm 2$ 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 $37 \pm 0.1^\circ\text{C}$ .		
The displayed C.O. value is within $5 \pm 0.25\text{L/min}$ .		
<b>Mainstream CO<sub>2</sub> test</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 $6 \pm 0.05\%$ .		

<b>Sidestream CO<sub>2</sub> test</b>		
Block the gas inlet or watertrap. The sidestream CO <sub>2</sub> flowrate is slower than 10ml/min and 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±0.3 %.		
<b>Miscrostream CO<sub>2</sub> test</b>		
Block the gas inlet or watertrap. 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±0.3 %		
<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, paper jam, etc. the 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 operates correctly from battery power when an AC power failure accidentally occurs.		
T5 patient monitor can operate independently on a single battery.		
The operating time of the battery meets the product specification.		

# 5 Troubleshooting

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## 5.1 Introduction

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

## 5.2 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 **6 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. If the trouble remains, exchange the replacement PCB with the original suspicious PCB and continue troubleshooting as directed in this chapter. Defective PCB can be sent to us for repair.

To obtain information on replacement parts or order them, refer to **7 Parts**.

## 5.3 Patient Monitor Status Check

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

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

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## 5.4 Software Version Check

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

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

## 5.5 Technical Alarm Check


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

## 5.6 Troubleshooting Guide

### 5.6.1 Power On/Off Failures

Symptoms	Possible Cause	Corrective Action
The patient monitor fails to start: AC LED, power on/off LED or battery LED does not light	AC mains not connected or battery too low	Check that AC mains is properly connected or battery capacity is sufficient.
	Power supply protection	Refer to <b>1.1.1</b> .
	Cables defective or poorly connected	1. Check that the cables from power switch & LED board to button board, button board to main board, power board to interface board, and interface board to main board are correctly connected. 2. Check that cables and connectors are not damaged.
	Power switch & LED board defective	Replace the power switch & LED board.
	Power board defective	Replace the power board.
	Interface board defective	Replace the interface board.
	Mother board Defective	Replace the mother board.

## 5.6.2 Display Failures

Symptoms	Possible Cause	Corrective Action
Integrated display is blank but the patient monitor still works correctly.	Cables defective or poorly connected.	1. Check that cables from the display to the main board 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.
	Cables defective or poorly connected.	1. Check that cables from the display to the main board are correctly connected. 2. Check that the cables and connectors are not damaged.
Secondary display does not function or displays snows or flashing specks	Cables defective or poorly connected	1. Check that the cable between the display and the patient monitor is correctly connected. 2. Check that the cables and connectors are not damaged.
	Interface board defective	Replace the interface board.
	The main board is damaged.	Replace the main board.
Touchscreen does not respond	Touchscreen disabled	Check if there is a symbol  shown above the [Main Menu] QuickKey. If yes, press the [Main Menu] QuickKey for more than 3s to enable the touchscreen.
	Cables defective or poorly connected.	1. Check that the cables from the touchscreen to the touchscreen control board, the touchscreen control board to the button board, and the button board to the mother board are correctly connected. 2. Check that the cables and connectors are properly connected
	Touchscreen control board defective	Replace the touchscreen control board
	Touchscreen defective.	Replace the touchscreen
	Main board defective	Replace the main board

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Symptoms	Possible Cause	Corrective Action
Touch position invalid	Touchscreen not calibrated	Calibrate the touchscreen

### 5.6.3 Alarm Lamp Problems

Symptoms	Possible Cause	Corrective Action
The alarm lamp is not light or extinguished, or the alarm lamp illuminates abnormally.	Cable defective or poorly connected	1. Check that the cable from alarm LED board to main board is properly connected. 2. Check that connecting cables and connectors are not damaged.
	Alarm LED board failure	Replace the alarm LED board.
	Main board failure	Replace the main board.

### 5.6.4 Button and Knob Failures

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

---

### 5.6.5 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.	Select [ <b>Main Menu</b> ]→[ <b>Screen Setup &gt;&gt;</b> ], and set the [ <b>Key Volume</b> ] to appropriate setting.
	Cable defective or poorly connected	1. Check that cable between speaker and interface board is properly connected. 2. Check that connecting cables and connectors are not damaged.
	Speaker failure	Replace the speaker.
	Main board failure	Replace the main board.
	Interface board failure	Replace the interface board.
No alarm sound or alarm sound abnormal	The alarm sound is set to zero.	1. 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 then in the popup menu, set [ <b>Minimum Alarm Volume</b> ] to appropriate setting. 2. Select [ <b>Main Menu</b> ]→[ <b>Alarm Setup &gt;&gt;</b> ]→[ <b>Others</b> ], and set [ <b>Alm Volume</b> ] to appropriate setting.
	Cable defective or poorly connected	1. Check that cable between speaker and main board is properly connected. 2. Check that connecting cables and connectors are not damaged.
	Speaker failure	Replace the speaker.
	Main board failure	Replace the main board.
	Interface board failure	Replace the interface board.

---

### 5.6.6 Power Supply Failures

Symptoms	Possible Cause	Corrective Action
1. Different battery voltages 2. Battery can not be fully charged 3. Battery can not be recharged 4. Battery on-site check abnormal	Battery failure	Replace battery.
	Cable defective or poorly connected	1. Check that the cable between battery interface board and interface board is correctly connected. 2. Check that cables and connectors are not damaged.
	Battery interface board failure	Replace the battery interface board.
	Interface board failure	Replace the interface board.
No voltage output from the main lead, or the voltage output abnormal.	Cable defective or poorly connected	1. Check that cables from interface board to power board, AC input to power board are correctly connected. 2. Check that cables and connectors are not damaged.
	Power board failure	Replace power board
No +12V output	1. Power supply protection 2. Power board failure	1. Turn off the monitor then restart it. 2. If the problem remains, disconnect the AC mains for 5 s and reconnect it, then restart the patient monitor.
No +5.0 V output		3. If the problem still remains, replace power board.

### NOTE

- When the power module has a failure, it may cause problems to other components, In this case, troubleshoot the power 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.
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### 5.6.7 Recorder Failures

Symptoms	Possible Cause	Corrective Action
No printout	Recorder module disabled	1. Check if the recorder status LED lights 2. If yes, enable the module in [ <b>Factory Maintenance</b> ] menu. Otherwise, check for other possible causes.
	Paper reversed	Re-install the paper roll.
	Cable defective or poorly connected	1. Check that cable between recorder and main board is properly connected. 2. Check that connecting cables and connectors are not damaged.
	Recorder power supply failure	Check if the power module outputs 5 V DC and 12V DC correctly.
	Recorder failure	Replace the recorder.
Poor print quality or paper not feeding properly	Paper roll not properly installed	Stop the recorder and re-install the paper roll.
	Print head dirty	1. Check the thermal print head and the paper roller for foreign matter. 2. Clean the thermal print head with an appropriate clean solution.
	Print head failure	Replace the print head.
	Recorder failure	Replace recorder.

---

### 5.6.8 Interface Failures

Symptoms	Possible Cause	Corrective Action
Analog output failure	Cable defective or poorly connected	1. Check that cable between parameter board and interface board is properly connected. 2. Check that connecting cables and connectors are not damaged.
	Interface board failure	Replace the interface board.
	Parameter board failure	Replace the parameter board.
1. USB device does not function (Assume that the peripheral devices are good) 2. USB drive data transfer failure	Cable defective or poorly connected	1. Check that cable between interface board and main board is properly connected. 2. Check that connecting cables and connectors are not damaged.
	Interface board failure	Replace the interface board.
	Main board failure	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 Drive</b> ]

### 5.6.9 SD Card Failures

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.
	SD card failure	Replace the SD card.
	Main board failure	Replace the main board.

---

### 5.6.10 Wired Network Failures

Symptoms	Possible Cause	Corrective Action
Connection failure	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. Reconfigure IP address.
	Cable defective or poorly connected	1. Check that cable between interface board and main board is properly connected. 2. Check that connecting cables and connectors are not damaged.
	Interface board failure	Replace the interface board.
	Main board failure	Replace the main board
Frequent dropouts and network disconnects	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 50m.
	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 configuration	Check for IP address conflict. Reconfigure IP address.

### 5.6.11 WiFi Failures

Symptoms	Possible Cause	Corrective Action
Frequent dropouts and network disconnects	Wi-Fi signals unstable	Check for WiFi signals.
	Wi-Fi antenna falls off	Disassemble the patient monitor and fix the WiFi antenna.
WiFi module connection failure	Incorrect IP configuration	Check for IP address conflict. Reconfigure IP address.
	Wi-Fi signals unstable	Check for WiFi signals.
	Wi-Fi antenna disconnected.	Re-fix the antenna.
	Main board failure	Replace the main board.

---

### 5.6.12 Software Upgrade Problems

Symptoms	Possible Cause	Corrective Action
Boot file upgrade fails	Power failure or unintended power off during boot file upgrade	Return the main board to factory for repair.
Program upgrade fails	Incorrect network connection	1. Check that network connector on the patient monitor is used. 2. Make sure that the hub or switch run normally. Check that net twines are of the right type and have been connected correctly.
	Wrong upgrade package has been downloaded	Upgrade package shall be .pkg files. Select package according to system requirement.
	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.

### 5.6.13 Technical Alarm Messages

Please refer to the Operator's manual.

# 6 Disassembly and Repair

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## 6.1 Tools Required

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

- Philips screwdrivers
- Tweezers
- Sharp nose pliers
- Clamp

## 6.2 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.
- 
- 

## 6.3 Disassembling the Main Unit

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### NOTE

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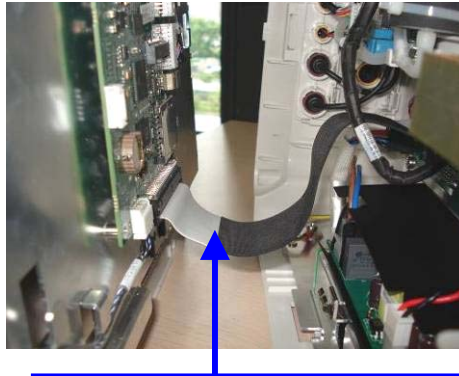
- The recorder can be disassembled separately.
  - To disassemble the equipment, place the equipment on a work surface free from foreign material, avoiding damaging the antiglare screen, touchscreen and the knob. Be careful not to break the two cotters on the front ends of rear housing.
  - All the operations 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.
- 
- 

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

1. Stand the equipment on the work surface. Loose and unscrew the five M4X10 screws as shown below:



- 
2. Separate the front housing assembly and rear housing assembly with caution. Disconnect the cable between the main control board and key board and then take off the front panel.



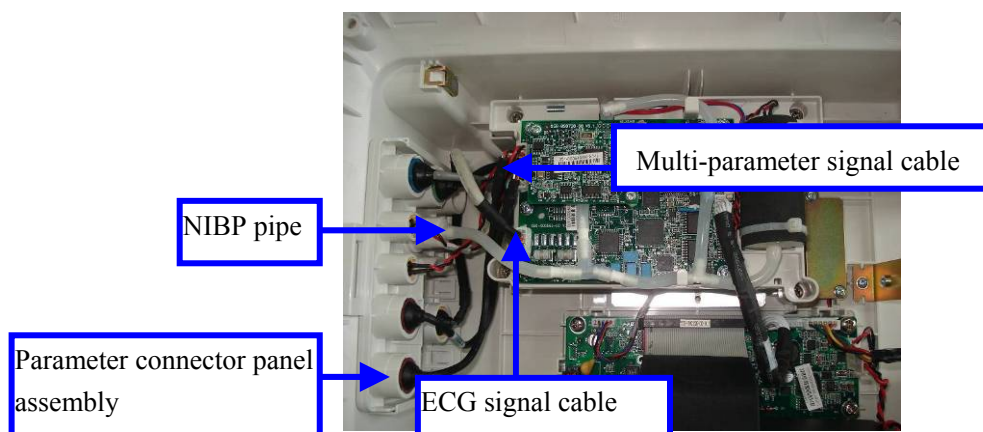
Cable between main control board and interface board

## NOTE

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

### 6.3.2 Removing the Parameter Connector Panel Assembly

1. For equipments with standard configuration, the parameter connector assembly can be removed directly. Disconnect the multi-parameter signal cable, NIBP pipe, and ECG signal cable as shown below. Then remove the parameter connector assembly.

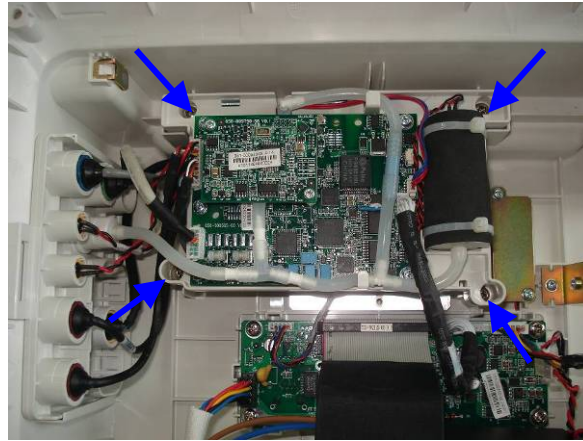


2. For equipments with optional C.O. and CO<sub>2</sub> modules, remove the parameter module assembly as described in 1.3.3 first.

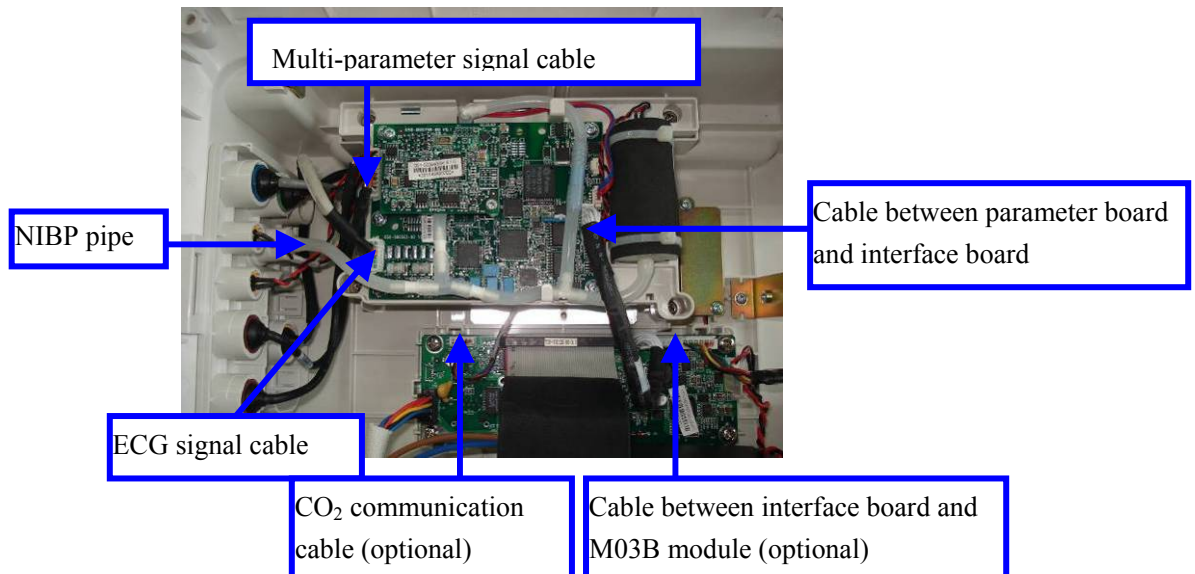
---

### 6.3.3 Removing the Parameter Module Assembly

1. Lay the equipment on the work surface as shown below, and unscrew the four M4X10 screws:



2. Disconnect the multi-parameter signal cable, NIBP pipe, ECG signal cable, the cable between the parameter board and interface board, CO<sub>2</sub> communication cable (optional), and the cable between the interface board and M03B module (optional) respectively, as shown below:



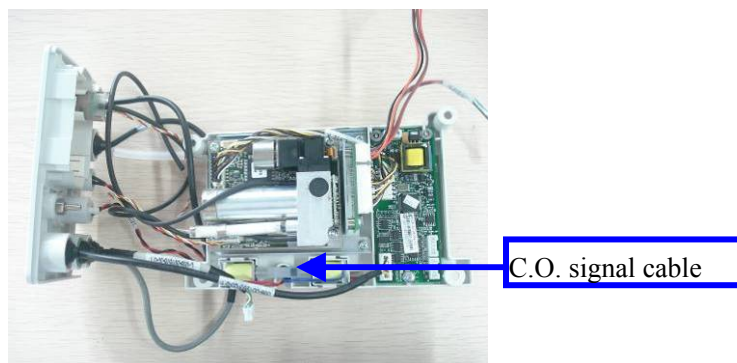


- 
3. For equipments with standard configuration, the parameter module assembly can be removed directly.

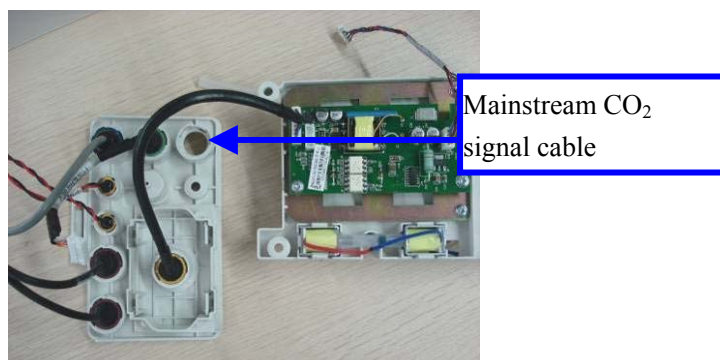


4. For equipments with non-standard configurations, take the parameter connector assembly and parameter module assembly out from the rear housing and then separate the two assemblies as per the actual configuration:

**For those configured with C.O. function:** disconnect the C.O. signal cable, and then separate the parameter connector assembly and parameter module assembly, as shown below;

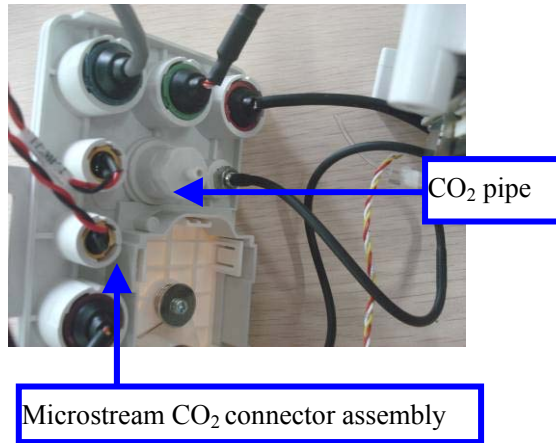


**For those configured with mainstream CO<sub>2</sub> function:** disconnect the mainstream CO<sub>2</sub> signal cable, and then separate the parameter connector assembly and parameter module assembly, as shown below;

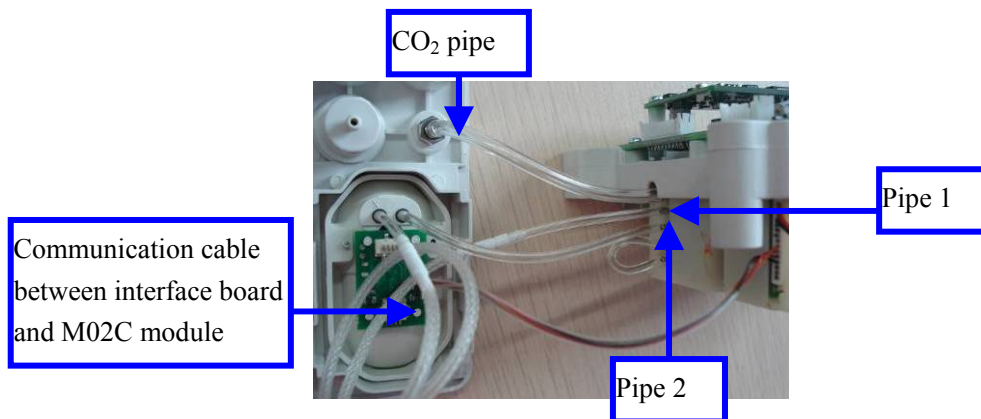


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**For those configured with microstream CO<sub>2</sub> function:** disconnect the CO<sub>2</sub> pipe, take the microstream CO<sub>2</sub> connector assembly out from the parameter connector assembly, and then separate the parameter connector assembly and parameter module assembly, as shown below:



**For those configured with Mindray M02C CO<sub>2</sub> module:** disconnect the CO<sub>2</sub> pipe, pipe 1, pipe 2, and the cable between the interface board and M02C module respectively, and then separate the parameter connector assembly and the parameter module assembly, as shown below:



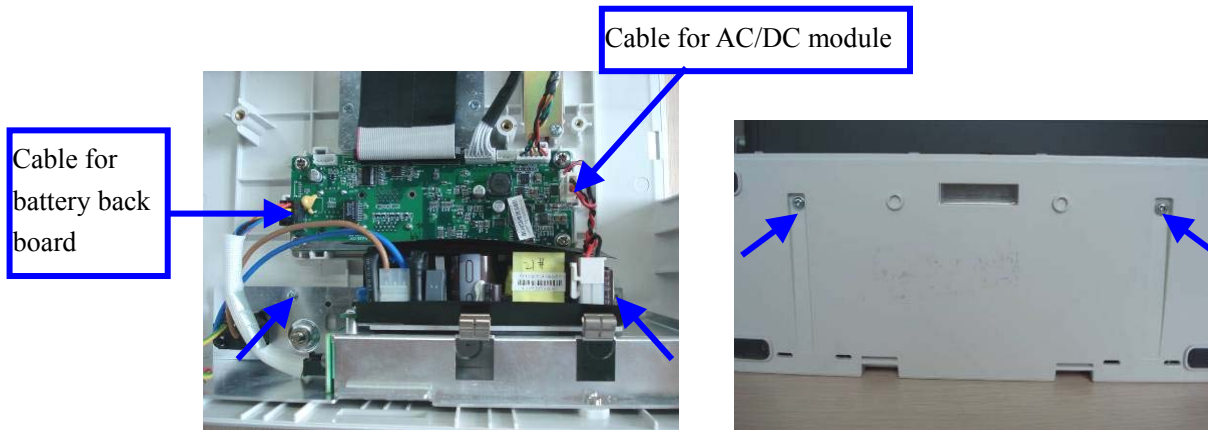
## NOTE

- All pipes should be assembled properly without occlusion during reassembly.
- For equipments configured with optional C.O. or CO<sub>2</sub> modules, be sure to remove the parameter connector assembly and parameter module assembly together from the rear housing and then separate the two module.
- For those with standard configuration, remove the parameter module separately.

