uMEC10/uMEC12/uMEC15

Patient Monitor

Operator's Manual

$C\,E_{0123}$

For this Operator's Manual, the issue date is 2016-1.

⚠ WARNING

- **Federal Law (USA) restricts this device to sale by or on the order of a physician.**

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■ the product is used in accordance with the instructions for use.

⚠ WARNING

- **This equipment must be operated by skilled/trained clinical professionals.**
- **It is important for the hospital or organization that employs this equipment to carry out a reasonable service/maintenance plan. Neglect of this may result in machine breakdown or personal injury.**

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Preface

Manual Purpose

This manual contains the instructions necessary to operate the product safely and in accordance with its function and intended use. Observance of this manual is a prerequisite for proper product performance and correct operation and ensures patient and operator safety.

This manual is based on the maximum configuration and therefore some contents may not apply to your product. If you have any question, please contact us.

This manual is an integral part of the product. It should always be kept close to the equipment so that it can be obtained conveniently when needed.

Intended Audience

This manual is geared for clinical professionals who are expected to have a working knowledge of medical procedures, practices and terminology as required for monitoring of critically ill patients.

Illustrations

All illustrations in this manual serve as examples only. They may not necessarily reflect the setup or data displayed on your patient monitor.

Conventions

- **■** ***Italic text*** is used in this manual to quote the referenced chapters or sections.
- **■** [ ] is used to enclose screen texts.
- **■** → is used to indicate operational procedures.

Content

1 Safety

1.1 Safety Information

⚠ **WARNING**

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

⚠ **CAUTION**

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

NOTE

- Provides application tips or other useful information to ensure that you get the most from your product.

1.1.1 Warnings

⚠ WARNING

- This equipment is used to one patient at a time.
- Before putting the system into operation, the operator must verify that the equipment, connecting cables and accessories are in correct working order and operating condition.
- To avoid risk of electric shock, this equipment must only be connected to a supply mains with protective earth.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.
- To avoid explosion hazard, do not use the equipment in the presence of oxygen-rich atmospheres, flammable anesthetics, or other flammable agents (such as gasoline).Use and store the equipment in specified environmental condition. The monitor and accessesories may not meet the performance specification due to aging, stored or used outside the specified temperature and humidity range.
- Do not open the equipment housings. All servicing and future upgrades must be carried out by the personnel trained and authorized by our company only.
- Do not come into contact with patients during defibrillation. Otherwise serious injury or death could result.
- Do not rely exclusively on the audible alarm system for patient monitoring. Adjustment of alarm volume to a low level or off may result in a hazard to the patient. Remember that alarm settings should be customized according to different patient situations and always keeping the patient under close surveillance is the most reliable way for safe patient monitoring.
- The physiological data and alarm messages displayed on the equipment are for reference only and cannot be directly used for diagnostic interpretation.
- To avoid inadvertent disconnection, route all cables in a way to prevent a stumbling hazard. Wrap and secure excess cabling to reduce risk of entanglement or strangulation by patients or personnel.
- When disposing of the package material, be sure to observe the applicable waste control regulations and keep it out of children's reach.
- Ensure that the patient monitor is supplied with continuous electric power during work. Sudden power failure leads to the loss of patient data.
- Do not touch the equipment's metal parts or connectors when in contact with the patient; otherwise patient injury may result.
- Never mix patient electrode types or brands. Dissimilar metals or other incompatibilities may cause considerable baseline drift and may increase trace recovery time after defibrillation.

1.1.2 Cautions

⚠ CAUTION

- To ensure patient safety, use only parts and accessories specified in this manual.
- At the end of its service life, the equipment, as well as its accessories, must be disposed of in compliance with the guidelines regulating the disposal of such products. If you have any questions concerning disposal of the equipment, please contact us.
- Magnetic and electrical fields are capable of interfering with the proper performance of the equipment. For this reason make sure that all external devices operated in the vicinity of the equipment comply with the relevant EMC requirements. 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.
- Always install or carry the equipment properly to avoid damage caused by drop, impact, strong vibration or other mechanical force.
- Dry the equipment immediately in case of rain or water spray.

1.1.3 Notes

NOTE

- Put the equipment in a location where you can easily view and operate the equipment.
- The equipment use a mains plug as isolation means to the mains power supply. Do not locate the equipment in a place difficult to operate the mains plug.
- In normal use, the operator shall stand in front of the equipment.
- Keep this manual in the vicinity of the equipment so that it can be obtained conveniently when needed.
- The software was developed in compliance with IEC60601-1. The possibility of hazards arising from software errors is minimized.
- This manual describes all features and options. Your equipment may not have all of them.

1.2 Equipment Symbols

NOTE

- **Some symbols may not appear on your equipment.**

Symbol	Description	Symbol	Description
⚠	General warning sign		Refer to instruction manual/booklet
⊙/Ȯ	Power ON/OFF (for a part of the equipment)	⊟⊞	Battery indicator
∼	Alternating current		ALARM PAUSED
	Alarm reset		Graphical recorder
▷◁	Freeze/unfreeze waveforms	■	Main menu
	NIBP start/stop key	⊖→	Output
	Equipotentiality	⊐→	VGA output
•⟵⟶	USB connector		Network connector
⊐→	Gas outlet	SN	Serial number
▼	Inserted direction	IPX1	Protection against vertically falling water drops
	Manufacturer		Date of Manufacture
CE 0123	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. Note: The product complies with the Council Directive 2011/65/EU.		
EC REP	AUTHORISED REPRESENTATIVE IN THE EUROPEAN COMMUNITY		
	Electrostatic sensitive devices		
⊣♥⊢	DEFIBRILLATION-PROOF TYPE CF APPLIED PART		

	DEFIBRILLATION-PROOF TYPE BF APPLIED PART
	The following definition of the WEEE label applies to EU member states only. 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. * For system products, this label may be attached to the main unit only.

FOR YOUR NOTES

2 The Basics

2.1 Monitor Description

2.1.1 Intended Use

The uMEC series patient monitors are intended to be used for monitoring, displaying, reviewing, storing and transferring of multiple physiological parameters including ECG, heart rate (HR), respiration (Resp), temperature (Temp), pulse oxygen saturation (SpO_2), pulse rate (PR), non-invasive blood pressure (NIBP), invasive blood pressure (IBP), cardiac output (C.O.) and carbon dioxide (CO_2).

The monitors are to be used in healthcare facilities by clinical professionals or under their direction.

⚠ WARNING

- **This patient monitor is intended for use only by clinical professionals or under their guidance. It must only be used by persons who have received adequate training in its use. Anyone unauthorized or untrained must not perform any operation on it.**

2.1.2 Applied Parts

The applied parts of the uMEC series patient monitors are:

- ECG electrodes and leadwires
- SpO_2 sensor
- NIBP cuff
- Temp probes
- IBP/ICP transducer
- C.O. sensor
- CO_2 sampling line/Nasal sampling cannula, watertrap, airway adapter and mask

2.2 Front View
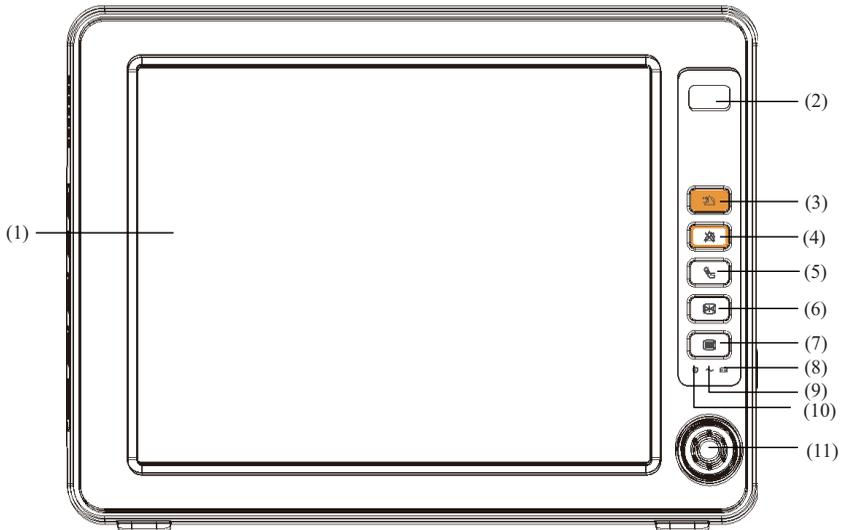
(1) Display Screen

(2) Alarm lamp

When a physiological alarm or technical alarm occurs, this lamp will flash as defined below.

- ◆ High level alarms: the lamp quickly flashes red.

- ◆ Medium level alarms: the lamp slowly flashes yellow.

- ◆ Low level physiological alarms: the lamp lights yellow without flashing.

- ◆ Low level technical alarms: the lamp does not light.

(3) Press to reset alarms.

(4) Press to pause or restore alarms.

(5) Press to start or stop NIBP measurements.

(6) Press to freeze or unfreeze waveforms.

(7) ■

If no menu is displayed on the screen, pressing it will enter the main menu. If there is a menu displayed on the screen, pressing it will close that menu.

(8) ⊟ Battery LED

◆ On: when the battery is installed and the AC source is connected.

◆ Off: when no battery is installed or the installed battery is malfunction, or no AC source is connected when the patient monitor is power off.

◆ Flash: when the patient monitor operates on battery power.

(9) ∿ AC power LED

It turns on when AC power is connected.

(10) ⊙ Power On/Off LED

It turns on when the patient monitor is on and turns off when the patient monitor is off.

(11) Knob

Rotate the Knob clockwise or anti-clockwise. With each click, the highlight jumps to the neighboring item. When you reach your desired item, press the Knob to select it.

2.3 Side View

2.3.1 uMEC10
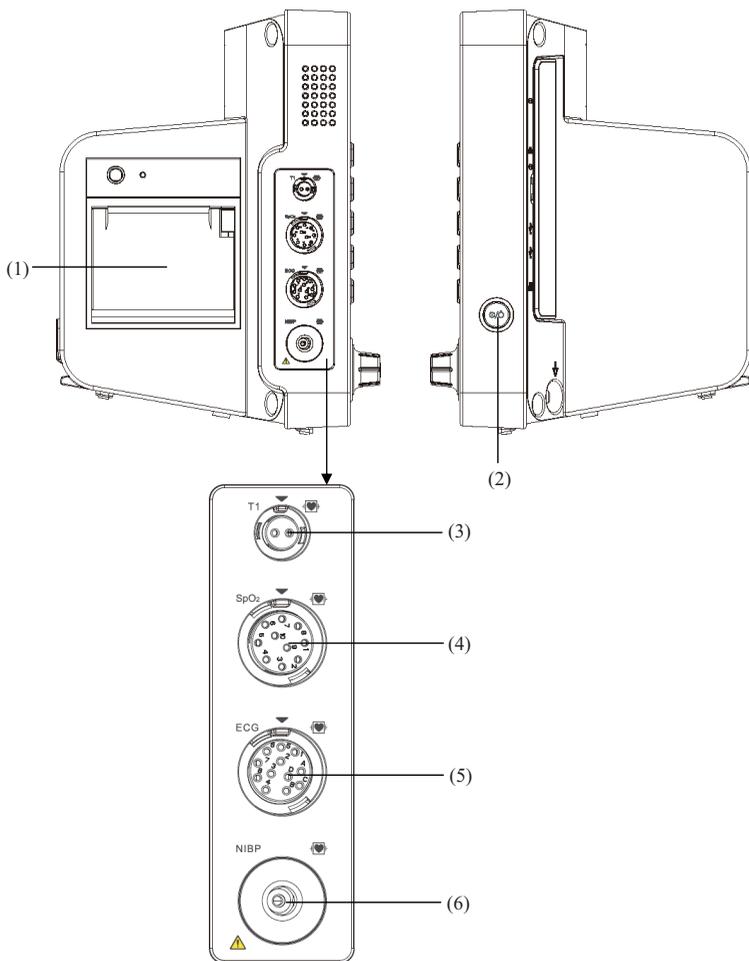
(1) Recorder

(2) Power On/Off switch

  ◆ Pressing this switch turns the patient monitor on.

  ◆ When the monitor is on, pressing and holding this switch turns the monitor off.

(3) Connector for Temp probe (4) Connector for SpO_2 cable

(5) Connector for ECG cable (6) Connector for NIBP cuff

2.3.2 uMEC12/uMEC15
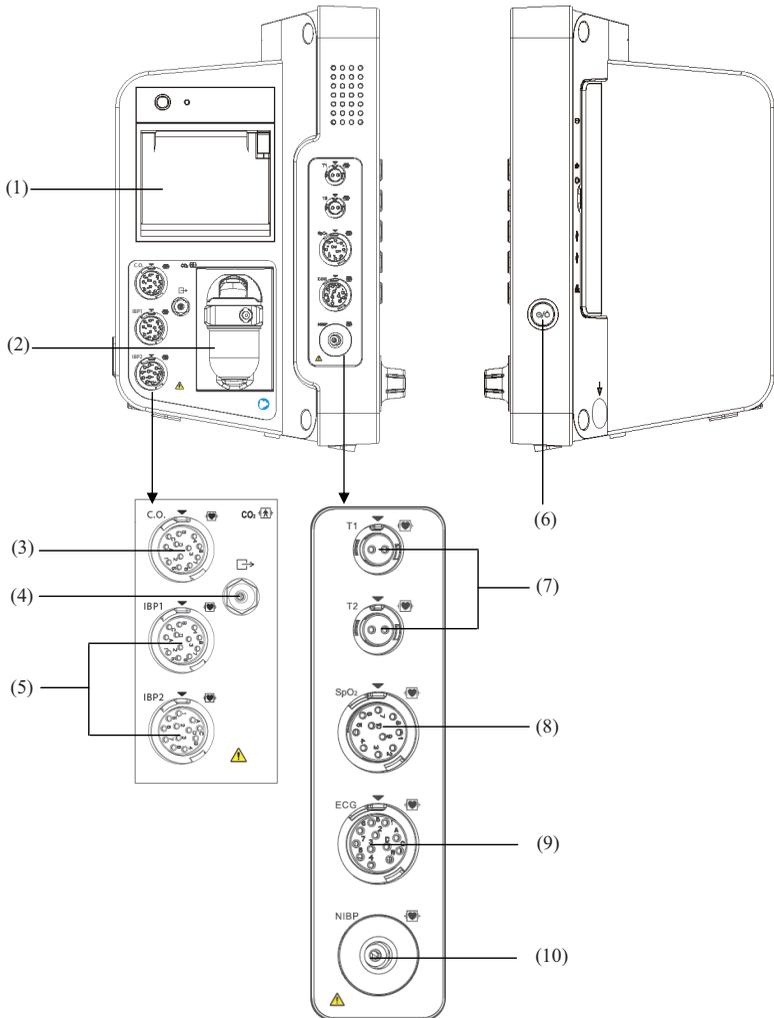
(1) Recorder   (2) Slot for CO_2 watertrap

(3) Connector for C.O. cable   (4) CO_2 gas outlet

(5) Connector for IBP cable

(6) Power On/Off switch

◆ Pressing this switch turns the patient monitor on.

◆ When the monitor is on, pressing and holding this switch turns the monitor off.

(7) Connector for Temp probe   (8) Connector for SpO_2 cable

(9) Connector for ECG cable   (10) Connector for NIBP cuff

2.4 Rear View
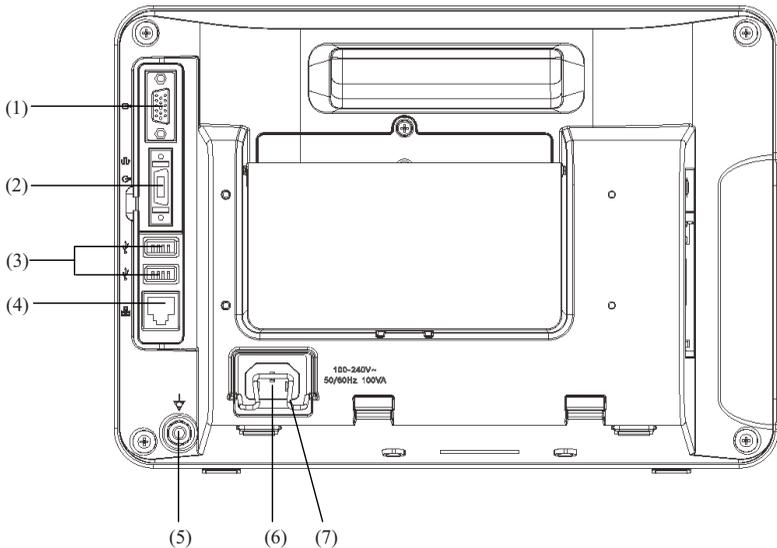
(1) VGA Connector

It connects a secondary display, which extends the display capability of your monitor. The contents displayed on the secondary display screen accords with those displayed on the monitor screen.

(2) Multifunctional Connector

It outputs defibrillator synchronization signals, nurse call signals and analogy output signals.

(3) USB Connector

It connects such devices as the USB mice, USB keyboard, barcode scanner, etc.

(4) Network Connector

It is a standard RJ45 connector which connects the patient monitor to CMS or other patient monitor for remote view. It also connects the patient monitor to PC for system upgrade.

(5) Equipotential Grounding Terminal

When the patient monitor and other devices are to be used together, their equipotential grounding terminals should be connected together, eliminating the potential difference between them.

(6) AC Power Input

(7) Power mousing- hook

2.5 Display Screen

This patient monitor adopts a high-resolution TFT LCD to display patient parameters and waveforms. A typical display screen is shown below.
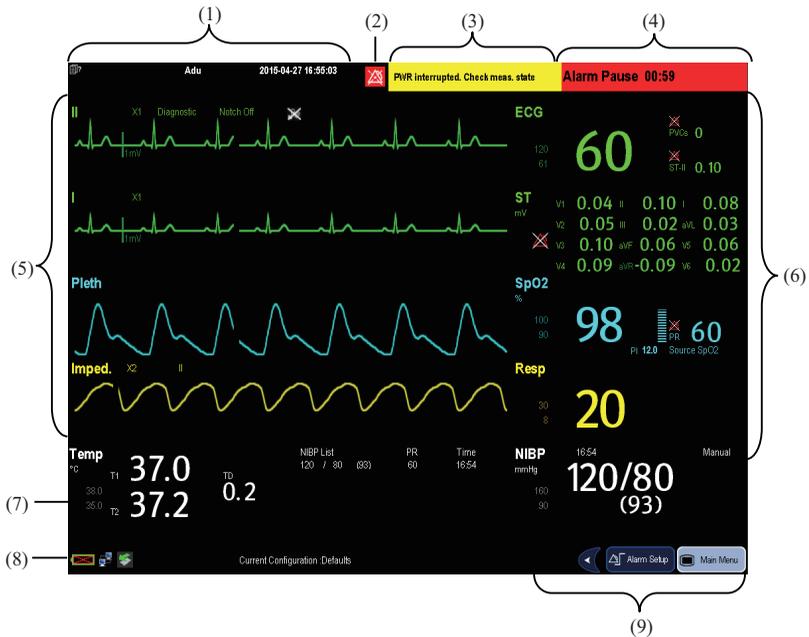
(1) Patient Information Area

This area shows the patient information such as department, bed number, patient name and patient category, 📄? indicates that no patient is admitted or the patient information is incomplete. If no patient is admitted, selecting this area will enter the [**Patient Setup**] menu. If a patient has been admitted, selecting this area will enter the [**Patient Demographics**] menu.

(2) Alarm Symbols

◆ indicates alarms are paused.

◆ indicates alarm are reset.

◆ indicates alarm sounds are turned off.

◆ indicates the system is in alarm off status.

(3) Technical Alarm Area

This area shows technical alarm messages and prompt messages. When multiple messages come, they will be displayed circularly. Select this area and the technical alarm list will be displayed.

(4) Physiological Alarm Area

This area shows physiological alarm messages. When multiple alarms occur, they will be displayed circularly. Select this area and the physiological alarm list will be displayed.

(5) Waveform Area

This area shows measurement waveforms. The waveform name is displayed at the left upper corner of the waveform. Select this area and the corresponding measurement setup menu will be displayed.

(6) Parameter Area A

This area shows measurement parameters. Each monitored parameter has a parameter window and the parameter name is displayed at the upper left corner. The corresponding waveform of each parameter is displayed in the same row in the waveform area. Select this area and the corresponding measurement setup menu will be displayed.

(7) Parameter Area B

For the parameters displayed in this area, their corresponding waveforms are not displayed.

(8) Prompt Message Area

This area shows the current configuration name, prompt messages, network status icons, battery status icons, etc. For details about battery status symbols, refer to the **23 Batteries**.

◆   indicates patient monitor is connected to a wired network successfully.

◆   indicates the patient monitor has failed to connect a wired network.

◆   indicates the wireless function is working.

◆   indicates the wireless function is not working.

◆   indicates a USB disk is inserted.

(9) QuickKeys Area

This area contains QuickKeys that give you fast access to functions.

2.6 QuickKeys

A QuickKey is a configurable graphical key, located at the bottom of the main screen. They give you fast access to functions. Their availability and the order in which they appear on your screen, depend on how your patient monitor is configured.

The following QuickKeys can be displayed on the screen:

Symbol	Label	Function
	/	Scrolls left to display more QuickKeys.
	/	Scrolls right to display more QuickKeys.
	Main Menu	Enters the main menu.
	Standby	Enters the Standby mode.
	Alarm Setup	Enters the [**Alarm Setup**] menu.
	Review	Enters the [**Review**] window.
	NIBP Measure	Enters the [**NIBP Measure**] menu.
	Stop All	Stops all NIBP measurements.

Symbol	Label	Function
	Zero IBP	Starts IBP zero calibration.
	Alarm Reset	Resets the alarm system.
	Alarm Pause	Pauses or restores alarms.
	Screens	Changes screen.
	Patient Setup	Enters the [**Patient Setup**] menu.
	Minitrends	Has a split-screen view of minitrends
	Volume Setup	Enters the [**Volume Setup**] menu.
	Load Config.	Enters the [**Load Configuration**] menu.
	Start C.O.	Starts cardiac output procedure.
	Calculations	Performs calculations.
	Others	Has a split-screen view of another patient's conditions.
	oxyCRG	Has a split-screen view of OxyCRG trends.
	7-lead ECG	Enters the full-screen 7-lead ECG screen.
	12-lead ECG	Enters the full-screen 12-lead ECG screen.
	Parameters	Enters the [**Parameters**] menu.
	NIBP STAT	Starts NIBP STAT measurement.
	Print Setup	Enters the [**Unit Setup**] menu.
	Unit Setup	Enters the [**Unit Setup**] menu.
	Privacy Mode	Enters the privacy mode.
	Night Mode	Enters the night mode.

You can also select your desired QuickKeys to display on the screen.

1. Select [**Main Menu**]→[**Maintenance** >>]→[**Manage Configuration >>**]→enter the required password→[**Ok**].

2. S**elect [Edit Config.>>]**→[**Edit**]→[**Screen Setup >>**].

3. In the [**Select QuickKeys**] screen, select your desired QuickKeys and arrange them.

FOR YOUR NOTES

3 Basic Operations

3.1 Installation

⚠ WARNING

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

3.1.1 Unpacking and Checking

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

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

NOTE

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

⚠ WARNING

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

3.1.2 Environmental Requirements

The operating environment of the equipment must meet the requirements specified in this manual.

The environment where the equipment is used shall be reasonably free from noises, vibration, dust, corrosive, flammable and explosive substances. If the equipment is installed in a cabinet, sufficient space in front and behind shall be left for convenient operation, maintenance and repair. Moreover, to maintain good ventilation, the equipment shall be at least 2 inches (5cm) away from around the cabinet.

When the equipment is moved from one place to another, condensation may occur as a result of temperature or humidity difference. In this case, never start the system before the condensation disappears.

⚠ WARNING

- Make sure that the operating environment of the equipment meets the specific requirements. Otherwise unexpected consequences, e.g. damage to the equipment, could result.
- The equipment use a mains plug as isolation means to the mains power supply. Do not locate the equipment in a place difficult to operate the mains plug.

3.2 Getting Started

3.2.1 Turning Power On

Once the patient monitor is installed, you can get ready for monitoring:

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.

⚠ WARNING

- **Do not use the patient monitor for any monitoring procedure on a patient if you suspect it is not working properly, or if it is mechanically damaged. Contact your service personnel or us.**

NOTE

- **Check that visual and auditory alarm signals are presented correctly when the equipment is powered on. Do not use the patient monitor for any monitoring procedure on a patient if you suspect it is not working properly, or if it is mechanically damaged. Contact your service personnel or us.**

3.2.2 Starting Monitoring

1. Decide which measurements you want to make.

2. Connect the required patient cables and sensors.

3. Check that the patient cables and sensors are correctly connected.

4. Check that the patient settings such as [**Patient Cat**.], [**Paced**], etc, are appropriate for your patient.

5. Refer to the appropriate measurement section for details of how to perform the measurements you require.

3.3 Disconnecting from Power

To disconnect the patient monitor from the AC power source, follow this procedure:

1. Confirm that the patient monitoring is finished.

2. Disconnect patient cables and sensors from the patient.

3. Make sure to save or clear the patient monitoring data as required.

4. Press and hold the power on/off switch. The patient monitor shuts down and you can unplug the power cable.

⚠ CAUTION

●   **Although not recommended, you can press and hold the power on/off switch for 10 seconds to forcibly shut down the monitor when it could not be shut down normally or under some special situations. This may cause loss of data of the patient monitor.**

NOTE

●   **To completely disconnect the power supply, unplug the power cord.**

3.4 Using Keys

The monitor has three types of keys:

■   Softkey: A softkey is a graphic key on the screen, giving you fast access to certain menus or functions. The monitor has two types of softkeys:

◆   Parameter keys: Each parameter area or waveform area can be seen as a softkey. You can enter a parameter setup menu by selecting its corresponding parameter area or waveform area.

◆   QuickKeys: QuickKeys are configurable graphical keys, located at the bottom of the main screen. For details, refer to the section *2.6 QuickKeys*.

■   Hardkeys: A hardkey is a physical key on a monitoring device, such as the main menu hardkey on the monitor's front.

■   Pop-Up Keys: Pop-up keys are task-related keys that appear automatically on the monitor screen when required. For example, the confirm pop-up key appears only when you need to confirm a change.

3.5 Using the Touchscreen

Select screen items by pressing them directly on the patient monitor's screen. You can enable or disable touchscreen operation by pressing and holding the [**Main Menu]** QuickKey for 3 seconds. A padlock symbol 🔒 is displayed if touchscreen operation is disabled.

3.6 Setting the Screen

You can enter the [**Screen Setup**] window as shown below by selecting [**Main Menu**]→ [**Screen Setup**]→[**Screen Layout >>**]. In this window, you can allocate the positions of the parameters and waveforms. The parameters or waveforms whose positions are not allocated will not be displayed.

The ECG parameter and the first ECG waveform always display in the first row. The configurable areas can be classified as Area A, Area B, and Area C.

- In Area A, you can choose to display the parameters (having waveforms) and their waveforms. Each parameter and the associated waveform are displayed in the same row.

- In Area B, you can choose to display the parameters and their waveforms. When there is no parameter displayed in area C, both the parameters and their waveforms will be displayed in area B. Otherwise, only the parameters will be displayed.

- In Area C, you can choose to display all the parameters whose associated waveforms will not be displayed.

The screen can automatically adjust to ensure the best view based on your screen setup.

If no corresponding parameter or waveform is displayed on the monitor screen, you should perform the following inspections:

■ Check the connection of the lead, cable, or sensor.

■ Enter the [**Screen Setup**] window for the desired display configuration.

■ Check that the parameter is switched on in [**Parameters Switch**] window.

⚠ **WARNING**

● **The parameters whose positions are not allocated in the [**Screen Setup**] window will not be displayed. However, the monitor can still give alarms of these parameters.**

3.7 Using the On-screen Keyboard

The onscreen keyboard enables you to enter information.

■ Use the ⬅ key to delete the previously entered character.

■ Use the key to toggle between uppercase and lowercase letters.

■ Select the key to confirm what you have entered and close the onscreen keyboard.

■ Select the @!# to access the symbol keyboard.

■ Select the ⤶ to exit the symbol keyboard.

3.8 Using the Main Menu

To enter the main menu, select [**Main Menu]** QuickKey or the ⬛ hardkey on the monitor's front. Most of monitor operations and settings can be performed through the main menu.
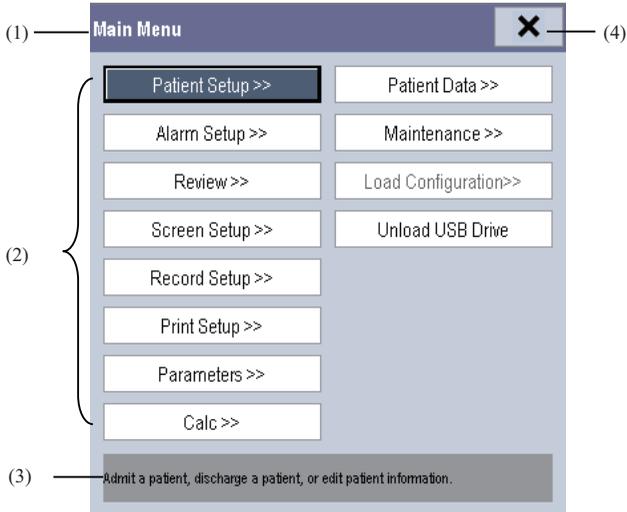
Other menus are similar to the main menu and contain the following parts:

(1)   Heading: gives a sum-up for the current menu.

(2)   Main body: displays options, buttons, prompt messages, etc. The menu button with ">>'' enlarges a secondary window to reveal more options or information.

(3)   Online help area: displays help information for the highlighted menu item.

(4)   ✖: select to exit the current menu.

3.9 Changing General Settings

This chapter covers only general settings such as language, brightness, date and time, etc. Measurement settings and other settings can be referred to in respective sections.

3.9.1 Setting up a Monitor

In situations where you install a patient monitor or change the patient monitor's application site, you need to setup the patient monitor as follows:

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

2. In the [**User Maintenance**] menu, select, in turn, [**Monitor Name**], [**Department**] and [**Bed No.**], and then change their settings.

3.9.2 Changing Language

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

2. In the [**User Maintenance**] menu, select [**Language**] and then select the desired language.

3. Restart the patient monitor.

3.9.3 Adjusting the Screen Brightness

1. Select the [**Main Menu**]→[**Screen Setup >>**]→[**Brightness**].

2. Select the appropriate setting for the screen brightness. 10 is the brightest, and 1 is the least bright.

If the patient monitor operates on battery power, you can set a less bright screen to prolong the operating time of the battery. When the patient monitor enters standby mode, the screen will change to the least brightness automatically.

3.9.4 Showing/Hiding the Help

The patient monitor provides online help information. The user can display or hide the help as required.

1. Select [**Main Menu**]→[**Screen Setup >>**].

2. Select [**Help**] and toggle between [**On**] and [**Off**].

3.9.5 Setting the Date and Time

1. Select [**Main Menu**]→[**Maintenance >>**]→[**System Time >>**].

2. Set the date and time.

3. Select [**Date Format**] and toggle between [**yyyy-mm-dd**], [**mm-dd-yyyy**] and [**dd-mm-yyyy**].

4. Select [**Time Format**] and toggle between [**24h**] and [**12h**].

If your patient monitor is connected to a central monitoring system (CMS), the date and time are automatically taken from that CMS. In that case, you cannot change the date and time settings on your patient monitor.

⚠ CAUTION

- **Changing date and time will affect the storage of trends and events and may cause data missing.**

3.9.6 Adjusting Volume

Alarm Volume

1. Select the [**Alarm Setup**] QuickKey→[**Others**], or [**Main Menu**]→[**Alarm Setup >>**]→[**Others**].

2. Select [**Alm Volume**] and then select the appropriate volume: X-10, in which X is the minimum volume, depending on the set minimum alarm volume (refer to *7Alarms*), and 10 the maximum volume.

Key Volume

When you press the navigation knob or the touchscreen, or the hardkeys on the panel, the patient monitor prompts you by making a sound of the key volume you have set.

1. Select the [**Volume Setup**] QuickKey, or [**Main Menu**]→[**Screen Setu**p >>].
2. Select [**Key Volume**] and then select the appropriate volume. 0 means off, and 10 the maximum volume.

QRS Volume

The QRS tone is derived from either the HR or PR, depending on which is currently selected as the alarm source in [**ECG Setup**] or [**SpO2 Setup**]. When monitoring SpO_2, there is a variable pitch tone which changes as the patient's saturation level changes. The pitch of the tone rises as the saturation level increases and falls as the saturation level decreases. The volume of this tone is user adjustable.

1. Select the [**Volume Setup**] QuickKey, or the ECG parameter window→[**Others >>**], or the SpO_2 parameter window.
2. Select [**QRS Volume**] or [**Beat Vol**] and then select the appropriate volume. 0 means off, and 10 the maximum volume.

3.10 Setting Parameters

3.10.1 Switching the Parameters On/Off

To switch the parameters on or off,

1. Select [**Main Menu**]→[**Maintenance >>**]→[**User Maintenance >>**]→enter the required password→[**Others**].
2. Configure the [**Para Switch Authority**] to [**Unprotected**] or [**Protected**].

   ◆ If [**Para Switch Authority**] is configured to [**Unprotected**], select[**Main Menu**]→ [**Screen Setup>>**]→[**Screen Layout >>**]→[**Parameters Switch**] to switch the parameters on or off.

   ◆ If [**Para Switch Authority**] is configured to [**Protected**], the parameter switch is password protected. To switch the parameters on or off, select [**Main Menu**]→ [**Maintenance >>**]→[**User Maintenance >>**]→enter the required password→ [**Others >>**]→[**Parameters Switch Setup >>**].

When a parameter is switched off, its corresponding parameter module stops working, and its parameter value and waveform are not shown on the monitor display.

NOTE

- **ECG is always selected, and you cannot switch it off.**

3.10.2 Accessing the Parameters Menu

Select [**Parameters >>**] from the main menu or select corresponding parameter area or waveform area to access a parameter setup menu.

3.11 Operating Modes

Your monitor has different operating modes. Some are password protected. This section lists the major operating modes.

3.11.1 Monitoring Mode

This is the normal, everyday working mode that you use for monitoring patients. Your monitor automatically enters the monitoring mode after being turned on.

3.11.2 Night Mode

To avoid disturbing the patient, night mode may be used.

To activate the night mode:

1. Select [**Main Menu**]→[**Screen Setup >>**]→[**Night Mode >>**].
2. In the pop-up menu, set the desired brightness, alarm volume, QRS volume, key volume, NIBP end tone, or whether to stop NIBP measurement or not. When [**Stop NIBP**] is selected, all the NIBP measurements terminate after entering the night mode.
3. Select the [**Enter Night Mode**] button.

To cancel the night mode:

1. Select [**Main Menu**]→[**Screen Setup >>**]→[**Night Mode >>**].
2. Select [**Ok**] in the popup.

⚠ WARNING

● **Before entering night mode, confirm the settings of brightness, alarm volume, QRS volume, and key volume. Pay attention to the potential risk when the setting value is a bit low.**

3.11.3 Privacy Mode

Privacy mode is only available when a patient who is admitted at a patient monitor is also monitored by the central station.

To activate the privacy mode, select [**Main Menu**]→[**Screen Setup >>**]→[**Privacy Mode**].

The patient monitor behaves as follows as soon as the privacy mode is activated:

■ The screen turns blank and [**Under monitoring. Press any key to exit the privacy mode.**] is displayed.

■ Monitoring and data storing continue but patient data is only visible at the central station.

■ Alarms can still be triggered. But all audible alarms are suppressed and the alarm light is deactivated at the patient monitor.

■ All system sounds are suppressed, including heart beat tone, pulse tone, all prompt tones, etc.

To cancel the privacy mode, press any key.

The patient monitor exits the privacy mode automatically in one of the following situations:

■ The patient monitor disconnects from central station.

■ The alarm [**Battery Too Low**] or [**System will shut down soon. Please replace the batteries or use the external power.**] is presented.

The touchscreen is locked automatically in the privacy mode.

⚠ WARNING

● **During privacy mode, all audible alarms are suppressed and the alarm light is deactivated at the patient monitor. Alarms sound only at the central station.**

3.11.4 Demo Mode

In Demo mode, the monitor can demonstrate its major functions when patient or patient simulator is not connected. The Demo mode is password protected.

To enter the Demo mode:

1. Select [**Main Menu**]→[**Maintenance >>**].

2. Select [**Demo >>**]. Enter the required password and then select [**Ok**].

To exit the Demo mode, select [**Main Menu**]→[**Maintenance >>**]→[**Exit Demo**].

⚠ WARNING

- **The Demo mode is for demonstration purpose only. To avoid that the simulated data are mistaken for the monitored patient's data, you must not change into Demo mode during monitoring. Otherwise, improper patient monitoring and delayed treatment could result.**

3.11.5 Standby Mode

In standby mode, you can temperately stops patient monitoring without turning off the

monitor. To enter the standby mode, select the Standby QuickKey .

FOR YOUR NOTES

4 Managing Patients

4.1 Discharging a Patient

Before monitoring a new patient, discharge the previous patient. After the patient is discharged, all patient data, including patient information, trend data, and physiological alarm information is deleted from the monitor. The technical alarms are reset, and monitor settings return to their defaults. For details, refer to *5.3 Setting Default Configuration*.

After a patient is discharged, the monitor automatically admits a new patient.

⚠ WARNING

- **Always discharge the previous patient before starting monitoring a new patient. Failure to do so can lead to data being attributed to the wrong patient.**

NOTE

- **Discharging a patient clears the current patient data from the monitor.**

4.1.1 Auto Discharging a Patient after Monitor Power Off

You can let the monitor automatically discharge after the monitor has been switched off for a period of time.

To set the time period of discharging a patient:
1. Select [**Main Menu**]→[**Maintenance >>**]→[**User Maintenance >>**]→enter the required password→[**OK**].
2. Select a time for [**Auto Discharge Pat.**]. The monitor will automatically discharge the patient when the selected time period is reached. The default is Never. That is to say the monitor will not discharge a patient no matter for how long the monitor has been switched off.

4.1.2 Manually Discharging a Patient

To manually discharge a patient:

1. Select the [**Patient Setup**] QuickKey, or [**Main Menu**]→[**Patient Setup >>**].

2. Select [**Discharge Patient**]. In the popup menu, you can either:

    ◆ Directly select [**Ok**] to discharge the current patient, or

    ◆ Select [**Standby**] then [**Ok**]. The patient monitor enters the standby mode after discharging the current patient, or

    ◆ Select [**Cancel**] to exit without discharging the patient.

4.2 Admitting a Patient

4.2.1 Auto Admitting a Patient

The monitor automatically admits a new patient in the following situations:

■ After a patient is manually discharged, the monitor automatically admits a new patient.

■ After being switched off for the selected time period, the monitor automatically discharges the previous patient and admits a new patient at startup.

Always inputs patient information as soon as the patient is admitted. For details, refer to *4.3.1 Editing Patient Information*.

⚠ WARNING

- **The settings of patient category and paced status always contain a default value, regardless of whether the patient is admitted or not. Check if the setting is correct for your patient.**
- **For paced patients, you must set [Paced] to [Yes]. If it is incorrectly set to [No], the patient monitor could mistake a pace pulse for a QRS and fail to alarm when the ECG signal is too weak.**
- **For non-paced patients, you must set [Paced] to [No].**

4.2.2 Manually Admitting a Patient

To manually admit a patient:

1. Select the [**Patient Setup**] QuickKey, or [**Main Menu**]→[**Patient Setup >>**].

2. Select [**Admit Patient]** or [**Quick Admit**].

   ◆ [**Admit Patient] to** fully admit a patient so that you can clearly identify your patient, on recordings, reports and networking devices.

   ◆ [**Quick Admit**] if you do not have the time or information to fully admit a patient. Complete the rest of the patient demographic details later. Otherwise, the 📄? symbol will always be displayed in the patient information area.

3. If a patient has been admitted at present, select [**OK**] to discharge the current patient. If .no patient is admitted, you can choose either:

   ◆ [**Yes**] to apply the data in your patient monitor to the new patient, or

   ◆ [**No**] to clear any previous patient data**.**

4.3 Managing Patient Information

4.3.1 Editing Patient Information

To edit the patient information after a patient has been admitted, or when the patient information is incomplete, or when you want to change the patient information:

1. Select the [**Patient Setup**] QuickKey, or [**Main Menu**]→[**Patient Setup >>**].

2. Select [**Patient Demographics**] and then make the required changes.

3. Select [**Ok**].

4.3.2 Querying and Obtaining Patient Information

The monitor can obtain patient information from HIS through eGateway. To query or obtain patient information from HIS,

1. Select [**Main Menu**]→[**Maintenance >>**]→[**User Maintenance >>**]→enter the required password→[**Network Setup >>**]→[**Gateway Comm Setup >>**], and set [**IP Address**] and [**Port**]. Set [**ADT Query**] to [**On**].

2. Click patient information area to enter the [**Patient Demographics**] menu.

3. Select [**Obtain Patient Info. >>**] to enter the [**Obtain Patient Information**] menu.

4. Input query condition and then select [**Query**]. The monitor will display the obtained patient information.

5. Select a patient and then click [**Import**]. Then the monitor will update the information of corresponding patient.

6. Select ✖ to exit the [**Obtain Patient Information**] menu.

NOTE

- **The option [Obtain Patient Information] is available in the [Patient Setup] menu only when [ADT Query] is set to [On].**

- **When obtaining patient information from HIS, the monitor only update patient inforamtion. The patient's monitoring data is not changed and the patient is not discharged.**

4.3.3 Associating Patient Information

After associating patient information with HIS, the monitor will automatically update patient information if corresponding information in HIS has been changed. The monitor can associate patient's MRN, first name, last name, date of birth, and gender with HIS.

NOTE

- **A keyword takes effect only when being defined in eGateway. Refer to *eGateway Integration Manager Installation Guide* for details.**

- **The monitor displays corresponding patient information only when all the keywords have been inputted.**

4.4 Transferring Patient Data via USB Drive

You can transfer patient data between monitors with a USB drive without re-entering the patient demographic information. Transferring of patient data enables you to understand the patient's history condition. The patient data that can be transferred includes: patient demographics, trend data, alarm events and parameters alarm limits.

Select [**Others >>**] from [**User Maintenance**] menu. In the popup menu, you can set [**Transferred Data Length**]. The default is [**4 h**]. You can also set [**Data Transfer Method**]. The default is [**Off**].

⚠ WARNING

- **Do not discharge a patient before the patient is successfully transferred.**
- **After a patient is successfully transferred, check if the patient settings (especially patient category, paced status and alarm limits settings, etc) on the monitor are appropriate for this patient.**

NOTE

- **The system automatically switches on the HR alarm and lethal arrhythmia alarm after transferring the patient data.**
- **Transisferring data via USB drive is only avaiable for the monitor configured with a storage card.**

4.4.1 Transferring Data from the Monitor to a USB Drive

1. Select [**Main Menu**]→[**Patient Setup >>**].

2. Select [**Transfer to Storage Medium**]. In the popup menu, select [**Ok**].

3. Wait until the following message appears: [**Transfer to storage medium successful. Please remove the USB drive.**].

4. Remove the USB drive from patient monitor.

4.4.2 Viewing Data on the Monitor via USB Drive

You can view patient data on the monitor via USB drive without transferring data.

1. Connect the USB drive to the destination monitor.

2. Select [**Main Menu**]→[**Patient Data >>**]→[**History Dat**].

You can also select [**Patient data in U disk**] to view history data if the monitor is configured with a storage card.

4.4.3 Transferring Data from the USB Drive to Monitor

1. Connect the USB drive to the destination monitor.

2. In the popup menu, you can:

    ◆   Select [**Transfer**] to transfer the patient data to the monitor, or

    ◆   Select [**Cancel Transfer**] to cancel the operation of transferring patient data.

    ◆   Select [**Unload USB Drive**] to not transfer the patient data and to unload the USB drive.

3. After you select [**Transfer**], in the popup menu you can further select the patient data contents that need to be transferred. [**Patient Demographics**] must be selected. After [**Ok**] is selected, the monitor compares the patient information stored in both the storage medium and monitor and deals with the patient data based on the following.

    ◆   Different Patients: The monitor erases all the current patient data, transfers the patient data from the storage medium, and loads the configuration according to the patient category.

    ◆   Same Patient: In the popup dialog box, you can:

        ◆   Select [**Yes**] to merge the patient data in the monitor and storage medium.
        ◆   Select [**No**] to erase all the current patient data in the monitor and to transfer the patient data from the storage medium.

4. Wait until the following message appears: [**Transfer from storage medium successful.**].

⚠ WARNING

- **The USB drive you use may have write-protect function. In this case, please make sure the USB drive for data transfer is in read/write mode.**
- **Do not discharge a patient before the patient is successfully transferred.**
- **Do not remove the storage medium during data transfer process. Otherwise, data files may be damaged.**
- **After a patient is successfully transferred, check if the patient settings (especially patient category, paced status and alarm limits settings, etc) on the monitor are appropriate for this patient.**

NOTE

- **The system automatically switches on the HR alarm and lethal arrhythmia alarm after transferring the patient data.**

4.5 Connecting to a Central Monitoring System

If your patient monitor is connected to a central monitoring system (CMS):

■ All patient information, measurement data and settings on the patient monitor can be transferred to the CMS.

■ All patient information, measurement data and settings can be displayed simultaneously on the patient monitor and CMS. For some functions such as editing patient information, admitting a patient, discharging a patient, starting/stopping NIBP measurements, etc., bi-directional control can be achieved between your patient monitor and the CMS.

For details, refer to the CMS's instructions for use.

FOR YOUR NOTES

5 Managing Configurations

5.1 Introduction

When performing continuous monitoring on a patient, the clinical professional often needs to adjust the monitor's settings according to the patient's condition. The collection of all these settings is called a configuration. Allowing you to configure the monitor more efficiently, the monitor offers different sets of configuration to suit different patient categories. You can change some settings from a certain set of configuration and then save the changed configuration as a user configuration.

⚠ WARNING

- **The configuration management function is password protected. The configuration management tasks must be performed by clinical professionals.**

The system configuration items can be classified as:

■ Parameter configuration items

These items relates to parameters, e.g., waveform gain, alarm switch, alarm limits..

■ Conventional configuration items

These items define how the monitor works, e.g., screen layout, record, print and alarm settings.

■ User maintenance items

These items relates to user maintenance settings, e.g., unit setup, time format and data format.

For the important configuration items and their default values and user maintenance items, see appendix *Configuration Default Information*.

5.2 Entering the [Manage Configuration] Menu

1. Press the ■ hardkey on the monitor's front to enter the main menu.

2. Select [**Maintenance >>**]→[**Manage Configuration >>**]. Enter the required password and then select [**Ok**].
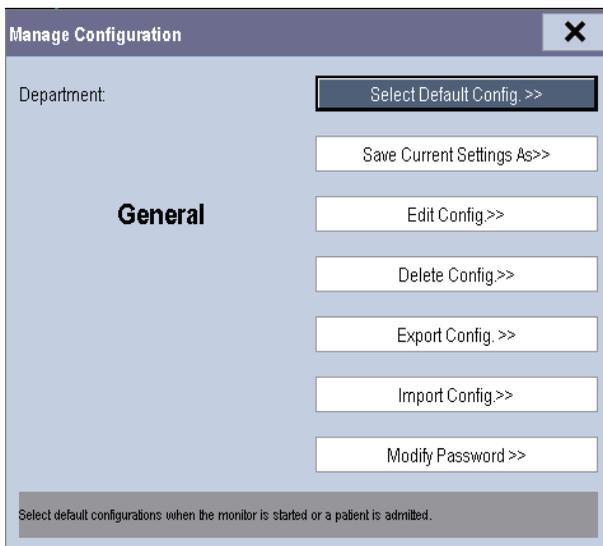
5.3 Setting Default Configuration

The monitor will load the pre-set default configuration in the following cases.

- The patient monitor restarts after quitting over 120 seconds.
- A patient is admitted.
- A patient is discharged.
- Patient data is cleared.
- Patient category is changed.

To set default configuration:

1. Select [**Select Default Config.** >>] in the [**Manage Configuration**] menu.

2. In the [**Select Default Config.**] menu, select [**Load the Latest Config.**] or [**Load Specified Config.**].

When you select [**Load Specified Config.**], the configuration (adult, pediatric or neonate) to be restored is subject to the patient category. This configuration can be either factory configuration or saved user configuration. Take adult as an example, select [**Default Adu Config.**] and toggle between [**Defaults**] or user configuration(s).

NOTE

- **To know what configuration is restored when the patient monitor starts, enter the main screen to check the prompt information at the lower part of the screen (displayed for about 10 seconds).**

5.4 Saving Current Settings

Current settings can be saved as user configuration. Up to 3 user configurations can be saved.

To save current settings:

1. Select [**Save Current Settings As >>**] in the [**Manage Configuration**] menu.

2. In the popup dialog box, enter the configuration name and then select [**Ok**].

5.5 Editing Configuration

1. Select [**Edit Config. >>**] in the [**Manage Configuration**] menu. The following menu appears.
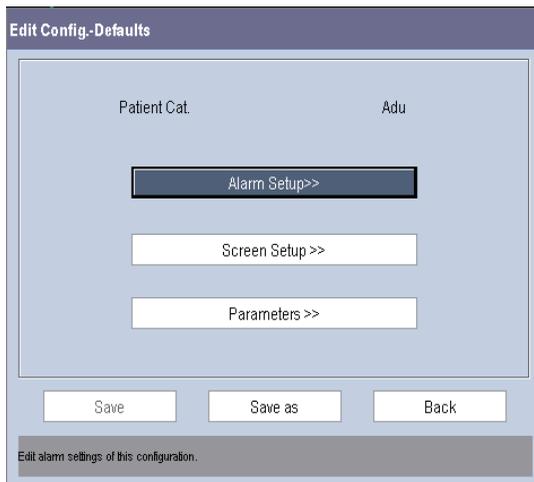
2. The popup menu shows the existing configurations on the monitor. Selecting [**Config. on USB drive >>**] will show the existing configurations on the USB drive. Select the desired configuration and then select the [**Edit**] button. The following menu appears.
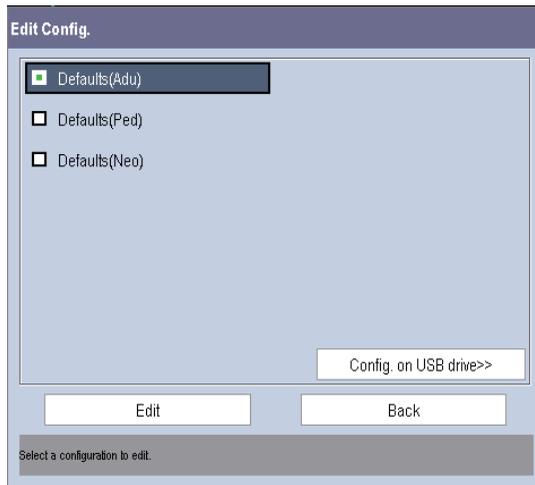
3. Select [**Alarm Setup >>**], [**Screen Setup >>**] or [**Parameter >>**] to enter the corresponding menu in which settings can be changed. The changed items of alarm setup will be marked in red.

4. You can select [**Save**] or [**Save as**] to save the changed configuration. Select [**Save**] to overwrite the original configuration. Select [**Save as**] to save the changed configuration in another name.

5.6 Deleting a Configuration

1. Select [**Delete Config. >>**] in the [**Manage Configuration**] menu.

2. The popup menu shows the existing user configurations on the monitor. Selecting [**Config. on USB drive >>**] will show the existing user configurations on the USB drive. Select the user configurations you want to delete and then select [**Delete**].

3. Select [**Yes**] in the popup.

5.7 Transferring a Configuration

When installing several monitors with identical user configuration it is not necessary to set each unit separately. An USB drive may be used to transfer the configuration from monitor to monitor.

To export the current monitor's configuration:

1. Connect the USB drive to the monitor's USB port.

2. Select [**Export Config. >>**] in the [**Manage Configuration**] menu.

3. In the [**Export Config.**] menu, select the configurations and [**User Maintenance Settings**] to export. Then select the [**Export**] button. A status message will report completion of the transfer.

To import the configuration on the USB drive to the monitor:

1. Connect the USB drive to the monitor's USB port.

2. Select [**Import Config. >>**] in the [**Manage Configuration**] menu.

3. In the [**Import Config.**] menu, select the configurations and [**User Maintenance Settings**] to import. Then select the [**Import**] button. A status message will report completion of the transfer.

5.8 Loading a Configuration

You may make changes to some settings during operation. However, these changes or the pre-selected configuration may not be appropriate for the newly admitted patient. Therefore, the monitor allows you to load a desired configuration so as to ensure that all the settings are appropriate for your patient.

To load a configuration,

1. Select [**Load Configuration >>**] from the main menu.

2. The popup menu shows the existing configurations on the monitor. Selecting [**Config. on USB drive >>**] will show the existing configurations on the USB drive.

3. Select a desired configuration.

4. Select [View] to view the configuration details. In the popup menu, you can select [**Alarm Setup >>**], [**Screen Setup >>**] or [**Parameter >>**] to view the corresponding contents. The alarm setup items which are different than those currently used are marked in red.

5. Select [**Load**] to load this configuration.

5.9 Restoring the Latest Configuration Automatically

During operation, you may make changes to some settings. However, these changes may not be saved as user configuration. To prevent the changes from losing in case of a sudden power failure, the patient monitor stores the configuration in real time. The saved configuration is the latest configuration.

The monitor restore the latest configuration if restarts within 60 seconds after the power failure. And it will restore the default configuration rather than the latest configuration if restarts 120 seconds later after the power failure. The monitor may load either the latest configuration or the default configuration if restarts from 60-120 seconds after the power failure.

5.10 Modifying Password

To modify the password for accessing the [**Manage Configuration**] menu,

1. Select [**Modify Password >>**] in the [**Manage Configuration**] menu.

2. Input a new password in the popup menu.

3. Select [**Ok**].

6 User Screens

6.1 Tailoring Your Screens

You can tailor your patient monitor's screens by setting:

- Wave line size

- The color in which each measurement's numerics and waveform are displayed

- The parameter to be monitored.

Changing some settings may be hazardous. Therefore, those setting are password-protected and can be modified by authorized personnel only. Once change is made, those who use the patient monitor should be notified.

6.1.1 Changing the Wave Line Size

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

2. Select [**Others >>**].

3. Select [**Wave Line**] and toggle between [**Thick**], [**Mediate**] and [**Thin**].

6.1.2 Changing Measurement Colors

1. Select [**Main Menu**]→[**Screen Setup >>**]→[**Measurement Color Setup >>**].

2. Select the color box next to your desired measurement and then select a color from the popup menu.

6.1.3 Changing Screen Layout

Select the [**Screens**] QuickKey, or [**Main Menu**]→[**Screen Setup >>**]→[**Screen Layout >>**] to enter the [**Screens**] menu.

- You can choose the desired screen type in the [**Choose Screen**] window.

- You can select the parameters and waveforms you want to view in the [**Screen Setup**] window. For details, please refer to the section *3.6 Setting the Screen*.

- You can select the parameters you want to view on big numerics screen in the [**Big Numerics Screen Setup**] window.

■ You can switch on or off the connected parameter modules in the [**Parameters Switch**] window. If a parameter module is switched off, parameter values and waveforms will not display on the screen.

6.2 Viewing Minitrends

6.2.1 Having a Split-Screen View of Minitrends

You can split the normal screen so that one part of the screen, on the left hand side, continuously shows graphic minitrends beside waveforms as shown in the figure below.

To have a split-screen view of minitrends, you can:

■ Select [**Minitrends**] QuickKey, or

■ Select [**Screens**] QuickKey→[**Choose Screen**]→[**Minitrends Screen**]→❌, or

■ Select [**Main Menu**]→[**Screen Setup** >>]→[**Screen Layout** >>]→[**Choose Screen**]→[**Minitrends Screen**]→❌.
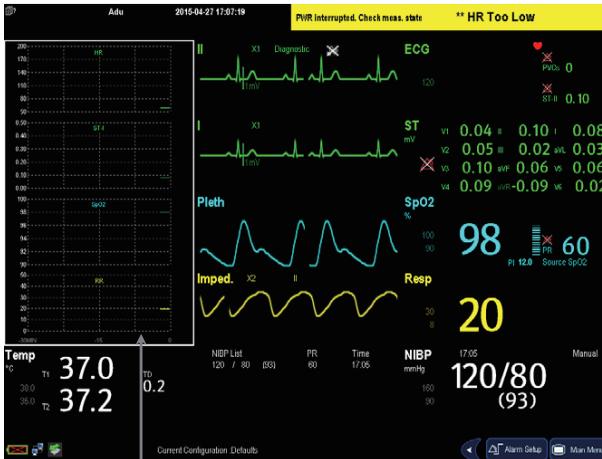
Minitrend View

The split-screen view provides minitrends for multiple parameters. In each field, the label and scale are respectively displayed at the top and left. The time is displayed at the bottom of the minitrends shown view.

6.2.2 Setting Minitrends

Select the minitrends area. From the pop-up [**Minitrend Setup**] menu, you can:

■ Select the parameters to be displayed, or

■ Select [**Minitrend Length**] and then select the appropriate setting.

6.3 Viewing OxyCRG

To have a split screen view of OxyCRG, you can:

■ Select [**OxyCRG**] QuickKey, or

■ Select [**Screens**] QuickKey→[**Choose Screen**]→[**OxyCRG Screen**]→✕, or.

■ Select [**Main Menu**]→[**Screen Setup** >>]→[**Screen Layout** >>]→[**Choose Screen**]→[**OxyCRG Screen**]→✕.
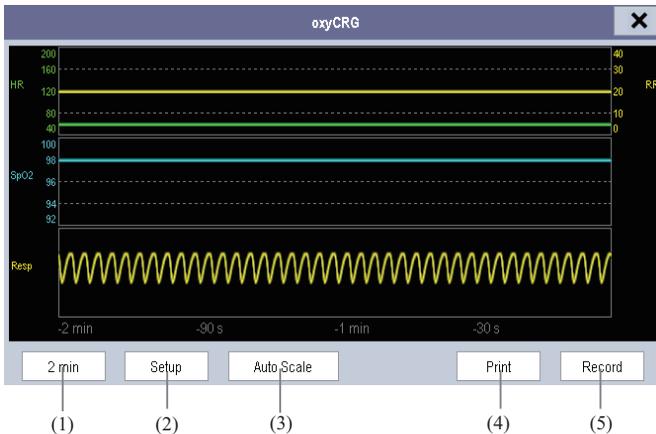
The split-screen view covers the lower part of the waveform area and shows HR trend, SpO_2 trend, RR trend, and a compressed wave (Resp wave or CO_2 wave). At the bottom, there are controls:

(1) Trend length list box

In the trend length list box, you can select [**1 min**], [**2 min**], [**4 min**], or [**8 min**].

(2) Setup

Select the [**Setup**] button to enter the [**Setup**] menu, in which you can select the parameters for display, the time length to be saved before and after an event, and the scale of the graphic trends and waveform. The trend area can display two parameter trends, e.g. HR trend and RR trend, simultaneously.

(3) Auto Scale

Select the [**Auto Scale**] button, and the system automatically adjusts the scaling.

(4) Print

Select [**Print**] to print out the realtime OxyCRG.

(5) Record

Through this button, you can print out the currently displayed OxyCRG trends by the recorder.

6.4 Viewing Other Patients

6.4.1 Care Group

You can select up to 10 patient monitors connected to the same LAN into a Care Group. This lets you:

■ View information on the monitor screen from another bed in the same Care Group.

■ Be notified of physiological and technical alarm conditions at the other beds in the same Care Group.

To have a Care Group:

1. Open the [**View Other Patient**] window by:

◆ Selecting [**Others**] QuickKey, or

◆ Selecting [**Screens**] QuickKey→[**Choose Screen**]→[**View Others Screen**]→✖, or

◆ Selecting [**Main Menu**]→[**Screen Setup >>**]→[**Screen Layout >>**]→[**Choose Screen >>**]→[**View Others Screen**]→✖.

2. Select [**Setup**] in the [**View Other Patient**] window.

3. Select the desired patient monitors from the [**Connected Monitor List**], and then select the ✖ button. The selected patient monitors constitute a Care Group.