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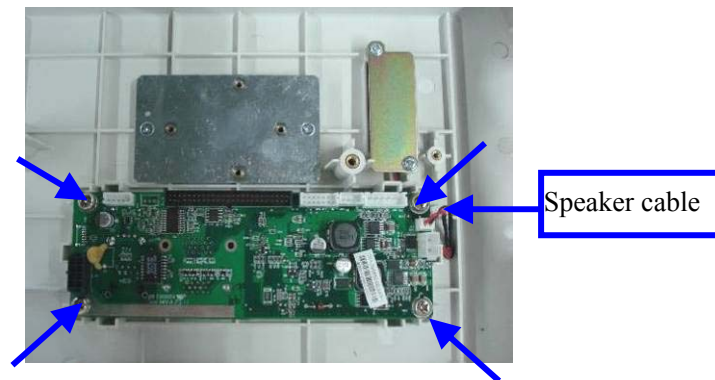
### 6.3.4 Removing the Battery Compartment Assembly

1. Loosen and unscrew the four M3X6 screws as shown below. Disconnect the cable for battery backboard and cable for AC/DC module, and then remove the battery compartment assembly.



### 6.3.5 Removing the Power Management and Interface Board

1. Unscrew the four M4X10 screws indicated below and unplug the speaker cable, and then remove the power management and interface board.



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### 6.3.6 Removing the Recorder (Optional)

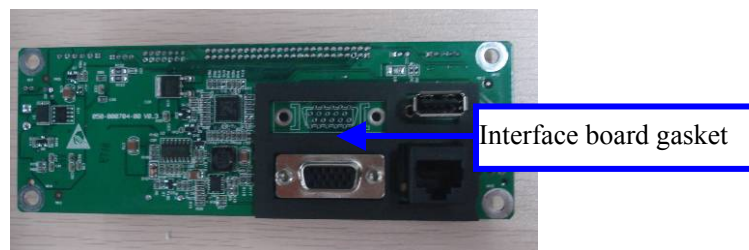
1. Unscrew the two M3X6 screws indicated below. Disconnect the recorder cable and remove the recorder. The recorder can be removed separately without disassembling any other components.



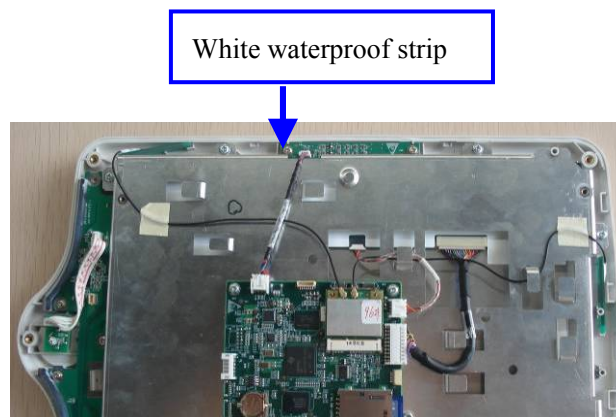
### 6.3.7 Checking Waterproof Strips Before Reassembling

Before reassembling the equipment, make sure that the waterproof material on the rear housing assembly and power base assembly is stuck to the proper places.

1. Check that the waterproof strip is properly stuck on the battery socket.



2. Check that the white waterproof strip is properly stuck on the front housing assembly.



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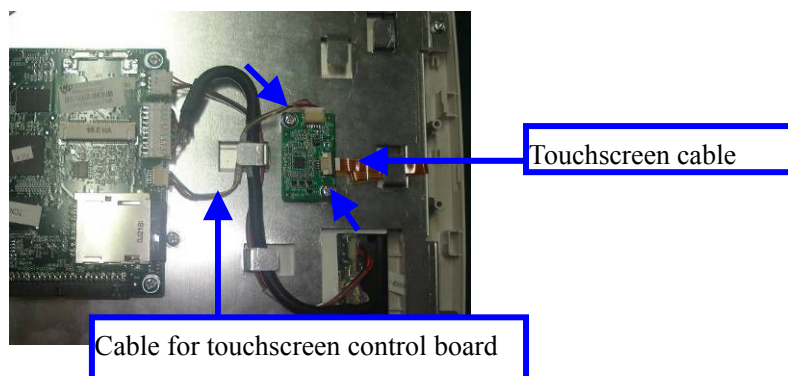
## 6.4 Disassembling the Front Housing Assembly

### NOTE

- 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.
- 

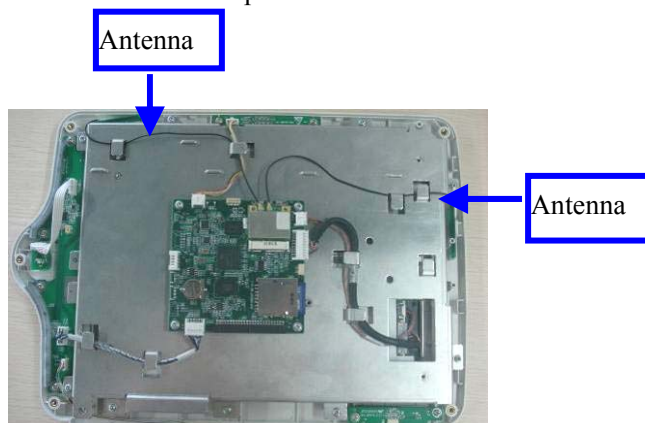
### 6.4.1 Removing the Touchscreen Control Board (Optional)

1. Loosen and unscrew the two M3X8 screws as shown below. Disconnect the touchscreen cable and cable for touchscreen control board, and then remove the touchscreen control board.



### 6.4.2 Removing Antenna (Optional)

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

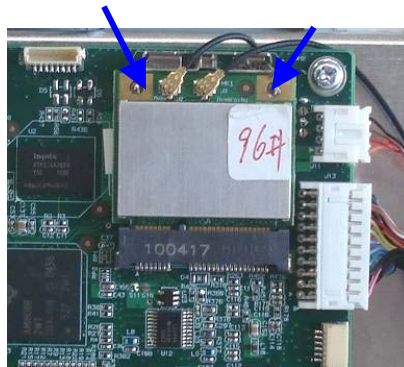




- 
2. Remove the antennas from the Cyberlink module PCBA.

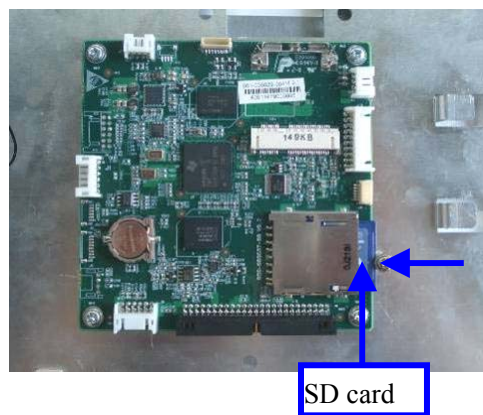


3. Put the clamps on the main control board aside and take out the Cyberlink module.



### 6.4.3 Removing SD Card (Optional)

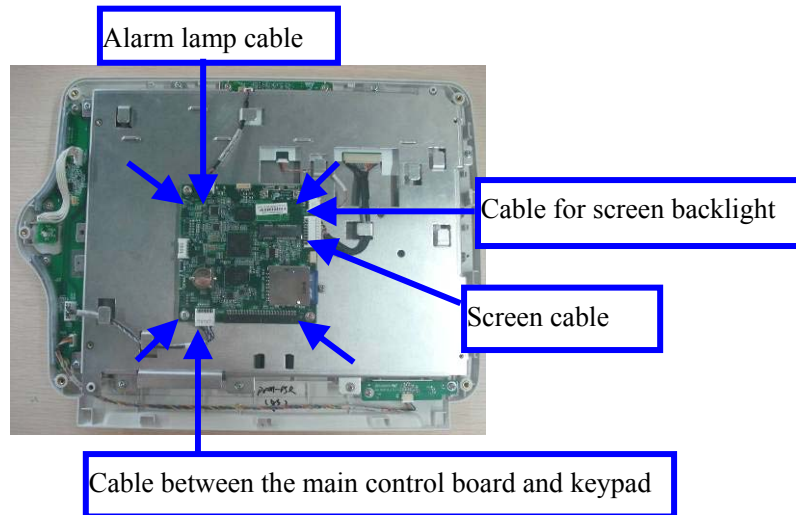
1. Unscrew the M3X6 screw and press the SD card as indicated below to remove the SD card:



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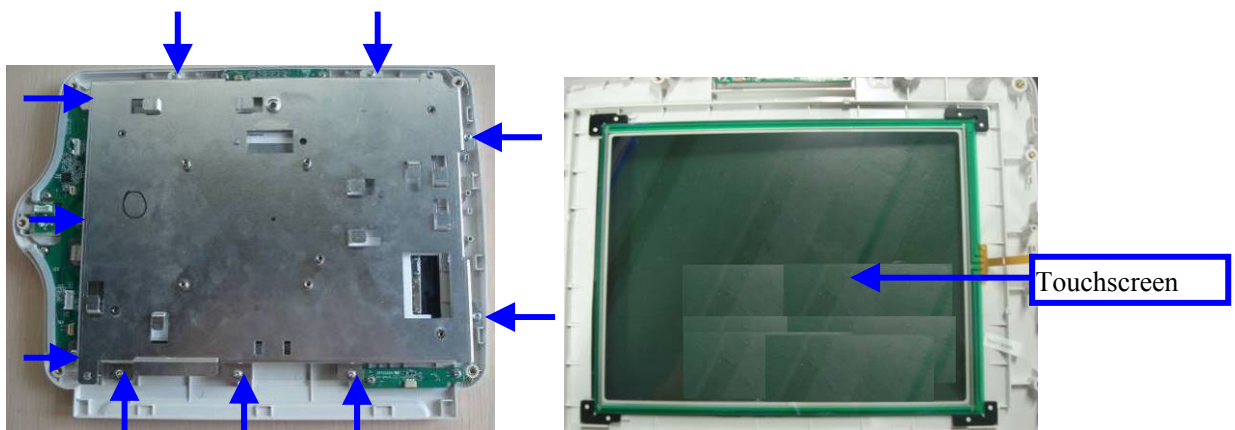
#### 6.4.4 Removing the Main Control Board

1. Disconnect the alarm lamp cable, cable for display backlight, display cable, and the cable between the main control board and keypad respectively. Unscrew the four M3X8 screws and take out the main control board, as shown below:



#### 6.4.5 Removing the Touchscreen (Optional)

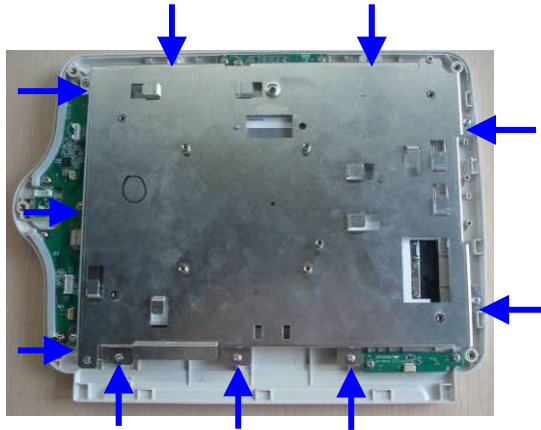
1. Unscrew the ten M3X8 screws indicated below. Take out the touchscreen bracket and then the touchscreen.



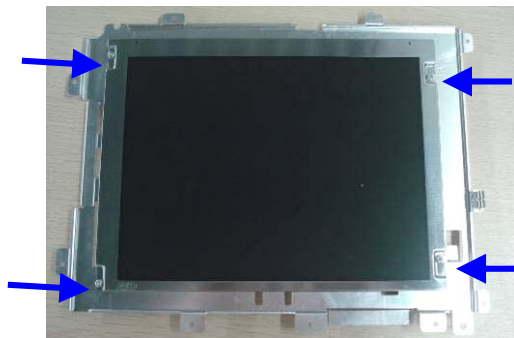
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### 6.4.6 Disassembling the Screen

1. Unscrew the ten M3X8 screws indicated below. Then take out the screen bracket.

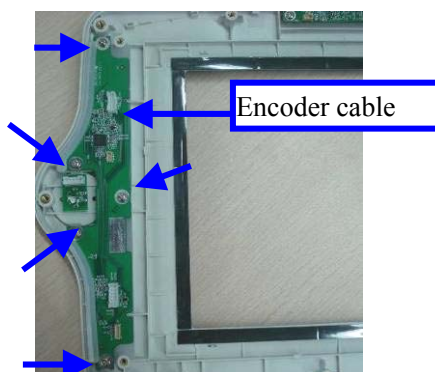


2. Unscrew the four M3X8 screws indicated below to remove the screen.



### 6.4.7 Removing the Keypad

1. Unplug the encoder cable and unscrew the five PT3X8 screws indicated below. Take out the keypad.

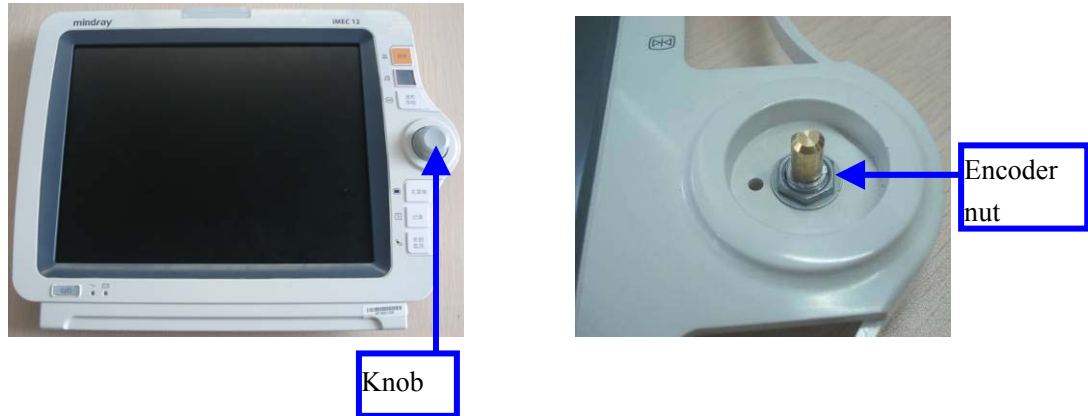




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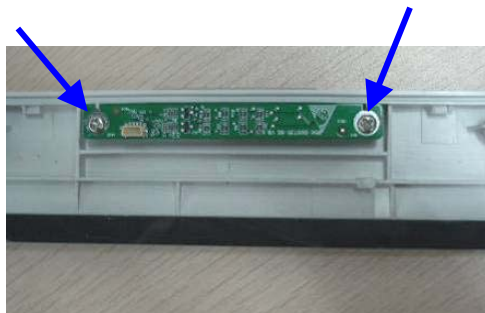
### 6.4.8 Removing the Encoder

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



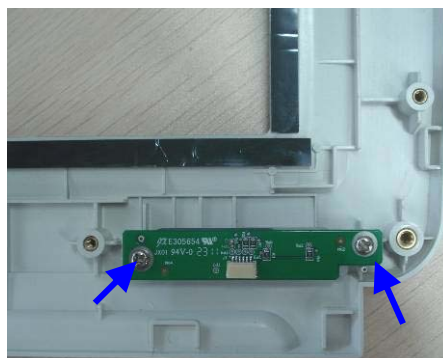
### 6.4.9 Removing the Alarm Lamp Board

1. Unscrew the two PT3X8 screws indicated below and take out the alarm lamp board.



### 6.4.10 Removing the ON/OFF Key Board

1. Unscrew the two PT3X8 screws indicated below and take out the ON/OFF key board.

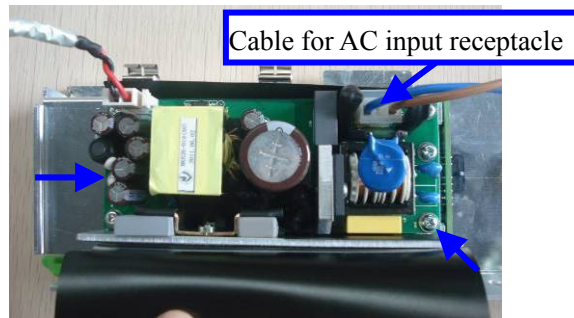


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## 6.5 Disassembling the Battery Compartment Assembly

### 6.5.1 Removing the Power Board

1. Disconnect the cable for AC input receptacle. Remove the three M3X6 screws indicated below and remove the power board.



#### NOTE

- Follow the instructions and unscrew the correct screws.