6.4.2 Viewing the Care Group Overview Bar

The Care Group overview bar locates at the bottom of the [**View Other Patient**] window. In the overview bar, the department and bed label for any Care Group beds are displayed. The color in which a Care Group bed appears matches its status:

■ Red: indicates the bed is giving high-level physiological alarms, such as nurse call or event.

■ Yellow: indicates the bed is giving medium- or low-level physiological alarms, or medium-level technical alarms.

■ Blue: indicates the bed is giving low-level technical alarms.

■ Grey: indicates the bed fails to be networked or stays in the standby mode.

You can view a Care Group bed's alarms by selecting it from the care group, and as well you can select the [**View This Patient**] button to view this bed in the [**View Other Patient**] window.

For more details about Care Group alarms, refer to *7 Alarms*.

6.4.3 Understanding the View Other Patient Window

When you first open the [**View Other Patient**] window, the patient monitor automatically selects a monitor from the network to display in the [**View Other Patient**] window.
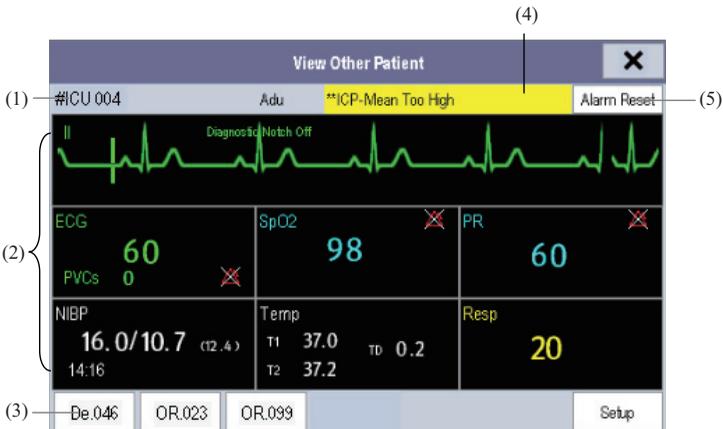
The [**View Other Patient**] window covers the lower part of the waveform area and consists of:

(1) Information Area: shows the patient information (including department, bed number, patient name, etc.), network status symbol.

(2) View Area: shows physiological waveforms and parameters. You can switch a waveform area to a parameter area by selecting your desired waveform area and then selecting [**Switch to Parameter Area**], or switch a parameter area to a waveform area by selecting your desired parameter area and then selecting [**Switch to Waveform Area**].

(3) Care Group Overview Bar.

(4) Message Area: shows physiological, technical and prompt messages from the currently viewed patient monitor. By selecting this area, you can enter the [**Alarm Information List**] to view all physiological, technical and prompt messages coming from the currently viewed patient.

(5) [**Alarm Reset**] button

   ◆ When [**Reset Other Bed's Alarms**] is set to [**On**] in [**Maintenance**]→[**User Maintenance**]→[**Alarm Setup**], the [**Alarm Reset**] button appears on the [**View Other Patient**] window. You can reset the alarm system for the selected monitor by pressing the button. Refer to *7.11.3 Resetting Care Group Alarms* for details.

   ◆ When [**Reset Other Bed's Alarms**] is set to [**Off**], there is no button appearing on the [**View Other Patient**] window.

Additionally, you can change a waveform or parameter for viewing

■ To change a waveform for viewing, select the waveform segment where you want a new waveform to appear and then select the waveform you want from the popup menu.

■ To change a parameter for viewing, select the parameter window where you want a new parameter to appear and then select the parameter you want from the popup menu.

⚠ **WARNING**

● **The data presented in the [View Other Patient] window have delay. Do not rely on this window for realtime data.**

6.5 Understanding the Big Numerics Screen

To enter the big numerics screen:

1.   Select the [**Screens**] QuickKey, or [**Main Menu**]→[**Screen Setup** >>]→[**Screen Layout** >>]→[**Choose Screen**].

2.   Select [**Big Numerics**]→☒.

You can select your desired parameters to display in this screen: select the [**Screens**] QuickKey→[**Big Numerics Screen Setup**] and then select the parameters you want. For parameters having a waveform, the waveform will also be displayed.

FOR YOUR NOTES

7 Alarms

Alarms, triggered by a vital sign that appears abnormal or by technical problems of the patient monitor, are indicated to the user by visual and audible alarm indications.

⚠ WARNING

- **A potential hazard can exist if different alarm presets are used for the same or similar equipment in any single area, e.g. an intensive care unit or cardiac operating room.**
- **If your patient monitor is connected to the central monitoring system (CMS) or other monitors, alarms can be displayed and controlled remotely. Remote suspension, inhibition, or reset of monitor alarms via the CMS or other monitors may cause a potential hazard. For details, refer to the operator's manual of the CMS and the other monitors.**

7.1 Alarm Categories

By nature, the patient monitor's alarms can be classified into three categories: physiological alarms, technical alarms and prompt messages.

1. Physiological alarms

   Physiological alarms, also called patient status alarms, are triggered by a monitored parameter value that violates set alarm limits or an abnormal patient condition. Physiological alarm messages are displayed in the physiological alarm area.

2. Technical alarms

   Technical alarms, also called system status alarms, are triggered by a device malfunction or a patient data distortion due to improper operation or mechanical problems. Technical alarm messages are displayed in the technical alarm area.

Apart from the physiological and technical alarm messages, the patient monitor shows some messages telling the system status or patient status. Messages of this kind are included into the prompt message category and usually displayed in the prompt information area. Some prompt messages that indicate the arrhythmia events are displayed in the physiological alarm area. For some measurements, their related prompt messages are displayed in their respective parameter windows.

7.2 Alarm Levels

By severity, the patient monitor's alarms can be classified into three categories: high level, medium level and low level.

	Physiological alarms	Technical alarms
High level	Indicate that your patient is in a life threatening situation, such as Asystole, Vfib/Vtac and so forth, and an emergency treatment is demanded.	Indicate a severe device malfunction or an improper operation, which could make it possible that the monitor cannot detect critical patient status and thus threaten the patient's life.
Medium level	Indicate that your patient's vital signs appear abnormal and an immediate treatment is required.	Indicate a device malfunction or an improper operation, which may not threaten the patient's life but may compromise the monitoring of vital physiological parameters.
Low level	Indicate that you patient's vital signs appear abnormal and an immediate treatment may be required.	Indicate a device malfunction or an improper operation, which may compromise a certain monitoring function but will not threaten the patient's life.

7.3 Alarm Indicators

When an alarm occurs, the patient monitor will indicate it to the user through visual or audible alarm indications.

- Alarm lamp
- Alarm message
- Flashing numeric
- Audible alarm tones

7.3.1 Alarm Lamp

If a technical alarm or physiological alarm occurs, the alarm lamp will flash. The flashing color and frequency match the alarm level as follows:

- High level alarms: the lamp quickly flashes red.
- Medium level alarms: the lamp slowly flashes yellow.
- Low level physiological alarms: the lamp turns yellow without flashing.
- Low level technical alarms: the lamp does not light.

7.3.2 Alarm Message

When an alarm occurs, an alarm message will appear in the technical or physiological alarm area. For physiological alarms, the asterisk symbols (*) before the alarm message match the alarm level as follows:

- High level alarms: ***
- Medium level alarms: **
- Low level alarms: *

Additionally, the alarm message uses different background color to match the alarm level:

- High level alarms: red
- Medium level alarms: yellow
- Low level physiological alarms: yellow
- Low level technical alarms: blue

You can view the alarm messages by selecting the physiological or technical alarm area.

7.3.3 Flashing Numeric

If an alarm triggered by an alarm limit violation occurs, the numeric of the measurement in alarm will flash every second, and the corresponding alarm limit will also flash at the same frequency indicating the high or low alarm limit is violated.

7.3.4 Audible Alarm Tones

The alarm tone is distinct from heart beat tone, keystroke tone and pulse tone in frequency. This monitor has three choices of alarm tones and patterns: ISO, Mode 1 and Mode 2. For each pattern, the alarm tones identify the alarm levels as follows:

- ISO pattern:
  - High level alarms: triple+double+triple+double beep.
  - Medium level alarms: triple beep.
  - Low level alarms: single beep.
- Mode 1:
  - High level alarms: high-pitched single beep.
  - Medium level alarms: double beep.
  - Low level alarms: low-pitched single beep.

■ Mode 2:

◆ High level alarms: high-pitched triple beep.

◆ Medium level alarms: double beep.

◆ Low level alarms: low-pitched single beep.

NOTE

- **When multiple alarms of different levels occur simultaneously, the patient monitor will select the alarm of the highest level, light the alarm lamp and give alarm sounds accordingly, while all the alarm messages are displayed circularly on the screen.**

- **Some physiological alarms, such as asystole, are exclusive. They have identical alarm tones and alarm lights with normal high level physiological alarms, but their alarm messages are displayed exclusively. That is to say, when an exclusive physiological alarm and a normal high level physiological alarm are triggered simultaneously, only alarm message of the exclusive physiological alarm is displayed.**

7.3.5 Alarm Status Symbols

Apart from the aforementioned alarm indicators, the patient monitor still uses the following symbols telling the alarm status:

■ indicates alarms are paused.

■ indicates alarms are reset.

■ indicates the alarm sound is turned off.

■ indicates individual measurement alarms are turned off or the system is in alarm off status.

7.4 Alarm Tone Configuration

7.4.1 Setting the Minimum Alarm Volume

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

2. Select [**Alarm Setup >>**] to enter the [**Alarm Setup**] menu.

3. Select [**Minimum Alarm Volume**] and toggle between 0 and 10.

The minimum alarm volume refers to the minimum value you can set for the alarm volume, which is not affected by user or factory default configurations. The setting of minimum alarm volume remains unchanged when the patient monitor shuts down and restarts.

7.4.2 Changing the Alarm Volume

1. Select the [**Volume Setup**] QuickKey or the [**Alarm Setup**] QuickKey→[**Others**], or [**Main Menu**]→[**Alarm Setup >>**]→[**Others**].

2. Select the appropriate volume from [**Alm Volume**]: X-10, in which X is the minimum volume, depending on the set minimum alarm volume, and 10 the maximum volume.

3. Select [**High Alarm Volume**] to set the volume of the high priority alarm as [**Alm Volume+0**], [**Alm Volume+1**] or [**Alm Volume+2**].

4. Select [**Reminder Vol**] to set the volume of the reminder tone as [**High**], [**Med**] or [**Low**].

When alarm volume is set to 0, the alarm sound is turned off and a ⊠ symbol appears on the screen.

7.4.3 Setting the Interval between Alarm Sounds

You cannot change the interval between alarm tones if you choose mode 1 or 2 as your desired alarm tone pattern. For these two patterns, the interval between alarm tones identifies the alarm levels as follows:

■ Mode 1:

 ◆ Interval between high level alarm tones: continuously.

 ◆ Interval between medium level alarm tones: 5 s.

 ◆ Interval between low level alarm tones: 20 s.

■ Mode 2:

◆ Interval between high level alarm tones: 1 s.

◆ Interval between medium level alarm tones: 5 s.

◆ Interval between low level alarm tones: 20 s.

If you choose the ISO pattern, you can change the interval between alarm tones. To change the interval between alarm tones:

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

2. Select [**Alarm Setup >>**] to enter the [**Alarm Setup**] menu.

3. Select [**High Alarm Interval (s)**], [**Med Alarm Interval (s)**] and [**Low Alarm Interval (s)**] in turn and then select the appropriate settings.

⚠ WARNING

- **When the alarm sound is switched off, the patient monitor will give no audible alarm tones even if a new alarm occurs. Therefore the user should be very careful about whether to switch off the alarm sound or not.**

- **Do not rely exclusively on the audible alarm system for patient monitoring. Adjustment of alarm volume to a low level may result in a hazard to the patient. Always keep the patient under close surveillance.**

7.4.4 Changing the Alarm Tone Pattern

To change the alarm tone pattern:

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

2. Select [**Alarm Setup >>**] to enter the [**Alarm Setup**] menu.

3. Select [**Alarm Sound**] and toggle between [**ISO**], [**Mode 1**]and [**Mode 2**].

User or factory default configurations exert no impact on the setup of alarm tone pattern. The alarm tone pattern remains unchanged after the monitor restarts.

7.4.5 Setting the Reminder Tones

When the alarm volume is set to zero, or the alarm tone is reset or switched off, the patient monitor issues a periodical reminder tone. To set the reminder tones:

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

2. Select [**Alarm Setup >>**] to enter the [**Alarm Setup**] menu.

3. Set the [**Reminder Tones**] to [**On**], [**Off**] or [**Re-alarm**]. When [**Re-alarm**] is selected, the current physiological alarms and technical alarms marked with " √ " will be re-generated after the [**Reminder Interval**] if the alarm condition persists.

To set the interval between reminder tones, select [**Reminder Interval**] and toggle between [**1min**], [**2min**] and [**3min**].

In addition, you can set the volume of alarm reminder tones. To set the volume of alarm reminder tones, select [**Main Menu**]→[**Alarm Setup >>**]→[**Others**] or the [**Alarm Setup**] QuickKey→[**Others**]. Then, select [**Reminder Vol**] and toggle between [**High**], [**Medium**] and [**Low**].

7.5 Understanding the Alarm Setup Menu

Select the [**Alarm Setup**] QuickKey or [**Main Menu**]→[**Alarm Setup >>**] to enter the [**Alarm Setup**], where you can:

- Set alarm properties for all parameters.
- Change ST alarm settings.
- Change arrhythmia alarm settings.
- Set the threshold for some arrhythmia alarms.
- Change other settings.
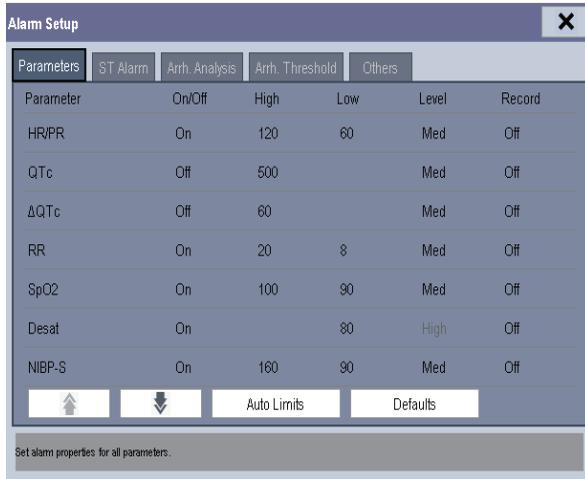
Please refer to *8 Monitoring ECG* for how to change ST alarm settings, how to change arrhythmia alarm settings and how to set the threshold for some arrhythmia alarms.

7.5.1 Setting Alarm Properties for All Parameters

In the main menu, select [**Alarm Setup >>**]→[**Parameters**]. You can review and set alarm limits, alarm switches, alarm level and alarm recordings for all parameters.

When a measurement alarm occurs, automatic recording of all the measurement numerics and related waveforms is possible when the measurement's [**On/Off**] and [**Record**] are set on.

⚠ WARNING

- **Make sure that the alarm limits settings are appropriate for your patient before monitoring.**
- **Setting alarm limits to extreme values may cause the alarm system to become ineffective. For example, High oxygen levels may predispose a premature infant to retrolental fibroplasia. If this is a consideration do NOT set the high alarm limit to 100%, which is equivalent to switching the alarm off.**
- **When monitoring patients that are not continuously attended by a clinical operator, properly configure the alarm system and adjust alarm settings as per the patient's condition.**

7.5.2 Adjusting Alarm Limits Automatically

The monitor can automatically adjust alarm limits according to the measured vital signs, using the auto limits function. When auto limits are selected, the monitor calculates safe auto limits based on the latest measured values.

To get accurate auto alarm limits, you need to collect a set of measured vital signs as a baseline. Then, in the main menu, select [**Alarm Setup >>**]→[**Parameters**]→[**Auto Limits**] →[**Ok**]. The monitor will create new alarm limits based on the measured values.

Before applying these automatically created alarm limits, confirm if they are appropriate for your patient in the mass alarm setup menu. If not, you can adjust them manually. These alarm limits will remain unchanged until you select auto limits again or adjust them manually.

The monitor calculates the auto limits based on the following rules.

Module	Parameter	Low alarm limit		High alarm limit		Auto alarm limits range
		Adult/ pediatric	Neonate	Adult/ pediatric	Neonate	
ECG	HR/PR	(HR × 0.8) or 40bpm (whichever is greater)	(HR – 30) or 90bpm (whichever is greater)	(HR × 1.25) or 240bpm (whichever is smaller)	(HR + 40) or 200bpm (whichever is smaller)	Adult/pediatric: 35 to 240 Neonate: 55 to 225
Resp	RR	(RR × 0.5) or 6 rpm (whichever is greater)	(RR – 10) or 30 rpm (whichever is greater)	(RR × 1.5) or 30 rpm (whichever is smaller)	(RR + 25) or 85 rpm (whichever is smaller)	Adult/pediatric: 6 to 55 Neonate: 10 to 90
SpO₂	SpO₂	Same as the default alarm limit	Same as the default alarm limit	Same as the default alarm limit	Same as the default alarm limit	Same as the measurement range
NIBP	NIBP-S	(SYS × 0.68 + 10) mmHg	(SYS – 15) or 45mmHg (whichever is greater)	(SYS × 0.86 + 38) mmHg	(SYS + 15) or 105mmHg (whichever is smaller)	Adult: 45 to 270 Pediatric: 45 to 185 Neonate: 40 to 115
	NIBP-D	(Dia × 0.68 + 6) mmHg	(Dia – 15) or 20mmHg (whichever is greater)	(Dia × 0.86 + 32) mmHg	(Dia + 15) or 80mmHg (whichever is smaller)	Adult: 25 to 210 Pediatric: 25 to 150 Neonate: 20 to 90

Module	Parameter	Low alarm limit		High alarm limit		Auto alarm limits range
		Adult/ pediatric	Neonate	Adult/ pediatric	Neonate	
	NIBP-M	(Mean × 0.68 + 8) mmHg	(Mean – 15) or 35mmHg (whichever is greater)	(Mean × 0.86 + 35) mmHg	(Mean + 15) or 95 mmHg (whichever is smaller)	Adult: 30 to 230 Pediatric: 30 to 165 Neonate: 25 to 105
Temp	T1	(T1 – 0.5)℃	(T1 – 0.5) ℃	(T1 + 0.5)℃	(T1 + 0.5)℃	1 to 49 ℃
	T2	(T2 – 0.5)℃	(T2 – 0.5) ℃	(T2 + 0.5)℃	(T2 + 0.5)℃	1 to 49 ℃
	TD	Same as the default alarm limit	Same as the default alarm limit	Same as the default alarm limit	Same as the default alarm limit	Same as the measurement range
IBP: ART/ Ao UAP/ BAP FAP/ LV/ P1-P4 (Arterial pressure)	IBP-S	(SYS × 0.68 ＋10) mmHg	(SYS – 15) or 45mmHg (whichever is greater)	(SYS × 0.86 ＋38) mmHg	(SYS + 15) or 105mmHg (whichever is smaller)	Adult: 45 to 270 Pediatric: 45 to 185 Neonate: 35 to 115
	IBP-D	(Dia × 0.68 + 6)mmHg	(Dia – 15) or 20mmHg (whichever is greater)	(Dia × 0.86 + 32)mmHg	(Dia + 15) or 80mmHg (whichever is smaller)	Adult: 25 to 225 Pediatric: 25 to 150 Neonate: 20 to 90
	IBP-M	(Mean × 0.68 + 8)mmHg	(Mean – 15) or 35mmHg (whichever is greater)	(Mean × 0.86 + 35)mmHg	(Mean + 15) or 95mmHg (whichever is smaller)	Adult: 30 to 245 Pediatric: 30 to 180 Neonate: 25 to 105
IBP: PA	IBP-S	SYS × 0.75	SYS × 0.75	SYS × 1.25	SYS × 1.25	3 to 120mmHg
	IBP-D	Dia × 0.75	Dia × 0.75	Dia × 1.25	Dia × 1.25	
	IBP-M	Mean × 0.75	Mean × 0.75	Mean × 1.25	Mean × 1.25	
IBP: CVP/ ICP/ LAP/ RAP/ UVP/ P1-P4 (Venous pressure)	IBP-M	Mean × 0.75	Mean × 0.75	Mean × 1.25	Mean × 1.25	3 to 40mmHg

Module	Parameter	Low alarm limit Adult/ pediatric	Neonate	High alarm limit Adult/ pediatric	Neonate	Auto alarm limits range
CO_2	$EtCO_2$	0 to 32mmHg: remains the same	0 to 32mmHg: remains the same	0 to 32mmHg: remains the same	0 to 32mmHg: remains the same	Same as the measurement range
		32 to 35mmHg: 29mmHg	32 to 35mmHg: 29mmHg	32 to 35mmHg: 41mmHg	32 to 35mmHg: 41mmHg	
		35 to 45mmHg: ($etCO_2$-6) mmHg	35 to 45mmHg: ($etCO_2$-6) mmHg	35 to 45mmHg: ($etCO_2$+6) mmHg	35 to 45mmHg: ($etCO_2$+6) mmHg	
		45 to 48mmHg: 39 mmHg	45 to 48mmHg: 39 mmHg	45 to 48mmHg: 51 mmHg	45 to 48mmHg: 51 mmHg	
		>48mmHg: remains the same	>48mmHg: remains the same	>48mmHg: remains the same	>48mmHg: remains the same	
	$FiCO_2$	N/A	N/A	Same as the default alarm limit	Same as the default alarm limit	Same as the measurement range
	awRR	awRR × 0.5 or 6 rpm (whichever is greater)	(awRR – 10) or 30 rpm (whichever is greater)	awRR × 1.5 or 30 rpm (whichever is smaller)	(awRR+25) or 85 rpm (whichever is smaller)	Adult/pediatric: 6 to 55 Neonate: 10 to 90
C.O.	BT	Adult: (BT – 1)℃	N/A	Adult: (BT – 1)℃	N/A	Same as the measurement range

7.5.3 Setting Alarm Delay Time

You can set the alarm delay time for over-limit alarms of continuously measured parameters. If the alarm-triggered condition disappears within the delay time, the patient monitor will not give the alarm. You can set the [**Alarm Delay**] in the [**Others**] window of [**Alarm Setup**] menu.

To set the alarm delay time,

1. Select [**Main Menu**]→ [**Maintenance >>**]→ [**User Maintenance >>**]. Enter the required password and then select [**Ok**].

2. Select [**Alarm Setup >>**]→[**Alarm Delay**].

Alarm delay is not applied to the following physiological alarms:

■ Apnea

■ ST alarms

■ Arrhythmia alarms

■ ECG Weak Signal

■ Resp Artifact

■ No Pulse

■ Measurements of noncontinuous parameters over alarm limits

■ HR over alarm limits

You can set [**Apnea Delay**] and [**ST Alarm Delay**] separately.

7.5.4 Setting SpO$_2$ Technical Alarm Delay

You can set [**Tech. Alarm Delay**] in the [**Others**] tab of the [**Alarm Setup**] menu. The options are [**Off**], [**5s**], [**10s**] and [**15s**]. The delay is effective to the following technical alarms: SpO$_2$ Sensor Off, SpO$_2$ Too Much Light, SpO$_2$ Low Signal and SpO$_2$ Interference.

7.5.5 Setting Recording Length

You can change the length of the recorded waveforms. In the [**Others**] window of the [**Alarm Setup**] menu, select [**Recording Length**] and toggle between [**8 s**], [**16 s**] and [**32s**]:

■ [**8 s**]: 4 seconds respectively before and after the alarm or manual event trigger moment.

■ [**16 s**]: 8 seconds respectively before and after the alarm or manual event trigger moment.

■ [**32 s**]: 16 seconds respectively before and after the alarm or manual event trigger moment.

7.6 Pausing Alarms

If you want to temporarily prevent alarms from sounding, you can pause alarms by pressing the ⚠ hardkey on the monitor's front. When alarms are paused:

■ No alarm lamps flash and no alarms are sounded.

■ No numeric and alarm limit flash.

■ No alarm messages are shown.

■ The remaining pause time is displayed in the physiological alarm area.

■ The ⚠ alarms paused symbol is displayed in the alarm symbol area.

The patient monitor enters into the alarm paused status as soon as it is turned on. The alarm pause time is fixed to be 2 minutes.

When the alarm pause time expires, the alarm paused status is automatically cancelled and the alarm tone will sound. You can also cancel the alarm paused status by pressing the ⚠ hardkey.

The alarm pause time can be set to [**1 min**], [**2 min**], [**3 min**], [**5 min**], [**10 min**], [**15 min**] or [**Permanent**]. The default alarm pause time is 2 minutes.

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

2. Select [**Alarm Setup >>**]→[**Alarm Pause Time**] and then select the appropriate setting from the popup list.

You can also temporarily prolong the alarm pause time after the monitor entersthe alarm paused status:

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

2. In the [**Alarm Setup**] menu, set the [**Max. Alarm Pause 15min**] to [**Enable**].

3. In the physiological alarm area, select a proper time in the [**Alarm Pause Time**] menu.

NOTE

- **[Max. Alarm Pause 15min] is configured to [Disable] by default. In this case, you cannot prolong the pause time.The prolonged pause time is only effective to the current paused alarms.**

7.7 Switching Off All Alarms

If [**Alarm Pause Time**] is set to [**Permanent**], the patient monitor enters into the alarm off status after the ⊠ hardkey is pressed. During the alarm off status,

- As for physiological alarms, no alarm lamps flash and no alarms are sounded.

- As for physiological alarms, no numeric and alarm limit flash.

- No physiological alarm messages are shown.

- [**Alarm Off**] is displayed in the physiological alarm area with red background.

- As for technical alarms, no alarms are sounded.

- The ⊠ alarm off symbol is displayed in the alarm symbol area.

You can cancel the alarm off status by pressing the ⊠ hardkey.

⚠ WARNING

- **Pausing or switching off alarms may result in a hazard to the patient. Please be very careful.**

7.8 Resetting Alarms

By selecting the [icon] QuickKey, you can reset the alarm system to acknowledging the on-going alarms and enable the alarm system to respond to a subsequent alarm condition. For physiological alarms, except the NIBP-related alarms, when the alarm system is reset:

■ The alarm sound is reset.

■ A √ appears before the alarm message, indicating that the alarm is acknowledged.

■ The icon [icon] appears in the alarm symbol area.

■ The parameter numeric and alarm limits still flash.

The indication of alarm lamp for the physiological alarm depends on the alarm light setting.

■ When [**Alarm Light on Alarm Reset**] is set to [**On]**, the alarm lamp remains flashing.

■ When [**Alarm Light on Alarm Reset**] is set to [**Off**], the alarm lamp stops flashing.

Technical alarms give different alarm indicators when the alarm system is reset:

■ For some technical alarms, including the NIBP-related alarms, a √ appears before the alarm message and [icon] appears in the alarm symbol area, indicating that the alarm is acknowledged.

■ Some technical alarms are changed to the prompt messages.

■ Some technical alarms are cleared. The monitor gives no alarm indications.

For details about the indications of technical alarms when the alarm system is reset, refer to *D.2 Technical Alarm Messages*.

To set [**Alarm Light on Alarm Reset**]:

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

2. Select [**Alarm Setup >>**] to enter the [**Alarm Setup**] menu.

3. Select [**Alarm Light on Alarm Reset**], and toggle between [**On**] and [**Off**]. The default setting for [**Alarm Light on Alarm Reset**] is [**On**].

7.9 Latching Alarms

The alarm latching setting for your patient monitor defines how the indicators of the physiological alarms behave when you do not acknowledge them:

■ If you do not "latch" the physiological alarms, their alarm indications disappear when the alarm condition ends.

■ If you "latch" the physiological alarms, all visual and audible alarm indications last until you acknowledge the alarms, except that the measurement numeric and violated alarm limit stop flashing as soon as the initial alarm condition goes away.

You can separately latch the visual indications or simultaneously latch the visual and the audible indication.

■ When the visual indications are latched, the visual indications, including alarm lamp, alarm message and its background remains when the alarm condition ends.

■ When the audible indications are latched, the monitor issues alarm sounds when the alarm condition ends.

To latch a physiological alarm:

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

2. Select [**Alarm Setup** >>]→[**Latching Alarms>>**].

3. In the [**Latching Alarms**] menu, select how you want to latch the alarms.

The rules for latching the alarms are:

■ You can separately select [**Latching Visual Signal**].

■ Selecting [**Latching Audible Signal**] simultaneously latches the visual signal.

■ Selecting alarms of lower priority simultaneously latches the alarms of higher priority.

NOTE

● **Changing of alarm priority may affect the latching status of corresponding alarm. Please determine if you need to reset the latching status for the specific alarm when you have changed its alarm priority.**

● **When the alarm system is reset, the latched physiological alarms are cleared.**

7.10 Testing Alarms

When the monitor starts up, a selftest is performed. In this case the alarm lamp is lit in yellow and red respectively, and the system gives a beep. This indicates that the visible and audible alarm indicators are functioning correctly.

For further testing of individual measurement alarms, perform the measurement on yourself (for example SpO_2 or CO_2) or use a simulator. Adjust alarm limits and check that appropriate alarm behaviour is observed.

7.11 Using Care Group Alarms

7.11.1 Care Group Auto Alarms

When a Care Group is set up on your monitor, a flashing symbol will appear beside the QuickKeys area if any monitor in your Care Group, which is not currently viewed by your monitor, is alarming. The alarm symbol is shown as below.

The background colors of the alarm symbols indicate alarm levels, and are the same as those of the corresponding alarm messages. If multiple alarms are active in the Care Group, the background color is the same as that of the highest-level alarm message. For more information about the alarm message and background color, see *7.3.2 Alarm Message*.

When a patient monitor in the Care Group is disconnected, the flashing symbol is shown as below.

The department and bed label of the alarming monitor appear on the symbol. You can enter the view other patient window by pressing this symbol.

7.11.2 Setting Care Group Alert Tone

When a monitor in the Care Group issues an alarm, your patient monitor prompts you by giving an alert tone. To set the alert tone:

1. In the main menu, select [**Screen Setup >>**]→[**Screen Layout >>**]→[**Choose Screen**].

2. In the [**Choose Screen**] window, select [**View Others Screen**].

3. In the view other patient window, select [**Setup>>**], and set [**Alert Tone**] to [**Repeat**], [**Once**] or [**Off**].

7.11.3 Resetting Care Group Alarms

You can reset the alarms presented on the viewed bed by pressing the [Alarm Reset] from the current monitor's [**View Other Patient**] window. To enable this function:

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

2. In the [**Alarm Setup**] menu, set [**Reset Other Bed's Alarms**] to [**On**].

The alarms presented on the current monitor can also be reset from another monitor viewing this monitor. To do so, proceed as follows:

1. In the current monitor, select [**Main Menu**]→[**Maintenance>>**]→[**User Maintenance>>**]→enter the required password→[**Alarm Setup>>**].

2. In the [**Alarm Setup**] menu, set [**Alarm Reset By Other Bed**] to [On].

3. In the other monitor, select the [**Alarm Reset**] button from the [**View Other Patient**] window.

⚠ WARNING

- **Resetting care group alarms may cause a potential hazard. Please act with caution.**

7.12 When an Alarm Occurs

When an alarm occurs, observe the following steps and take proper actions:

1. Check the patient's condition.

2. Confirm the alarming parameter or alarm category.

3. Identify the source of the alarm.

4. Take proper action to eliminate the alarm condition.

5. Make sure the alarm condition is corrected.

For troubleshooting specific alarms, see appendix **_D Alarm Messages_**.

8 Monitoring ECG

8.1 Introduction

The electrocardiogram (ECG) measures the electrical activity of the heart and displays it on the patient monitor as a waveform and a numeric. For uMEC10, ECG monitoring provides 3-, 5-lead ECG monitoring, ST-segment analysis and arrhythmia analysis. For uMEC12 and uMEC15, ECG monitoring provides 3-, 5- and 12-lead ECG monitoring, ST-segment analysis and arrhythmia analysis.

8.2 Safety

⚠ WARNING

- **Use only ECG electrodes and cables specified by the manufacturer.**
- **Make sure the conductive parts of electrodes and associated connectors for applied parts, including the neutral electrode, should not contact any other conductive parts including earth.**
- **Periodically inspect the electrode application site to ensure skin quality. If the skin quality changes, replace the electrodes or change the application site.**
- **Use defibrillation-proof ECG cables during defibrillation.**
- **Do not touch the patient, or table, or instruments during defibrillation.**
- **This equipment is not suitable for direct cardiac application.**
- **To reduce the hazard of burns during high-frequency surgical procedure, ensure that the monitor's cables and transducers never come into contact with the electro-surgery unit (ESU).**
- **The neutral electrode of the electro-surgery unit (ESU) shall properly contact the patient. Otherwise, burns may result.**

⚠ CAUTION

- **Interference from a non-grounded instrument near the patient and electrosurgery interference can cause problems with the waveform.**

NOTE

- **After defibrillation, the screen display recovers within 10 seconds if the correct electrodes are used and applied in accordance with the manufacturer's instructions for use.**

8.3 Preparing to Monitor ECG

8.3.1 Preparing the Patient and Placing the Electrodes

1. Prepare the patient's skin. Proper skin preparation is necessary for good signal quality at the electrode, as the skin is a poor conductor of electricity. To properly prepare the skin, choose flat areas and then follow this procedure:

   ◆ Shave hair from skin at chosen sites.

   ◆ Gently rub skin surface at sites to remove dead skin cells.

   ◆ Thoroughly cleanse the site with a mild soap and water solution. We do not recommend using ether or pure alcohol, because this dries the skin and increases the resistance.

   ◆ Dry the skin completely before applying the electrodes.

2. Attach the clips or snaps to the electrodes before placing them.

3. Place the electrodes on the patient.

4. Attach the electrode cable to the patient cable and then plug the patient cable into the ECG connector.

8.3.2 Choosing AHA or IEC Lead Placement

1. Select the ECG parameter window or waveform area to enter the [**ECG Setup**] menu.

2. Select [**Others**]→[**Lead Set**] and then select [**3-lead**], [**5-lead**], [**12-lead**] (for uMEC12/uMEC15) or [**Auto**] according to the applied electrodes.

3. Select [**Main Menu**]→[**Maintenance >>**]→[**User Maintenance >>**]→ enter the required password

4. Select [**Others >>**]→[**ECG Standard**] and then select [**AHA**] or [**IEC**] according to the standard that is applied for your hospital.

8.3.3 ECG Lead Placements

The electrode placement illustrations in this chapter adopt the AHA standard.

3-Leadwire Electrode Placement

Following is an electrode configuration when using 3 leadwires:

- RA placement: directly below the clavicle and near the right shoulder.
- LA placement: directly below the clavicle and near the left shoulder.
- LL placement: on the left lower abdomen.
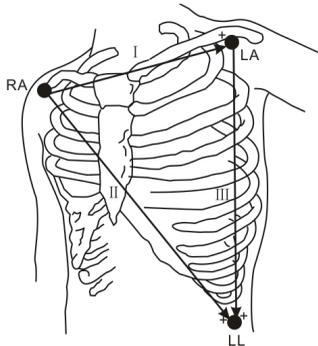
5-Leadwire Electrode Placement

Following is an electrode configuration when using 5 leadwires:

- RA placement: directly below the clavicle and near the right shoulder.
- LA placement: directly below the clavicle and near the left shoulder.
- RL placement: on the right lower abdomen.
- LL placement: on the left lower abdomen.
- V placement: on the chest.
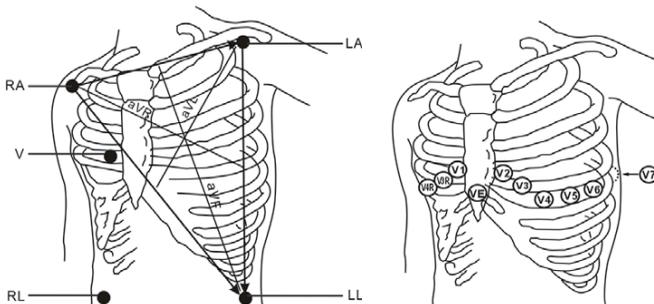
The chest (V) electrode can be placed on one of the following positions:

■ V1 placement: on the fourth intercostal space at the right sternal border.

■ V2 placement: on the fourth intercostal space at the left sternal border.

■ V3 placement: midway between the V2 and V4 electrode positions.

■ V4 placement: on the fifth intercostal space at the left midclavicular line.

■ V5 placement: on the left anterior axillary line, horizontal with the V4 electrode position.

■ V6 placement: on the left midaxillary line, horizontal with the V4 electrode position.

■ V3R-V6R placement: on the right side of the chest in positions corresponding to those on the left.

■ VE placement: over the xiphoid process.

■ V7 placement: on posterior chest at the left posterior axillary line in the fifth intercostal space.

■ V7R placement: on posterior chest at the right posterior axillary line in the fifth intercostal space.

12-Leadwire Electrode Placement (for uMEC12/uMEC15)

12-lead ECG uses 10 electrodes, which are placed on the patient's four limbs and chest. The limb electrodes should be placed on the soft skin and the chest electrodes placed according to the physician's preference.
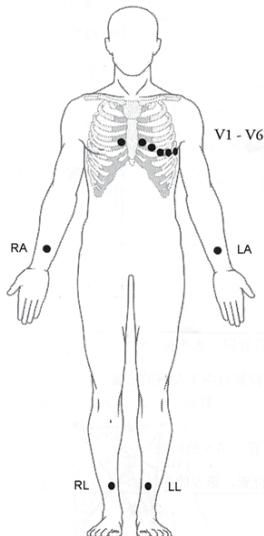
Lead Placement for Surgical Patients

The surgical site should be taken into consideration when placing electrodes on a surgical patient. e.g. for open-chest surgery, the chest electrodes can be placed on the lateral chest or back. To reduce artifacts and interference from electrosurgical units, you can place the limb electrodes close to the shoulders and lower abdomen and the chest electrodes on the left side of the mid-chest. Do not place the electrodes on the upper arm. Otherwise, the ECG waveform will be very small.

⚠ WARNING

- **When using electrosurgical units (ESU), patient leads should be placed in a position that is equal distance from the Electrosurgery electrotome and the grounding plate to avoid burns to the patient. Never entangle the ESU cable and the ECG cable together.**
- **When using electrosurgical units (ESU), never place ECG electrodes near to the grounding plate of the ESU, as this can cause a lot of interference on the ECG signal.**

8.3.4 Checking Paced Status

It is important to set the paced status correctly when you start monitoring ECG. The paced symbol is displayed in the ECG waveform area when the [**Paced**] status is set to [**Yes**]. The pace pulse markers "|" are shown on the ECG wave when the patient has a paced signal.

If [**Paced**] is set to [**No**] or the patient's paced status is not selected, the symbol will be shown in the ECG waveform area.

To change the paced status, you can select either:

- the patient information area, or
- [**Main Menu**]→[**Patient Setup**]→[**Patient Demographics**], or,
- the ECG parameter window or waveform area→[**Others >>**],

and then, select [**Paced**] from the popup menu and toggle between [**Yes**] and [**No**].

If you do not set the paced status, the patient monitor issues a prompt tone when pace pulse is detected. At the same time, the paced symbol flashes and the message [**Please confirm the pace of patient**] appears in the ECG waveform area. Then, please check and set the paced status of the patient.

⚠ WARNING

- **For paced patients, you must set [Paced] to [Yes]. If it is incorrectly set to [No], the patient monitor could mistake a pace pulse for a QRS and fail to alarm when the ECG signal is too weak. Do not rely entirely on rate meter alarms when monitoring patients with pacemakers. Always keep these patients under close surveillance.**

- **For non-paced patients, you must set [Paced] to [No].**

- **The auto pacer recognition function is not applicable to pediatric and neonatal patients.**

- **False low heart rate indicators or false Asystole calls may result with certain pacemakers because of pacemaker artifact such as electrical overshoot of the pacemaker overlapping the true QRS complexes.**

8.4 Understanding the ECG Display

Your display may be configured to look slightly different.
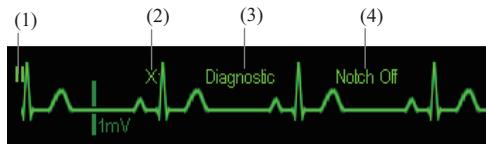
(1) Lead label of the displayed wave

(2) ECG gain

(3) ECG filter label

(4) Notch filter status

When a paced signal has been detected, the pace pulse marks "|" are shown on the ECG wave if the [**Paced**] has been set to [**Yes**].
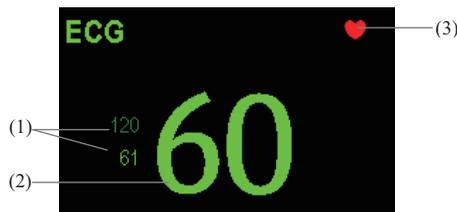
(1) Current heart rate alarm limits

(2) Current heart rate

(3) Heart beat symbol

For 12-lead ECG display screen, refer to *8.11 12-Lead ECG Monitoring (for uMEC12/uMEC15)*.

8.5 Changing ECG Settings

8.5.1 Accessing ECG Menus

By selecting the ECG parameter window or waveform area, you can access the [**ECG Setup**] menu.

8.5.2 Choosing the Alarm Source

In most cases the HR and PR numerics are identical. In order to avoid simultaneous alarms on HR and PR, the monitor uses either HR or PR as its active alarm source. To change the alarm source, select [**Alm Source**] in the [**ECG Setup**] menu and then select either:

■ [**HR**]: if you want the HR to be the alarm source for HR/PR.

■ [**PR**]: if you want the PR to be the alarm source for HR/PR.

■ [**Auto**]: If the [**Alm Source**] is set to [**Auto**], the patient monitor will use the heart rate from the ECG measurements as the alarm source whenever a valid heart rate is available. If the heart rate becomes unavailable, for example the ECG module is turned off or becomes disconnected, the patient monitor will automatically switch to PR as the alarm source.

8.5.3 Setting the ECG Lead Set

You can set the [**Lead Set**] by selecting [**ECG Setup**]→[**Others>>**]. You can set the [**Lead Set**] as [**Auto**] if the auto lead detection function is available.

8.5.4 Choosing an ECG Display Screen

When monitoring with a 5-lead set or 12-lead set, you can select the [**Screens**] Quickkey. In the [**Choose Screen**] window, choose the screen type as:

■ [**Normal Screen**]: The ECG waveform area shows 2 ECG waveforms.

■ [**ECG 7-Lead Full-Screen**]: The whole waveform area shows 7 ECG waveforms only.

■ [**ECG 7-Lead Half-Screen**]: The upper half part of the whole waveform area displays 7 ECG waveforms.

When monitoring with a 12-lead set, you can also choose the screen type as [**ECG 12-Lead Full-Screen**].

When the screen type is set to [**Normal Screen**], cascaded ECG waveforms can be displayed. To cascade ECG waveforms:

1. Select the [**Screens**] Quickkey→[**Screen Setup**].

2. Select [**ECG1 Casc.**] in the second row. A cascaded waveform is displayed in two waveform positions.

8.5.5 Changing the ECG Filter Settings

The ECG filter setting defines how ECG waves are smoothed. To change the filter setting, select [**Filter**] from [**ECG Setup**] and then select the appropriate setting.

■ [**Monitor**]: Use under normal measurement conditions.

■ [**Diagnostic**]: Use when diagnostic quality is required. The unfiltered ECG wave is displayed so that changes such as R-wave notching or discrete elevation or depression of the ST segment are visible.

■ [**Surgery**]: Use when the signal is distorted by high frequency or low frequency interference. High frequency interference usually results in large amplitude spikes making the ECG signal look irregular. Low frequency interference usually leads to wandering or rough baseline. In the operating room, the surgery filter reduces artifacts and interference from electrosurgical units. Under normal measurement conditions, selecting [**Surgery**] may suppress the QRS complexes too much and then interfere with ECG analysis.

■ [**ST**]: Use when ST monitoring is applied.

⚠ WARNING

● **The [Diagnostic] filter is recommended when monitoring a patient in an environment with slight interference only.**

8.5.6 Setting the Notch Filter

The notch filter removes the line frequency interference. Only when [**Filter**] is set to [**Diagnostic**], the [**Notch Filter**] is adjustable.

1. Select the ECG parameter window or waveform area to enter its setup menu. Then select [**Others >>**].

2. Set [**Notch Filter**] to [**On**] or [**Off**].

Set notch frequency according to the electric power frequency of your country. Follow this procedure:

1. When [**Notch Filter**] is set on, select [**Main Menu**]→[**Maintenance >>**]→[**User Maintenance >>**]→enter the required password.

2. Select [**Others >>**]→[**Notch Freq.**] and then select [**50Hz**] or [**60Hz**] according to the power line frequency.

8.5.7 Changing the Pacer Reject Settings

Select [**ECG Setup**]→[**Others>>**]→[**Pacer Reject**], and toggle between [**On**] and [**Off**]. When [**Paced**] is set to [**Yes**]:

■ When [**Pacer Reject**] is switched on, the pace pulses are not counted as extra QRS complexes.

■ The pace pulse marks "|" are shown on the ECG wave when pace pulses are detected.

When [**Paced**] is set to [**No**], the pace markers are not shown on the ECG wave, and the options of [**Pacer Reject**] are invalid.

8.5.8 Changing ECG Wave Settings

In the [**ECG Setup**] menu:

■ You can select [**ECG**], [**ECG1**], or [**ECG2**] to select a lead to view. The waveform of selected lead should have the following characteristics:

◆ The QRS should be either completely above or below the baseline and it should not be biphasic.

◆ The QRS should be tall and narrow.

◆ The P-waves and T-waves should be less than 0.2mV.

■ If the wave is too small or clipped, you can change its size by selecting an appropriate [**Gain**] setting. If you select [**Auto**] from [**Gain**], the patient monitor will automatically adjust the size of the ECG waves. In normal screen, only the selected ECG wave's size is adjusted. In other screens, all ECG waves' size is adjusted simultaneously.

■ You can change the wave sweep speed by selecting [**Sweep**] and then selecting the appropriate setting.

8.5.9 Enabling Smart Lead Off

When the smart lead off function is set on and there is a "lead off" in the lead that has an ECG waveform in filter mode and notch status, if another lead is available, this available lead automatically becomes that lead. The system will re-calculate HR and analyze and detect arrhythmia. When the "lead off" condition is corrected, the leads are automatically switched back.

To switch on/off the smart lead off function, select [**Others >>**] from the [**ECG Setup**] menu; select [**Smart Lead Off**] and toggle between [**On**] and [**Off**] from the popup menu.

8.5.10 Setting the Alarm Level for ECG Lead Off Alarms

Select [**Alarm Setup >>**] from the [**User Maintenance**] menu. You can set [**ECGLeadOff Lev.**] from the popup menu.

8.5.11 Adjusting QRS Volume

QRS sounds are produced based on the alarm source. To adjust the QRS volume, select [**Others >>**] from the [**ECG Setup**] menu; select [**QRS Volume**] from the popup menu and select the appropriate setting. When valid SpO_2 measured value is available, the system adjusts the pitch tone of QRS sound based on the SpO_2 value.

8.5.12 About the Defibrillator Synchronization

If a defibrillator is connected, a defibrillator synchronization pulse (100 ms, +5V) is outputted through the Multifunctional Connector every time when the patient monitor detects an R-wave.

⚠ WARNING

- **Improper use of a defibrillator may cause injury to the patient. The user should determine whether to perform defibrillation or not according to the patient's condition.**
- **Before defibrillation, the user must ensure both defibrillator and monitor has passed the system test and can be safely used jointly.**
- **Before defibrillation, make sure that the [Filter] is set to [Diagnostic].**
- **After defibrillation is finished, select the filter mode as required.**

8.6 About ST Monitoring

- ST segment analysis calculates ST segment elevations and depressions for individual leads and then displays them as numerics in the ST1 and ST2 areas.

- A positive value indicates ST segment elevation; a negative value indicates ST segment depression.

- Measurement unit of the ST segment: mV or mm. You can set the unit in the [**Unit Setup**] menu from the [**User Maintenance**] menu.

- Measurement range of the ST segment: -2.0 mV to +2.0 mV.

⚠ WARNING

- **The ST algorithm has been tested for accuracy of the ST segment data. The significance of the ST segment changes need to be determined by a clinician.**

8.6.1 Switching ST On and Off

To switch ST monitoring on or off:

1. In the [**ECG Setup**] menu, select [**ST Analysis >>**].

2. Select [**ST Analysis**] to toggle between [**On**] and [**Off**].

Reliable ST monitoring can hardly be ensured if:

- You are unable to get a lead that is not noisy.

- Arrhythmias such as atrial fib/flutter cause irregular baseline.

- The patient is continuously ventricularly paced.

- The patient has left bundle branch block.

In these cases, you may consider switching ST monitoring off.

8.6.2 Changing ST Filter Settings

ST-segment analysis can be carried out only when the filter mode is set to [**Diagnostic**] or [**ST**]. When ST-segment analysis is switched on, [**Filter**] will automatically switch to [**ST**] if it is not [**Diagnostic**] or [**ST**]. When ST-segment analysis is switched off, the filter mode automatically switches to previous manual setting.

However, if you switch [**Filter**] to [**Monitor**] or [**Surgery**], ST-segment analysis will turn off automatically. In case that you change [**Monitor**] or [**Surgery**] to [**Diagnostic**] or [**ST**], ST-segment analysis keeps off, you can turn it on manually.

NOTE

- **When the filter mode is switched to [Diagnostic], the notch filter automatically switches to [Off]. In this case, you can still set the notch filter to [On] manually.**
- **When the filter mode is [Monitor], [Surgery] or [ST], the notch filter is fixed to [On], and can not be changed.**

8.6.3 Understanding the ST Display

8.6.3.1 ST Numerics

This example shows ST numerics with 5-lead ECG. Your monitor screen may look slightly different from the illustration.
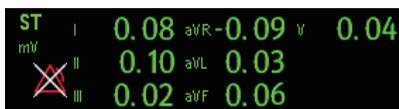
8.6.3.2 ST Segment

ST segment shows a QRS complex segment for each measured ST lead. The current ST segment is drawn in the same color as the ECG wave, usually green, superimposed over the stored reference segment, drawn in a different color. The information is updated once every ten seconds.

To display the ST segment on normal screen:

1. Enter the [**ST Analysis**] menu. Set [**ST Analysis**] to [**On**].

2. Enter the [**Screen Setup**] window of [**Screens**] menu. Set [**ST Segment**] to be displayed.

Select the ST parameter window or ST segment area and you can enter the [**ST Analysis**] menu.
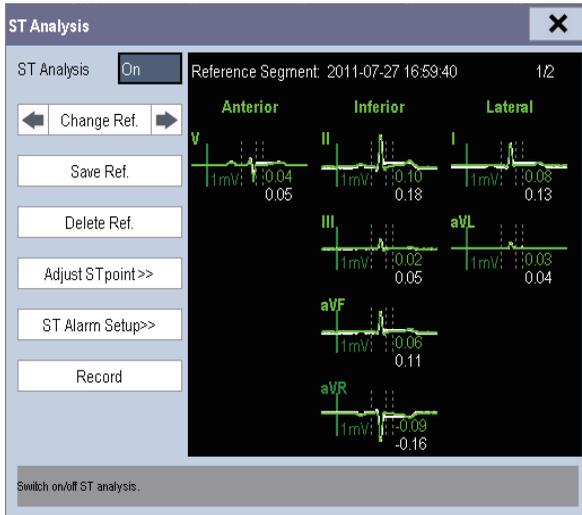
8.6.4 Saving the Current ST Segment as Reference

Select [**Save Ref**.] in the [**ST Analysis**] menu to save the current segment as reference. Up to 20 reference segment groups can be saved.

NOTE

● **If the memory is full and you do not delete a group before saving a new one, the oldest saved group is deleted automatically.**

8.6.5 Changing the Reference Segment

Select the ◀ and ▶ arrow keys beside the [**Change Ref.**] to switch between different reference segment groups.

8.6.6 Deleting a Reference Segment

To delete the current ST reference segment, select [**Delete Ref.**] in the [**ST Analysis**] menu and then select [**Ok**] in the popup.

8.6.7 Recording the ST Segment

To record the current ST segment and reference segment, select [**Record**] in the [**ST Analysis**] menu.

8.6.8 Changing the ST Alarm Limits

High and low ST alarm limits can be set individually for each ECG lead. Alarm limits can also be set separately for single-lead and multi-lead ST monitoring. You can select [**ST Alarm Setup >>**] from [**ST Analysis**] menu and then change ST alarm settings for each lead.

8.6.9 Setting the ST Alarm Delay Time

To set the ST alarm delay time,

1. Select [**Main Menu**]→[**Maintenance >>**]→[**User Maintenance >>**]. Enter the required password and then select [**OK**].

2. Select [**Alarm Setup >>**]→[**ST Alarm Delay**].

8.6.10 Adjusting ST Measurement Points

As shown in the figure below, the ST measured for each beat complex is the vertical difference between two measurement points with the R-wave peak as the baseline for the measurement.
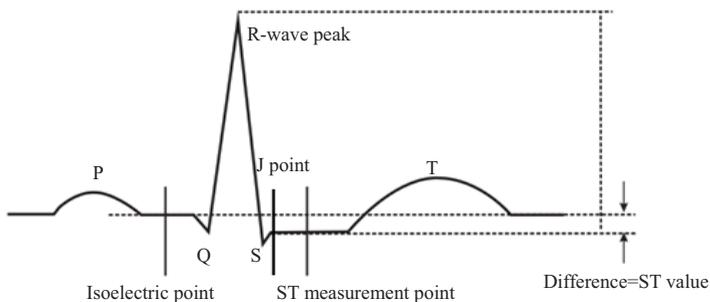
The ISO and ST points need to be adjusted when you start monitoring and if the patient's heart rate or ECG morphology changes significantly. Exceptional QRS complexes are not considered for ST-segment analysis.

⚠ WARNING

- **Always make sure that the positions of ST measurement points are appropriate for your patient.**

To adjust the ST measurement points:

1. In the [**ST Analysis**] menu, select [**Adjust ST Point >>**]. In the [**Adjust ST Point**] window, three vertical lines represent the ISO, J and ST point positions respectively.

2. Select [**View Leads**] and use the Knob to select an ECG lead with obvious J point and R wave.

3. Select [**ISO**], [**J**] or [**ST Point**] and then use the Knob to adjust the position of each point.

   ◆ The ISO-point (isoelectric) position is given relative to the R-wave peak. Position the ISO-point in the middle of the flattest part of the baseline (between the P and Q waves).

   ◆ The J-point position is given relative to the R-wave peak and helps locating the ST-point. Position the J-point at the end of the QRS complex and the beginning of the ST segment.

   ◆ The ST-point is positioned a fixed distance from the J-point. Move the J-point to position the ST-point at the midpoint of the ST segment. Position the ST-point relative to the J-point at either [**J+60/80ms**], [**J+40ms**], [**J+60ms**] or [**J+80ms**]. When [**J+60/80ms**] is selected, the ST-point will be positioned 80 ms (heart rate 120 bpm or less) or 60 ms (heart rate more than 120 bpm) from the J-point.

8.7 About Arrhythmia Monitoring

Arrhythmia analysis provides information about your patient's condition, including heart rate, PVC rate, rhythm and ectopics.

> ## ⚠ WARNING
>
> - **Arrhythmia analysis program is intended to detect ventriculararrhymias and atrial fibrillation. It is not designed to detect all the atrial or supraventricular arrhythmias. It may incorrectly identify the presence or absence of an arrhythmia. Therefore, a physician must analyze the arrhythmia information with other clinical findings.**
> - **Atrial fibrillation (Afib) detection function is not intended for pediatric and neonatal patients.**
> - **Heart-rate reading may be affected by cardiac arrhythmias. Do not rely entirely on heart rate alarms when monitoring patients with arrhythmia. Always keep these patients under close surveillance.**

8.7.1 Understanding the Arrhythmia Events

Arrhythmia message	Description	Category
Asystole	No QRS detected within the set time threshold in absence of ventricular fibrillation or chaotic signal.	Lethal arrhythmia
VFib/VTac	A fibrillatory wave for 6 consecutive seconds. A dominant rhythm of adjacent Vs and a HR > the V-Tac HR limit.	Lethal arrhythmia
Vtac	The consecutive PVCs ≥ Vtac PVCs limit, and the HR ≥ the Vtac rate limit.	Lethal arrhythmia
Vent. Brady	The consecutive PVCs ≥ the Vbrd threshold and the ventricular HR < the Vbrd Rate threshold.	Lethal arrhythmia
Extreme Tachy	The heart rate is equal to or greater than the extreme tachycardia limit.	Lethal arrhythmia
Extreme Brady	The heart rate is equal to or less than the extreme bradycardia limit.	Lethal arrhythmia
PVCs/min	PVCs/min exceeds high limit	Nonlethal arrhythmia
Pacer Not Pacing	No pace pulse detected for 1.75 x average R-to-R intervals following a QRS complex (for paced patients only).	Nonlethal arrhythmia
Pacer Not Capture	No QRS complex detected for 300 ms following a pace pulse (for paced patients only).	Nonlethal arrhythmia

Arrhythmia message	Description	Category
PVC	One PVC detected in normal heartbeats.	Nonlethal arrhythmia
Couplet	Paired PVCs detected in normal heartbeats.	
Run PVCs	More than two consecutive PVCs, lower than Vent. Brady PVCs threshold, and HR lower than Vent Rate threshold.	
Bigeminy	A dominant rhythm of N, V, N, V, N, V.	
Trigeminy	A dominant rhythm of N, N, V,N, N, V, N, N, V.	
R on T	R on T detected in normal heartbeats.	
Missed Beats	At least 3 consecutive Ns, andThe current RR interval is greater than 1.5 x previous RR interval, andThe next RR interval is lower than 1.5 x average RR interval, andHR greater than 100 and the current RR interval is greater than 1.75 x average RR interval , or HR is greater than or equal to 100 and the current RR interval is greater than 1000 ms.	
Brady	The average heart rate is lower than the bradycardia limit.	
Tachy	The average heart rate is greater than the tachycardia limit.	
Vent. Rhythm	The consecutive PVCs is greater or equal to Vbrd PVCs limit, and HR is greater or equal to Vbrd Rate limit but lower than Vtac Rate limit.	
Multif. PVC	Multiform PVCs detected in Multif. PVC's Window (which is adjustable).	
Nonsus. Vtac	Consecutive PVCs (V) is lower than Vtac PVCs limit but greater than 2, and HR is greater or equal to the Vtac Rate limit.	
Pause	No QRS is detected within the set time threshold of pause.	
Irr. Rhythm	Consistently irregular rhythm (N, irregular RR interval change is greater than 12.5%)	
Afib (for adult only)	P wave is absent and normal beat RR intervals are irregular.	
Pauses/min	Pause/min exceeds high limit	

8.7.2 Changing Arrhythmia Alarm Settings

To change arrhythmia alarm settings, select the ECG parameter area or waveform area →[**ECG Setup**]→ [**Arrh. Analysis >>**]. In the pop-up menu, you can set the [**Alm Lev**] to [**High**], [**Med**], [**Low**] or [**Message**], or switch on lethal arrhythmia analysis alarms only or switch on/off all arrhythmia analysis alarms. In the [**Alarm Setup**] menu from the [**User Maintenance**] menu, you can enable/disable turning off lethal arrhythmia analysis alarms.

⚠ WARNING

- **If you switch off all arrhythmia analysis alarms, the monitor cannot give any arrhythmia analysis alarm. Always keep the patient under close surveillance.**
- **The priority of lethal arrhythmia alarms is always high. It is unchangeable.**

8.7.3 Changing Arrhythmia Threshold Settings

Select the ECG parameter window or waveform area→[**Arrh. Analysis >>**]→[**Arrh. Threshold**], and you can then change threshold settings for some arrhythmia alarms. In case an arrhythmia violates its threshold, an alarm will be triggered. The asystole delay time relates to ECG relearning. When HR is less than 30 bpm, it is recommended to set the asystole delay time to 10 seconds.