### 6.5.2 Removing the Battery Interface Board Assembly

1. Unscrew the two M3 nuts with a sharp nose plier and remove the battery interface board assembly.



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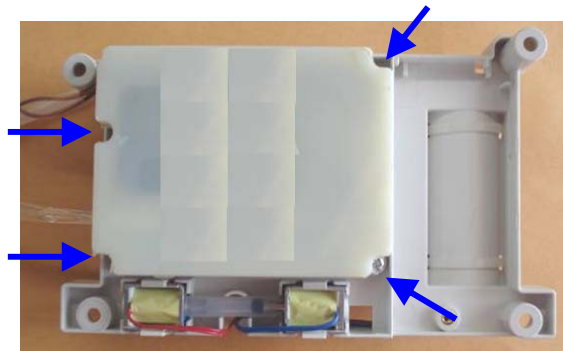
## 6.6 Disassembling the Parameter Module Assembly

### NOTE

- Perform disassembly with exercise care to protect the boards on both sides of the module from damage.
  - Be sure to reassemble the fast valve (red) and slow valve (blue) in correct sequence. The slow valve should be connected to the reducer-equipped end of the pipe.
  - Operations relating to optional parts, like C.O. and CO<sub>2</sub>, may not apply to your equipment.
- 

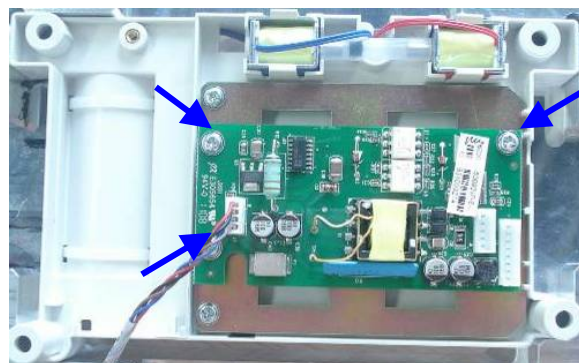
### 6.6.1 Removing the Mindray M02C CO<sub>2</sub> Module (Optional)

1. Unscrew the four M3X8 screws indicated below and then take out the Mindray M02C CO<sub>2</sub> module.



### 6.6.2 Removing the Mainstream CO<sub>2</sub> Module (Optional)

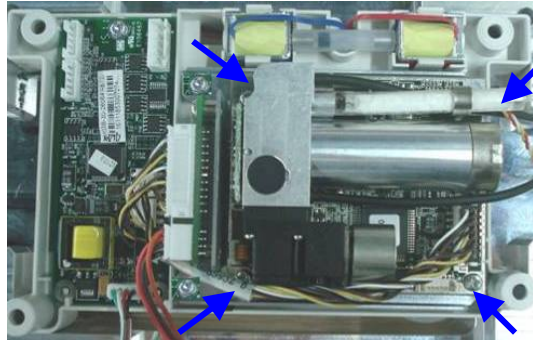
1. Unscrew the three M3X6 screws indicated below and then take out the mainstream CO<sub>2</sub> board.



---

### 6.6.3 Removing the Microstream CO<sub>2</sub> module (Optional)

1. Unscrew the four M3X6 screws indicated below and then take out the microstream CO<sub>2</sub> module.

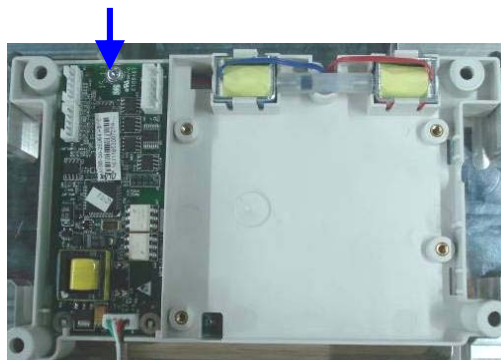


2. Then unscrew the three M3X6 screws and then take out the microstream converter, as shown below:



### 6.6.4 Removing the C.O. Module (Optional)

1. Unscrew the M3X6 screw indicated below and take out the C.O. module.



---

### 6.6.5 Removing the SpO<sub>2</sub> Board

1. Unscrew the two M3X6 screws indicated below and take out the SpO<sub>2</sub> board.



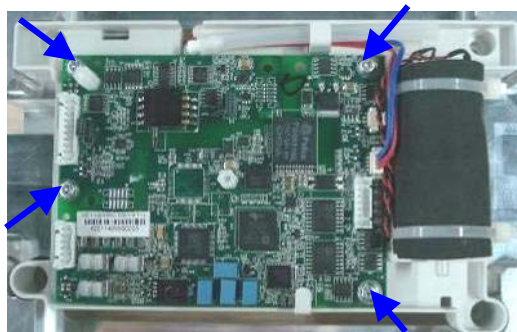
Nellcor SpO<sub>2</sub> board



Masimo SpO<sub>2</sub> board

### 6.6.6 Removing the Multi-parameter Board

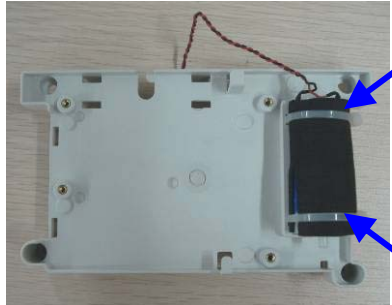
1. Disconnect the pipe from the board. Then unscrew the four M3X6 screws and take out the multi-parameter board, as shown below:



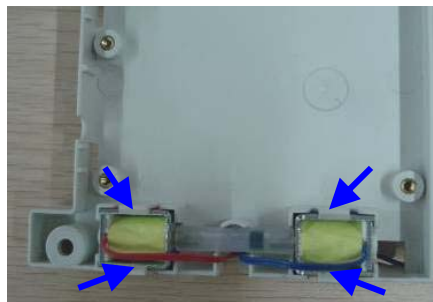
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## 6.6.7 Removing the Pump and Valve

1. Clip the cable holders indicated below with a clamp and take out the pump.



2. Push the four clamps indicated below aside and take out the valve.

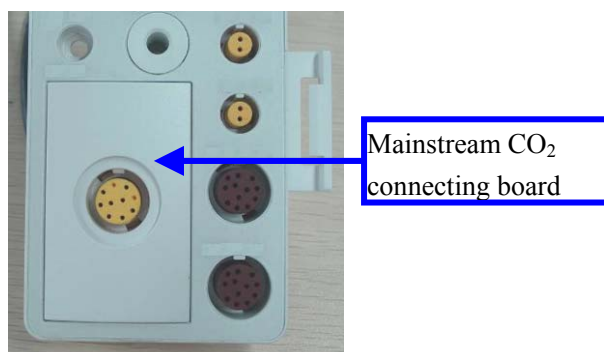


## 6.7 Removing the Parameter Connector Panel

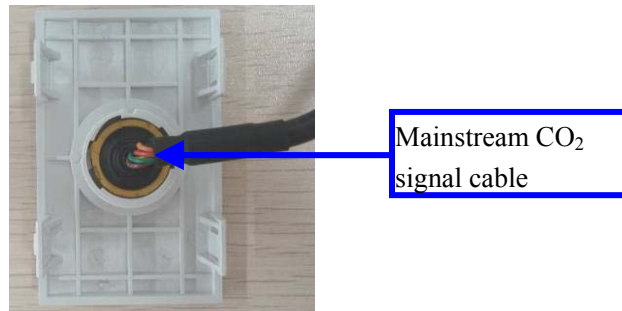
### Assembly

#### 6.7.1 Removing the Mainstream CO<sub>2</sub> Signal Cable (Optional)

1. Push the four clamps aside as shown below and take out the mainstream CO<sub>2</sub> interface board.



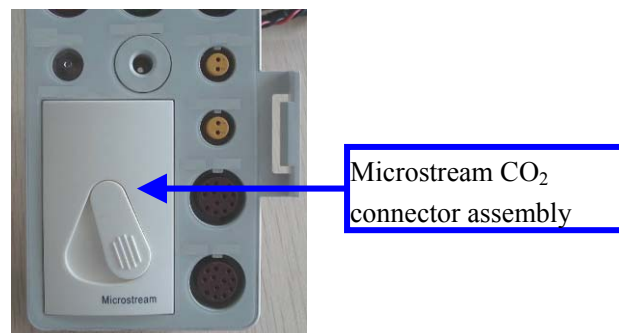
- 
2. Screw the connector of the mainstream signal cable clockwise with a sharp nose plier.  
Pull the connector up to remove the mainstream signal cable.



### 6.7.2 Removing the Microstream CO<sub>2</sub> Connector Assembly

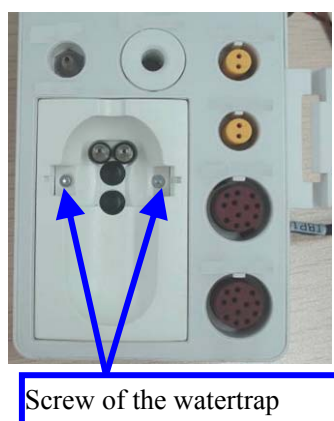
#### (Optional)

1. Push the four clamps aside as shown below and take out the microstream CO<sub>2</sub> interface assembly.



### 6.7.3 Removing the Watertrap Base Assembly (Optional)

1. Unscrew the two screws of the watertrap indicated below with a screwdriver and remove the watertrap base assembly.





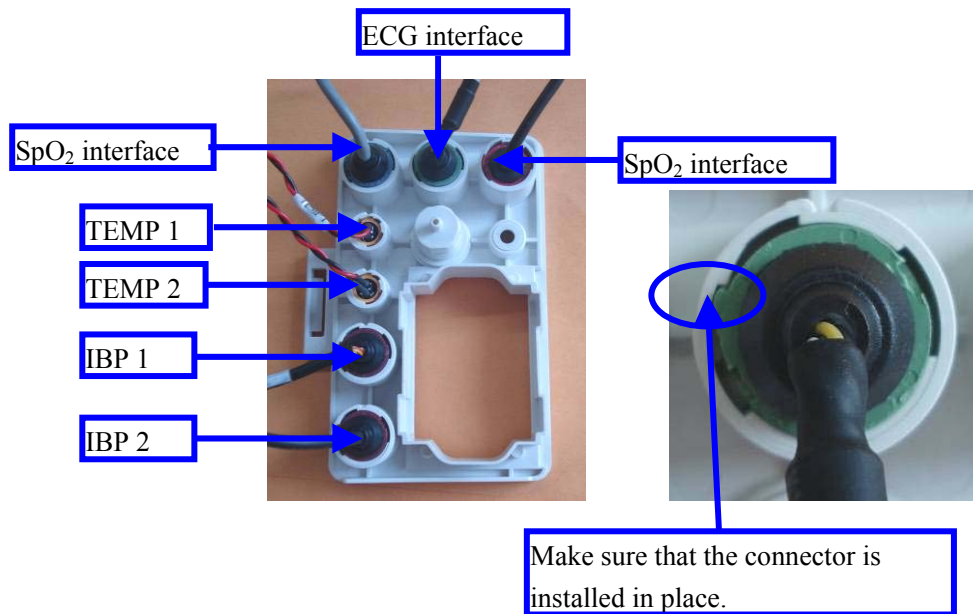
- 
2. Unscrew the four PT2X6 screws indicated below and take out the watertrap base bracket.



## 6.7.4 Removing the Cables From the Parameter Connector Panel

### Panel

1. To remove the cables, loose the connectors clockwise with a sharp nose plier; To reassemble the cables, screw the connectors counter-clockwise to the correct sockets as shown below:

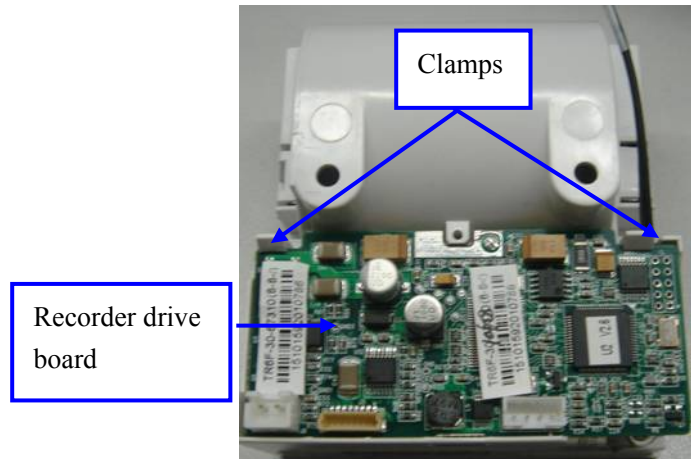




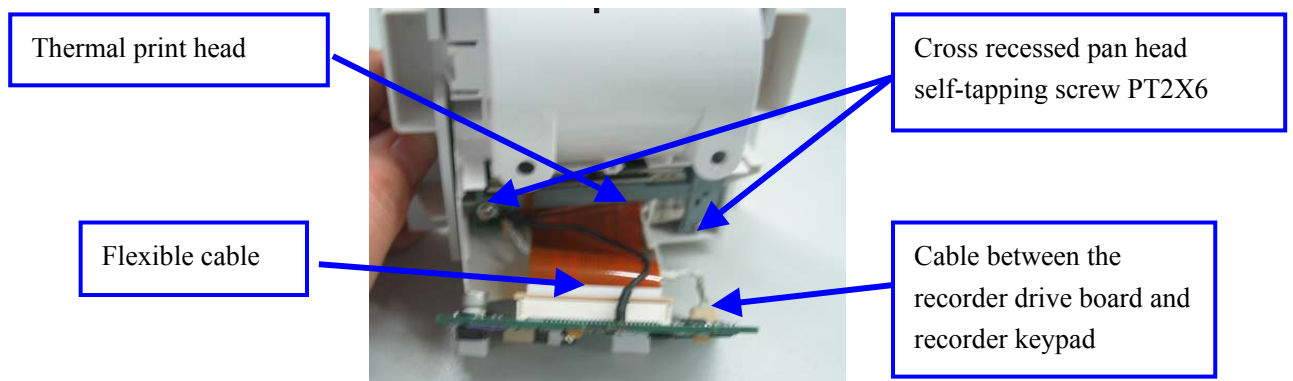
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## 6.7.5 Removing the Recorder

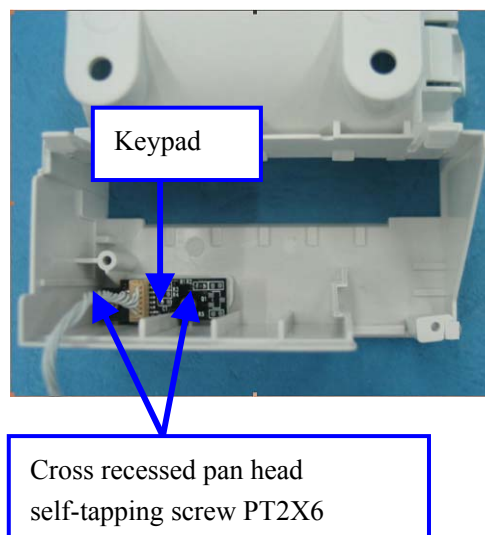
1. Push the two clamps aside and take out the recorder drive board, as shown below:



2. Unscrew the two PT2X6 screws and disconnect the cable between the recorder drive board and recorder keypad and the flexible cable, as shown below. Then remove the thermal print head and recorder drive board.



3. Unscrew the two PT2X6 screw indicated below and take out the keypad.



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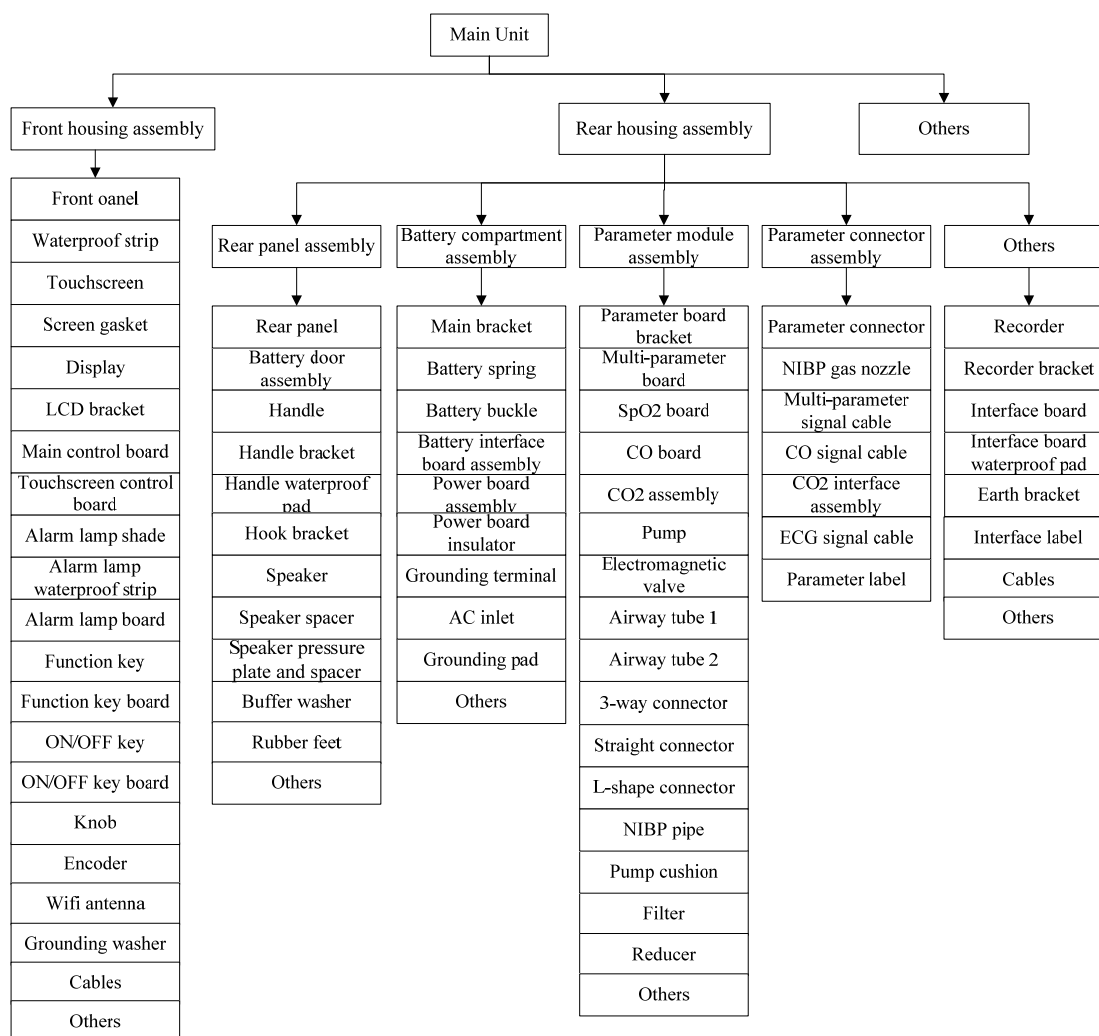
**FOR YOUR NOTES**

# 7 Parts

## 7.1 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.

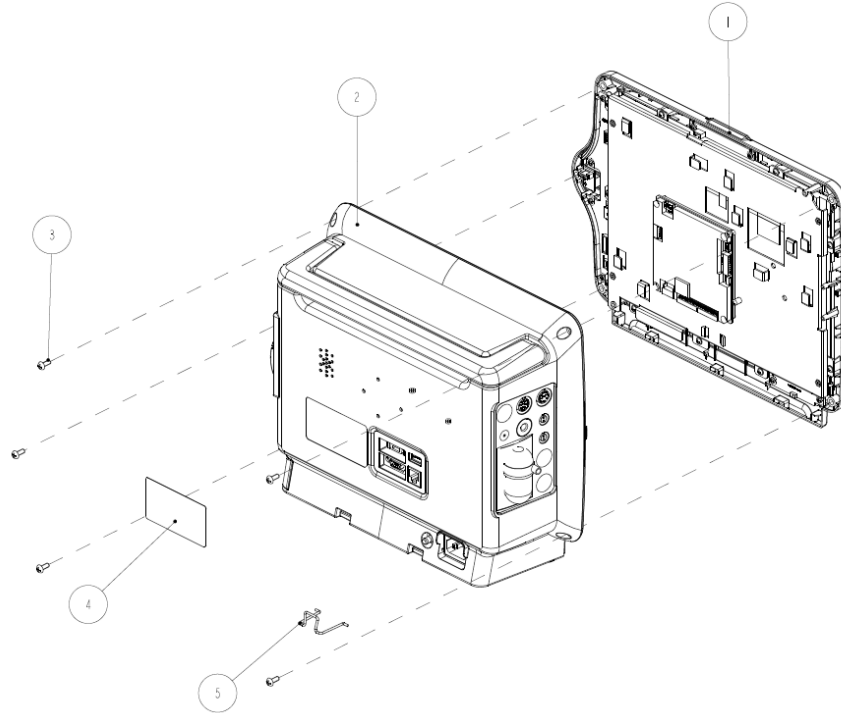
Hardware architecture of the main unit is shown below:



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## 7.2 Main Unit (10"/12")