Arrh. event	Range	Default	Step	Unit
PVCs High	1 to 100	10	1	/min
Asys. Delay	3 to 10	5	1	s
Tachy High	60 to 300	Adult: 120 Pediatric: 160 Neonate: 180	5	bpm
Brady Low	15 to 120	Adult: 50 Pediatric: 75 Neonate: 90	5	bpm
Extreme Tachy	120 to 300	Adult: 160 Pediatric: 180 Neonate: 200	5	bpm
Extreme Brady	15 to 60	Adult: 35 Pediatric: 50 Neonate: 60	5	bpm
Multif. PVC's Window	3 to 31	15	1	/min

Arrh. event	Range	Default	Step	Unit
Vtac Rate	100 to 200	Adult, pediatric: 130 Neonate: 160	5	bpm
Vtac PVCs	3 to 99	6	1	/min
Pause Time	1.5, 2.0,2.5	2	/	s
Vbrd PVCs	3 to 99	5	1	/min
Vbrd Rate	15 to 60	40	5	bpm

8.7.4 Setting the Extended Arrhythmia

The following arrhythmia events are defined as extended arrhythmia:

- Extreme Tachy
- Extreme Brady
- Vent. Brady
- Nonsus. Vtac
- Multif. PVC
- Irr. Rhythm
- Pause
- Afib

You can select [**Main Menu**]→[**Maintenance >>**]→[**User Maintenance >>**]→enter the required password→select [**Alarm Setup >>**], and set [**Extended Arrh.**] to [**Enable**] or [**Disable**]. When [**Extended Arrh.**] is set to [**Disable**], the patient monitor does not analysis the extended arrhythmia events and corresponding alarms are not given.

⚠ CAUTION

- Set [Extended Arrh.] to [Disable] when the patient monitor is connected to the Central Monitoring System of version prior to 06.01.00. Failure to do so may cause the Central Monitoring System unable to display extended arrhythmia related alarms normally when extended arrhythmia occurs.

8.7.5 Reviewing Arrhythmia Events

Please refer to *18 Review*.

8.8 About QT/QTc Interval Monitoring

The QT interval is defined as the time between the beginning of the Q-wave and the end of the T-wave. It measures the total duration of the depolarization (QRS duration) and repolarization (ST-T) phases of the ventricular action potential. QT interval monitoring can assist in the detection of prolonged QT interval syndrome.

The QT interval has an inverse relationship to heart rate. Faster heart rates shorten the QT interval and slower heart rates prolong the QT interval. Therefore, several formulas can be used to correct the QT interval for heart rate. The heart rate corrected QT interval is abbreviated as QTc.

QT/QTc interval monitoring is intended for adult, pediatric, and neonatal patients.

8.8.1 QT/QTc Monitoring Limitations

Some conditions may make it difficult to achieve reliable QT/QTc monitoring, for example:

- R-wave amplitudes are too low
- Too many ventricular beats
- RR intervals are not stable
- A high heart rate causes the P-wave to encroach on the end of the previous T-wave
- The T-wave is very flat or T-wave are not well defined
- The end of the T-wave is difficult to define because of the presence of U-waves
- QTc measurements are not stable
- In the presence of noise, asystole, ventricular fibrillation, and ECG lead off

For these cases you should select a lead with good T-wave amplitude and no visible flutter activity, and without a predominant U-wave or P-wave.

Some conditions such as left or right bundle branch block or hypertrophy can lead to a widened QRS complex. If a long QTc is observed you should verify it to ensure that it is not caused by QRS widening.

Because normal beats followed by ventricular beats are not included in the analysis, no QT measurement will be generated in the presence of a bigeminy rhythm.

If the heart rate is extremely high (over 150bpm for adults and over 180bpm for pediatrics and neonates), QT will not be measured. When the heart rate changes, it can take several minutes for the QT interval to stabilize. For reliable QTc calculation it is important to avoid the region where the heart rate is changing.

8.8.2 Enabling QT/QTc Monitoring

The QT monitoring function is disabled by default.

To enable the QT function:
1. Select the ECG parameter window or waveform area to enter the [**ECG Setup**] menu.
2. Select the [**QT Analysis >>**] tab.
3. Set [**QT Analysis**] to [**On**].

8.8.3 Displaying QT Numerics and Segments

To display QT numerics and Segments:
4. Select [**Main Menu**]→[**Screen Setup >>**]→[**Screen Layout >>**].
5. Select the parameter area where you want to display the QT numerics, and then select [**QT**].

The following picture shows the QT parameter area.
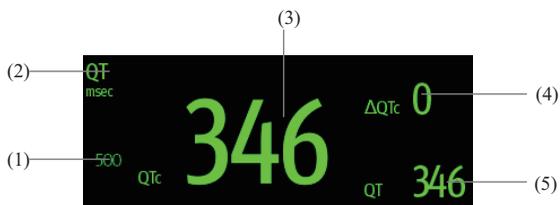
(1) QTc alarm limit (if QTc alarm is off, the alarm off symbol is displayed)
(2) Parameter label
(3) QTc value
(4) ΔQTc value (the difference between the current and baseline QTc values)
(5) QT value

NOTE

- **The display of the QT numeric area differs as related settings change.**

8.8.4 Saving the Current QTc as Reference

In order to quantify changes in the QTc value, you can set a QTc reference.

To set the current values as reference:
1. Select the ECG parameter window or waveform area to enter the [**ECG Setup**] menu.
2. Select the [**QT Analysis >>**] tab.
3. Select [**Save Ref.**]. This QTc will then be used to calculate ΔQTc.

8.8.5 Changing QT Settings

8.8.5.1 Setting QT Alarm Properties

To set QT alarm properties:
1. Select the ECG parameter window or waveform area to enter the [**ECG Setup**] menu.
2. Select the [**QT Analysis >>**] tab.
3. Set QTc and ΔQTc alarm properties.

8.8.5.2 Selecting Leads for QT Calculation

You can select one lead or all leads for QT calculation.

To select leads:
1. Select the ECG parameter window or waveform area to enter the [**ECG Setup**] menu.
2. Select the [**QT Analysis >>**] tab.
3. Set [**Analysis Lead**]. [**All**] is selected by default. This means all leads are used for QT calculation.

8.8.5.3 Selecting the QTc Formula

The monitor uses the Hodges correction formula by default to correct the QT interval for heart rate.

To select the QTc formula:
1. Select the ECG parameter window or waveform area to enter the [**ECG Setup**] menu.
2. Select the [**QT Analysis >>**] tab.
3. Set [**QTc Formula**].

◆ Hodges: $QTc = QT + 1.75 \times (HeartRate - 60)$

◆ Bazett: $QTc = QT \times \left(\dfrac{HeartRate}{60} \right)^{\frac{1}{2}}$

◆ Fridericia: $QTc = QT \times \left(\dfrac{HeartRate}{60} \right)^{\frac{1}{3}}$

◆ Framingham: $QTc = QT + 154 \times \left(1 - \dfrac{60}{HeartRate} \right)$

8.9 About HR Analysis

HR analysis provides the user a dynamic analysis of heart rate changes and distribution over the time scale. It allows you to know the patient's condition of the latest 24 hours before you entering the [**HR Analysis**] window.

To make HR analysis:

1. Select the ECG parameter window or waveform area to enter the [**ECG Setup**] menu.

2. Select the [**HR Analysis >>**] tab.

   ◆ Analysis area: The area provides information including time duration, average HR, daytime average HR, nighttime avearge HR, maximum HR, minimum HR and normal HR ratio. The normal HR range is set based on HR limits.

   ◆ [**Nighttime**]: Set the period for HR analysis at night time. The minimum period can be set to 30 minutes.

   ◆ [**Print**]: Select it to print out HR analysis report which includes patient information, information in the [**HR Analysis**] window and heart rate distribution chart.

You can also click anywhere in the [**HR Analysis**] window to enter the [**Review**] window. For details, refer to *18 Review*.

8.10 ECG Relearning

8.10.1 Initiating an ECG Relearning Manually

During ECG monitoring, you may need to initiate an ECG relearning when the patient's ECG template changes dramatically. A change in the ECG template could result in:

■ incorrect arrhythmia alarms

■ loss of ST measurement, and/or

■ inaccurate heart rate

ECG relearning allows the monitor to learn the new ECG template so as to correct arrhythmia alarms and HR value, and restore ST measurements. To initiate relearning manually, select the ECG parameter window or waveform area→[**Relearn**]. When the patient monitor is learning, the message [**ECG Learning**] is displayed in the technical alarm area.

⚠ CAUTION

● **Take care to initiate ECG relearning only during periods of normal rhythm and when the ECG signal is relatively noise-free. If ECG learning takes place during ventricular rhythm, the ectopics may be incorrectly learned as the normal QRS complex. This may result in missed detection of subsequent events of V-Tach and V-Fib.**

8.10.2 Automatic ECG Relearning

ECG relearning is initiated automatically whenever:

■ The ECG lead or lead label is changed

■ The ECG lead is re-connected

■ A new patient is admitted

■ After the calibration is completed, select [**Stop Calibrating ECG**]

■ A switch happens between the options of screen type during 5/12-lead ECG monitoring.

■ The paced status of the patient is changed.

8.11 12-Lead ECG Monitoring (for uMEC12/uMEC15)

8.11.1 Entering the 12-lead ECG Monitoring Screen

1. Refer to **8.3.3 ECG Lead Placements** to place the electrodes.

2. In the [**ECG Setup**] menu, select [**Others>>**] to enter the [**Other Setup Menu**].

3. Set [**Lead Set**] to [**12-Lead**], and set [**ECG Display**] to [**12-Lead**].
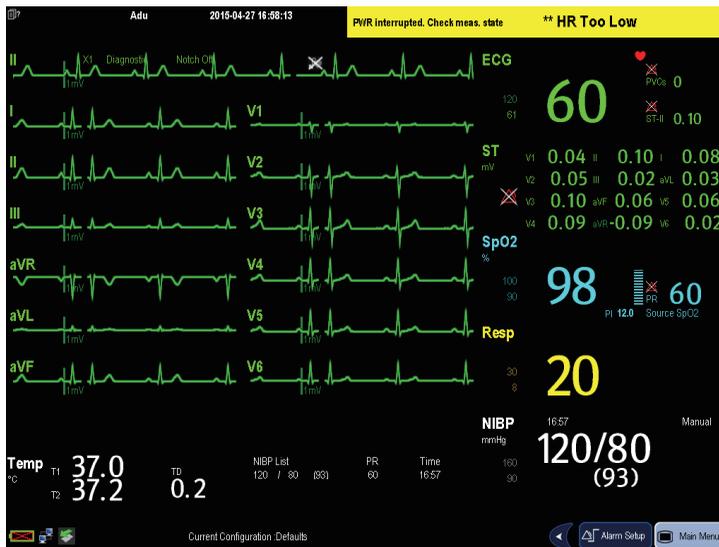
There are a total of 12 ECG waves and 1 rhythm wave displayed on the screen. The rhythm lead is consistent with what is set for ECG1 before entering the 12-lead ECG screen.

Additionally, the 12-lead ECG monitoring has the following features:

■ The [**Filter**] mode is automatically switched to [**Diagnostic**] when the patient monitor accesses the 12-lead full-screen; the [**Filter**] mode resumes to the configuration before accessing the 12-lead full screen when the patient monitor exits the 12-lead full screen.

■ In the adult mode, the ⊠ hardkey on the monitor's front is disabled.

8.11.2 Extending the Rhythm Lead Waveform Area

You can extend the height of rhythm lead waveform area. To do so,

1. In the [**ECG Setup**] menu, select [**Others>>**] to enter the [**Others Setup Menu**].

2. Set [**ECG Display Area**] to [**Extended**].

8.12 Troubleshooting

This section lists the problems that might occur. If you encounter the problems when using the equipment or accessories, check the table below before requesting for services. If the problem persists, contact your service personnel.

⚠ CAUTION

●   **Never try to disassemble the equipment or supplied accessories. There are no internal user-serviceable parts.**

Symptoms	Possible Cause	Correction Action
Noisy ECG traces	Loose or dry electrodes	Apply fresh and moist electrodes.
	Defective electrode wires	Replace wires if necessary.
	Patient cable or leads are routed too close to other electrical devices	Move the patient cable or leads away from the electrical device.
Excessive Electro-surgical Interference	Wrong ECG cable used	Use ESU-proof ECG cables. For details, refer to *26.1 ECG Accessories*.
Muscle Noise	Inadequate skin preparation prior to application of electrode, tremors, tense subject, and/or poor electrode placement	Repeat skin preparation as described in *8.3.1 Preparing the Patient and Placing the Electrodes* and re-place the electrodes. Apply fresh, moist electrodes. Avoid muscular areas.
Intermittent Signal	Connections not tight and/or properly secured	Check that the cables are properly connected.
	Electrodes dry or loose	Repeat skin preparation as described in *8.3.1 Preparing the Patient and Placing the Electrodes* and apply fresh and moist electrodes.
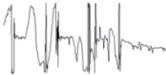
Symptoms	Possible Cause	Correction Action
	Cable or lead wires damaged	Change cable and lead wires.
Excessive alarms: heart rate, lead fault	Electrodes dry	Repeat skin preparation as described in *8.3.1 Preparing the Patient and Placing the Electrodes* and apply fresh, moist electrodes.
	Excessive patient movement or muscle tremor	Reposition the electrodes. Replace fresh and moist electrodes if necessary.
Low Amplitude ECG Signal	Gain set too low	Set the gain as required. For details, refer to *8.5.8 Changing ECG Wave Settings.*
	Electrodes dry / old	Apply fresh and moist electrodes.
	Skin improperly prepared	Repeat skin preparation as described in *8.3.1 Preparing the Patient and Placing the Electrodes*.
	This could be the patient's normal QRS complex	Verify with another well-functioning monitor.
	Electrode could be positioned over a bone or muscle mass	Move ECG patches away from the bone or muscle mass.
No ECG Waveform	Gain set too low	Set the gain as required. For details, refer to *8.5.8 Changing ECG Wave Settings.*
	Lead wires and patient cable not fully or properly inserted	Check that the leadwires and patient cables are properly connected.
	Cable or lead wires damaged	Change cable and lead wires.
Base Line Wander	Patient moving excessively	Secure leadwires and cable to patient.
	Electrodes dry or loose	Repeat skin preparation as described in *8.3.1 Preparing the Patient and Placing the Electrodes* and apply fresh and moist electrodes.
	ECG Filter set to ST or Diagnostic mode	Set ECG Filter to "Monitor" mode.
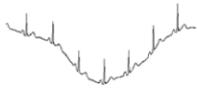
FOR YOUR NOTES

9 Monitoring Respiration (Resp)

9.1 Introduction

Impedance respiration is measured across the thorax. When the patient is breathing or ventilated, the volume of air changes in the lungs, resulting in impedance changes between the electrodes. Respiration rate (RR) is calculated from these impedance changes, and a respiration waveform appears on the patient monitor screen.

9.2 Safety Information

⚠ Warning

- **When monitoring the patient's respiration, do not use ESU-proof ECG cables.**
- **If you do not set the detection level for the respiration correctly in manual detection mode, it may not be possible for the monitor to detect apnea. If you set the detection level too low, the monitor is more likely to detect cardiac activity, and to falsely interpret cardiac activity as respiratory activity in the case of apnea.**
- **The respiration measurement does not recognize the cause of apneas. It only indicates an alarm if no breath is detected when a pre-adjusted time has elapsed since the last detected breath. Therefore, it cannot be used for diagnostic purpose.**
- **If operating under conditions according to the EMC Standard IEC 60601-1-2 (Radiated Immunity 3V/m), field strengths above 1V/m may cause erroneous measurements at various frequencies. Therefore it is recommended to avoid the use of electrically radiating equipment in close proximity to the respiration measurement unit.**

9.3 Understanding the Resp Display
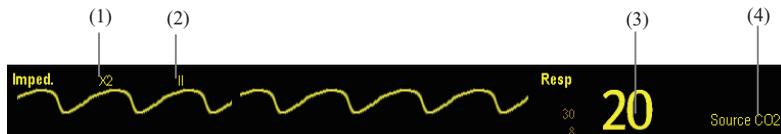
(1) Gain

(2) Resp lead label

(3) Respiration rate

(4) RR source

By selecting the waveform area or parameter area, you can enter the [**Resp Waveform**] menu. By selecting the Resp parameter window, you can enter the [**Resp Setup**] menu.

NOTE

- **Respiration monitoring is not for use on the patients who are very active, as this will cause false alarms.**

9.4 Placing Resp Electrodes

As the skin is a poor conductor of electricity, preparing the skin is necessary for a good Respiration signal. You can refer to *8 Monitoring ECG* for how to prepare the skin.

As the Respiration measurement adopts the standard ECG electrode placement, you can use different ECG cables (3-lead or 5-lead). Since the respiration signal is measured between two ECG electrodes, if a standard ECG electrode placement is applied, the two electrodes should be RA and LA of ECG Lead I, or RA and LL of ECG Lead II.

NOTE

- **To optimize the respiration waveform, place the RA and LA electrodes horizontally when monitoring respiration with ECG Lead I; place the RA and LL electrodes diagonally when monitoring respiration with ECG Lead II.**

Lead I   Lead II
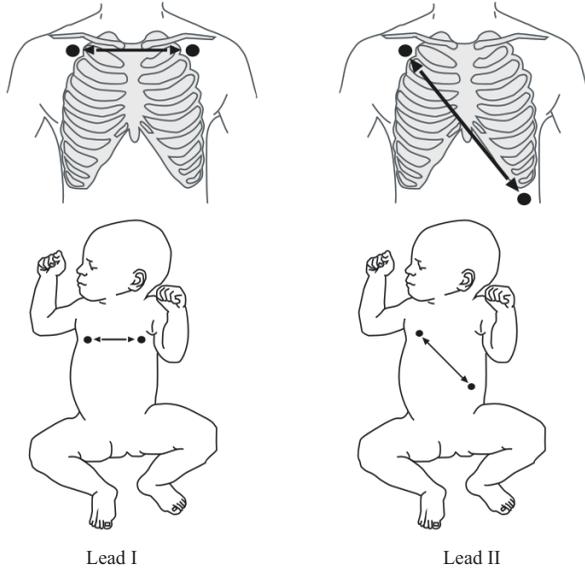
9.4.1 Optimizing Lead Placement for Resp

If you want to measure Resp and you are already measuring ECG, you may need to optimize the placement of the two electrodes between which Resp will be measured. Repositioning ECG electrodes from standard positions results in changes in the ECG waveform and may influence ST and arrhythmia interpretation.

9.4.2 Cardiac Overlay

Cardiac activity that affects the Resp waveform is called cardiac overlay. It happens when the Resp electrodes pick up impedance changes caused by the rhythmic blood flow. Correct electrodes placement can help to reduce cardiac overlay: avoid the liver area and the ventricles of the heart in the line between the respiratory electrodes. This is particularly important for neonates.

9.4.3 Abdominal Breathing

Some patients with restricted movement breathe mainly abdominally. In these cases, you may need to place the left leg electrode on the left abdomen at the point of maximum abdominal expansion to optimise the respiratory wave.

9.4.4 Lateral Chest Expansion

In clinical applications, some patients (especially neonates) expand their chests laterally, causing a negative intrathoracic pressure. In these cases, it is better to place the two respiration electrodes in the right midaxillary and the left lateral chest areas at the patient's maximum point of the breathing movement to optimise the respiratory waveform.

9.5 Choosing the Respiration Lead

In the [**Resp Setup**] menu, set [**Resp Lead**] to [**I**], [**II**] or [**Auto**].

9.6 Changing the Apnea Alarm Delay

The apnea alarm is a high-level alarm used to detect apneas. You can set the apnea alarm delay time after which the patient monitor alarms if the patient stops breathing. In the [**Resp Setup**] menu, select [**Apnea Delay**] and then select the appropriate setting. The [**Apnea Delay**] of Resp and CO_2, module keeps consistent with each other.

9.7 Changing Resp Detection Mode

In the [**Resp Setup**] menu, select [**Detection Mode**] and toggle between [**Auto**] and [**Manual**].

■ In auto detection mode, the patient monitor adjusts the detection level automatically, depending on the wave height and the presence of cardiac artifact. Note that in auto detection mode, the detection level (a dotted line) is not displayed on the waveform.

■ Use auto detection mode for situations where:

The respiration rate is not close to the heart rate.
Breathing is spontaneous, with or without continuous positive airway pressure (CPAP).
Patients are ventilated, except patients with intermittent mandatory ventilation (IMV).

■ In manual detection mode, you adjust the dotted detection level line to the desired level by selecting [**Upper Line**] or [**Lower Line**] and then selecting ▲ or ▼ beside them. Once set, the detection level will not adapt automatically to different respiration depths. It is important to remember that if the depth of breathing changes, you may need to change the detection level.

■ Use manual detection mode for situations where:

◆ The respiration rate and the heart rate are close.

◆ Patients have intermittent mandatory ventilation.

◆ Respiration is weak. Try repositioning the electrodes to improve the signal.

In Auto Detection Mode, if you are monitoring Resp and ECG is switched off, the monitor cannot compare the ECG and Resp rates to detect cardiac overlay. The respiration detection level is automatically set higher to prevent the detection of cardiac overlay as respiration.

In Manual Detection Mode, cardiac overlay can in certain situations trigger the respiration counter. This may lead to a false indication of a high respiration or an undetected apnea condition. If you suspect that cardiac overlay is being registered as breathing activity, raise the detection level above the zone of cardiac overlay. If the Resp wave is so small that raising the detection level is not possible, you may need to optimize the electrode placement as described in the section "Lateral Chest Expansion".

9.8 Changing Resp Wave Settings

⚠WARNING

- **When monitoring in manual detection mode, make sure to check the respiration detection level after you have increased or decreased the size of the respiration wave.**

- In the [**Resp Setup**] menu, you can:
- Select [**Gain**] and then select an appropriate setting. The bigger the gain is, the larger the wave amplitude is.
- Select [**Sweep**] and then select an appropriate setting. The faster the wave sweeps, the wider the wave is.

9.9 Setting RR Source

To set RR source:

1. Enter the [**Resp Setup**] menu.
2. Select [**RR Source**] and then select a source or [**Auto**] from the dropdown list.

The dropdown list displays the currently available RR source. When you select [**Auto**], the system will automatically select the RR source according to the priority. When the current RR source does not have valid measurement, the system will automatically switch the [**RR Source**] to [**Auto**]. RR source switches back to the valid source if you press the ⚐ hardkey on the monitor's front during an apnea alarm.

The priority of RR source is (from high to low): CO_2 measurement and impedance respiration measurement.

The [**RR Source**] settings of Resp and CO_2 are linked.

The RR source options and description are shown in the table below.

Option	Description
Auto	RR source is automatically selected according to the priority.
CO_2	RR source is from CO_2 measurement.
ECG	RR source is from impedance respiration measurement.

9.10 Setting Alarm Properties

Select [**Alarm Setup >>**] from the [**Resp Setup**] menu. In the popup menu, you can set alarm properties for this parameter.

9.11 Switching Resp Measurement On/Off

To switch Resp measurement on, select [**Imped. Resp Measure. ON**] from the [**Resp Setup**] menu. To switch Resp measurement off, select [**Imped. Resp Measure. OFF**] from the [**Resp Setup**] menu and then select [**Yes**] from the popup dialog box. Then, a line is displayed in the waveform area and no numeric but [**Measurement OFF**] message is displayed in the parameter area.

10 Monitoring PR

10.1 Introduction

The pulse numeric counts the arterial pulsations that result from the mechanical activity of the heart. You can display a pulse from any measured SpO_2 or any arterial pressure (see the IBP section). The displayed pulse numeric is color-coded to match its source.

(1) PR Source

(2) PR: detected beats per minute.

10.2 Setting the PR Source

The current pulse source is displayed in the PR parameter area. The pulse rate chosen as pulse source:

■ is monitored as system pulse and generates alarms when you select PR as the active alarm source;

■ is stored in the monitor's database and reviewed in the graphic/tabular trends; in trend graphs, as the PR curve is in the same color with the PR source , it is unlikely to distinguish the PR source ;

■ is sent via the network to the central monitoring system, if available.

To set which pulse rate as PR source:

1. Enter the [**SpO₂ Setup**] menu.

2. Select [**PR Source**] and then select a label or [**Auto**] from the popup menu.

The popup menu displays the currently available PR sources from top to bottom by priority. When you select [**Auto**], the system will automatically select the first option as the PR source from the popup menu. When the current PR source is unavailable, the system will automatically switch [**PR Source**] to [**Auto**]. When you select [**IBP**], the system will automatically select the first pressure label as the PR source from the popup menu.

10.3 Selecting the Active Alarm Source

In most cases the HR and pulse numerics are identical. In order to avoid simultaneous alarms on HR and Pulse, the monitor uses either HR or Pulse as its active alarm source. To change the alarm source, select [**Alm Source**] in the [**ECG Setup**] or [**SpO$_2$ Setup**] menu and then select either:

■ [**HR**]: The monitor will use the HR as the alarm source for HR/pulse.

■ [**PR**]: The monitor will use the PR as the alarm source for HR/pulse.

■ [**Auto**]: If the [**Alm Source**] is set to [**Auto**], the monitor will use the heart rate from the ECG measurement as the alarm source whenever the ECG measurement is switched on and a valid heart rate is available. If the heart rate becomes unavailable, for example if leads becomes disconnected, and a pulse source is switch on and available, the monitor will automatically switch to Pulse as the alarm source. When the Leads Off condition is corrected, the monitor will automatically switch back to the heart rate as the alarm source.

10.4 QRS Tone

When PR is used as the alarm source, the PR source will be used as a source for the QRS tone. You can change the QRS volume by adjusting [**Beat Vol**] in the [**SpO$_2$ Setup**] menu. When a valid SpO$_2$ value exists, the system will adjust the pitch tone of QRS volume according to the SpO$_2$ value.

11 Monitoring SpO$_2$

11.1 Introduction

SpO$_2$ monitoring is a non-invasive technique used to measure the amount of oxygenated haemoglobin and pulse rate by measuring the absorption of selected wavelengths of light. The light generated in the probe passes through the tissue and is converted into electrical signals by the photodetector in the probe. The SpO$_2$ module processes the electrical signal and displays a waveform and digital values for SpO$_2$ and pulse rate.

This device is calibrated to display functional oxygen saturation. It provides four measurements:
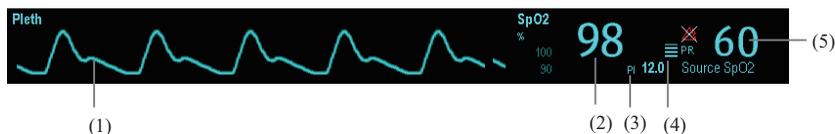
(1)   Pleth waveform (Pleth): visual indication of patient's pulse. The waveform is not normalized.

(2)   Oxygen saturation of arterial blood (SpO$_2$): percentage of oxygenated hemoglobin in relation to the sum of oxyhemoglobin and deoxyhemoglobin.

(3)   Perfusion index (PI): gives the numerical value for the pulsatile portion of the measured signal caused by arterial pulsation. PI is an indicator of the pulsatile strength. You can also use it to assess the quality of SpO$_2$ measurement.

◆   Above 1 is optimal,

◆   Between 0.3 and 1 is acceptable.

◆   Below 0.3 indicates low perfusion; When PI is below 0.3, a question mark (?) is displayed to the right of the SpO$_2$ value, indicating that the SpO$_2$ value may be inaccurate. Reposition the SpO$_2$ sensor or find a better site. If low perfusion persists, choose another method to measure oxygen saturation if possible.

PI value can be displayed under the PR value in larger characters if [PI Zoom] is enabled.

(4)   Perfusion indicator: the pulsatile portion of the measured signal caused by arterial pulsation.

(5)   Pulse rate (derived from pleth wave): detected pulsations per minute.

- A functional tester or SpO$_2$ simulator cannot be used to assess the accuracy of a SpO$_2$ module or a SpO$_2$ sensor.
- A functional tester or SpO$_2$ simulator can be used to determine the pulse rate accuracy.

11.2 Safety

⚠ WARNING

- Use only SpO$_2$ sensors specified in this manual. Follow the SpO$_2$ sensor's instructions for use and adhere to all warnings and cautions.
- When a trend toward patient deoxygenation is indicated, blood samples should be analyzed by a laboratory co-oximeter to completely understand the patient's condition.
- Do not use SpO$_2$ sensors during magnetic resonance imaging (MRI). Induced current could potentially cause burns. The sensor may affect the MRI image, and the MRI unit may affect the accuracy of the oximetry measurements.
- Prolonged continuous monitoring may increase the risk of undesirable changes in skin characteristics, such as irritation, reddening, blistering or burns. Inspect the sensor site every two hours and move the sensor if the skin quality changes. Change the application site every four hours. For neonates, or patients with poor peripheral blood circulation or sensitive skin, inspect the sensor site more frequently.

11.3 Applying the Sensor

1. Select an appropriate sensor according to the module type, patient category and weight.
2. Remove colored nail polish from the application site.
3. Apply the sensor to the patient.
4. Select an appropriate adapter cable according to the connector type and plug this cable into the SpO$_2$ connector.
5. Connect the sensor cable to the adapter cable.

⚠ WARNING

- **If the sensor is too tight because the application site is too large or becomes too large due to edema, excessive pressure for prolonged periods may result in venous congestion distal from the application site, leading to interstitial edema and tissue ischemia.**

11.4 Changing SpO$_2$ Settings

11.4.1 Accessing SpO$_2$ Menus

By selecting the SpO$_2$ parameter window or waveform area, you can access the [**SpO$_2$ Setup**] menu.

11.4.2 Adjusting the Desat Alarm

The desat alarm is a high level alarm notifying you of potentially life threatening drops in oxygen saturation. Select [**Alarm Setup >>**] from the [**SpO$_2$ Setup**] menu. From the popup menu, you can set low alarm limit, alarm switch, and alarm recording for [**Desat**]. When the SpO$_2$ value is below the desat alarm limit and desat alarm switch is set on, the message [**SpO$_2$ Desat**] is displayed.

11.4.3 Changing Averaging Time

The SpO$_2$ value displayed on the monitor screen is the average of data collected within a specific time. The shorter the averaging time is, the quicker the patient monitor responds to changes in the patient's oxygen saturation level. Contrarily, the longer the averaging time is, the slower the patient monitor responds to changes in the patient's oxygen saturation level, but the measurement accuracy will be improved. For critically ill patients, selecting shorter averaging time will help understanding the patient's state.

To set the averaging time:

6. Enter the [**SpO$_2$ Setup**] menu.
7. Select [**Sensitivity**] and then toggle between [**High**], [**Med**] and [**Low**], which respectively correspond to 7 s, 9 s and 11 s.

11.4.4 Monitoring SpO$_2$ and NIBP Simultaneously

When monitoring SpO$_2$ and NIBP on the same limb simultaneously, you can switch [**NIBP Simul**] on in the [**SpO$_2$ Setup**] menu to lock the SpO$_2$ alarm status until the NIBP measurement ends. If you switch [**NIBP Simul**] off, low perfusion caused by NIBP measurement may lead to inaccurate SpO$_2$ readings and therefore cause false physiological alarms.

11.4.5 Changing the Speed of the Pleth Wave

In the [**SpO$_2$ Setup**] menu, select [**Sweep**] and then select the appropriate setting. The faster the waveform sweeps, the wider the waveform is.

11.4.6 Zooming PI Value

For Mindray SpO2 module, you can display PI value in larger characters for better view. To zoom in the display of PI value, set [**PI Zoom**] to [**Yes**] from the [**SpO2 Setup**] menu.

11.4.7 Setting the Alarm Level for SpO$_2$ Sensor Off Alarm

Select [**Alarm Setup >>**] from the [**User Maintenance**] menu. You can set the [**SpO2SensorOff Lev.**] in the popup menu.

11.4.8 Setting the SpO$_2$ Tone Mode

Select [**Others >>**] from the [**User Maintenance**] menu. In the popup menu, you can set [**SpO$_2$ Tone**] as [**Mode 1**] or [**Mode 2**].

⚠ WARNING

- **The same SpO$_2$ tone mode shall be used for the same patient monitors in a single area.**

11.5 Measurement Limitations

If you doubt the measured SpO_2, check patient vital signs first. Then check the patient monitor and SpO_2 sensor. The following factors may influence the accuracy of measurement:

- Ambient light

- Physical movement (patient and imposed motion)

- Diagnostic testing

- Low perfusion

- Electromagnetic interference, such as MRI environment

- Electrosurgical units

- Dysfunctional haemoglobin, such as carboxyhemoglobin (COHb)and methemoglobin (MetHb)

- Presence of certain dyes, such as methylene and indigo carmine

- Inappropriate positioning of the SpO_2 sensor, or use of incorrect SpO_2 sensor

- Drop of arterial blood flow to immeaurable level caused by shock, anemia, low temperature or vasoconstrictor.

11.6 Troubleshooting

This section lists the problems that might occur. If you encounter the problems when using the equipment or accessories, check the table below before requesting for services. If the problem persists, contact your service personnel.

CAUTION

- **Never try to disassemble the equipment or supplied accessories. There are no internal user-serviceable parts.**

Symptoms	Possible Cause	Correction Action
Dashes "- -" display in place of numerics.	Measurement is invalid.	Check that the sensor is properly applied. Change the application site if necessary.
Do not see SpO$_2$ parameter tiles in display.	Parameter not configured to display.	Switch the SpO$_2$ monitoring function on as described in *3.10.1 Switching the Parameters On/Off*.
Unable to obtain SpO$_2$ reading	Patient has poor perfusion	Switch limbs/notify physician
	Sensor not on patient	Check if the "SPO2 Sensor Off" alarm is reported. If so, reapply the sensor. If not, contact the service personnel.
	Cables loose/not connected	Check connections, switch cable
	Ambient light	Check if the "SpO2 Too Much Light" alarm is reported. If so, move the sensor to a place with lower level of ambient light or cover the sensor to minimize the ambient light.
No SpO2 waveform	Waveform not selected to display	Switch the SpO$_2$ monitoring function on as described in *3.10.1 Switching the Parameters On/Off*.
	Cable or sensor not plugged in	Check that the cable is properly connected and sensor securely applied.
Low amplitude SpO$_2$ signal	SpO$_2$ sensor on same limb as cuff	Check that the sensor is properly applied. Change the application site if necessary.
	Patient has poor perfusion	Change the application site.

12 Monitoring NIBP

12.1 Introduction

The patient monitor uses the oscillometric method for measuring the non-invasive blood pressure (NIBP). This measurement can be used for adults, pediatrics and neonates.

Automatic non-invasive blood pressure monitoring uses the oscillometric method of measurement. To understand how this method works, we'll compare it to the auscultative method. With auscultation, the clinician listens to the blood pressure and determines the systolic and diastolic pressures. The mean pressure can then be calculated with reference to these pressures as long as the arterial pressure curve is normal.

Since the monitor cannot hear the blood pressure, it measures cuff pressure oscillation amplitudes. Oscillations are caused by blood pressure pulses against the cuff. The oscillation with the greatest amplitude is the mean pressure. This is the most accurate parameter measured by the oscillometric method. Once the mean pressure is determined, the systolic and diastolic pressures are calculated with reference to the mean.

Simply stated, auscultation measures systolic and diastolic pressures and the mean pressure is calculated. The oscillometric method measures the mean pressure and determines the systolic and diastolic pressures.

As specified by IEC 60601-2-30, NIBP measurement can be performed during electro-surgery and discharge of defibrillator.

NIBP diagnostic significance must be decided by the doctor who performs the measurement.

NOTE

- **Blood pressure measurements determined with this device are equivalent to those obtained by a trained observer using the cuff/stethoscope auscultatory method or an intra-arterial blood pressure measurement device, within the limits prescribed by the American National Standard, Manual, electronic, or automated sphygmomanometers.**

12.2 Safety

⚠ WARNING

- **Be sure to select the correct patient category setting for your patient before measurement. Do not apply the higher adult settings for pediatric or neonatal patients. Otherwise it may present a safety hazard.**

- **Do not measure NIBP on patients with sickle-cell disease or any condition where skin damage has occurred or is expected.**

- **Use clinical judgement to determine whether to perform frequent unattended blood pressure measurements on patients with severe blood clotting disorders because of the risk of hematoma in the limb fitted with the cuff.**

- **Do not use the NIBP cuff on a limb with an intravenous infusion or arterial catheter in place. This could cause tissue damage around the catheter when the infusion is slowed or blocked during cuff inflation.**

- **Do not use the NIBP cuff on the arm on the side of a mastectomy.**

- **NIBP reading can be affected by the measurement site, the position of the PATIENT, exercise, or the patient's physiologic condition. If you doubt the NIBP measurements, determine the patient's vital signs by alternative means and then verify that the monitor is working correctly.**

- **Continuous CUFF pressure due to connection tubing kinking may cause blood flow interference and resulting harmful injury to the patient.**

12.3 Measurement Limitations

Measurements are impossible with heart rate extremes of less than 40bpm or greater than 240bpm, or if the patient is on a heart-lung machine.

The measurement may be inaccurate or impossible:

- If a regular arterial pressure pulse is hard to detect

- With excessive and continuous patient movement such as shivering or convulsions

- With cardiac arrhythmias

- Rapid blood pressure changes

- Severe shock or hypothermia that reduces blood flow to the peripheries

- Obesity, where a thick layer of fat surrounding a limb dampens the oscillations coming from the artery

12.4 Measurement Methods

There are three methods of measuring NIBP:

- Manual: measurement on demand.
- Auto: continually repeated measurements at set intervals.
- STAT: continually rapid series of measurements over a five minute period, then return to the previous mode.

12.5 Setting Up the NIBP Measurement

12.5.1 Preparing the Patient

In normal use, perform NIBP measurement on a patient who is in the following position:

- Comfortably seated
- Legs uncrossed
- Feet flat on the floor
- Back and arm supported
- Middle of the cuff at the level of the right atrium of the heart

NOTE

- **It is recommended that the patient relaxes as much as possible before performing measurement and that the patient does not talk during NIBP measurement.**
- **It is recommended that 5 min should elapse before the first reading is taken**
- **The operator should not touch the cuff or tubing during NIBP measurement.**

12.5.2 Preparing to Measure NIBP

1. Power on the monitor.
2. Verify that the patient category is correct. If not, select the [**Patient Setup**] QuickKey →[**Patient Demographics**]→[**Patient Cat.**] and set the patient category to [**Adu**], [**Ped**] or [**Neo**].
3. Plug the air tubing into the NIBP connector on the patient monitor.
4. Select a correct sized cuff and then apply it as follows:

◆ Determine the patient's limb circumference.

◆ Select an appropriate cuff by referring to the limb circumference marked on the cuff. The width of the cuff should be 40% (50% for neonates) of the limb circumference, or 2/3 of the upper arm's length. The inflatable part of the cuff should be long enough to encircle at least 50% to 80% of the limb.

◆ Apply the cuff to an upper arm or leg of the patient and make sure the Φ marking on the cuff matches the artery location. Do not wrap the cuff too tightly around the limb. It may cause discoloration, and ischemia of the extremities. Make sure that the cuff edge falls within the marked range. If it does not, use a larger or smaller cuff that will fit better.

5. Connect the cuff to the air tubing and make sure that the air tubing is not compressed or twisted. Air must pass unrestricted through the tubing.

NOTE

● **The use of the equipment is restricted to one patient at a time.**

12.5.3 Starting and Stopping Measurements

Select the [**NIBP Measure**] QuickKey and you can start the desired measurement from the popup menu. You can select [**Stop All**] QuickKey to stop all NIBP measurements. You can also start and stop measurements by using the 🖐 hardkey on the monitor's front panel.

12.5.4 Correcting the Measurement if Limb is not at Heart

Level

The cuff should be applied to a limb at the same level as the patient's heart. If the limb is not at the heart level, to the displayed value:

■ Add 0.75 mmHg (0.10 kPa) for each centimetre higher, or

■ Deduct 0.75 mmHg (0.10 kPa) for each centimeter lower.

12.5.5 Enabling NIBP Auto Cycling and Setting the Interval

1. Select the NIBP parameter window to enter the [**NIBP Setup**] menu.

2. Select [**Interval**] and then select a desired time interval. Selecting [**Manual**] switches to manual mode.

3. Start a measurement manually. The monitor will then automatically repeat NIBP measurements at the set time interval.

Or

1. Select [**NIBP Measure**] QuickKey .

2. Select a proper interval.

3. Start a measurement manually. The monitor will then automatically repeat NIBP measurements at the set time interval.

In auto mode, you can enable the clock function to synchronize the NIBP automatic measurements with the real time clock.

For example, when the clock is enabled, if interval is [**20min**], and then you start NIBP auto measurement at 14: 03, the next measurement will be taken at 14: 20, and the following measurement time will be 14: 40, 15: 00, and so on.

To enable the clock, in the [**NIBP Setup**] menu, set [**Clock**] to [**On**].

NOTE

- **The clock function is available only when the auto measurement internal is 5 minutes or more.**

12.5.6 Starting a STAT Measurement

1. Select the NIBP parameter window to enter the [**NIBP Setup**] menu.

2. Select [**NIBP STAT**].

Or

1. Select [**NIBP Measure**] QuickKey .

2. Select [**STAT**].

The STAT mode initiates 5 minutes of continuous, sequential, automatic NIBP measurements.

⚠️WARNING

- **Continuous non-invasive blood pressure measurements may cause purpura, ischemia and neuropathy in the limb with the cuff. Inspect the application site regularly to ensure skin quality and inspect the extremity of the cuffed limb for normal color, warmth and sensitivity. If any abnormity occurs, move the cuff to another site or stop the blood pressure measurements immediately.**

12.6 Understanding the NIBP Numerics

The NIBP display shows numerics only as below. Your display may be configured to look slightly different.
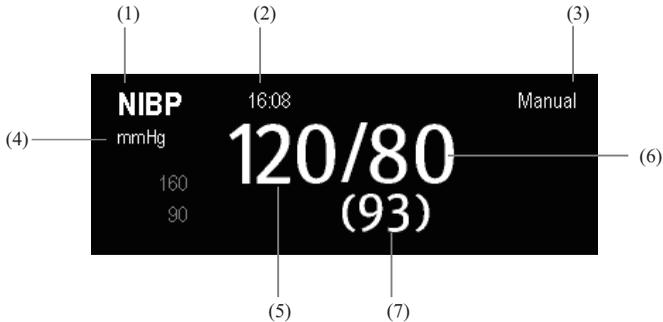
(1)   Time of last measurement

(2)   Time remaining to next measurement

(3)   Measurement mode

(4)   Unit of pressure: mmHg or kPa

(5)   Systolic pressure

(6)   Diastolic pressure

(7)   Mean pressure obtained after the measurement and cuff pressure obtained during the measurement

If the NIBP measurement exceeds the measurement range, "---" will be displayed.

12.7 Making NIBP Analysis

NIBP analysis provides the user a dynamic analysis of NIBP changes and distribution over the time scale. It allows you to know the patient's condition of the latest 24 hours before you entering the [**NIBP Analysis**] window.

To make NIBP analysis:

1.   Select the ECG parameter window or waveform area to enter the [**ECG Setup**] menu.

2.   Select the [**NIBP Analysis >>**] tab.

◆   Analysis area: The area provides information including time duration, average NIBP, daytime average NIBP, nighttime average NIBP, maximum NIBP, daytime maximum NIBP, nighttime maximum NIBP, minimum NIBP, daytime minimum NIBP, night time minimum NIBP and normal NIBP ratio. The normal NIBP range is set based on NIBP limits.

◆   [**Nighttime**]: Set the period for NIBP analysis at night time. The minimum period can be set to 30 minutes.

◆   [**Print**]: Select it to print out the NIBP analysis report.

You can also click anywhere in the [**NIBP Analysis**] window to enter the [**Review**] window. For details, refer to *18 Review*.

12.8 Changing NIBP Settings

By selecting the NIBP parameter window, you can enter the [**NIBP Setup**] menu.

12.8.1 Setting the Initial Cuff Inflation Pressure

You can set the initial cuff inflation pressure manually. In the [**NIBP Setup**] menu, select [**Initial Pressure**] and then select the appropriate setting.

NOTE

●   **For known hypertensive patients, you need to set initial cuff pressure to a higher value to reduce the measurement time.**

12.8.2 Setting NIBP Alarm Properties

Select [**Alarm Setup >>**] from the [**NIBP Setup**] menu. You can set the alarm properties for this parameter in the popup menu.

12.8.3 Displaying NIBP List

Select [**Screens**] QuickKey→[**Screen Setup**]. You can set [**NIBP List**] to be displayed at the bottom area of the screen. Then, multiple sets of most recent NIBP measurements will be displayed. And PR displayed is derived from NIBP.

You can not display NIBP list in some screens such as the big numerics screen.

12.8.4 Setting the Pressure Unit

Select [**Unit Setup >>**] from the [**User Maintenance**] menu. In the popup menu, select [**Press. Unit**] and toggle between [**mmHg**] and [**kPa**].

12.8.5 Switching On NIBP End Tone

The monitor can issue a reminder tone at the completion of NIBP measurement. The NIBP End Tone is off by default. You can switch it on by accessing the [**NIBP Setup**] menu.

13 Monitoring Temp

13.1 Introduction

The equipment is used to monitor skin temperature and core temperature. You can simultaneously monitor two temperature sites using the uMEC12/uMEC15.

13.2 Safety

⚠ WARNING

- **Verify that the probe detection program works correctly before monitoring. Plug out the temperature probe cable from the T1 or T2 connector, and the monitor can display the message [**T1 Sensor Off**] or [T2 Sensor Off] and give alarm tones correctly.**

13.3 Making a Temp Measurement

1. Select an appropriate probe for your patient according to the patient type and measuring site.
2. If you are using a disposable probe, connect the probe to the temperature cable.
3. Plug the probe or temperature cable to the temperature connector.
4. Attach the probe to the patient correctly.
5. Check that the alarm settings are appropriate for this patient.

13.4 Understanding the Temp Display

The temperature monitoring is displayed on the monitor as three numerics: T1, T2 and TD.
By selecting this area, you can enter the [**Alarm Setup**] menu.

13.5 Setting the Temperature Unit

Select [**Unit Setup >>**] from the [**User Maintenance**] menu. In the popup menu, select
[**Temp Unit**] and toggle between [**ºC**] and [**ºF**]

14 Monitoring IBP
(for uMEC12/uMEC15)

14.1 Introduction

The monitor can monitor up to 2 invasive blood pressures and displays the systolic, diastolic and mean pressures and a waveform for each pressure.

14.2 Safety

⚠ WARNING

- **Use only pressure transducers specified in this manual. Never reuse disposable pressure transducers.**

- **Make sure that the applied parts never contact other conductive parts.**

- **To reduce the hazard of burns during high-frequency surgical procedure, ensure that the monitor's cables and transducers never come into contact with the high-frequency surgical units.**

- **When using accessories, their operating temperature should be taken into consideration. For details, refer to instructions for use of accessories.**

- **The neutral electrode of the electro-surgery unit (ESU) shall properly contact the patient. Otherwise, burns may result.**

14.3 Zeroing the Transducer

To avoid inaccurate pressure readings, the monitor requires a valid zero. Zero the transducer in accordance with your hospital policy (at least once per day). Zero whenever:

■ A new transducer or adapter cable is used.

■ You reconnect the transducer cable to the monitor.

■ The monitor restarts.

■ You doubt the readings.

1. Turn off the stopcock to the patient.
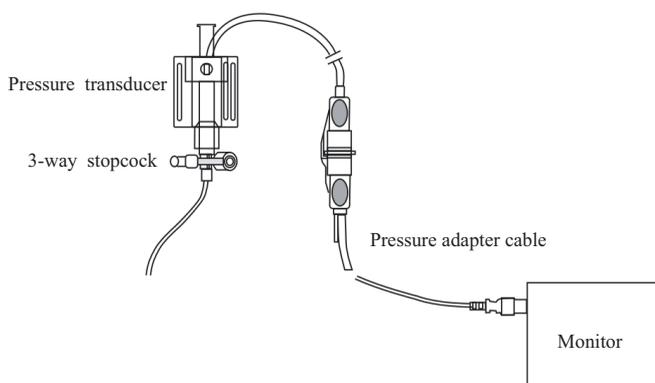
2. Vent the transducer to the atmospheric pressure by turning on the stopcock to the air.

3. In the setup menu for the pressure (e.g. Art), select [**Art Zero >>**]→[**Zero**]. During zero calibration, the [**Zero**] button appears dimmed. It recovers after the zero calibration is completed. To zero all IBP channels, select [**Zero IBP**] QuickKey, and then select [**Zero All Channels**] in the popup menu.

4. After the zero calibration is completed, close the stopcock to the air and open the stopcock to the patient.

NOTE

● **Your hospital policy may recommend that the ICP transducer is zeroed less frequently than other transducers.**

14.4 Setting Up the Pressure Measurement

1. Plug the pressure cable into the IBP connector.

2. Prepare the flush solution.

3. Flush the system to exhaust all air from the tubing. Ensure that the transducer and stopcocks are free of air bubbles.

⚠ WARNING

- **If air bubbles appear in the tubing system, flush the system with the infusion solution again. Air bubble may lead to wrong pressure reading.**

---

4. Connect the pressure line to the patient catheter.

5. Position the transducer so that it is level with the heart, approximately at the level of the midaxillary line.

6. Select the appropriate label.

7. Zero the transducer. After a successful zeroing, turn off the stopcock to the atmosphere and turn on the stopcock to the patient.
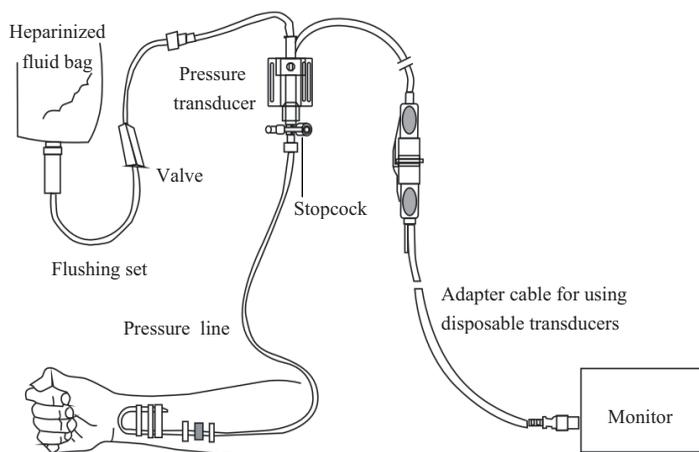
⚠ WARNING

- **If measuring intracranial pressure (ICP) with a sitting patient, level the transducer with the top of the patient's ear. Incorrect leveling may give incorrect values.**

14.5 Understanding the IBP Display

The IBP measurement is displayed on the monitor as a waveform and numeric pressures. The figure below shows the waveform and numerics for the Art pressure. For different pressures, this display may be slightly different.

(1)   (2)   (3)   (4)   (5)

(1) Waveform

(2) Pressure unit

(3) Systolic pressure

(4) Diastolic pressure

(5) Mean pressure

For some pressures, the parameter window may show the mean pressure only. For different pressures, their defaults unit may be different. If the Art and ICP pressures are measured simultaneously, the ICP parameter area will display numeric CPP, which is obtained by subtracting ICP from the Art mean.

14.6 Changing IBP Settings

14.6.1 Changing a Pressure for Monitoring

1. Select the pressure you want to change to enter its setup menu. In the menu, there is a figure showing the current IBP measurement connector.

2. Select [**Label**] and then select your desired label from the list. The already displayed labels cannot be selected.

Label	Description	Label	Description
PA	Pulmonary artery pressure	CVP	Central venous pressure
Ao	Aortic pressure	LAP	Left atrial pressure
UAP	Umbilical arterial pressure	RAP	Right atrial pressure
BAP	Brachial arterial pressure	ICP	Intracranial pressure
FAP	Femoral arterial pressure	UVP	Umbilical venous pressure
Art	Arterial blood pressure	LV	Left ventricular pressure
P1 to P4	Non-specific pressure label		

NOTE

- **When two pressures are deteted having the same label, the patient monitor changes one pressure label to a currently unused one.**

14.6.2 Setting the Pressure Label Order

Select [**IBP Label Order Setup >>**] from the parameter setup menu to set the display order of the pressure labels. The default display order is: Art, pArt, CVP, pCVP, ICP, PA, Ao, UAP, FAP, BAP, LV, LAP, RAP, UVP, P1, P2, P3, P4. To restore the default setting, you can select [**Defaults**] from the [**IBP Label Order Setup**] window

14.6.3 Setting Alarm Properties

Select [**Alarm Setup >>**] from the parameter setup menu. You can set alarm properties for this parameter in the popup menu.

14.6.4 Changing Averaging Time

The IBP value displayed on the monitor screen is the average of data collected within a specific time. The shorter the averaging time is, the quicker the patient monitor responds to changes in the patient's blood pressure. Contrarily, the longer the averaging time is, the slower the patient monitor responds to changes in the patient's blood pressure, but the measurement accuracy will be improved. For critically ill patients, selecting shorter averaging time will help understanding the patient's state.

To set the averaging time, in the parameter setup menu, select [**Sensitivity**] and toggle between [**High**], [**Med**] and [**Low**], the corresponding averaging time is about 1 s, 8 s and 12 s respectively.

14.6.5 Setting Up the IBP Wave

In the setup menu for the pressure, you can:

- Select [**Sweep**] and then select the appropriate setting. The faster the wave sweeps, the wider the wave is.

- Select [**Scale**] and then select the appropriate setting. If [**Auto**] is selected, the size of the pressure's waveform will be adjusted automatically.

- Select [**Filter**] and then select the desired option.

14.6.6 Setting the Pressure Unit

Select [**Unit Setup >>**] from the [**User Maintenance**] menu. In the popup menu, select [**Press. Unit**] and toggle between [**mmHg**] and [**kPa**]. Select [**CVP Unit**] and toggle between [**mmHg**], [**cmH₂O**] and [**kPa**].

14.7 Troubleshooting

This section lists the problems that might occur. If you encounter the problems when using the equipment or accessories, check the table below before requesting for services. If the problem persists, contact your service personnel.

⚠ CAUTION

- **Never try to disassemble the equipment or supplied accessories. There are no internal user-serviceable parts.**

Symptoms	Possible Cause	Correction Action
Damped invasive waveform	Air bubbles in tubing	Eliminate air from tubing as described in *14.4 Setting Up the Pressure Measurement*.
	Kinked catheter	Change the position of catheter.
	Blood in tubing	Pressurize the solution bag to 300 mmHg. For details, refer to the instructions for use of the solution bag.
IBP not displayed/no IBP waveform	Improper setup	Check display setup in monitor setup.
	Cable not plugged in	Check that the cables are properly connected.
	Transducer not connected.	Check that the transducer is properly connected.
	Stopcock turned improperly.	Check that the stopcock is turned to the correct position.
	Transducer not zeroed	Check and zero the transducer as described in *14.3 Zeroing the Transducer.*
Dashes "- -" display in place of numerics.	The measured result is invalid or out of range. IBP might be set to non-pulsatile labels like CVP, LA, RA, and ICP.	Change to a pulsatile label.

Symptoms	Possible Cause	Correction Action
Abnormally high or low readings	Transducer too High or too Low.	Adjust the position of the transducer and make sure that it is level with the heart, approximately at the level of the midaxillary line. Zero the transducer as described in *14.3 Zeroing the Transducer.*
Unable to Zero	Stopcock not open to atmosphere.	Check the transducer and make sure the stopcock is turned to the air.

15 Monitoring Cardiac Output (for uMEC12/uMEC15)

15.1 Introduction

The cardiac output (C.O.) measurement invasively measures cardiac output and other hemodynamic parameters using the right heart (atria) thermodilution method. A cold solution of known volume and temperature is injected into the right atrium through the proximal port of a pulmonary artery (PA) catheter. The cold solution mixes with the blood in the right ventricle and the change in blood temperature is measured with a thermistor at the distal end of the catheter in the pulmonary artery. The temperature change is displayed as a curve in the C.O. split screen, and the monitor calculates the C.O. value from this curve. The C.O. value is inversely proportional to the area under the curve. As cardiac output varies continuously, a series of measurements must be carried out to achieve a reliable C.O. average value. Always use the average of multiple thermodilution measurements for therapy decisions. The monitor is capable of storing 6 measurements.

⚠ WARNING

● **C.O. monitoring is restricted to adult patients only.**

15.2 Understanding the C.O. Display

The C.O. measurement is displayed on the monitor as numeric C.O., C.I. and TB in the C.O. parameter window as shown below. To enter the [**C.O. Setup**] menu, select the C.O. parameter window.

(1) Cardiac output

(2) Time at which the C.O. average is calculated

(3) Cardiac index

(4) Blood temperature

15.3 Influencing Factors

The factors that affect cardiac output are:

- temperature of injectate solution,

- volume of injectate solution,

- patient's baseline blood temperature,

- patient's inspiratory/expiratory cycle,

- placement of catheter with relation to proximity of lung field,

- the catheter itself,

- the patient rhythm and hemodynamic status, and

- any other rapid IV solutions which are infused while the C.O. measurement is being performed.

Followings are some technique suggestions to obtain accurate C.O.:

- Injectate solution must be cooler than the patient's blood.

- Inject solution rapidly and smoothly.

- Inject at end expiration.

15.4 Setting Up the C.O. Measurement

⚠️**WARNING**

- **Use only accessories specified in this manual. Make sure that the accessories never come into contact with conductive parts.**
---

1. Connect the C.O. cable to the C.O. connector on the monitor.

2. Interconnect the patient monitor, catheter and syringe as shown below. Make sure that:

   ◆ The PA catheter is in place in the patient.

   ◆ The C.O. cable is properly connected to the monitor.

Patient monitor

PA catheter

Hole

Balloon inflation port

C.O. cable

Syringe

Stopcock

In-line probe

Injectate

Ice water
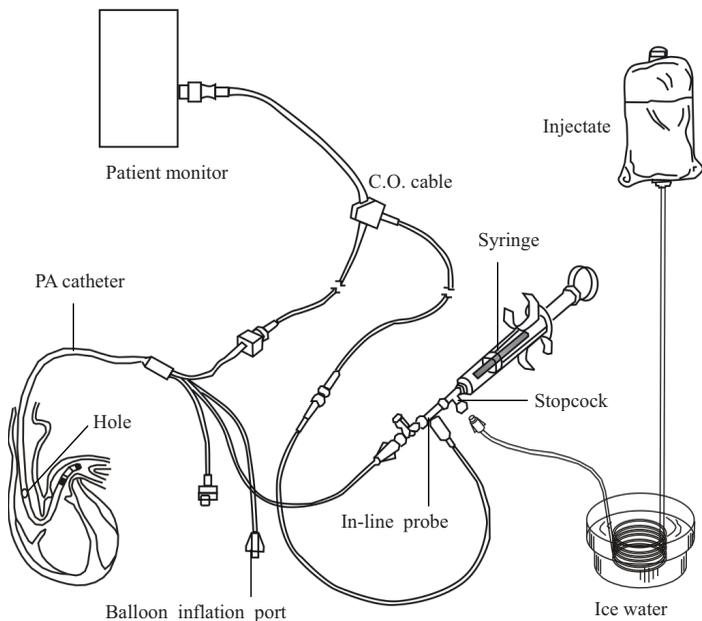
NOTE

● **The above picture is connecting illustration when TI sensor PN 6000-10-02079 is used. The connection may be different if other TI sensors are used.**

3. Select the C.O. parameter window to enter the [**C.O. Setup**] menu. Check if the height and weight are appropriate for your patient. Change if necessary.

4. In the [**C.O. Setup**] menu:

◆ Check that the correct computation constant is entered. Refer to the Instruction for Use of pulmonary artery catheter to determine the [**Comp. Const**] according to the entered injectate volume and temperature. To change the computation constant, select [**Comp. Const**] and then enter the correct value. When a new catheter is used, the computation constant should be adjusted in accordance with the manufacturer's instructions for use.

◆ Set the [**Auto TI**] to [**Manual**] or [**Auto**]. If you select [**Auto**], the system automatically detects the injectate temperature, and the [**Manual TI**] is disabled. If you select [**Manual**], you need to enter the injectate temperature at [**Manual TI**] manually.

◆ Set the [**Measuring Mode**] to [**Manual**] or [**Auto**]. In [**Auto**] mode, the monitor automatically takes C.O. measurement after establishing a baseline blood

temperature. In [**Manual**] mode, you need to click the [**Start**] button in the C.O. measurements window when the monitor is ready for new C.O. measurement.