### 7.2.1 Exploded View



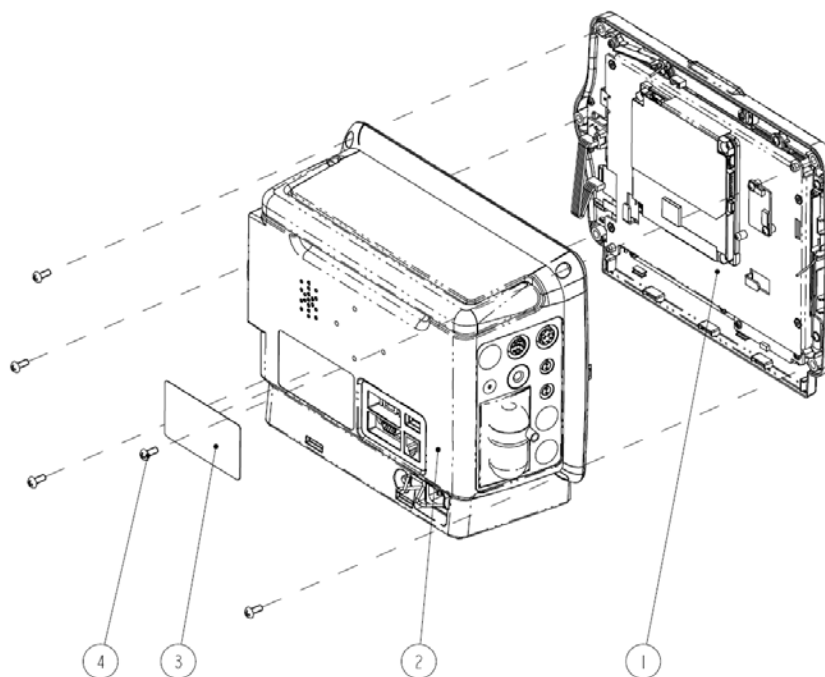
### 7.2.2 Parts List

SN	P/N	Description	Qty
1.	/	Front panel subassembly (12 Inch)	As configured
	/	Front panel subassembly (12 Inch/1G SD card)	
	/	Front panel subassembly (12 Inch/WiFi)	
	/	Front panel subassembly (12 Inch/WiFi + 1G SD card)	
	/	Front panel subassembly (12 Inch/Touchscreen)	
	/	Front panel subassembly (12 Inch/Touchscreen/1G SD card)	
	/	Front panel subassembly (12 Inch/Touchscreen/WiFi)	
	/	Front panel subassembly (12 Inch/Touchscreen/WiFi+ 1G SD card)	
	/	Front panel subassembly (12 Inch/VGA/USB)	
	/	Front panel subassembly (12 Inch/Touchscreen)	
	/	Front panel subassembly (10 Inch)	
	/	Front panel subassembly (10 Inch/1G SD)	
	/	Front panel subassembly (10 Inch/WiFi)	
	/	Front panel subassembly (10 Inch/WiFi+ 1G SD card)	

	/	Front panel subassembly (10 Inch/Touchscreen)	
	/	Front panel subassembly (10 Inch/touchscreen/1G SD)	
	/	Front panel subassembly (10 Inch/touchscreen/WiFi)	
	/	Front panel subassembly (10 Inch/touchscreen/WiFi+ 1G SD card)	
	/	Front panel subassembly (10 Inch/VGA/USB)	
	/	Front panel subassembly (10 Inch/Touchscreen)	
2.	/	Rear housing of the main unit (12 inch/single network connector)	As configured
	/	Rear housing of the main unit (12 inch/Network/VGA/USB/Analog input & output)	
3.	/	Cross pan head screw M4X10	5
4.	/	iMEC12 rear label (CN)	1
5.	9211-20-87369	AC Inlet Hook	1

## 7.3 Main Unit (8")

### 7.3.1 Exploded View



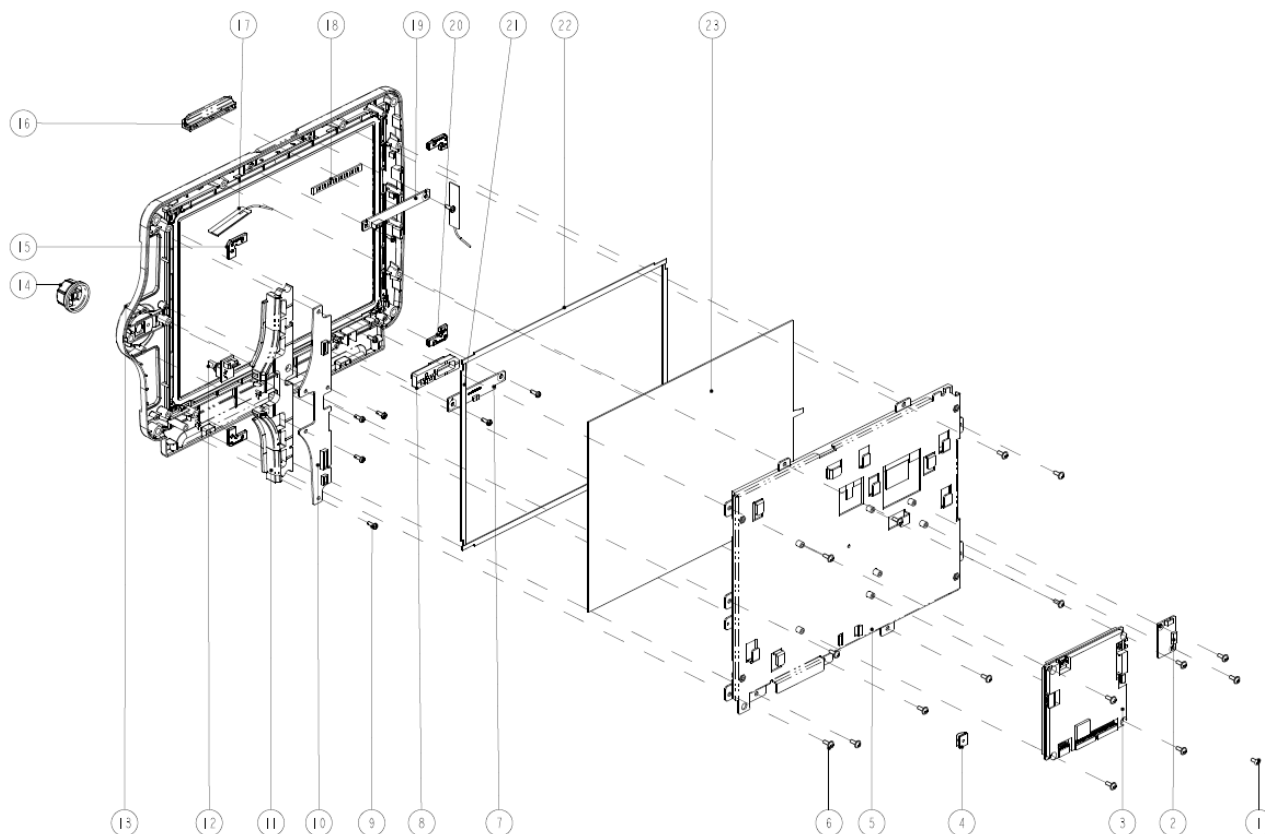
### 7.3.2 Parts List

SN	P/N	Description	Qty
1.	/	Front panel subassembly (8 Inch/WIFI + 1G)	1
2.	/	Rear housing of the main unit (8 inch)	1

3.	/	iMEC12 rear label (CN)	1
4.	/	Cross pan head screw M4X10	5

## 7.4 Front Housing Subassembly (12 Inch/Touchscreen)

### 7.4.1 Exploded View



### 7.4.2 Parts List

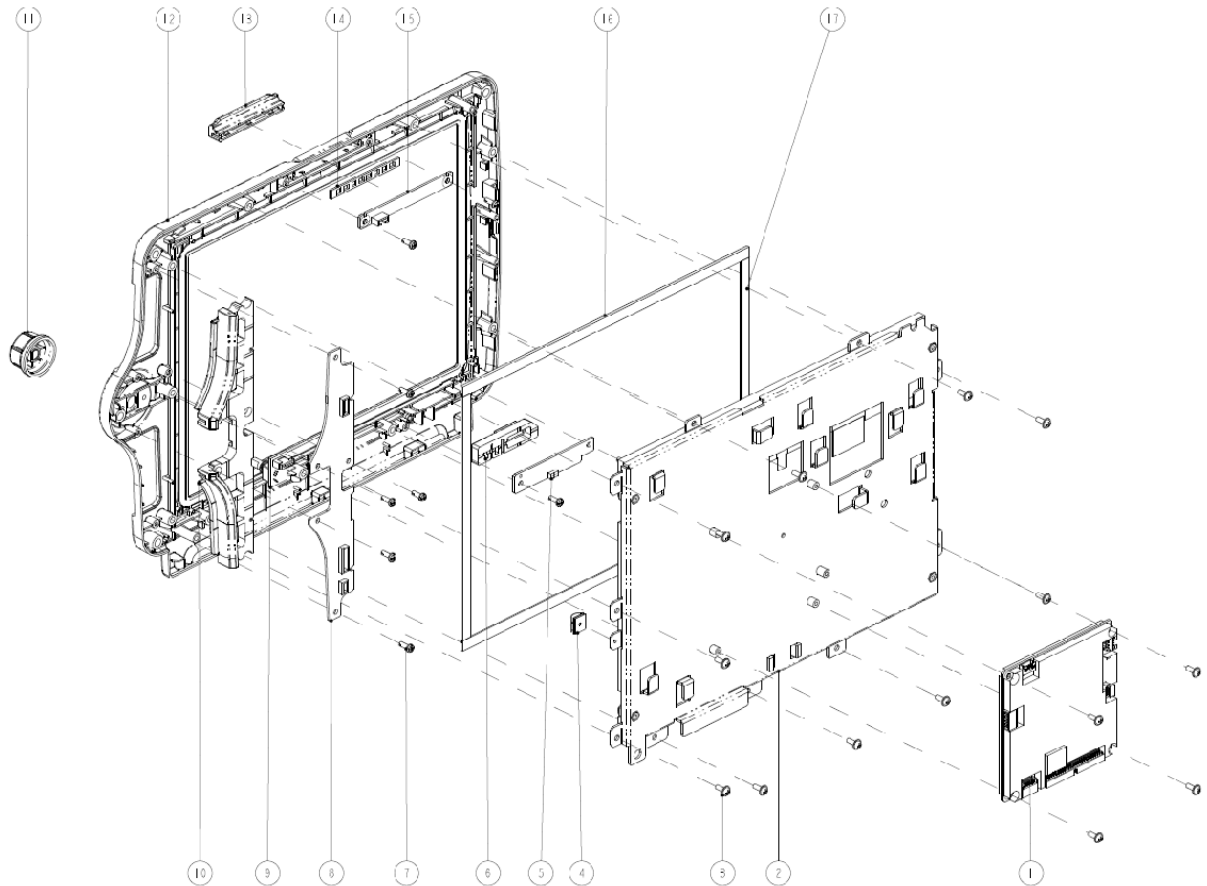
SN	P/N	Description	Qty
1.	/	Screw, pan head cross recessed M3X6	1
2.	051-000881-00	6301 touch control board PCBA	1
3.	801-6301-00003-00	6301 main control PCBA, complete, 12 inch	As configured
	801-6301-00004-00	6301 main control PCBA, standard, 12 inch	
4.	/	Spring, EMI	1
5.	801-6301-00008-00	AU LCD service kit (LED backlight, 12 Inch touchscreen)	1
6.	/	Cross pan head screw with washer, GB9074.5, M3X8	16
7.	051-000880-00	6301 On/Off key board PCBA	1
8.	6802-20-66691-51	Power button	1

9.	/	Screw, self-tapping, PT3X8	9
10.	051-000878-00	6301 keyboard PCBA 12.1 inch	1
11.	049-000335-00	Key (12 inch-Chinese)	As configured
	049-000351-00	Key (12 inch-English)	
	049-000385-00	Key (12 inch-Italian)	
	049-000386-00	Key (12 inch-Spanish)	
	049-000387-00	Key (12 inch- Portuguese)	
	049-000388-00	Key (12 inch-French)	
	049-000389-00	Key (12 inch-German)	
12.	0010-30-43089	Encoder	1
13.	801-6301-00010-00	Front housing assembly (12 inch touchscreen)	1
14.	043-001790-00	Knob	1
15.	/	FUJI 12 Touchscreen long position pad	2
16.	/	Alarm lamp shade	1
17.	115-010845-00	Antenna and cable assembly	2
18.	/	Alarm gasket	1
19.	801-6301-00005-00	6301 alarm board PCBA	1
20.	/	FUJI12 Touchscreen short position pad	2
21.	/	12 inch touchscreen short gasket	2
22.	/	12 inch touchscreen long gasket	2
23.	021-000059-00	touch-panel, resistive-type, 12.1", 4-line	1

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## 7.5 Front Housing Subassembly (12 Inch/Nakescreen)

### 7.5.1 Exploded View



### 7.5.2 Parts List

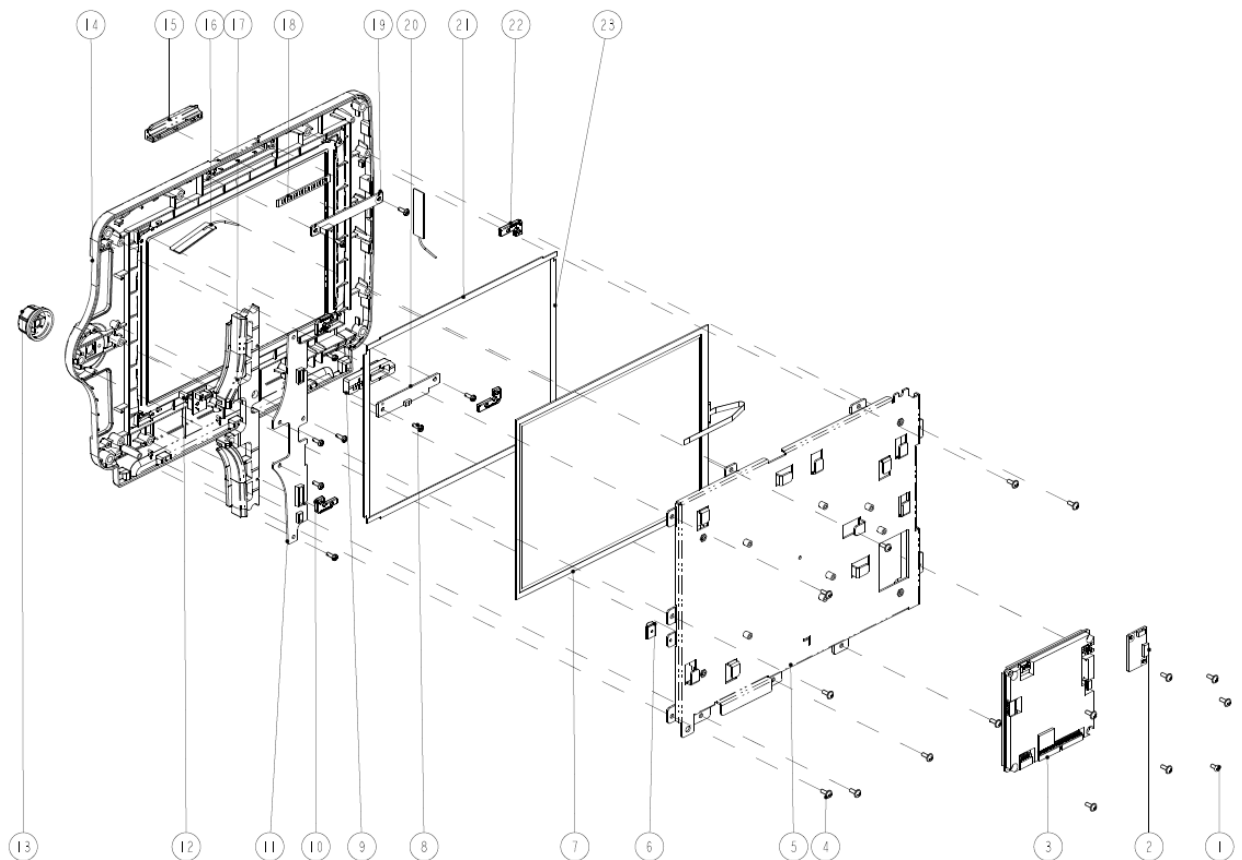
SN	P/N	Description	Qty
1.	801-6301-00003-00	6301 Mainboard PCBA ( complete, 12 inch)	As configured
	801-6301-00004-00	6301 Mainboard PCBA (Standard, 12 inch)	
2.	/	AU LCD kit (12 Inch)	1
3.	/	Cross pan head screw with washer, GB9074.5, M3X8	14
4.	/	Spring, EMI	1
5.	051-000880-00	6301 On/Off key board PCBA	1
6.	6802-20-66691-51	Power button (T5, mould MR66691)	1
7.	/	Screw, self-tapping, PT3X8	9
8.	051-000878-00	6301 keyboard PCBA 12.1 inch	1
9.	0010-30-43089	Encoder	1



10.	049-000335-00	Key (12 inch-Chinese)	As configured
	049-000351-00	Key (12 inch-English)	
	049-000385-00	Key (12 inch-Italian)	
	049-000386-00	Key (12 inch-Spanish)	
	049-000387-00	Key (12 inch-Portuguese)	
	049-000388-00	Key (12 inch-French)	
	049-000389-00	Key (12 inch-German)	
11.	043-001790-00	Knob	1
12.	801-6301-00009-00	Front housing (12 inch)	1
13.	/	Alarm lamp shade	1
14.	/	Alarm gasket	1
15.	801-6301-00005-00	6301 alarm board PCBA	1
16.	/	12 inch nakescreen long gasket	2
17.	/	12 inch nakescreen short gasket	2

## 7.6 Front Housing Subassembly (10 Inch/Touchscreen)

### 7.6.1 Exploded View

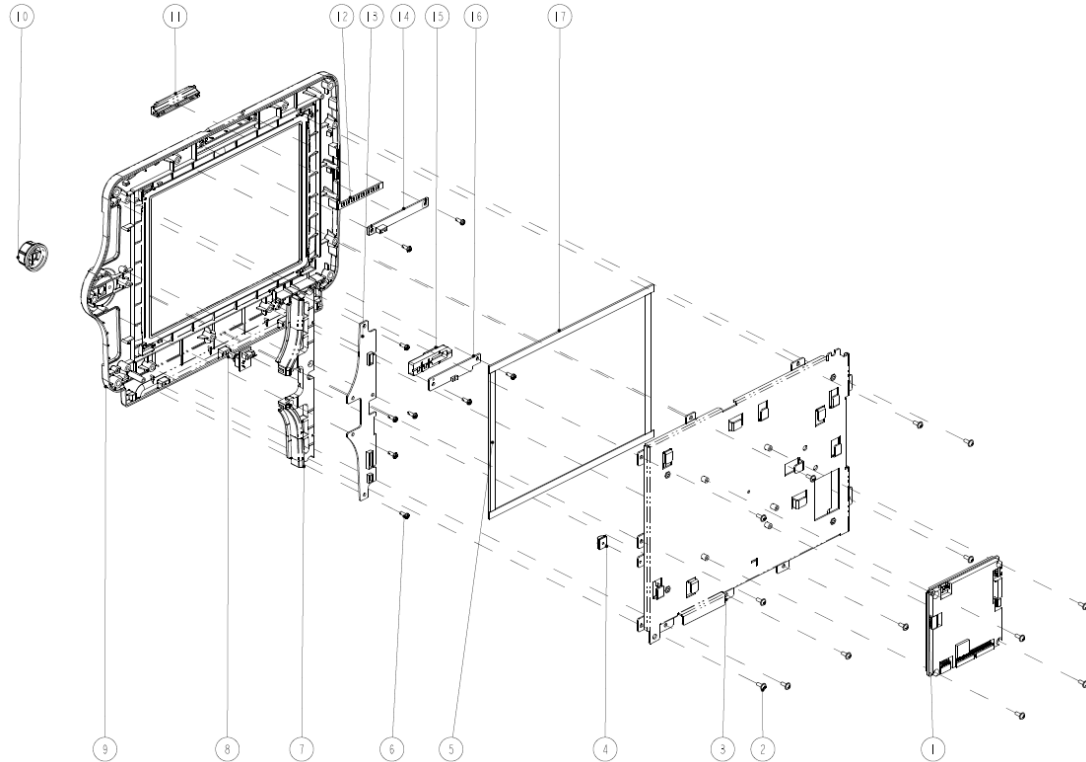


## 7.6.2 Parts List

SN	P/N	Description	Qty
1.	/	Screw, pan head cross recessed M3X6	1
2.	051-000881-00	6301 touch control board PCBA	1
3.	801-6303-00001-00	6301 main control PCBA (complete, 10 inch)	As configured
	801-6303-00002-00	6301 main control PCBA (standard, 10 inch)	
4.	/	Cross pan head screw with washer, GB9074.5, M3X8	16
5.	801-6303-00003-00	AU LCD service kit (LED backlight, 10 inch touchscreen)	As configured
	801-6303-00010-00	Tianma LCD service kit (10 inch touchscreen)	
6.	/	Spring, EMI	1
7.	021-000005-00	Touch panel	1
8.	/	Screw, self-tapping, PT3X8	9
9.	6802-20-66691-51	Power button (T5, mould MR66691)	1
10.	/	DMC touchscreen position pad	2
11.	051-000878-00	6301 keyboard PCBA 12.1 inch	1
12.	0010-30-43089	Encoder	1
13.	043-001790-00	Knob	1
14.	801-6303-00005-00	Front housing assembly (10 inch touchscreen)	1
15.	/	Alarm lamp shade	1
16.	115-010845-00	Antenna and cable assembly	2
17.	049-000335-00	Key (12 inch-Chinese)	As configured
	049-000351-00	Key (12 inch-English)	
	049-000385-00	Key (12 inch-Italian)	
	049-000386-00	Key (12 inch-Spanish)	
	049-000387-00	Key (12 inch-Portuguese)	
	049-000388-00	Key (12 inch-French)	
	049-000389-00	Key (12 inch-German)	
18.	/	Alarm gasket	1
19.	801-6301-00005-00	6301 alarm board PCBA	1
20.	051-000880-00	6301 On/Off key board PCBA	1
21.	/	10 inch touchscreen long gasket	2
22.	/	DMC touchscreen position pad	2
23.	/	10 inch touchscreen short gasket	2