5. Select [**Enter C.O. Screen**] to enter the C.O. measurements window.
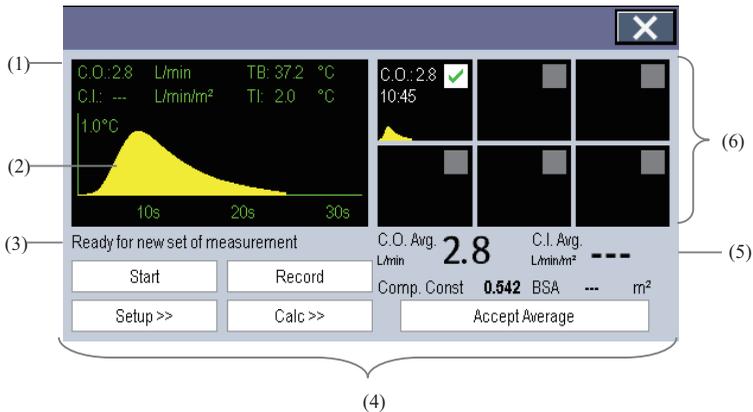
(1) Currently measured numeric

(2) Currently measured C.O. curve

(3) Prompt message area

(4) Buttons

(5) Averaged values

(6) Measurement windows

6. Proceed as follows.

◆ In [**Manual**] measure mode, select the [**Start**] button and then inject the solution quickly when you see the message [**Ready for new set of measurement**]. As shown in the figure above, during the measurement, the currently measured thermodilution curve is displayed. At the end of the measurement, the thermodilution curve is transferred to one of the 6 measurement windows and the monitor prompts you to wait for a certain period of time before starting a new measurement.

◆ In [**Auto**] measure mode, the monitor consecutively takes C.O. measurements automatically without the need for pressing the [**Start**] button between two measurements. A new thermodilution measurement is possible as soon as the message [**Inject now!**] is displayed on the screen. The patient monitor automatically detects further thermodilution measurements.

7. Consecutively take 3 to 5 single measurements as instructed by Step 6.

A maximum of 6 measurements can be stored. If you perform more than six measurements without rejecting any, the oldest will automatically be deleted when a seventh curve is stored. Select from the 6 measurement curves and the system will automatically calculate and display the averaged C.O. and C.I. values. Then select the [**Accept Average**] button to accept and store the averaged values.

When injecting, the stopcock to the PA catheter is open and the stopcock to the injectate solution is closed. After the measurement is completed, turn off the stopcock to the PA catheter and turn on the stopcock to the injectate solution, and then draw the injectate solution into the injectate syringe.

In the buttons area, you can:

■ Select [**Start**] to start a C.O. measurement.

■ Select [**Stop**] to stop the current measurement.

■ Select [**Cancel**] during a measurement to cancel the measurement. Selecting it after a measurement deletes the measured results.

■ Select [**Record**] to print out the curves selected for average calculation, numerics and averaged values by the recorder.

■ Select [**Setup >>**] to access the [**C.O. Setup**] menu.

■ Select [**Calc >>**]→[**Hemodynamic >>**] to access the [**Hemodynamic Calculation**] menu.

The system can automatically adjust the X-axis scale range to 30 s or 60 s and Y-axis scale range to 0.5℃, 1.0℃, or 2.0℃.

NOTE

● **Starting measuring without blood temperature being stable yet may cause measuring failure.**

● **During the cardiac output measurement, blood temperature alarms are inactive.**

● **Please refer to the Instructions for Use of pulmonary artery catheter delivered with the patient monitor to determine the [Comp. Const] and the volume of injectate.**

15.5 Measuring the Blood Temperature

As shown below, the blood temperature is measured with a temperature sensor at the distal end of the catheter in the pulmonary artery. During C.O. measurements, blood temperature alarms are suppressed to avoid false alarms. They will automatically recover as soon as the C.O. measurements are completed.
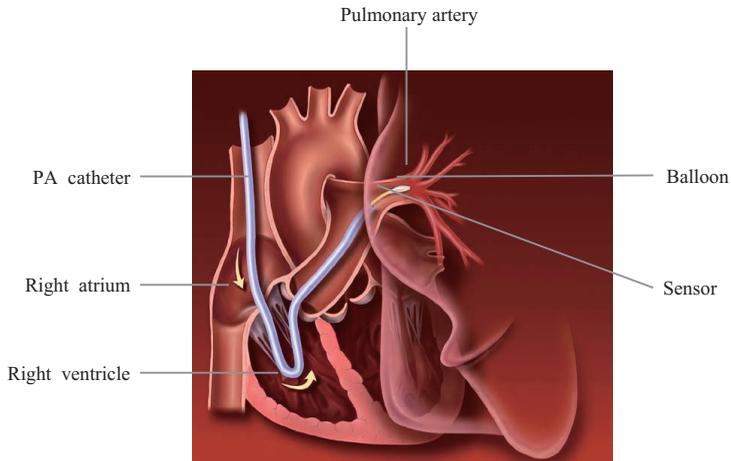
15.6 Changing C.O. Settings

15.6.1 Setting the Temperature Unit

Select [**Unit Setup >>**] from the [**User Maintenance**] menu. In the popup menu, select [**Temp Unit**] to toggle between [℃] and [℉].

15.6.2 Setting Alarm Properties

Select [**Alarm Setup >>**] from the [**C.O. Setup**] menu. You can set alarm properties for this parameter in the popup menu.

16 Monitoring Carbon Dioxide (for uMEC12/uMEC15)

16.1 Introduction

CO_2 monitoring is a continuous, non-invasive technique for determining the concentration of CO_2 in the patient' airway by measuring the absorption of infrared (IR) light of specific wavelengths. CO_2 has its own absorption characteristic and the amount of light passing the gas probe depends on the concentration of the measured CO_2. When a specific band of IR light is passed through respiratory gas samples, some of IR light will be absorbed by the CO_2 molecules. The amount of IR light transmitted after it has been passed through the respiratory gas sample is measured with a photodetector. From the amount of IR light measured, the concentration of CO_2 is calculated.

CO_2 measurements are used to monitor the patient's respiratory status.

CO_2 monitoring is intended for adult, pediatric and neonatal patients.

16.2 Safety

⚠WARNING

- **Remove the airway sampling line from the patient's airway while nebulized medications are being delivered.**
- **Leakage in the breathing or sampling system may cause the displayed $EtCO_2$ values to be significantly low. Always make sure that all components are securely connected.**
- **$EtCO_2$ values measured from the CO_2 module may differ from those of from the blood gas analysis.**
- **Route all tubing away from the patient's throat to avoid strangulation.**
- **Inspect the airway adapter for a tight connection and proper operation before attaching it to the patient.**
- **Squeezing or bending the sampling line during the CO_2 measurement may cause inaccurate CO_2 reading or no reading.**
- **Avoid mechanical shock to the CO_2 module configuring the paramagnetic oxygen sensor.**

16.3 Measurement Limitations

The following factors may influence the measurement accuracy:

- Leaks or internal venting of sampled gas

- Mechanical shock

- Cyclic pressure up to 10 kPa (100 cmH$_2$O)

- Other sources of interference, if any

Measurement accuracy may be affected by the breath rate and inspiration/expiration (I/E) ratio as follow:

- EtCO$_2$ value is within specification for breath rate ≤ 60 bpm and I/E ratio ≤ 1: 1;

- EtCO$_2$ value is within specification for breath rate ≤ 30 bpm and I/E ratio ≤ 2: 1.

Measurement accuracy is unspecified for breath rate larger than 60 bpm.

16.4 Understanding CO$_2$ Display

The CO2 parameter and waveform areas provide FiCO2 measurement, EtCO2 measurement, awRR measurement, and a CO2 waveform.

(1) CO2 waveform

(2) Fraction of inspired CO$_2$ (FiCO2)

(3) End tidal CO$_2$ value (EtCO2)

(4) Airway respiration rate (awRR)

16.5 Measuring CO_2

16.5.1 Making a CO_2 Measurement

1. Select the appropriate watertrap and sampling line according to the patient category.
2. Connect the watertrap and sampling line.

    ◆   If you use DRYLINE II watertrap (*PN: 100-000080-00* or *PN: 100-000081-00*), connect the watertrap to the watertrap receptacle, and then connect the sampling line to the watertrap as shown below.
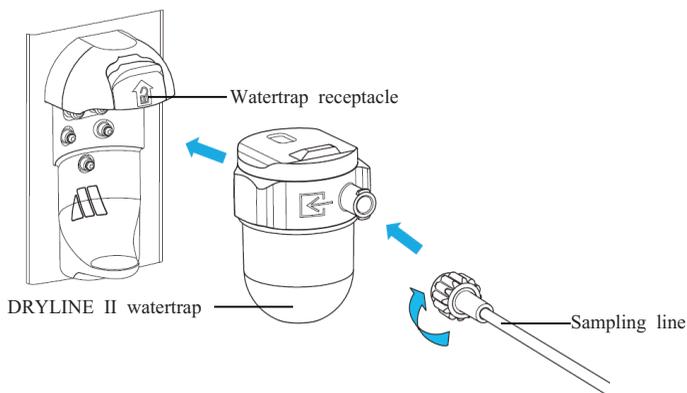
    ◆   If you use DRYLINE PRIME watertrap mini, connect the DRYLINE PRIME receptacle to the watertrap receptacle, connect the DRYLINE PRIME watertrap mini to the DRYLINE PRIME receptacle adapter, and then connect the DRYLINE PRIME sampling line to the watertrap mini as shown below.
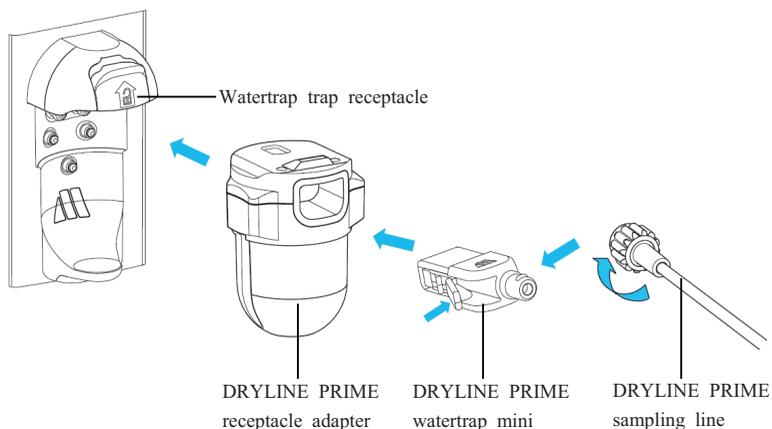
3. Connect the other end of the sampling line to the patient.

◆ For intubated patients requiring an airway adapter, install the airway adapter between the patient circuit and the ventilator Y-piece.

Sampling line

Connect to the ventilator

Airway adapter

Connect to the patient
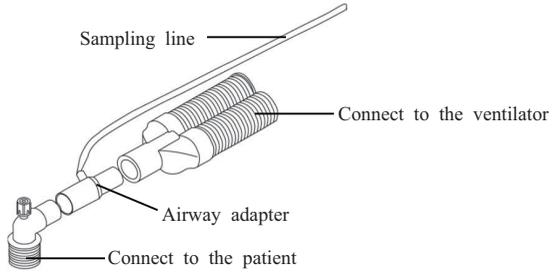
◆ For non-intubated patients, place the nasal cannula onto the patient.

4. Connect the gas outlet to the scavenging system using an exhaust tube.

After the CO_2 module is connected to the SMR, it enters measure mode by default and the monitor displays **CO2 Starting**. CO_2 can be measured after the start-up is complete.

⚠WARNING

● **Connect the gas outlet to the scavenging system when measuring CO_2.**

⚠ CAUTION

- **To avoid blocking the airway, empty the DRYLINE II watertrap container whenever half full. Replacing the DRYLINE II watertrap once a month is recommended.**
- **The DRYLINE PRIME watertrap mini is automatically blocked when its service life is reached. Replace the DRYLINE PRIME watertrap mini if the alarm "CO2: Change Watertrap" occurs.**
- **The watertrap has a filter preventing bacterium, water and secretions from entering the module. Extended use could destroy the filter in watertrap and fail to stop the bacterium, water and secretions entering the module, result in damaging the gas module and having infection risk..**

NOTE

- **Do not apply adult watertrap to the neonate patient. Otherwise, patient injury could result.**
- **To extend the lifetime of the watertrap and module, disconnect the watertrap from the module and set the operating mode to Standby mode when CO_2 monitoring is not required.**
- **The sapmle rates are different when different types of watertraps are used.**

16.5.2 Zeroing the CO_2 Module

The CO_2 module performs zero calibration automatically when needed.

NOTE

- **The CO_2 module temporally stops measuring during zeroing.**

16.6 Changing CO$_2$ Settings

16.6.1 Changing CO$_2$ Alarm Settings

1. Select the CO$_2$ parameter area or waveform area to enter the [**CO2 Setup**] menu.
2. Select the [**Alarm Setup**] tab.
3. Set the following alarm properties:

   ◆ Switch on or switch off the alarms or alarm recording.

   ◆ Adjust the alarm limits or alarm priority.

   ◆ Select [**Apnea Delay**] to set the delay time of the apnea alarm.

16.6.2 Changing the CO$_2$ Unit

1. Select [**Main Menu**]→[**Maintenance >>**]→[**User Maintenance >>**]→ enter the required password and then select [**Ok**].
2. Select the [**Unit Setup**] tab.
3. Set [**CO2 Unit**].

16.6.3 Setting the CO$_2$ Waveform

In the [**CO2 Setup**] menu, you can:

■ Select [**Wave Type**] and toggle between [**Draw**] and [**Fill**]:

   ◆ [**Draw**]: The CO$_2$ wave is displayed as a curved line.

   ◆ [**Fill**]: The CO$_2$ wave is displayed as a filled area.

■ Select [**Sweep**] and then select the appropriate setting. The faster the wave sweeps, the wider the wave is.

■ Change the size of the CO$_2$ waveform by adjusting the wave [**Scale**].

16.6.4 Setting the RR Source

1. Select the CO$_2$ parameter area or waveform area to enter the [**CO2 Setup**] menu.
2. Set [**RR Source**].

When the current RR source does not have valid measurement, the system will automatically switch [**RR Source**] to [**Auto**].

The [**RR Source**] settings of Resp and CO$_2$ module are linked. For details, please refer to *9.9 Setting RR Source*.

16.6.5 Entering the Standby Mode

You can set the CO_2 module to one of the following modes according to the module status:

■ Select [**Measure**] mode when you use the CO_2 modue for monitoring.

■ Select [**Standby**] mode when you does not use the CO_2 module to prolong the serviec life of the CO_2 module.

The default operating mode is [**Measure**]. If you are not using the CO_2 module, you can proceed as follows to enter the standy mode:

1. Select the CO_2 parameter area or waveform area to enter the [**CO2 Setup**] menu.
2. Set [**Operating Mode**] to [**Standby**].

16.6.6 Setting the Auto Standby

The monitor enters the standby mode automatically after the configured period of time if no breath is detected since the last detected breath. To set the auto standby, follow this procedure:

1. Select the CO_2 parameter area or waveform area to enter the [**CO2 Setup**] menu.
2. Set [**Auto Standby**].

16.6.7 Setting the Gas Compensations

The presence of interfering gas affects the CO2 measurement. To get the best possible measuring result, it is needed to set the gas compensation. The configured concentration of the interfering gas should be in accordance with its actual proportion.

⚠**WARNING**

● **Make sure to use the appropriate compensations. Inappropriate compensations may cause inaccurate measurement values and result in misdiagnosis.**

1. Select the CO_2 parameter area or waveform area to enter the [**CO2 Setup**] menu.
2. Set the compensation according to the actual condition.

16.6.8 Setting Humidity Compensation

The CO_2 modules is configured to compensate CO_2 readings for either Body Temperature and Pressure, Saturated Gas (BTPS), to account for humidity in the patient's breath, or Ambient Temperature and Pressure, Dry Gas (ATPD).

- ATPD: $P_{co_2}(mmHg) = CO_2(vol \%) \times P_{amb} / 100$

- BTPS: $P_{co_2}(mmHg) = CO_2(vol \%) \times (P_{amb} - 47) / 100$

Where, P_{co_2} = partial pressure, $vol \%$ = CO_2 concentration, P_{amb} = ambient pressure, and unit is mmHg.

To set the humidity compensation:

1. Select the CO_2 parameter area or waveform area to enter the [**CO2 Setup**] menu.
2. Select [**BTPS Compen**] and then toggle between [**On**] and [**Off**].

    ◆ Switch on for BTPS.

    ◆ Switch off for ATPD.

16.7 Calibrating the CO_2 Module

A calibration should be performed once a year or when the readings go far beyond the range. For details, refer to *25 Maintenance.*

17 Freezing Waveforms

During patient monitoring, the freeze feature allows you to freeze the currently displayed waveforms on the screen so that you can have a close examination of the patient's status. Besides, you can select any frozen waveform for recording.

17.1 Freezing Waveforms

1. To freeze waveforms, select the ⊠ hardkey on the monitor's front.
2. The system closes the displayed menu (if any), and opens the [**Freeze**] menu.
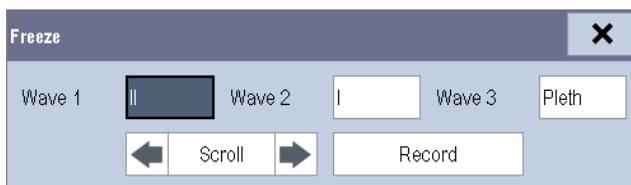
3. All displayed waveforms are frozen, i.e. the waveforms stop being refreshed or scrolling.

The freeze feature exerts no effect on the split-screen view of minitrends, OxyCRG and other patients.

17.2 Viewing Frozen Waveforms

To view the frozen waveforms, you can either:

■ Select the [**Scroll**] button and then rotate the Knob clockwise or counter-clockwise, or

■ Directly select the ◀ or ▶ beside the [**Scroll**] button using a mouse or through the touchscreen.

The frozen waveforms will scroll left or right accordingly. And meanwhile, at the lower right corner of the bottommost waveform, there is an upward arrow. The freeze time is displayed below the arrow and the initial frozen time is [**0 s**]. With the waveforms scrolling, the freeze time changes at intervals of 1 second. This change will be applied for all waveforms on the screen.

17.3 Unfreezing Waveforms

To unfreeze the frozen waveforms, you can either:

■ Select the ✖ button at the upper right corner of the [**Freeze**] menu,

■ Select the ⊞ hardkey on the monitor's front, or

■ Perform any other action that causes the screen to be readjusted or opens a menu, such as plugging in or out a module, pressing the ▣ hardkey, etc.

17.4 Recording Frozen Waveforms

1. In the [**Freeze**] menu, select, in turn, [**Wave 1**], [**Wave 2**] and [**Wave 3**] and then select your desired waveforms.

2. Select the [**Record**] button. The selected waveforms and all numerics at the frozen time are printed out by the recorder.

18 Review

18.1 Accessing Respective Review Windows

1. Select the [**Review**] QuickKey, or [**Main Menu**]→[**Review >>**].

2. Select [**Graphic Trends**], [**Tabular Trends**], [**Events**], or [**Full Disclosure**] to access their respective review windows.

18.2 Reviewing Graphic Trends

In the [**Review**] menu, select [**Graphic Trends**] to access the following window.

(1) Event mark area   (2) Time axis

(3) Graphic trends area   (4) Parameter area

(5) Cursor

Events are marked with colors in the event mark area. Red represents high level alarm event. Yellow represents medium/low level alarm event. Green represents manual event.

In this review window:

■ Select [**Trend Group**] and you can select a trend group for viewing in the popup menu. If [**Custom 1**] or [**Custom 2**] is selected, you can further select [**Define Trend Group**]. Then you can select the parameters for viewing in the popup menu.

■ You can set the time length of the review window by selecting [**Zoom**].

■ You can set the number of waves displayed in one page by selecting [**Waves**].

■ To browse the graphic trends, you can either:

◆ Select ← or → beside [**Scroll**] to move the cursor one step to the left or right to navigate through the graphic trends, or

◆ Select ↞ or ↠ to move the cursor one page to the left or right to navigate through the graphic trends.

A time indicating your current position is displayed above the parameter area. Numeric measurement values corresponding to the cursor location change as the cursor is moved. The measurement value that triggered high level alarm has red background. The one that triggered medium/low level alarm has yellow background.

■ By selecting ← or → beside [**Event**], you can position the cursor to different event time.

■ By selecting the [**Record**] button, you can print out the currently displayed graphic trends by the recorder.

■ By selecting the [**Print**] button, you can set and print out the graphic trends report by the printer. For how to set the graphic trends report, please refer to chapter *21 Printing*.

18.3 Reviewing Tabular Trends

In the [**Review**] menu, select [**Tabular Trends**] to access the following window.
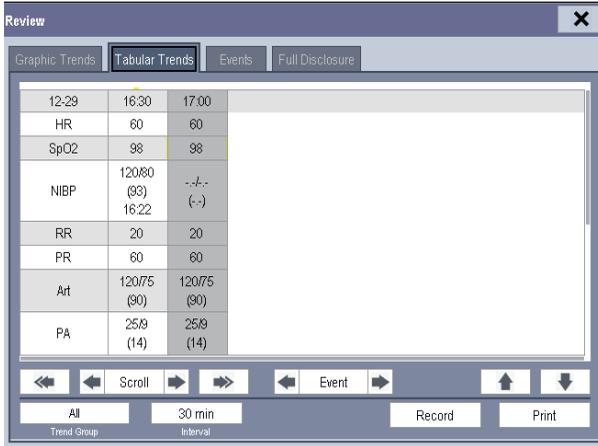
Events are marked with colors in window's top area. Red represents high level alarm event. Yellow represents medium/low level alarm event. Green represents manual event.

In this review window:

- Select [**Trend Group**] and you can select a trend group for viewing in the popup menu. If [**Custom 1**] or [**Custom 2**] is selected, you can further select [**Define Trend Group**]. Then you can select the parameters for viewing in the popup menu.

- You can change the resolution of the trend data by selecting [**Interval**] and then selecting the appropriate setting:

   ◆ [**5 s**] or [**30 s**]: select to view up to 4 hours of tabular trends at 5- or 30-second resolution.

   ◆ [**1 min**], [**5 min**], [**10 min**], [**15 min**], [**30 min**], [**1 h**], [**2 h**] or [**3 h**]: select to view up to 120 hours of tabular trends at your selected resolution.

   ◆ [**NIBP**]: select to view the tabular trends when NIBP measurements were acquired.

- To browse the tabular trends, you can either:

   ◆ Select ◄ or ► beside [**Scroll**] to drag the scrollbar left or right to navigate through the trend database, or

   ◆ Select ◄◄ or ►► to scroll left or right to navigate through the trend database.

The measurement value that triggered high level alarm has red background. The one that triggered medium/low level alarm has yellow background.

■ By selecting ◀ or ▶ beside [**Event**], you can position the cursor to different event time.

■ By selecting the [**Record**] button, you can access the [**Record Setup**] menu and set the start and end time of the tabular trends you want to record. This feature is not available when reviewing a history patient. By further selecting [**Record**], you can print out the currently displayed tabular trends by the recorder.

■ By selecting the [**Print**] button, you can set and print out the tabular trends report by the printer. For how to set the tabular trends report, please refer to *21 Printing*.

18.4 Reviewing Events

The monitor saves the events in real time. You can review these events.

In the [**Review**] menu, select [**Events**] to access the following window.

The events that can be reviewed include parameter alarm events, arrhythmia alarm events and manual events. When an event occurs, all the measurement numerics at the event trigger time and related waveforms 4 seconds, 8 seconds, or 16 seconds, as per the setting of recording length, respectively before and after the event trigger time are stored.
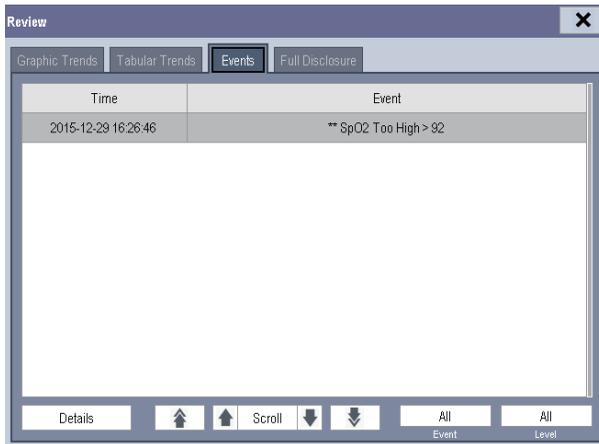
In this window:

■ You can view the desired events by selecting [**Event**].

■ You can view the desired events according to the level by selecting [**Level**].

After selecting the desired event, you can select [**Details**] to access the following window. In this window, the waveform area displays the waveforms related to the event, and the parameter area displays the parameter values happened at the event trigger time.

NOTE

- **P ausing or switching off alarms will not be recorded as events. The time of these operations will not be recorded in the system log.**
- **A total loss of power has no impact on the saved events.**
- **Earlier-recorded events might be overwritten by later ones if it reaches capacity.**

(1) Waveform area   (2) Parameter area

In this window:

- You can select ◄ or ► to navigate through the waveforms.
- You can select ◄ or ► beside the [**Event**] button to switch between events.
- You can set the desired [**Gain**] for ECG waveform.
- You can set the desired [**Sweep**].
- By selecting the [**Record**] button, you can print out the currently displayed alarm events by the recorder.
- By selecting the [**Events List**] button, you can view the events list.
- By selecting the [**Print**] button, you can print out the currently displayed alarm events by the printer, please refer to *21 Printing*.

18.5 Reviewing Waveforms

In the [**Review**] menu, select [**Full Disclosure**] to access the following window.

(1)   Waveform area   (2)   Parameter area

In this review window:

■ To review full-disclosure waveforms, you need to save waveforms first. Select [**Save Waves >>**] and then select the parameters whose waveforms you want to view. To save full-disclosure waveform, your monitor must be equipped with a storage card.

■ To view the waveforms, you can either:

◆ Select ← or → beside the [**Scroll**] button to move the cursor one step left or right to navigate through the waveforms, or

◆ Select ⟨⟨ or ⟩⟩ to move the cursor one page left or right to navigate through the waveforms.

A time indicating your current position is displayed at the top of the waveform area. Numeric measurement values corresponding to the cursor location are displayed in the parameter area, and change as the cursor is moved.

■ You can change the ECG wave gain by selecting [**Gain**] and then selecting the appropriate setting.

■ You can change the waveform sweep speed by selecting [**Sweep**] and then selecting the appropriate setting.

■ By selecting the [**Record**] button, you can print out the first three waveforms and measurement numerics by the recorder.

■ By selecting ◀ or ▶ beside the [**Event**] button, you can position the cursor between events.

FOR YOUR NOTES

19 Calculations

19.1 Introduction

The calculation feature is available with your patient monitor. The calculated values, which are not directly measured, are computed based on the values you provide.

Your can perform the following calculations:

- Dose calculations
- Hemodynamic calculations

To perform a calculation, select [**Main Menu**]→[**Calc >>**], or the [**Calculations**] QuickKey and then select the calculation you want to perform.

NOTE

- **The calculation feature is independent of other monitoring functions and can be therefore used for patients being monitored by other monitors. Any operation in a calculation window does not affect the patient monitoring by the local patient monitor.**

⚠ WARNING

- **After the calculation is finished, verify the entered values are correct and the calculated values are appropriate. We assume no responsibility for any consequences caused by wrong entries and improper operations.**

19.2 Dose Calculations

19.2.1 Performing Calculations

To perform a dose calculation:

1. Select [**Main Menu**]→[**Calculations >>**]→[**Dose >>**], or select [**Calculations**] QuickKey→[**Dose >>**].

2. Select, in turn, [**Patient Cat.**] and [**Drug Name**] and then select the appropriate settings. The dose calculation program has a library of commonly used drugs, of which Drug A through Drug E are for those not specified in this library.

    - ◆ Drug A, B, C, D, E
    - ◆ Aminophylline
    - ◆ Dobutamine
    - ◆ Dopamine
    - ◆ Epinephrine
    - ◆ Heparin

    - ◆ Isuprel
    - ◆ Lidocaine
    - ◆ Nipride
    - ◆ NItroglycerin
    - ◆ Pitocin

3. The system gives a set of default values when the above steps are finished. However, these values cannot be used as the calculated values. The user must enter values following the doctor's instructions, and then the calculated values can only be used

4. Enter the patient's weight.

5. Enter other values.

6. Verify if the calculated values are correct.

19.2.2 Selecting the Proper Drug Unit

Each drug has its fixed unit or unit series. Among a unit series, one unit may change to another automatically depending on the entered value.

The units for each drug are as follows:

- ■ Drug A, B, C, Aminophylline, Dobutamine, Dopamine, Epinephrine, Isuprel, Lidocaine, Nipride and NItroglycerin use the unit series: g, mg and mcg.
- ■ Drug D, Heparin and Pitocin use the unit series: Unit, KU (kilo units) and MU (million units).
- ■ Drug E uses the unit: mEq (milli-equivalents).

You must select the proper drug name (A, B, C, D or E) according to the units when you define a drug not listed in this library.

NOTE

- **For neonate patients, [Drip Rate] and [Drop Size] are disabled.**

19.2.3 Titration Table

To open the titration table, select [**Titration Table >>**] in the [**Dose Calculation**] window after the dose calculation is finished.

In the titration table, when you change:

- [**Reference**]
- [**Interval**]
- [**Dose Type**]

The titrated values change accordingly.

You can also:

- Select ▲ or ▼, or ▲ or ▼ beside the vertical scrollbar to view more values.
- Select [**Record**] to print out the currently displayed titrated values by the recorder.

19.2.4 Drug Calculation Formulas

Abbreviation	Unit	Formula
Conc.	g/ml, unit/ml or mEq/ml	Amount / Volume
Dose	Dose/hr, Dose/kg/min	Rate × Conc.
Volume	ml	Rate × Duration
Amount	g, unit, mEq	Rate × Duration
Duration	h	Amount/Dose
Drip Rate	gtt/min	INF Rate × Drop Size / 60

19.3 Hemodynamic Calculations

19.3.1 Performing Calculations

To perform a hemodynamic calculation:

1. Select [**Main Menu**]→[**Calculations >>**]→[**Hemodynamic >>**], or select [**Calculations**] QuickKey→[**Hemodynamic >>**].