## 7.7 Front Housing Subassembly (10 Inch/Nakescreen)

### 7.7.1 Exploded View



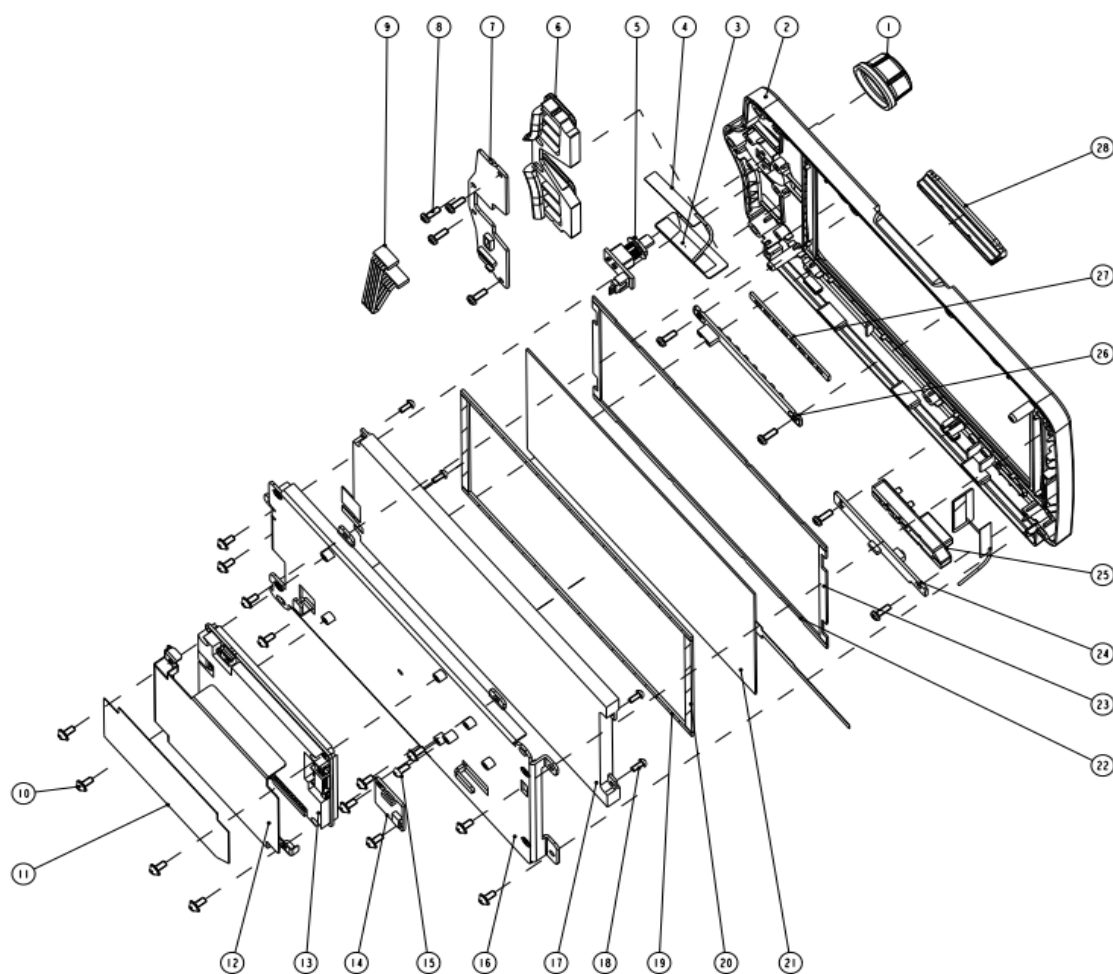
### 7.7.2 Parts List

SN	P/N	Description	Qty
1.	801-6303-00001-00	6301 Mainboard PCBA (complete, 10 inch)	As configured
	801-6303-00002-00	6301 Mainboard PCBA (standard, 10 inch)	
2.	/	Cross pan head screw with washer, GB9074.5, M3X8	14
3.	/	AU LCD kit (10 Inch)	1
4.	/	Spring, EMI	1
5.	/	10 inch nakescreen short gasket	2
6.	/	Screw, self-tapping, PT3X8	9
7.	049-000335-00	Key (12 inch-Chinese)	As configured
	049-000351-00	Key (12 inch-English)	
	049-000385-00	Key (12 inch-Italian)	
	049-000386-00	Key (12 inch-Spanish)	
	049-000387-00	Key (12 inch-Portuguese)	
	049-000388-00	Key (12 inch-French)	
	049-000389-00	Key (12 inch-German)	

8.	0010-30-43089	Encoder	1
9.	801-6303-00004-00	Front housing assembly (10 inch nakescreen)	1
10.	043-001790-00	Knob	1
11.	/	Alarm lamp shade	1
12.	/	Alarm gasket	1
13.	051-000878-00	6301 keyboard PCBA 12.1 inch	1
14.	801-6301-00005-00	6301 alarm board PCBA	1
15.	6802-20-66691-51	Power button (T5, mould MR66691)	1
16.	051-000880-00	6301 On/Off key board PCBA	1
17.	/	10 inch nakescreen long gasket	2
	021-000014-00	LCD, TFT 10.4" 800*600	

## 7.8 Front Housing Subassembly (8 Inch/Touchscreen)

### 7.8.1 Exploded View

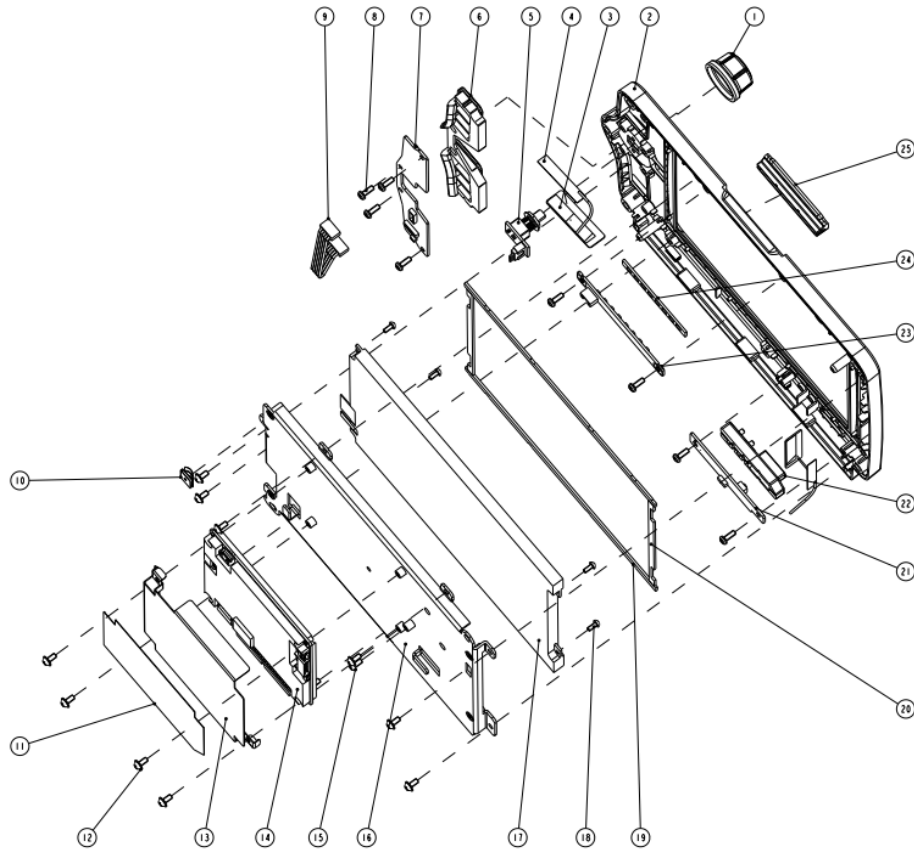


## 7.8.2 Parts List

SN	P/N	Description	Qty
1.	043-001790-00	Knob	1
2.	801-6302-00006-00	Front housing assembly (8 inch touchscreen)	1
3.	/	6301 Antenna attached PCB	2
4.	/	Antenna, 2400-2500 MHz, 2.15 dBI, IPEX-II	2
5.	0010-30-43089	Knob	1
6.	049-000350-00	Key (8 inch-English)	As configured
	049-000334-00	Key (8 inch-Chinese)	
	049-000380-00	Key (8 inch-Italian)	
	049-000381-00	Key (8 inch-Spanish)	
	049-000382-00	Key (8 inch-Potuguese)	
	049-000383-00	Key (8 inch-French)	
	049-000384-00	Key (8 inch-German)	
7.	051-000877-00	6301 keyboard PCBA 8.4 inch	1
8.	/	Screw, self-tapping, PT3X8	8
9.	9200-21-10460	Encoder connection cable	1
10.	/	Screw, Pan head w/washer, Phillips M3X6	14
11.	/	PCB shielding insulator	1
12.	/	PCB-shielding	1
13.	801-6302-00001-00	6301 main control PCBA, complete, 8 inch	As configured
	801-6302-00002-00	6301 main control PCBA, standard, 8 inch	
14.	051-000881-00	6301 touch control board PCBA	1
15.	/	Screw, pan head cross recessed M3X6	1
16.	/	Screen bracket (8 inch touchscreen)	1
17.	801-6302-00003-00	AU LCD service kit, LED-Backlight, 8 inch touchscreen	As configured
	801-6302-00013-00	Truly LCD service kit, 8 inch touchscreen	
18.	/	Screw, M2.5x6, display	4
19.	/	LCD-PORON-L	2
20.	/	LCD-PORON-S	2
21.	021-000058-00	Touch-panel, resistive-type, 8.4" 4-line	1
22.	/	Long gasket, IPM8, touchscreen	1
23.	/	Short gasket, IPM8, touchscreen	1
24.	051-000880-00	6301 On/Off key board PCBA	1
25.	6802-20-66691-51	Power button	1
26.	801-6301-00005-00	6301 alarm board PCBA	1
27.	/	Alarm gasket	1
28.	/	Alarm lamp shade	1

## 7.9 Front Housing Subassembly (8 Inch/Nakescreen)

### 7.9.1 Exploded View



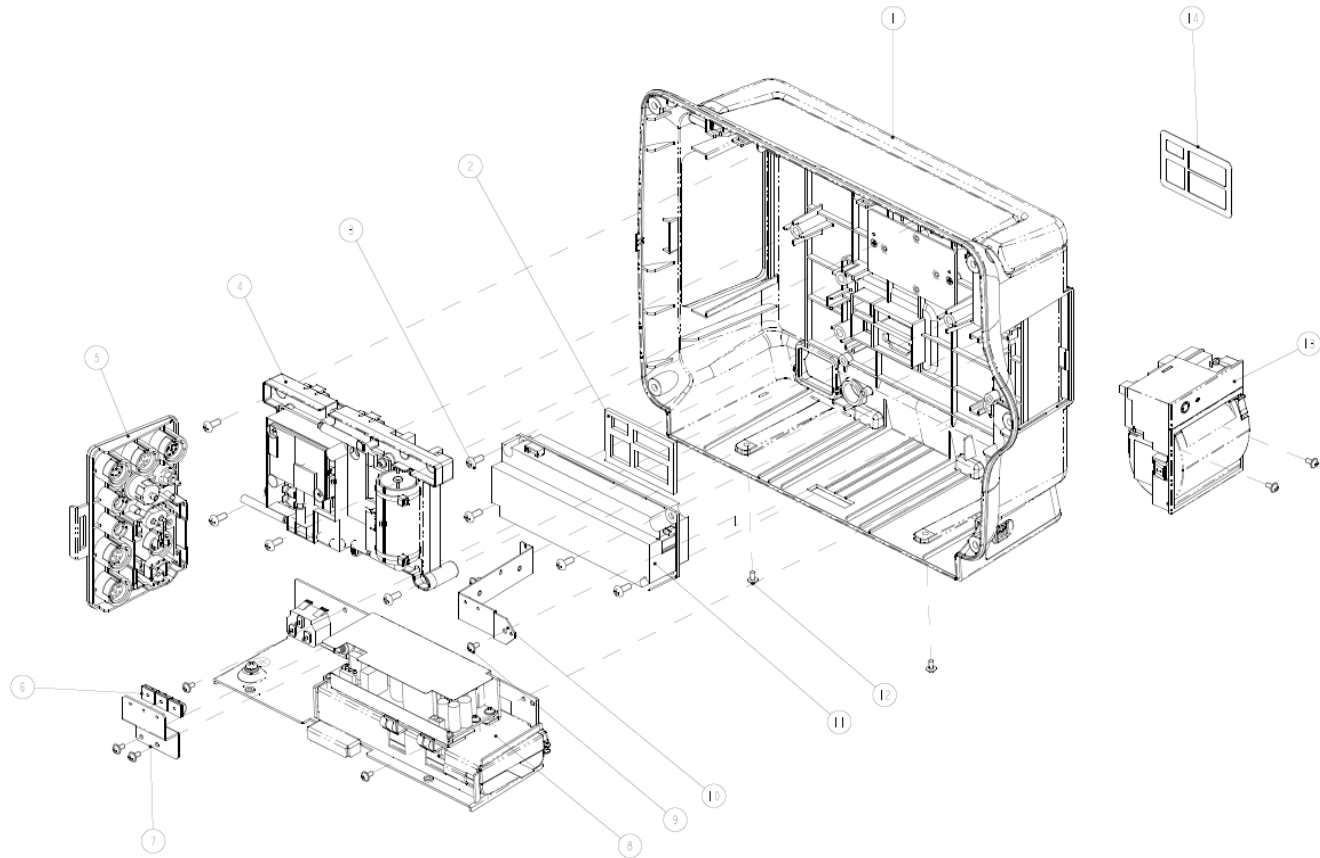
### 7.9.2 Parts List

SN	P/N	Description	Qty
1.	043-001790-00	Knob	1
2.	801-6302-00005-00	Front housing assembly (8 inch nakescreen)	1
3.	/	6301 Antenna attached PCB	2
4.	/	Antenna, 2400-2500 MHz, 2.15 dBI, IPEX-II	2
5.	0010-30-43089	Knob	1
6.	049-000350-00	Key (8 inch-English)	As configured
	049-000334-00	Key (8 inch-Chinese)	
	049-000380-00	Key (8 inch-Italian)	
	049-000381-00	Key (8 inch-Spanish)	
	049-000382-00	Key (8 inch-Portuguese)	
	049-000383-00	Key (8 inch-French)	
	049-000384-00	Key (8 inch-German)	

7.	051-000877-00	6301 keyboard PCBA 8.4 inch	1
8.	/	Screw, self-tapping, PT3X8	8
9.	9200-21-10460	Encoder connection cable	1
10.	/	Spring, EMI	1
11.	/	PCB shielding insulator	1
12.	/	Screw, Pan head w/washer, Phillips M3X6	12
13.	/	PCB-shielding	1
14.	801-6302-00001-00	6301 main control PCBA, complete, 8 inch	As configured
	801-6302-00002-00	6301 main control PCBA, standard, 8 inch	
15.	/	Screw, pan head cross recessed M3X6	1
16.	/	Screen bracket (8 inch nakescreen)	1
17.	021-000060-00	LCD TFT 8.4" 800*600 LED-Backlight	As configured
	021-000078-00	LCD TFT 8.4" 800*600 3.3v 345cd/m2 LED backlight	
18.	/	Screw, M2.5x6, display	4
19.	/	LCD-Gasket-L	2
20.	/	LCD-Gasket-S	2
21.	051-000880-00	6301 On/Off key board PCBA	1
22.	6802-20-66691-51	Power button, T5 (MR66691)	1
23.	801-6301-00005-00	6301 alarm board PCBA	1
24.	/	Alarm gasket	1
25.	/	Alarm lamp shade	1

## 7.10 Rear Housing Subassembly (12 Inch)

### 7.10.1 Exploded View



### 7.10.2 Parts List

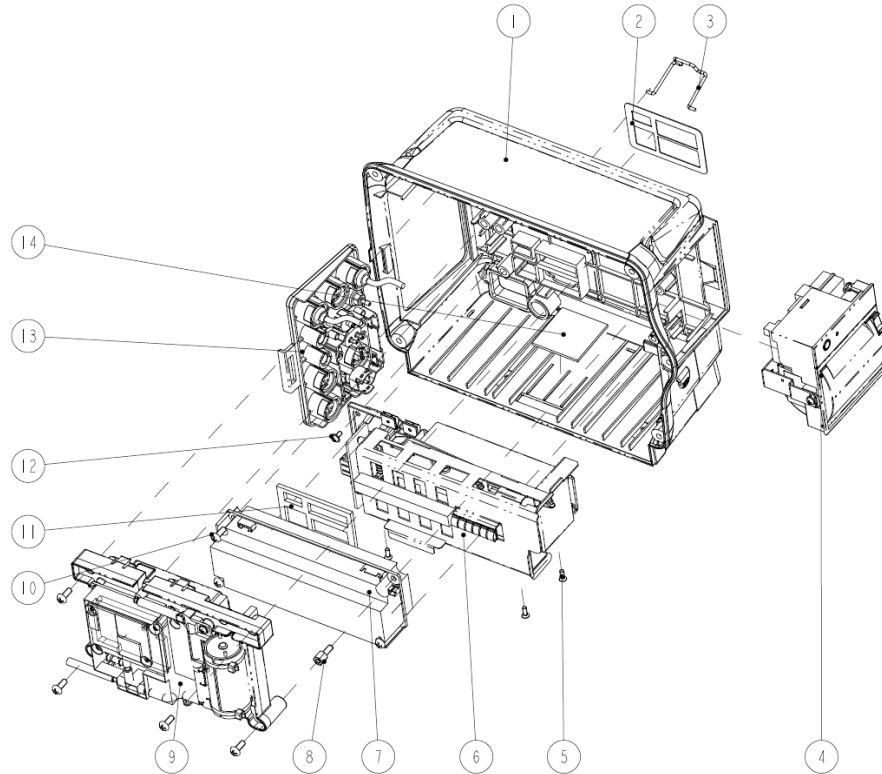
SN	P/N	Description	Qty
1.	115-010374-00	Rear cover subassembly (12 Inch)	1
2.	/	Interface board gasket	1
3.	/	Cross pan head screw, M4X10	8
4.	/	Parameter module subassembly	1
5.	115-010355-00	Parameter panel subassembly	As configured
	115-010356-00	Parameter panel subassembly	
	115-010357-00	Parameter panel subassembly	
	115-010358-00	Parameter panel subassembly	
	115-010359-00	Parameter panel subassembly	
	115-010360-00	Parameter panel subassembly	



6.	/	Spring, EMI	3
7.	/	Earth bracket	1
8.	115-010373-00	Battery compartment subassembly (12 Inch)	1
9.	/	Screw, Pan Head W/Washer, Phillips M3X6	4
10.	/	Recorder bracket (12 inch)	1
11.	801-6301-00001-00	PCBA, Power management/interface board, complete	As configured
	801-6301-00001-00	PCBA, Power management/interface board, standard	
12.	/	Screw, Pan Head W/Washer, Phillips M3X6	6
13.	TR6F-30-67306	TR6F recorder	1
14.	047-005546-00	Label (standard)	As configured
	047-005756-00	Label (Standard + IBP)	
	047-005757-00	Label (Standard + C.O.)	
	047-005758-00	Label (Standard + non-mainstream CO <sub>2</sub> )	
	047-005759-00	Label (Standard + mainstream CO <sub>2</sub> )	
	047-005760-00	Label (Standard + C.O. + non-mainstream CO <sub>2</sub> )	
	047-005761-00	Label (Standard + C.O. + mainstream CO <sub>2</sub> )	
	047-005762-00	Label (Standard + IBP + C.O.)	
	047-005763-00	Label (Standard + IBP + non-mainstream CO <sub>2</sub> )	
	047-005764-00	Label (Standard + IBP + mainstream CO <sub>2</sub> )	
	047-005765-00	Label (Standard + IBP + C.O. + mainstream CO <sub>2</sub> )	
	047-005695-00	Label (Standard + IBP + C.O. + non-mainstream CO <sub>2</sub> )	

## 7.11 Rear Housing Subassembly (8 Inch)

### 7.11.1 Exploded View



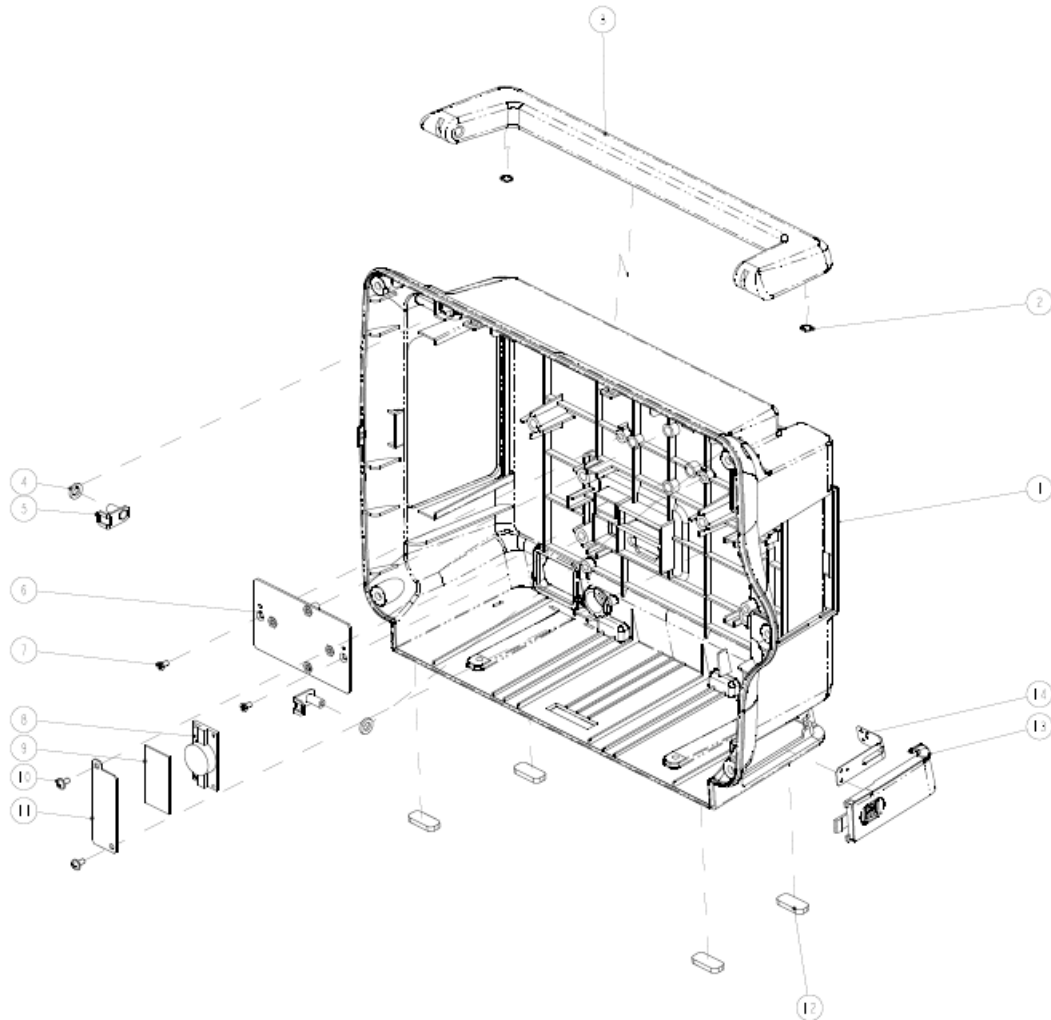
### 7.11.2 Parts List

SN	P/N	Description	Qty
1.	115-010391-00	Rear cover subassembly (8 Inch)	1
2.	/	Output interface label (ALL)	1
3.	9211-20-87369	AC Inlet Hook	1
4.	/	TR6F recorder kit (8 inch)	1
5.	/	Screw, Flat Head Phillips, M3X8	3
6.	115-010390-00	Battery compartment subassembly (8 inch)	1
7.	/	PCBA, 6301 Power management/interface board	1
8.	/	Stainless steel screw, M4X6	1
9.	/	Parameter Module	1
10.	/	Cross pan head screw M4X10	7
11.	/	Interface board gasket	1
12.	/	Screw, Pan head w/washer, Phillips M3X6	1
13.	115-010358-00	Parameter connector panel assembly	1
14.	/	Thermal conductive gel for AC board	1

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## 7.12 Rear Housing Subassembly (12 Inch)

### 7.12.1 Exploded View



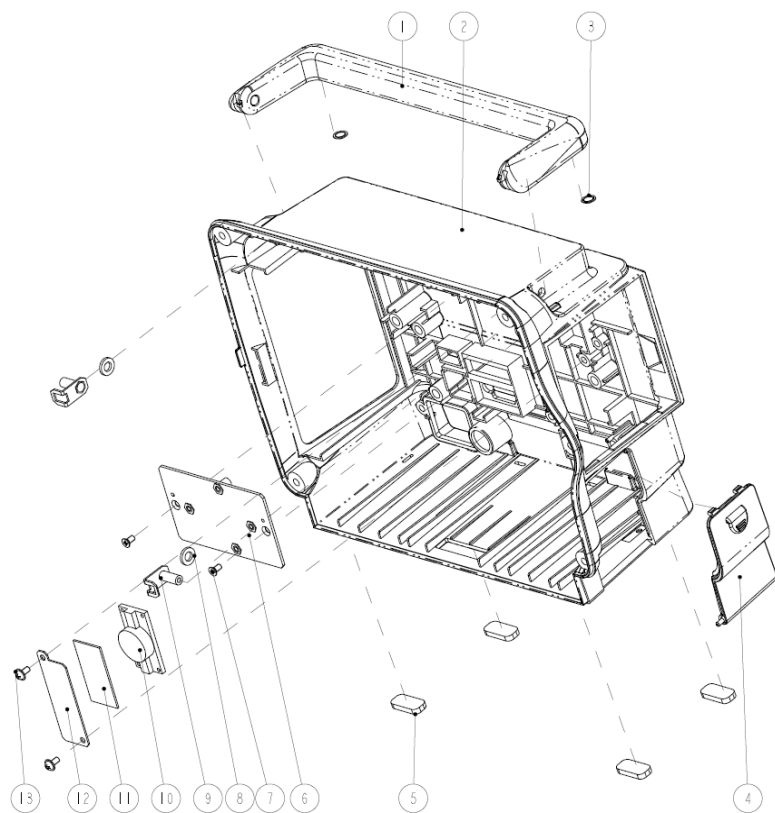
### 7.12.2 Parts List

SN	P/N	Description	Qty
1.	/	Rear panel (12 inch)	1
2.	/	Buffer washer, Bumpon SJ5302 white and transparent	2
3.	801-6301-00011-00	Handle (12/10 inch)	1
4.	/	Handle waterproof pad	2
5.	/	Handle bracket	2
6.	/	Hook bracket	1
7.	/	Screw, Flat Head, Phillips M3X6	2
8.	020-000015-00	Speaker, 2W, 4ohm, 60mm	1

9.	/	Gasket, speaker pressure plate and spacer	1
10.	/	Screw, Pan Head W/Washer, Phillips M3X6	2
11.	/	Gasket, speaker spacer	1
12.	/	Rubber feet	4
13.	115-010376-00	Battery door (12 inch)	1
14.	/	Battery door belt	1

## 7.13 Rear Housing Subassembly (8 Inch)

### 7.13.1 Exploded View



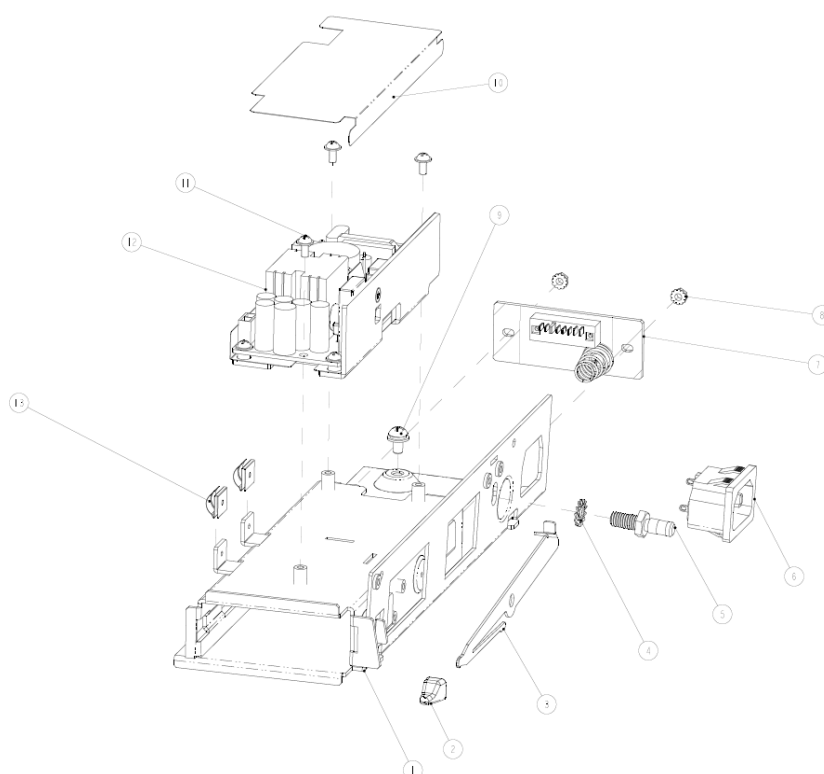
### 7.13.2 Parts List

SN	P/N	Description	Qty
1.	801-6302-00007-00	Handle (8 inch)	1
2.	115-010391-00	Rear panel (8 inch)	1
3.	/	Buffer washer, Bumpon SJ5302 white and transparent	2
4.	801-6302-00004-00	Battery door subassembly (8 inch)	1
5.	/	Rubber feet	4
6.	/	Hook bracket	1
7.	/	Screw, Flat Head Phillips, M3X8	2

8.	/	Handle waterproof pad	2
9.	/	Handle bracket	2
10.	020-000015-00	Speaker, 2W, 4ohm, 60mm	1
11.	/	Gasket, speaker pressure plate and spacer	1
12.	/	Gasket, speaker spacer	1
13.	/	Screw, Pan head w/washer, Phillips M3X6	2

## 7.14 Battery Compartment Subassembly (12 Inch)

### 7.14.1 Exploded View



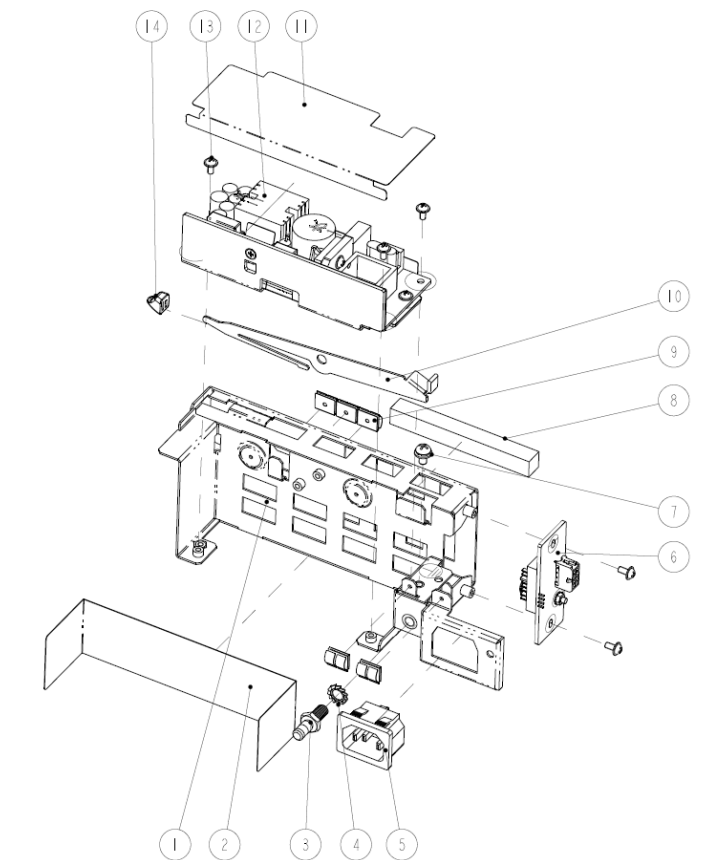
### 7.14.2 Parts List

SN	P/N	Description	Qty
1.	/	Main bracket (12 inch)	1
2.	/	Knob, battery latch	1
3.	/	Battery spring (12 inch)	1
4.	/	Serrated lock washers external teeth 6	1
5.	/	Grounding terminal	1
6.	009-002107-00	Cable for AC input receptacle	1
7.	/	Battery charge board assembly (12 inch)	1
8.	/	M3 nut with washer	2

9.	/	M4X8 combined screw	1
10.	/	Power board insulator	1
11.	/	Screw, Pan head w/washer, Phillips M3X6	3
12.	051-000824-00	6301 AC/DC power supply PCBA	1
13.	/	Spring, EMI	2

## 7.15 Battery Compartment Subassembly (8 Inch)

### 7.15.1 Exploded View



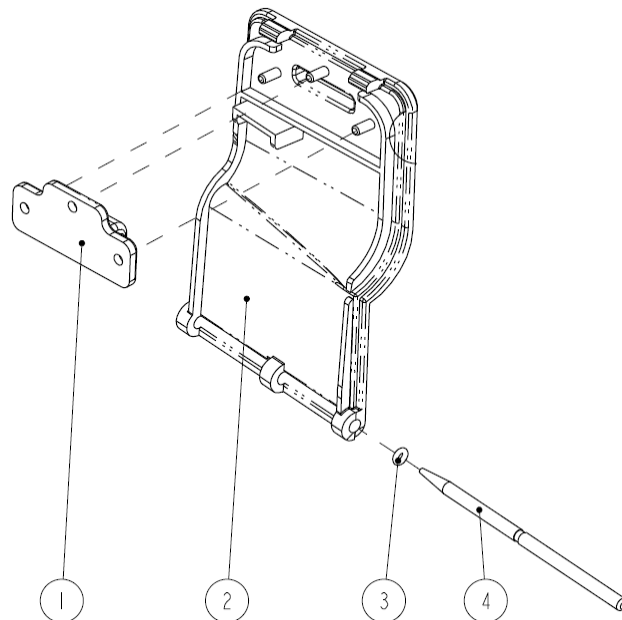
### 7.15.2 Parts List

SN	P/N	Description	Qty
1.	/	Main bracket (8 inch)	1
2.	/	Bracket insulator	1
3.	/	Grounding terminal	5
4.	/	Serrated lock washers external teeth 6	1
5.	009-002107-00	Cable for AC input receptacle	1
6.	051-000891-00	Battery interface	1

7.	/	M4X8 combined screw	1
8.	/	Conductive sponge	1
9.	/	Spring, EMI	5
10.	/	Battery Spring (8 inch)	1
11.	/	Power board insulator	1
12.	051-000824-00	6301 AC/DC power supply PCBA	1
13.	/	Screw, Pan head w/washer, Phillips M3X6	5
14.	/	Knob, battery latch	1

## 7.16 Battery Door Subassembly (8 Inch)

### 7.16.1 Exploded View



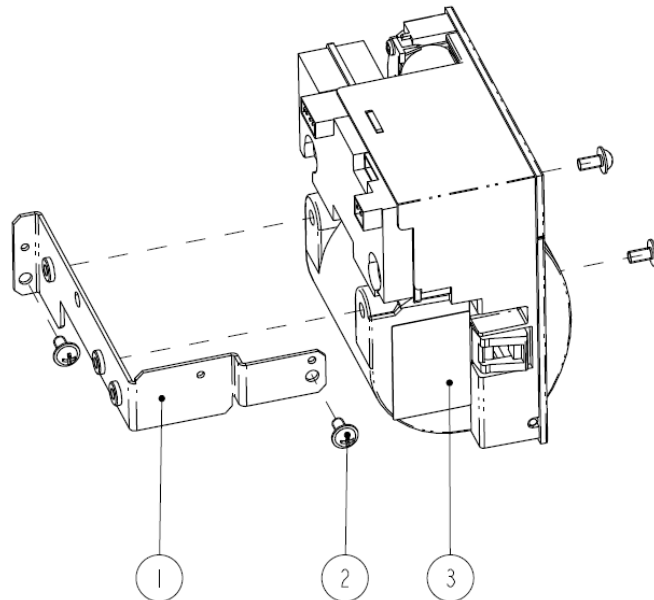
### 7.16.2 Parts List

SN	P/N	Description	Qty
1.	/	Battery door handle	1
2.	/	Battery door (8 inch)	1
3.	/	O-ring	1
4.	/	Axis of battery door	1

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## 7.17 TR6F Recorder Kit (8 Inch)

### 7.17.1 Exploded View



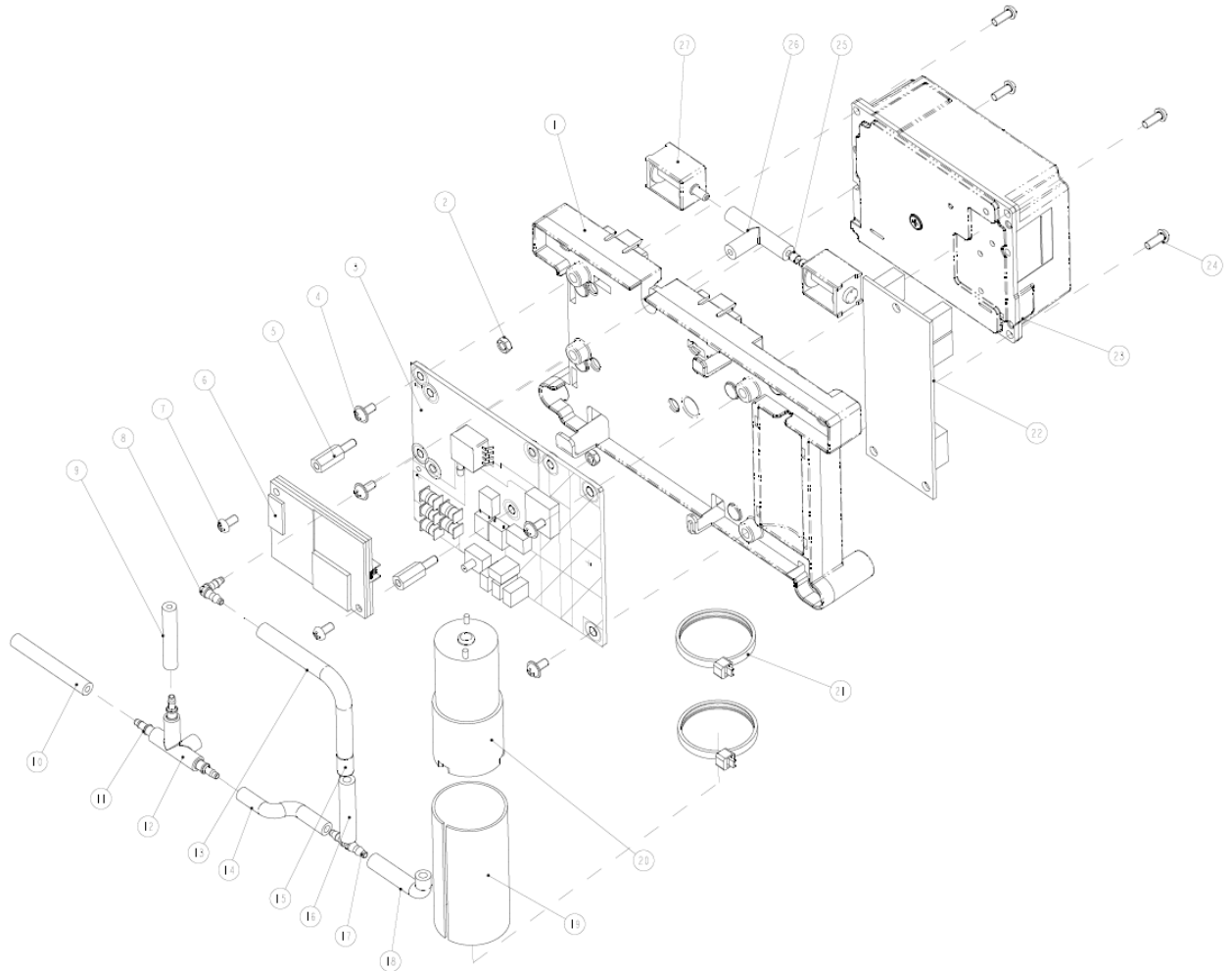
### 7.17.2 Parts List

SN	P/N	Description	Qty
1.	/	Recorder bracket (8 inch)	1
2.	/	Screw, Pan head w/washer, Phillips M3X6	4
3.	TR6F-30-67306	TR6F recorder	1



## 7.18 Parameter Module Assembly

### 7.18.1 Exploded View



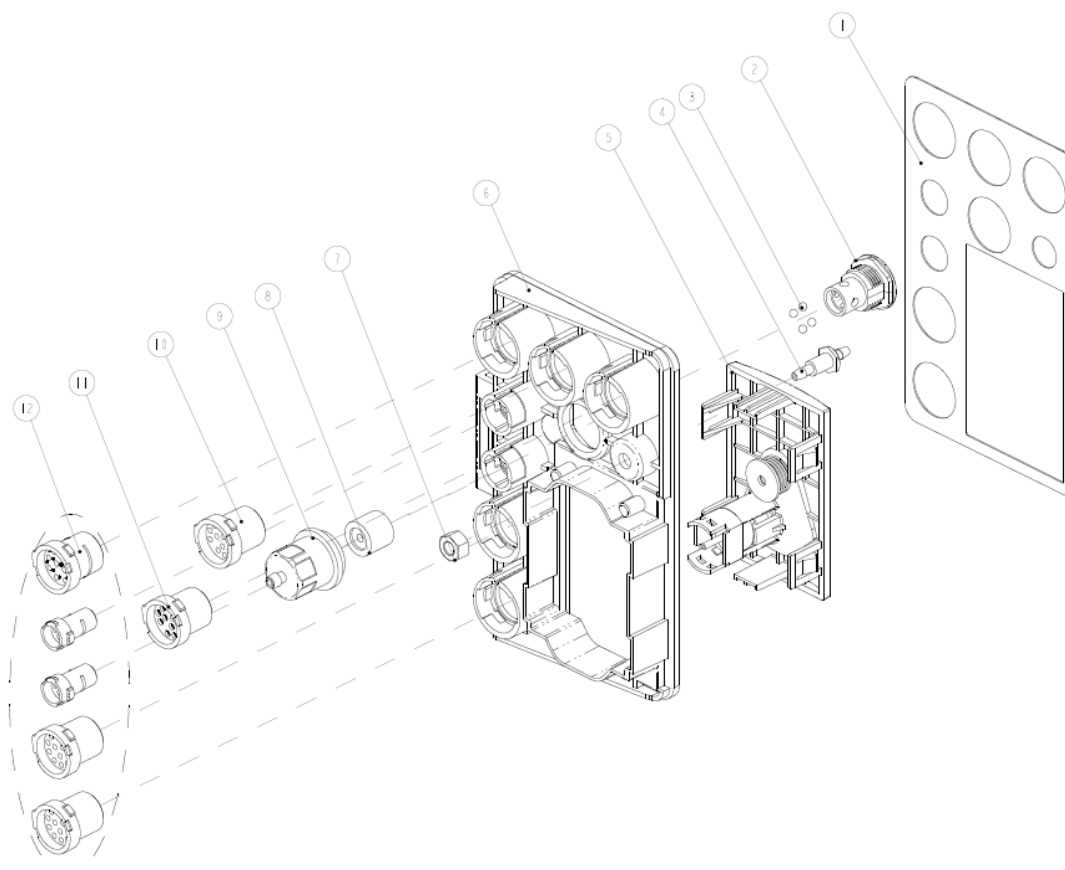
### 7.18.2 Parts List

SN	P/N	Description	Qty
1.	/	Parameter PCBA bracket	1
2.	/	Hexagon plastic nut, M3X0.5P PC	2
3.	051-000950-00	MEC Multi-parameter board PCBA (complete)	As configured
	051-000949-00	MEC Multi-parameter board PCBA (standard)	
4.	/	Screw, Pan Head W/Washer, Phillips M3X6	5
5.	/	Hexagon plastic nut, TPS-12 M3X12+8-8, nylon, UL1000	2
6.	0671-00-0102-01	Nellcor SpO2 board	As configured
	040-001149-00	Masimo MS-2013 SpO2 board (For Shenzhen Mindray only)	
	051-000943-00	9008 V2.0 SpO2 board PCBA	

7.	/	Screw, Pan Head Cross Recessed M3X6	2
8.	/	Connector, Elbow, 200Barb, 3/32"ID, White Nylon	1
9.	/	NIBP pipe 2	1
10.	/	NIBP pipe 7	1
11.	/	Connector, Straight, 400Barb, 3/32"ID, White	3
12.	/	Airway tube 2	1
13.	/	NIBP pipe 5	1
14.	/	NIBP pipe 3	1
15.	/	Filter, inline filter 43um 1/8" I.D.Tubing	1
16.	/	NIBP pipe 6	1
17.	/	Connector, Tee, 200Barb, 3/32"ID, White Nylon	1
18.	/	NIBP pipe 4	1
19.	/	Pump cushion	1
20.	082-000862-00	Pump, 12V DC, with 120 mm wire and connector	1
21.	/	Cable holder, CHS-4X150mm, Nylon	2
22.	M03B-30-26064	CO/IBP (M03B) module	1
23.	/	Mindray sidestream CO <sub>2</sub> kit	As configured
	/	Capnostat mainstream CO <sub>2</sub> kit	
	/	Oridion microstream CO <sub>2</sub> kit	
24.	/	Screw, Pan Head Phillips M3X8	4
25.	/	630F reducer	1
26.	/	Airway tube	1
27.	082-000861-00	Valve, CJV13-A12B1	1

## 7.19 Parameter Connector Panel Assembly

### 7.19.1 Exploded View



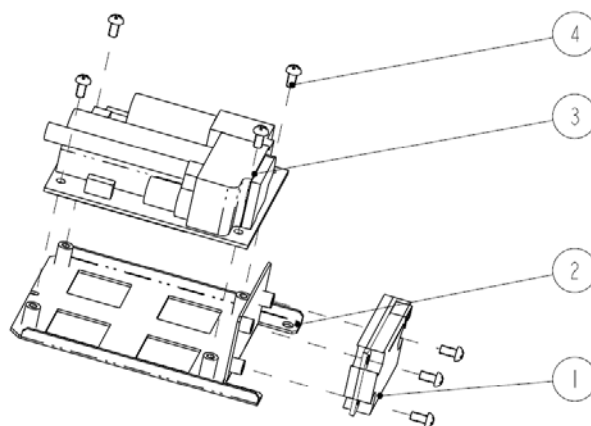
### 7.19.2 Parts List

SN	P/N	Description	Qty
1.	047-005546-00	Parameter label (standard)	As configured
	047-005695-00	Label (standard+IBP+C.O.+CO <sub>2</sub> )	
	047-005756-00	Label (standard+IBP)	
	047-005757-00	Label (standard+C.O.)	
	047-005758-00	Label (standard+CO <sub>2</sub> )	
	047-005759-00	Label (standard+Capnostat CO <sub>2</sub> )	
	047-005760-00	Label (standard+C.O.+CO <sub>2</sub> )	
	047-005761-00	Label(standard+C.O.+Capnostat CO <sub>2</sub> )	
	047-005762-00	Label (standard+IBP+C.O.)	
	047-005763-00	Label (standard+IBP+CO <sub>2</sub> )	
	047-005764-00	Label (standard+IBP+Capnostat CO <sub>2</sub> )	
	047-005765-00	Label (standard+IBP+C.O.+Capnostat CO <sub>2</sub> )	

2.	/	NIBP pedestal (hexagon)	1
3.	/	Steel ball, 2.5	4
4.	/	Gas outlet	1
5.	/	AG watertrap receptacle	As configured
	/	Mainstream CO <sub>2</sub> connecting board	
	9201-30-35923	Microstream CO <sub>2</sub> connector assembly	
6.	/	Parameter panel	1
7.	/	Nut, Stainless Steel M5 GB6170	1
8.	/	Silicon jacket	1
9.	/	NIBP external	1
10.	009-001678-00	ECG signal cable	1
11.	009-001993-00	C.O. signal cable	1
12.	009-001679-00	Multi-parameter signal cable, Mindray	As configured
	009-001680-00	Multi-parameter signal cable (Nellcor SpO <sub>2</sub> +TEMP+IBP)	
	009-001681-00	Multi-parameter signal cable (Masimo SpO <sub>2</sub> +TEMP+IBP)	
	009-002123-00	Multi-parameter signal cable (Mindray SpO <sub>2</sub> +TEMP)	
	009-002124-00	Multi-parameter signal cable (Nellcor SpO <sub>2</sub> +TEMP)	
	009-002125-00	Multi-parameter signal cable (Masimo SpO <sub>2</sub> +TEMP)	

## 7.20 Oridion Microstream CO<sub>2</sub> Kit

### 7.20.1 Exploded View



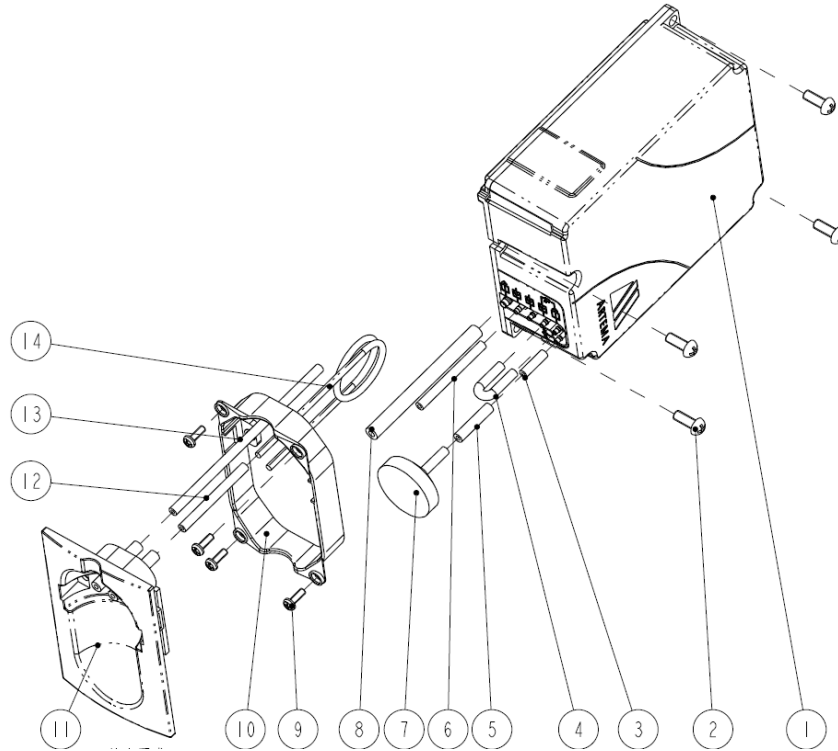
### 7.20.2 Parts List

No.	P/N	Description	Qty
1.	051-000892-00	6301 Microstream CO <sub>2</sub> converter PCBA	1
2.	/	Microstream CO <sub>2</sub> bracket	1
3.	0010-10-42559	Microstream CO <sub>2</sub> module	1
4.	/	Screw, pan head cross recessed M3X6	7

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## 7.21 Mindray Sidestream CO<sub>2</sub> Kit

### 7.21.1 Exploded View



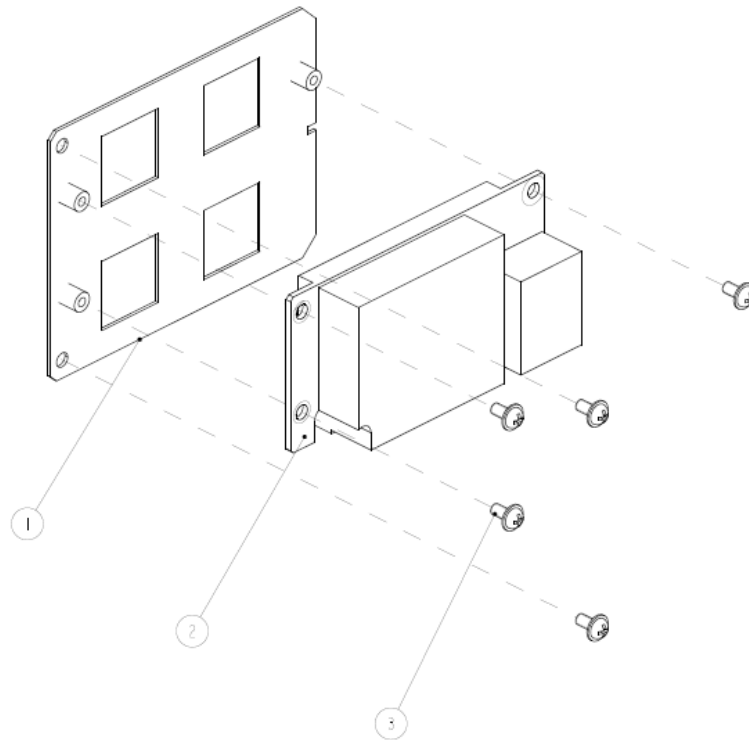
### 7.21.2 Parts List

No.	P/N	Description	Qty
1.	115-010077-00	CO <sub>2</sub> module unit (M02C)	1
2.	/	Screw, pan head, Phillips M3X8	4
3.	/	AG airway sampling line (T=10)	1
4.	/	AG airway sampling line (T=50, U-type)	1
5.	/	Silicon tube (T=15)	1
6.	/	AG airway sampling line (T=50)	1
7.	/	Air filter GB8368-98	1
8.	/	AG airway sampling line (T=90)	1
9.	/	Screw, pan head, self-tapping, PT2X6	4
10.	/	AG watertrap bracket	1
11.	/	AG watertrap receptacle	1
12.	/	AG airway sampling line (T=30)	1
13.	/	AG airway sampling line (T=110)	1
14.	/	Moisture exchanger (Nafion Tube for Mindray CO <sub>2</sub> )	1

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## 7.22 Capnostat Mainstream CO2 Kit

### 7.22.1 Exploded View



### 7.22.2 Parts List

No.	P/N	Description	Qty
1.	/	Mainstream CO2 bracket	1
2.	/	Power insulation board of module	1
3.	/	Screw, Pan head w/washer, Phillips M3X6	5

## 7.23 Replacement Parts

### 7.23.1 Main Unit

No.	P/N	Description	Qty
1.	801-6301-00001-00	Power management/interface board (complete)	1
2.	801-6301-00002-00	Power management/interface board (standard)	1
3.	801-6302-00001-00	Main control PCBA (complete, 8 inch)	1
4.	801-6302-00002-00	Main control PCBA (standard, 8 inch)	1
5.	801-6303-00001-00	Main control PCBA (complete, 10 inch)	1
6.	801-6303-00002-00	Main control PCBA (standard, 10 inch)	1
7.	801-6301-00003-00	Main control PCBA (complete, 12 inch)	1
8.	801-6301-00004-00	Main control PCBA (standard, 12 inch)	1
9.	051-000878-00	6301 keyboard PCBA (12/10 inch)	1
10.	051-000877-00	6301 keyboard PCBA (8 inch)	1
11.	051-000880-00	6301 On/Off key board PCBA	1
12.	801-6301-00005-00	Alarm board PCBA	1
13.	051-000811-00	Cyberlink module PCBA	1
14.	051-000892-00	6301 Microstream converter PCBA	1
15.	051-000891-00	6301 battery interface PCBA	1
16.	051-000824-00	6301 AC/DC power supply PCBA	1
17.	051-000881-00	6301 touch control board PCBA	1
18.	801-6301-00006-00	MEC Multi-parameter PCBA (complete)	1
19.	801-6301-00007-00	MEC Multi-parameter PCBA (standard)	1
20.	051-000950-00	MEC Multi-parameter (complete) board PCBA	1
21.	051-000949-00	MEC Multi-parameter (standard) board PCBA	1
22.	M03B-30-26064	C.O./IBP (M03B) module	1
23.	051-001038-00	Power isolation board PCBA of 6301 mainstream CO <sub>2</sub>	1
24.	051-000943-00	9008 V2.0 SpO <sub>2</sub> board PCBA	1
25.	0010-30-43089	Encoder	1
26.	082-000861-00	Valve, CJV13-A12B1	1
27.	082-000862-00	Pump, 12V DC, with 120 mm wire and connector	1
28.	020-000015-00	Speaker, 2W, 4ohm, 60mm	1
29.	021-000058-00	Touch-panel, resistive-type, 8.4" 4-line	1
30.	021-000059-00	Touch-panel, resistive-type, 12.1" 4-line	1
31.	021-000005-00	Touch panel, resistive-type, 10.4" 4-line	1
32.	021-000060-00	LCD, TFT, 8.4", 800*600, LED-BackLight	1
33.	801-6302-00003-00	AU LCD service kit (8 inch touchscreen )	1
34.	021-000061-00	LCD, TFT, 12.1", 800*600, LED-BackLight	1
35.	801-6301-00008-00	AU LCD service kit (12 inch touchscreen )	1
36.	021-000062-00	LCD, TFT, 10.4", 800*600, LED-BackLight	1
37.	801-6303-00003-00	AU LCD service kit (10 inch touchscreen )	1

38.	021-000078-00	8" LCD, Truly	1
39.	801-6302-00013-00	TRULY LCD kit (8 inch touchscreen)	1
40.	021-000014-00	10" LCD, TianMa	1
41.	801-6303-00010-00	AU LCD service kit (10 inch touchscreen )	1
42.	0010-10-42633	12" AU LCD	1
43.	801-6301-00024-00	AU LCD service kit (12 inch touchscreen )	1
44.	022-000053-00	Li-ion battery, 11.1, 2600mAh, LI13I001A	1
45.	023-000278-00	Industrial SD card (SLC), 1G	1
46.	040-001149-00	Masimo MS-2013 SpO2 board (For Shenzhen Mindray only)	1
47.	0010-10-42559	Microstream CO <sub>2</sub> module, MiniMediCO2-9	1
48.	M05-010R03---	Cell battery, Lithium, 3V, 35mAh, D12.5*2.0	1
49.	0671-00-0102-01	Nellcor SpO <sub>2</sub> board (MDU)	1
50.	043-001790-00	Knob	1
51.	6802-20-66691-51	Power button	1
52.	049-000334-00	Key (8 inch-Chinese)	1
53.	049-000350-00	Key (8 inch-English)	1
54.	049-000380-00	Key (8 inch-Italian)	1
55.	049-000381-00	Key (8 inch-Spanish)	1
56.	049-000382-00	Key (8 inch-Portuguese)	1
57.	049-000383-00	Key (8 inch-French)	1
58.	049-000384-00	Key (8 inch-German)	1
59.	049-000335-00	Key (12 inch-Chinese)	1
60.	049-000351-00	Key (12 inch-English)	1
61.	049-000385-00	Key (12 inch-Italian)	1
62.	049-000386-00	Key (12 inch-Spanish)	1
63.	049-000387-00	Key (12 inch-Portuguese)	1
64.	049-000388-00	Key (12 inch-French)	1
65.	047-005546-00	Parameter label (standard)	1
66.	047-005756-00	Label (standard+IBP)	1
67.	047-005757-00	Label (standard+C.O.)	1
68.	047-005758-00	Label (standard+CO <sub>2</sub> )	1
69.	047-005759-00	Label (standard+Capnostat CO <sub>2</sub> )	1
70.	047-005760-00	Label (standard+C.O.+CO <sub>2</sub> )	1
71.	047-005761-00	Label(standard+C.O.+Capnostat CO <sub>2</sub> )	1
72.	047-005762-00	Label (standard+IBP+C.O.)	1
73.	047-005763-00	Label (standard+IBP+CO <sub>2</sub> )	1
74.	047-005764-00	Label (standard+IBP+Capnostat CO <sub>2</sub> )	1
75.	047-005765-00	Label (standard+IBP+C.O.+Capnostat CO <sub>2</sub> )	1
76.	047-005695-00	Label (standard+IBP+C.O.+CO <sub>2</sub> )	1
77.	049-000389-00	Key (12 inch-German)	1
78.	9211-20-87369	AC Inlet Hook	1
79.	9211-20-87402	Recording cover	1



80.	115-010355-00	Parameter panel subassembly (ECG+TEMP+NIBP+Mindray SpO <sub>2</sub> )	1
81.	115-010356-00	Parameter panel subassembly (ECG+TEMP+NIBP+Nellcor SpO <sub>2</sub> )	1
82.	115-010357-00	Parameter panel subassembly (ECG+TEMP+NIBP+Masimo SpO <sub>2</sub> )	1
83.	115-010358-00	Parameter panel subassembly (ECG+TEMP+NIBP+Mindray SpO <sub>2</sub> +IBP)	1
84.	115-010359-00	Parameter panel subassembly (ECG+TEMP+NIBP+Nellcor SpO <sub>2</sub> +IBP)	1
85.	115-010360-00	Parameter panel subassembly (ECG+TEMP+NIBP+Masimo SpO <sub>2</sub> +IBP)	1
86.	115-010376-00	Battery door subassembly (10/12 Inch)	1
87.	801-6302-00004-00	Battery door subassembly (8 inch)	1
88.	115-010845-00	Antenna cable	1
89.	801-6301-00009-00	Front Housing Subassembly (12 Inch/Nakescreen)	1
90.	801-6301-00010-00	Front Housing Subassembly (12 Inch/Touchscreen)	1
91.	801-6303-00004-00	Front Housing Subassembly (10 Inch/Nakescreen)	1
92.	801-6303-00005-00	Front Housing Subassembly (10 Inch/Touchscreen)	1
93.	801-6302-00005-00	Front Housing Subassembly (8 Inch/Nakescreen)	1
94.	801-6302-00006-00	Front Housing Subassembly (8 Inch/Touchscreen)	1
95.	115-010374-00	Rear cover subassembly (10/12 Inch)	1
96.	115-010391-00	Rear cover subassembly (8 Inch)	1
97.	801-6301-00011-00	Handle (10/12 inch)	1
98.	801-6302-00007-00	Handle (8 inch)	1
99.	115-010540-00	Watertrap pedestal assembly (M02C)	1
100.	115-010077-00	CO <sub>2</sub> module unit (M02C)	1
101.	9201-30-35923	Microstream CO <sub>2</sub> connector assembly	1
102.	115-010373-00	Battery compartment subassembly (12 inch)	1
103.	115-010390-00	Battery compartment subassembly (8 inch)	1
104.	TR6F-30-67306	TR6F recorder	1

## 7.23.2 Connecting Cables

### 12 Inch

No.	P/N	Description	Qty
1.	009-001678-00	ECG signal cable	1
2.	009-001679-00	Multi-parameter signal cable (Masimo SpO <sub>2</sub> +TEMP+IBP)	1
3.	009-001680-00	Multi-parameter signal cable (Nellcor SpO <sub>2</sub> +TEMP+IBP)	1
4.	009-001681-00	Multi-parameter signal cable (Masimo SpO <sub>2</sub> +TEMP+IBP)	1
5.	009-001993-00	C.O. signal cable	1

6.	009-001994-00	Mainstream CO <sub>2</sub> signal cable	1
7.	009-001995-00	M02C sidestream communication cable	1
8.	009-001996-00	Cable between interface board and M03B module	1
9.	009-001997-00	Interface board to the mainstream converter	1
10.	009-001998-00	Interface board to Micro-stream board converter	1
11.	009-002000-00	Recorder cables	1
12.	009-002107-00	Cable for AC input receptacle	1
13.	009-002108-00	Cable for AC/DC module	1
14.	009-002109-00	Cable for touchscreen control board	1
15.	009-002112-00	Cable for display signal (AU 12")	1
16.	009-002115-00	Cable for backlight of 12.1" display (AU)	1
17.	009-002116-00	Cable between mother board and alarm lamp	1
18.	009-002117-00	Cable between mother board and keypad	1
19.	009-002119-00	Cable between parameter board and interface board	1
20.	009-002123-00	Multi-parameter signal cable (Mindray SpO <sub>2</sub> +TEMP)	1
21.	009-002124-00	Multi-parameter signal cable (Nellcor SpO <sub>2</sub> +TEMP)	1
22.	009-002125-00	Multi-parameter signal cable (Masimo SpO <sub>2</sub> +TEMP)	1
23.	009-002126-00	Cable between mother board and interface board	1
24.	009-002127-00	Cable between keypad and ON/OFF key board (12")	1
25.	009-002132-00	Cable for battery backboard	1

## 10 Inch

No.	P/N	Description	Qty
1.	009-001678-00	ECG signal cable	1
2.	009-001679-00	Multi-parameter signal cable (Masimo SpO <sub>2</sub> +TEMP+IBP)	1
3.	009-001680-00	Multi-parameter signal cable (Nellcor SpO <sub>2</sub> +TEMP+IBP)	1
4.	009-001681-00	Multi-parameter signal cable (Masimo SpO <sub>2</sub> +TEMP+IBP)	1
5.	009-001993-00	C.O. signal cable	1
6.	009-001994-00	Mainstream CO <sub>2</sub> signal cable	1
7.	009-001995-00	M02C sidestream communication cable	1
8.	009-001996-00	Cable between interface board and M03B module	1
9.	009-001997-00	Interface board to the mainstream converter	1
10.	009-001998-00	Interface board to Micro-stream board converter	1
11.	009-002000-00	Recorder cables	1
12.	009-002107-00	Cable for AC input receptacle	1
13.	009-002108-00	Cable for AC/DC module	1
14.	009-002109-00	Cable for touchscreen control board	1
15.	009-002111-00	Cable for display signal (AU 10")	1
16.	009-002114-00	Cable for backlight of 10.4" display (AU)	1
17.	009-002116-00	Cable between mother board and alarm lamp	1
18.	009-002117-00	Cable between mother board and keypad	1

19.	009-002119-00	Cable between parameter board and interface board	1
20.	009-002123-00	Multi-parameter signal cable (Mindray SpO <sub>2</sub> +TEMP)	1
21.	009-002124-00	Multi-parameter signal cable (Nellcor SpO <sub>2</sub> +TEMP)	1
22.	009-002125-00	Multi-parameter signal cable (Masimo SpO <sub>2</sub> +TEMP)	1
23.	009-002126-00	Cable between mother board and interface board	1
24.	009-002127-00	Cable between keypad and ON/OFF key board (12")	1
25.	009-002132-00	Cable for battery backboard	1

## 8 Inch

No.	P/N	Description	Qty
1.	009-001678-00	ECG signal cable	1
2.	009-001679-00	Multi-parameter signal cable (Masimo SpO <sub>2</sub> +TEMP+IBP)	1
3.	009-001680-00	Multi-parameter signal cable (Nellcor SpO <sub>2</sub> +TEMP+IBP)	1
4.	009-001681-00	Multi-parameter signal cable (Masimo SpO <sub>2</sub> +TEMP+IBP)	1
5.	009-001993-00	C.O. signal cable	1
	009-001994-00	Mainstream CO <sub>2</sub> signal cable	1
6.	009-001995-00	M02C sidestream communication cable	1
7.	009-001996-00	Cable between interface board and M03B module	1
8.	009-001997-00	Interface board to the mainstream converter	1
9.	009-001998-00	Interface board to Micro-stream board converter	1
10.	009-002000-00	Recorder cables	1
11.	009-002107-00	Cable for AC input receptacle	1
12.	009-002108-00	Cable for AC/DC module	1
13.	009-002109-00	Cable for touchscreen control board	1
14.	009-002110-00	Cable for display signal (AU 8")	1
15.	009-002113-00	Cable for backlight of 8.4" display (AU)	1
16.	009-002116-00	Cable between mother board and alarm lamp	1
17.	009-002117-00	Cable between mother board and keypad	1
18.	009-002118-00	Cable between keypad and ON/OFF key board (8")	1
19.	009-002119-00	Cable between parameter board and interface board	1
20.	009-002123-00	Multi-parameter signal cable (Mindray SpO <sub>2</sub> +TEMP)	1
21.	009-002124-00	Multi-parameter signal cable (Nellcor SpO <sub>2</sub> +TEMP)	1
22.	009-002125-00	Multi-parameter signal cable (Masimo SpO <sub>2</sub> +TEMP)	1
23.	009-002126-00	Cable between mother board and interface board	1
24.	009-002132-00	Cable for battery backboard	1

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**FOR YOUR NOTES**

# 8 Upgrade

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## 8.1 Introduction

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

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### NOTE

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- **If you have to disassemble the patient monitor for software upgrade, be sure to eliminate the static charges before disassembling the equipment. When disassembling the part labeled with a ESD warning symbol, 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.**
  - **Disconnect all the cables before disassembling any parts. Be careful not to damage any cables or connectors.**
  - **Properly place removed screws and disassembled parts, preventing them from being lost or contaminated.**
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## 8.2 Upgrading Software

You can upgrade the software with the System Update Tool (PN: G-110-000493-00) through network. This tool can directly run on a PC. Through network or by connecting the patient monitor to a PC via a crossover network cable, you can upgrade the following programs:

Software	PN	Description
Boot program	110-001792-00	BIOS program
System software	110-001851-00	System software
Multilingual library	110-1795-00	Language library
BMP resource file	110-001796-00	Icon library
	110-001847-00	Startup Logo
LINUX platform software	110-001848-00	LINUX kernel (including drive)
Module program	110-001861-00	M0 software for power management board
	110-001839-00	BF512 software for M51A V2.0 module
	110-000539-00	Software for 9008 SpO <sub>2</sub> module
	110-001838-00	STM32 software for M02C module
	M03B-30-86661	Software for M03B module (download online)

All programs except the module software will be cleared during the upgrade of LINUX kernel (including drive). Therefore, remember to upgrade the system software and boot program etc. after the LINUX kernel (including drive) is upgraded.

### 8.2.1 How to Upgrade Software

Follow the procedure below to upgrade the software with iMEC System Update Tool (PN: G-110-000493-00):

1. Connect the patient monitor to a PC through a network cable. Set the IP to 77.77.XX.XX and subnet mask to 255.255.255.0.
2. Run the System Update Tool in the PC. Select [Miracle] in the [Machine Type Selection] window and confirm.
3. Select [Select Package] in the main screen of the Mindray Patient Monitor Software Upgrade Tool. Choose the package you want to upgrade and click [Start].
4. Start up the patient monitor and press quickly the [Silence]+[Main Menu] hardkeys to enter upgrade mode. Determine if the software is upgraded successfully according to the prompt message of the patient monitor when finishing upgrading the software.

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Software upgrade is taken in the sequence of LINUX kernel (including drive) → system software package (including system software, language library, BMP resource files, and boot program) → Module software.

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

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## **CAUTION**

- **Disconnect the patient monitor from patient and make sure important data are saved before upgrade.**
- **Do not shut down or power off the equipment when upgrading the boot program. Otherwise, the equipment may break down.**
- **Program upgrade should be performed by qualified service personnel only.**

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## **NOTE**

- **After upgrading the BIOS program, you have to upgrade system program and other programs to ensure compatibility.**
  - **Make sure the version of the upgrade package is you desired one. If you want to obtain the latest upgrade package, contact Mindray Customer Service Department.**
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**FOR YOUR NOTES**



# 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. 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

### A.1.1 The Power 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.

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## 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

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## A.4 Earth Leakage Test

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

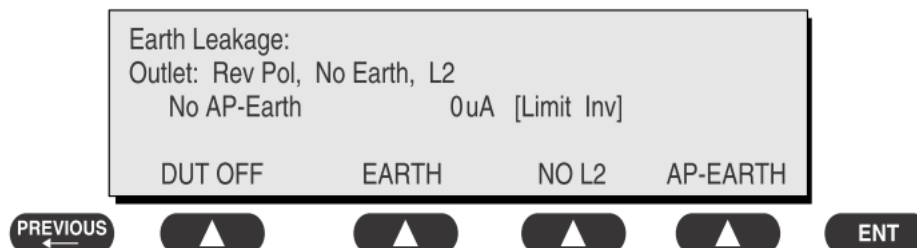
Leakage current is measured the following ways:

- 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.

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## 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 USA,

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

For other countries:

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

## A.5 Patient Leakage Current

Patient leakage currents are measured between a selected applied part and mains earth. All measurements may have either a true RMS or a DC-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 |

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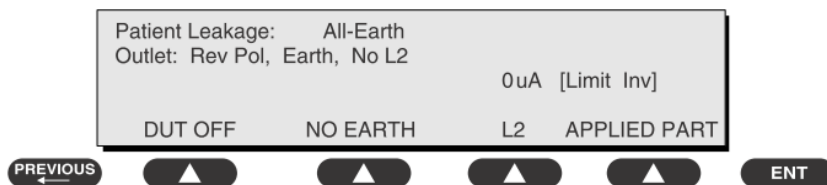
## WARNING

---

- 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.

### NOTE

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- If the current test standard being used does not include Patient Leakage DC readings, or the DC option is not enabled, then DC readings will not be available through the APPLIED PART SOFT KEY selections. Refer to Chapter 8, Standards and Principles.
-

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## 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

- ◆ 10 $\mu$ A DC, 100 $\mu$ A AC in Normal Condition
- ◆ 50 $\mu$ A DC, 500 $\mu$ A AC in Single Fault Condition

## A.6 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.

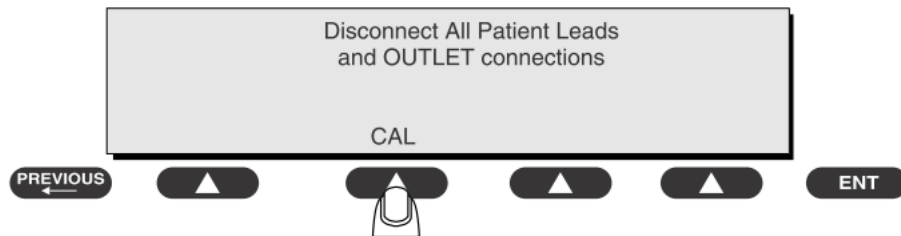
- Normal Polarity;
- Reversed Polarity

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## 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.

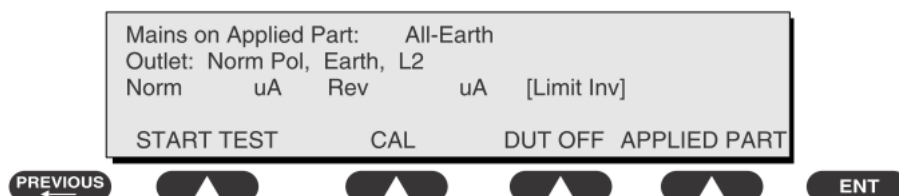
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## WARNING

- 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



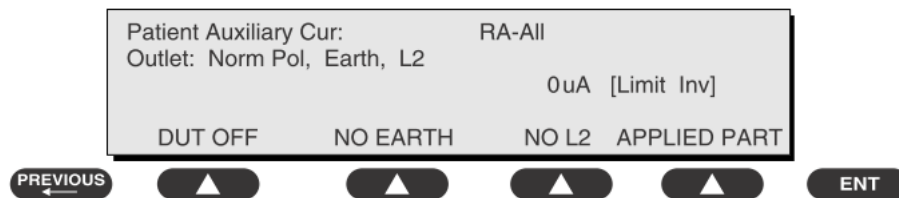
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## A.7 Patient Auxiliary Current

Patient Auxiliary currents are measured between any selected ECG jack and the remaining selected ECG jacks. All measurements may have either a true RMS or a DC-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.

### NOTE

- 
- **If the current test standard being used does not include Patient Auxiliary Current DC readings, or the DC option is not enabled, then DC readings will not be available through the APPLIED PART SOFT KEY selections.**
-

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## 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,

- ◆ 10 $\mu$ A DC, 100 $\mu$ A AC in Normal Condition
- ◆ 50 $\mu$ A DC, 500 $\mu$ A AC in Single Fault Condition

## A.8 Functional test

For functional test items, please refer to relevant functional tests in *Chapter 3 Testing and Maintenance*.

## ELECTRICAL SAFETY INSPECTION FORM (American Version)

### Overall assessment:

Scheduled inspection	Test item: 1, 2, 3, 8
Unopened repair type	Test item: 1, 2, 3, 8
Opened repair type, not modify the power part including transformer or patient circuit board	Test item: 1, 2, 3, 4,8
Opened repair type, modify the power part including transformer or patient circuit board	Test item: 1, 2, 3, 4, 5, 6, 7, 8

<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>Comments</b>
1	Power Cord Plug				
2	Device Enclosure and Accessories				
3	Device Labeling				
4	Earth Leakage	Normal condition(NC)	____μA		Max: NC: 300μA SFC: 1000μA
		Single Fault condition(SFC)	____μA		
5*	Patient Leakage Current	Normal condition(NC)	____μA		Max: CF applied part: NC:10μA, SFC: 50μA BF applied part: NC:100μA, SFC: 500μA
		Single Fault condition(SFC)	____μA		
6*	Mains on Applied Part Leakage		____μA		Max: CF applied part: 50μA BF applied part: 5000μA
7*	Patient Auxiliary Current	Normal condition(NC)	____μA		Max: CF applied part: NC:10μA, SFC: 50μA BF applied part: NC:100μA, SFC: 500μA
		Single Fault condition(SFC)	____μA		
8	Functional test (parameters tested):				

Note: The test items marked “\*” are needed only for incoming inspections and after repairs or modifications that may have affected lead leakage [NFPA 99 (2005)8.5.2.1.3].

Deficiency /Note:

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

## ELECTRICAL SAFETY INSPECTION FORM (International version)

### Overall assessment:

Scheduled inspection	Test item: 1, 2, 3, 8
Unopened repair type	Test item: 1, 2, 3, 8
Opened repair type, not modify the power part including transformer or patient circuit board	Test item: 1, 2, 3, 4,8
Opened repair type, modify the power part including transformer or patient circuit board	Test item: 1, 2, 3, 4, 5, 6, 7, 8

<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>Comments</b>
1	Power Cord Plug				
2	Device Enclosure and Accessories				
3	Device Labeling				
4	Earth Leakage	Normal condition(NC)	____μA		Max NC:500μA SFC:1000μA
		Single Fault condition(SFC)	____μA		
5*	Patient Leakage Current	Normal condition(NC)	____μA		Max CF applied part NC:10μA, SFC: 50μA BF applied part NC:100μA, SFC: 500μA
		Single Fault condition(SFC)	____μA		
6*	Mains on Applied Part Leakage		____μA		Max: CF applied part: 50μA BF applied part: 5000μA
7*	Patient Auxiliary Current	Normal condition(NC)	____μA		Max: CF applied part: NC:10μA, SFC: 50μA BF applied part: NC:100μA, SFC: 500μA
		Single Fault condition(SFC)	____μA		
8	Functional test (parameters tested):				

Note: The test items marked “\*” are needed only for incoming inspections and after repairs or modifications that may have affected lead leakage [NFPA 99 (2005)8.5.2.1.3].

Deficiency /Note:

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