2. Enter values for calculation.

   ◆ For a patient who is being monitored, [**HR**], [**Art mean**], [**PA mean**] and [**CVP**] are automatically taken from the currently measured values. If you just have performed C.O. measurements, [**C.O.**] is the average of multiple thermodilution measurements. [**Height**] and [**Weight**] are the patient's height and weight you have entered. If the monitor does not provide these values, their fields appear blank.

   ◆ For a patient who is not being monitored, confirm the values you have entered.

3. Select the [**Calculate**] button. The system performs a calculation per the current settings and displays the calculated values.

   ◆ If a calculated value is outside the range, its background will highlight in yellow. You can select [**Range**] to view its normal range in the unit field.

   ◆ Invalid values are displayed as [**---**].

In the [**Hemodynamic Calculation**] window, you can:

■ Trigger a recording by selecting the [**Record**] button. The currently displayed hemodynamic calculation is printed out by the recorder.

■ Review the previously performed calculations by selecting [**Review**].

19.3.2 Entered Parameters

Abbreviation	Unit	Full Spelling
C.O.	L/min	cardiac output
HR	bpm	heart rate
Art Mean	mmHg	artery mean pressure
PA Mean	mmHg	pulmonary artery mean pressure
CVP	mmHg	central venous pressure
EDV	ml	end-diastolic volume
Height	cm	height
Weight	kg	weight

19.3.3 Calculated Parameters and Formulas

Abbreviation	Unit	Full spelling	Formula
BSA	m^2	body surface area	$Wt^{0.425} \times Ht^{0.725} \times 0.007184$
C.I.	$L/min/m^2$	cardiac index	C.O. / BSA
SV	ml	stroke volume	C.O. / HR × 1000
SI	ml/m^2	stroke index	SV/ BSA
SVR	DS/cm^5	systemic vascular resistance	$79.96 \times (AP\ MAP - CVP) / C.O.$
SVRI	$DS \cdot m^2/cm^5$	systemic vascular resistance index	SVR × BSA
PVR	DS/cm^5	pulmonary vascular resistance	$79.96 \times (PAMAP - PAWP) / C.O.$
PVRI	$DS \cdot m^2/cm^5$	pulmonary vascular resistance index	PVR × BSA
LCW	kg·m	left cardiac work	0.0136 × APMAP × C.O.
LCWI	$kg \cdot m/m^2$	left cardiac work index	LCW / BSA
LVSW	g·m	left ventricular stroke work	0.0136 × APMAP× SV
LVSWI	$g \cdot m/m^2$	left ventricular stroke work index	LVSW / BSA
RCW	kg·m	right cardiac work	0.0136 × PAMAP × C.O.
RCWI	$kg \cdot m/m^2$	right cardiac work index	RCW / BSA
RVSW	g·m	right ventricular stroke work	0.0136 × PAMAP × SV
RVSWI	$g \cdot m/m^2$	right ventricular stroke work index	RVSW / BSA
EF	%	ejection fraction	100 × SV / EDV

19.4 Understanding the Review Window

With the review feature, you can review oxygenation, ventilation, hemodynamic and renal calculations. The review window for each calculation is similar. Take the hemodynamic calculations review window for example, you can access it by selecting [**Review**] in the [**Hemodynamic Calculation**] window.

In this review window:

■   You can select ◀, ▶ ◀◀ or ▶▶ to view more values.

■   The values that exceed the range are displayed in yellow background. The [**Unit**] field displays parameter units. If some parameter values are outside of their normal ranges, you can view their normal range in the [**Unit**] field by selecting [**Range**].

■   You can review an individual calculation by selecting its corresponding column and then selecting [**Original Calc**]. You can record the currently displayed calculations or perform another calculation is this window.

20 Recording

20.1 Using a Recorder

The thermal recorder records patient information, measurement numerics, up to three waveforms, etc.
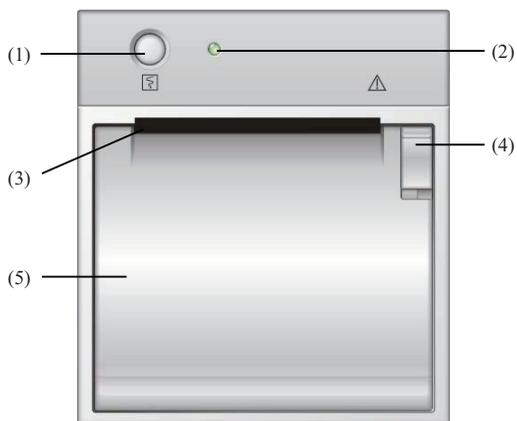
(1) Start/Stop key: press to start a recording or stop the current recording.

(2) Indicator

- ◆ On: when the recorder works correctly.

- ◆ Off: when the monitor is switched off.

- ◆ Flashes: if an error occurred to the recorder, e.g., the recorder runs out of paper.

(3) Paper outlet

(4) Latch

(5) Recorder door

20.2 Overview of Recording Types

By the way recordings are triggered, the recordings can be classified into the following categories:

- Manually-triggered realtime recordings.

- Timed recordings.

- Alarm recordings triggered by an alarm limit violation or an arrhythmia event.

- Manually-triggered, task-related recordings.

NOTE

- **For details about alarm recording, refer to** *7 Alarms***.**

- **For details about task-related recordings, refer to respective sections of this manual.**

20.3 Starting and Stopping Recordings

To manually start a recording, you can either:

- Select the ⑤ hardkey on the recorder module, or

- Select the [**Record**] button from the current menu or window.

Automatic recordings will be triggered in the following conditions:

- Timed recordings will start automatically at preset intervals.

- If both [**Alarm**] and [**Alm Rec**] for a measurement are set on, an alarm recording will be triggered automatically as alarms occur.

To manually stop a recording, you can either:

- Select the ⑤ hardkey again, or

- Select [**Clear All Tasks**] in the [**Record Setup**] menu.

Recordings stop automatically when:

- A recording is completed.

- The recorder runs out of paper.

- When the recorder has an alarm condition.

When a recording is stopped, the following markers will be added:

- Automatically stopped recording: print two columns of '*' at the end of the report.

- Manually or abnormally stopped recording: print one column of '*' at the end of the report.

20.4 Setting Up the Recorder

20.4.1 Accessing the Record Setup Menu

By selecting [**Main Menu**]→[**Record Setup** >>], you can access the [**Record Setup**] menu.

20.4.2 Selecting Waveforms for Recording

The recorder can record up to 3 waveforms at a time. You can select, in turn, [**Waveform 1**], [**Waveform 2**] and [**Waveform 3**] in the [**Record Setup**] menu, and then select the waveforms you want. You can also turn off a waveform recording by selecting [**Off**]. These settings are intended for realtime and scheduled recordings.

20.4.3 Setting the Realtime Recording Length

After starting a realtime recording, the recording time depends on your monitor's settings. In the [**Record Setup**] menu, select [**Length**] and toggle between [**8 s**] and [**Continuous**].

- [**8 s**]: record 4-second waveforms respectively before and after current moment.

- [**Continuous**]: record the waveforms from the current moment until stopped manually.

20.4.4 Setting the Interval between Timed Recordings

Timed recordings start automatically at preset intervals. Each recording lasts 8 seconds. To set the interval between timed recordings: in the [**Record Setup**] menu, select [**Interval**] and then select the appropriate setting.

20.4.5 Changing the Recording Speed

In the [**Record Setup**] menu, select [**Paper Speed**] and toggle among [**12.5 mm/s**], [**25 mm/s**] and [**50 mm/s**]. This setting is for all recordings containing waveforms.

20.4.6 Clearing Recording Tasks

In the [**Record Setup**] menu, select [**Clear All Tasks**]. All queued recording tasks are cleared and the current recording is stopped.

20.5 Loading Paper

1. Use the latch at the upper right of the recorder door to pull the door open.

2. Insert a new roll into the compartment as shown below.

3. Close the recorder door.

4. Check if paper is loaded correctly and the paper end is feeding from the top.

Paper roll
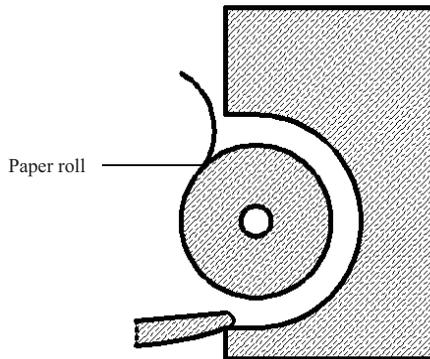
⚠**CAUTION**

- **Use only specified thermal paper. Otherwise, it may cause damage to the recorder's printhead, the recorder may be unable to print, or poor print quality may result.**

- **Never pull the recorder paper with force when a recording is in process. Otherwise, it may cause damage to the recorder.**

- **Do not leave the recorder door open unless you reload paper or remove troubles.**

20.6 Removing Paper Jam

If the recorder works incorrectly or produces unusual sounds, check if there is a paper jam first. If a paper jam is detected, follow this procedure to remove it:

1. Open the recorder door.

2. Take out the paper and tear off the draped part.

3. Reload the paper and close the recorder door.

20.7 Cleaning the Recorder Printhead

If the recorder has been used for a long time, deposits of paper debris may collect on the printhead compromising the print quality and shortening the lifetime of the roller. Follow this procedure to clean the printhead:

1. Take measures against the static electricity such as Disposable Wrist Strap for the work.

2. Open the recorder door and take out the paper.

3. Gently wipe around the printhead using cotton swabs dampened with alcohol.

4. After the alcohol has completely been dried, reload the paper and close the recorder door.

⚠CAUTION

- **Do not use anything that may destroy the thermal element.**
- **Do not add unnecessary force to the thermal head.**

FOR YOUR NOTES

21 Printing

21.1 Printer

The monitor can output patient reports via a connected printer. So far, the monitor supports the following printer:

- HP LaserJet Pro 400 M401n
- HP LaserJet 600 M602

The specifications of the reports the monitor prints are:

- Paper: A4, Letter
- Resolution: 300 dpi

For more details about the printer, see the document accompanying the printer. With the upgrading of products, the monitor will support more printers and no prior notice will be given. If you have any doubt about the printer you have purchased, contact our company.

21.2 Connecting a printer

To print the reports or the trend data of a patient, you can choose either:

- the local printer

  Connect the printer and the patient monitor through the network, and then start printing what you want, or

- the Central Monitoring System

  If your monitor is connected to a central monitoring system, it is recommended to use the central monitoring system for printing.

21.3 Setting Up the Printer

To set the printer's properties, select [**Main Menu**]→[**Print Setup >>**]→[**Printer Setup >>**]. In the [**Printer Setup**] menu, you can:

■ Select a connected printer

Select [**Printer**] and then select a connected printer as the monitor's printer.

■ Search for a printer

If your selected printer is not in the list or a new printer is added into the network, you can select the [**Search Printer**] to re-search for all printers in the network.

■ Set up the paper

Select [**Paper Size**] and toggle between [**A4**] and [**Letter**].

21.4 Starting Report Printouts

Reports	Contents	Procedures
ECG reports	ECG waveforms and relevant parameter values	Select [**Main Menu**]→[**Print Setup >>**]→[**ECG Reports >>**]→[**Print**]
Tabular trends	Depend on the selected parameter group, resolution and time period	Select [**Main Menu**]→[**Print Setup >>**] →[**Tabular Trends Reports >>**]→[**Print**], or select [**Main Menu**]→[**Review >>**]→[**Tabular Trends**] →[**Print**]→[**Print**]
Graphic trends	Depend on the selected parameter group, resolution and time period	Select [**Main Menu**]→[**Print Setup >>**] →[**Graphic Trends Reports >>**]→[**Print**], or select [**Main Menu**]→[**Review >>**]→[**Graphic Trends**] →[**Print**]→[**Print**]
Parameter alarm review	Depend on the selected alarms	Select [**Main Menu**]→[**Review >>**]→[**Alarms**] →[**Print**]
Realtime waves	Depend on the selected waveforms	Select [**Main Menu**]→[**Print Setup >>**] →[**Realtime Reports >>**]→[**Print**]

21.5 Stopping Reports Printouts

To stop report printouts, select [**Main Menu**]→[**Print Setup >>**]→[**Stop All Reports**].

21.6 Setting Up Reports

21.6.1 Setting Up ECG Reports

You can print out ECG reports only under full-screen, half-screen or 12-lead monitoring screen. To set up ECG reports, select [**Main Menu**]→[**Print Setup >>**]→[**ECG Reports >>**].

■ [**Amplitude**]: set the amplitude of the ECG waveforms.

■ [**Sweep**]: set the wave print speed to 25 mm/s or 50 mm/s.

■ [**Auto Interval**]: If [**Auto Interval**] is set to [**On**], the system will automatically adjust the space between waveforms to avoid overlapping.

■ [**12-Lead Format**]: If you select [**12×1**], 12 waveforms will be printed on a paper from top to bottom. If you select [**6×2**], 12 waveforms will be printed from left to right with 6 waveforms on each half part and a rhythm waveform will be printed at the bottommost. If you select [**3×4+1**], 12 waveforms will be printed from left to right with 3 waveforms on each of the 4 columns and a rhythm waveform will be printed at the bottommost.

21.6.2 Setting Up Tabular Trends Reports

To set up tabular trends reports, select [**Main Menu**]→[**Print Setup >>**]→[**Tabular Trends Reports >>**].

■ Date: Select the desired date on which a tabular trends report is recorded for printing.

■ Start time: You can set a time period whose trend data will be printed out by setting [**From**] and [**Back**]. For example, if you set [**From**] as 2007-4-2 10: 00: 00 and [**Back**] as [**2 h**], the outputted data will be from 2007-4-2 08: 00: 00 to 2007-4-2 10: 00: 00. In addition, the [**Back**] can be set to either:

◆ [**Auto**]: If [**Report Layout**] is set to [**Time Oriented**], the report will be printed by time. If [**Report Layout**] is set to [**Parameter Oriented**], the report will be printed by parameters.

◆ [**All**]: If you select [**All**], all trend data will be printed out. In this case, it is no need to set [**From**].

■ [**Spacing**]: choose the resolution of the tabular trends printed on the report.

◆ [**NIBP**]: prints a tabular trends report when NIBP measurements were acquired. Each NIBP measurement will generate a column in the tabular trends review window. The values for the other measurements are added to the column to provide a complete dataset for the NIBP measurement time.

◆ [**Auto**]: prints a tabular trends report during the period selected and at the interval set in the [Interval] option. The [Interval] option is located at the bottom the [Tabular Trends] tab of the [Review] window.

- [**Report Format**]: If you select [**Time Oriented**], the report will be printed by time. If you select [**Parameter Oriented**], the report will be printed by parameters.
- [**Select Parameter >>**]: from the popup menu, you can:
  - [**Currently Displayed Trended Parameters**]: print the parameter trend data selected from the [**Tabular Trends**].
  - [**Standard Parameter Group**]: select the standard parameter group for printing.
  - [**Custom**]: You can define a parameter group for printing from the parameters displayed in the low part of the menu.

21.6.3 Setting Up Graphic Trends Reports

To set up graphic trends reports, select [**Main Menu**]→[**Print Setup >>**]→[**Graphic Trends Reports >>**]. As setting up graphic trends reports is similar with tabular trends reports, you can refer to the *21.6.2 Setting Up Tabular Trends Reports* for details.

21.6.4 Setting Up Realtime Reports

To set up realtime reports, select [**Main Menu**]→[**Print Setup >>**]→[**Realtime Reports >>**].

- [**Sweep**]: set the wave print speed to 12.5 mm/s, 25 mm/s, 50 mm/s, or Auto.
- [**Select Wave >>**]: from the popup menu, you can:
  - [**Current**]: select the currently displayed waves for printing.
  - [**Select Wave**]: select the desired waves for printing.

21.7 Printer Statuses

21.7.1 Printer Out of Paper

When the printer runs out of paper, the print request will not be responded. If there are too many print jobs that are not responded, a printer error may occur. In these cases, you need to install paper and then re-send the print request. Restart the printer if necessary.

Therefore, you'd better ensure that there is enough paper in the printer before sending a print request.

21.7.2 Printer Status Messages

Printer Status Message	Possible causes and suggested action
Printer unavailable	The selected printer is not available. Check if the printer is switched on or correctly connected or installed with paper.

FOR YOUR NOTES

22 Other Functions

22.1 Analog Output

The patient monitor provides analog output signals to accessory equipment via the multifunctional connector on the rear of the monitor. To obtain analog output signals, connect the accessory equipment such as an oscillograph, etc. to the monitor.

NOTE

- **The analog output feature is seldom applied in clinical applications. You can contact your service personnel for more details.**

22.2 Exporting the Log

The monitor stores system status information, including failures, abnormity, and technical alarms, into the log. You can export the log to a USB drive.

To export the log,

1. Connect a USB drive to the monitor's USB connector. See *2.2.3 Rear View* for the proper location of the USB connector.

2. Select [**Main Menu**]→[**Maintenance >>**]→[**User Maintenance >>**]→enter the required password→[**Others >>**].

3. Select [**Export Log**].

22.3 Transferring Data

You can transfer the patient data saved in the monitor to a PC via a crossover network cable or within a LAN for data management, review or print.

22.3.1 Data Export System

You must install the data export system on the intended PC before performing the data transfer operation. Refer to the document accompanying the installation CD-ROM for installation instructions.

The data transfer feature supports patient management, data review, data format conversion, print, etc. in addition to data transfer. Refer to the help file of the system software for more details.

22.3.2 Transferring Data by Different Means

NOTE

- **Never enter the data transfer mode when the patient monitor is in normal operation or performs monitoring. You must re-start the patient monitor to exit the data transfer mode.**

Transfer data via a crossover network cable

Before transferring data using a crossover network cable, do as follows:

1. Connect one end of the crossover network cable to the patient monitor and the other end to the PC.

2. Set the IP address of the PC. This IP address must be in the same network segment with that of the patient monitor.

3. Make sure that the data export system is active on the PC.

Then, follow this procedure to transfer data:

1. Select [**Main Menu**]→[**Patient Data >>**]→[**Transfer Data**].

2. Select [**Yes**] from the popup message box.

3. Input the IP address already set on the PC.

4. Select [**Start**] to start transferring data.

Transfer data within a LAN

Before transferring data within a LAN, do as follows:

1. Connect the patient monitor and the intended PC into the same LAN and acquire the PC's IP address.

2. Make sure that the data export system is active on the PC.

Follow the same procedure as via a crossover network cable to transfer data.

22.4 Nurse Call

The patient monitor provides a nurse call connector to output nurse call signal when a userdefined alarm occurs. To obtain nurse call signal, use the nurse call cable (*PN: 009-003116-00*) we supply to connect the hospital nurse call system to the nurse call connector of the monitor and then follow this procedure:

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

2. Select [**Others >>**] to access the [**Others**] menu.

3. Select [**Nurse Call Setup >>**] to change the nurse call settings as follows:

■ Select [**Signal Type**] and toggle between [**Pulse**] and [**Continuous**].

◆ [**Pulse**]: the nurse call signals are pulse signals and each pulse lasts 1 second. When multiple alarms occur simultaneously, only one pulse signal is outputted. If an alarm occurs but the previous one is not cleared yet, a new pulse signal will also be outputted.

◆ [**Continuous**]: the nurse call signal lasts until the alarm ends, i.e. the duration of a nurse call signal equals to that of the alarm condition.

■ Select [**Contact Type**] and toggle between [**Normally Open**] and [**Normally Closed**].

◆ [**Normally Open**]: select if your hospital's nurse call relay contact is normally open.

◆ [**Normally Closed**]: select if your hospital's nurse call relay contact is normally closed.

■ Select [**Alm Lev**] and set the alarm level for nurse call-triggering alarms.

■ Select [**Alarm Cat.**] and then select the category to which the nurse call-triggering alarms belong.

Alarm conditions are indicated to nurses only when:

■ The nurse call system is enabled,

■ An alarm that meets your preset requirements occurs, and

■ The monitor is not in the alarm paused or reset status.

⚠WARNING

● **To obtain the nurse call signal, use the nurse call cable (***PN: 009-003116-00***) we supply. Otherwise the nurse call function will not work and the monitor may be damaged.**

● **Do not rely exclusively on the nurse call system for alarm notification. Remember that the most reliable alarm notification combines audible and visual alarm indications with the patient's clinical condition.**

NOTE

- **If no setting is selected from [Alm Lev] or [Alarm Cat.], no nurse call signal will be triggered whatever alarms occur.**

22.5 Network Connection

22.5.1 Selecting a Network Type

The patient monitor supports both wired and wireless network. To set the monitor network:

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

9. Set [**Network Type**] to [**LAN**] or [**Wireless AP**].

22.5.2 Setting the Wired Network

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

2. Set [**Network Type**] to [**LAN**].

3. Set [**Address Type**].

   ◆ [**DHCP**]: the monitor can automatically acquire network parameters.

   ◆ [**Manual**]: you need to manually input the monitor IP address, subnet mask and gateway address.

22.5.3 Setting the Wireless Network

The patient monitors can be connected to a wireless network via a built-in Wi-Fi module.

To set the wireless network:

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

2. Set [**Network Type**] to [**Wireless AP**].

3. Select [**Ok**]→[**WLAN Setup >>**] to access the [**WLAN Setup**] menu.

   ◆ Select [**WLAN Band**] to [**5G**] or [**2.4G**] according to the band you are using. The deault is [**Auto**], which means the monitor can automatically identify the WLAN band.

◆ Select [**BG Channel**] to set the type of B and G channels.

◆ Select [**A Channel**] to set the type of A channels.

22.5.4 Testing the Wireless Network

To test the availability of the wireless network:

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

2. Enter the [**IP Address**] of wireless AP.

3. Click [**Connection Test**].

The Wi-Fi device used in the monitor is in compliance with IEEE 802.11a/b/g/n.
You should not change the patient monitor's IP address randomly. If you want to know details about IP address setup, contact the technical personnel in charge of the CMS.

NOTE

- **The design, installation, restruction and maintenance of the wireless network's distribution shall be performed by authorized service personnel of our company.**

- **The existence of obstacles (such as wall) will exert impact on data transferring or even cause network interruption.**

- **The Central Monitoring System is capable of connecting up to 32 bedside monitors via the wireless network.**

22.5.5 Setting the Multicast Parameters

Whether the equipment is presented by broadcast or multicast is defined before the equipment leaves the factory. If [**Multicast**] is selected, you need to set the multicast parameters.

To set the multicast parameters:

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

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

22.5.6 Connecting the monitor to the CMS

To connect the monitor to the CMS, proceed as follows:

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

2. Set [**Network Type**] and [**Address Type**].

3. Input the monitor IP address, subnet mask and gateway address if the [**Address Type**] is set to [**Manual**]

4. Connect the monitor to the CMS through either of the following methods:

    ◆ Admit the monitor on the CMS. Refer to the ***Hypervisor VI Operator's Manual (PN: H-300B-20-47610)*** for details of admitting a monitor.

    ◆ Setting the CMS (refer to ***22.5.6.1 Setting the CMS*** for details), and then selecting a CMS (refer to ***22.5.6.2 Selecting a CMS*** for details).

22.5.6.1 Setting the CMS

You can configure up to 30 central stations (CMS) for your monitor. To set the CMSs,

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

2. Set [**Select CMS**] to [**On**].

3. Select [**Central Station Setup >>**].

4. Set CMS names and corresponding IP addresses.

22.5.6.2 Selecting a CMS

If [**Select CMS**] is enabled, you can select the CMS for the current monitoring.

To select the CMS, select the prompt message area at the bottom of the screen. Then the selected CMS name will display.

If the CMS you select does not have a name, this area displays "???".

23 Batteries

23.1 Overview

This monitor is designed to operate on rechargeable Lithium-ion battery power during intra-hospital patient transfer or whenever the power supply is interrupted. The battery is charged automatically when the monitor is connected to AC power, no matter the monitor is powered on or not. Whenever the AC power is interrupted during patient monitoring, the patient monitor will automatically run power from the internal batteries.

On-screen battery symbols indicate the battery status as follows:

- ◧▮▮▮ Indicates that the battery works correctly. The solid portion represents the current charge level of the battery in proportion to its maximum charge level.

- ◧▭▭▮ Indicates that the battery has low charge level and needs to be charged. In this case, the patient monitor provides an alarm message.

- ◧▭▭▭ Indicates that the battery is almost depleted and needs to be charged immediately. Otherwise, the patient monitor shuts down automatically.

- ◧⊠ Indicates that no battery is installed.

The capacity of the internal battery is limited. If the battery charge is too low, a technical alarm will be triggered and the message [] or [] displayed. At this moment, apply AC power to the patient monitor. Otherwise, the patient monitor will power off automatically before the battery is completely depleted.

23.2 Battery Guidelines

Life expectancy of a battery depends on how frequent and how long it is used. For a properly maintained and stored lithium ion battery, its life expectancy is about 3 years. For more aggressive use models, life expectancy can be less. We recommend replacing lithium ion batteries every 3 years.

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

- The battery performance test must be performed every two years, before monitor repairs, or whenever the battery is suspected as being the source of the problems.

- Condition a battery once when it is used or stored for 3 months, or when its operating time becomes noticeably shorter.

- Take out the battery before the monitor is transported or will not be used for more than 3 months.

- Remove the battery from the monitor if it is not being used regularly. (Leaving the battery in a monitor that is not in regular use will shorten the life of the battery).

- The shelf life of a Lithium Ion battery is about 6 months when the battery is stored with the battery power being 50% of the total power. In 6 months the battery power must be depleted before the Lithium Ion battery is fully charged. Then run the monitor on this fully charged battery .When its battery power becomes 50% of the total power, take out the battery from the monitor and store it.

⚠WARNING

- **Keep the battery out of the reach of children.**

- **Use only the battery specified by the manufacturer.**

- **If the battery shows signs of damage or signs of leakage, replace it immediately. Do not use a faulty battery in the monitor.**

23.3 Battery Maintenance

Conditioning a Battery

A battery should be conditioned before it is used for the first time. A battery conditioning cycle is one uninterrupted charge of the battery, followed by an uninterrupted battery discharge and charge. Batteries should be conditioned regularly to maintain their useful life.

NOTE

- **The actual battery capacity will decrease over time with use of batteries. When a monitor operates on batteries that have been used before, the full capacity battery symbol does not indicate the capacity and operating time of this battery can still fulfill battery specifications in the operator's manual. When conditioning a battery, please replace the battery if its operating time is significantly lower than the specified time.**

To condition a battery, follow this procedure:

1. Disconnect the monitor from the patient and stop all monitoring or measuring.

2. Insert the battery in need of conditioning in the battery slot of the monitor.

3. Apply AC/DC power to the monitor and allow the battery to charge uninterrupted for 10 hours.

4. Remove AC/DC power and allow the monitor to run from the battery until it shuts off.

5. Apply AC/DC power again to the monitor and allow the battery to charge uninterrupted for 10 hours.

6. This battery is now conditioned and the monitor can be returned to service.

Checking a Battery

The battery performance test must be performed every two years, before monitor repairs, or whenever the battery is suspected as being the source of the problems. The performance of a rechargeable battery may deteriorate over time. To check the performance of a battery, follow this procedure:

1. Disconnect the monitor from the patient and stop all monitoring or measuring.

2. Apply AC/DC power to the monitor and allow the battery to charge uninterrupted for 10 hours.

3. Remove AC/DC power and allow the monitor to run from the battery until it shuts off.

4. The operating time of battery reflects its performance directly.

Please replace the battery or contact with the maintenance personnel if its operating time is significantly lower than the specified time.

NOTE

- **The battery might be damaged or malfunctioned if its operating time is too short after being fully charged. The operating time depends on the configuration and operation. For example, measuring NIBP more frequently will also shorten the operating time.**

- **When a battery has visual signs of damage, or no longer holds a charge, it should be replaced. Remove the old battery from the monitor and recycle it properly.**

23.4 Battery Recycling

When a battery has visual signs of damage, or no longer holds a charge, it should be replaced. Remove the old battery from the monitor and recycle it properly. To dispose of the batteries, follow local laws for proper disposal.

⚠WARNING

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

FOR YOUR NOTES

24 Care and Cleaning

Use only the substances approved by us and methods listed in this chapter to clean or disinfect your equipment. Warranty does not cover damage caused by unapproved substances or methods.

We make no claims regarding the efficacy of the listed chemicals or methods as a means for controlling infection. For the method to control infection, consult your hospital's Infection Control Officer or Epidemiologist.

In this chapter we only describe cleaning and disinfection of the main unit. For the cleaning and disinfection of other reusable accessories, refer to instructions for use of corresponding accessories.

24.1 General Points

Keep you equipment and accessories free of dust and dirt. To avoid damage to the equipment, follow these rules:

■ Always dilute according the manufacturer's instructions or use lowest possible concentration.

■ Do not immerse part of the equipment into liquid.

■ Do not pour liquid onto the equipment or accessories.

■ Do not allow liquid to enter the case.

■ Never use abrasive materials (such as steel wool or silver polish), or erosive cleaners (such as acetone or acetone-based cleaners).

⚠ WARNING

● **The responsible hospital or institution shall carry out all cleaning and disinfection procedure specified in this chapter.**

● **Be sure to disconnect all power cables from the outlets before cleaning the equipment.**

⚠ CAUTION

● **If you spill liquid on the equipment or accessories, contact us or your service personnel.**

NOTE

- **To clean or disinfect reusable accessories, refer to the instructions delivered with the accessories.**
- **Avoid the external connectors and thermovent during cleaning or disinfection procedures.**

24.2 Cleaning

Your equipment should be cleaned on a regular basis. If there is heavy pollution or lots of dust and sand in your place, the equipment should be cleaned more frequently. Before cleaning the equipment, consult your hospital's regulations for cleaning the equipment.

Recommended cleaning agents are:

Product Name	Product Type	Ingredient
Water	Liquid	/
Ethanol	Liquid	Ethanol 70%
Isopropyl alcohol	Liquid	Isopropyl alcohol 70%
Sodium hypochlorite bleach	Liquid	Sodium hypochlorite bleach 10%
Hydrogen peroxide	Liquid	Hydrogen peroxide 3%
1-Propanol	Liquid	1-Propanol 50%
Rely+On™ Virkon®	Powder	Used as 1% solution (prepared the concentration directed by the accompanying instructions for use) Biocidal active: ■ Pentapotassium bis (peroxymonosulphate) bis (sulphate) (500g/kg) ■ Contains dipotassium peroxodisulphate
Super Sani-cloth® Germicidal Disposable Wipe	Wipe	Quaternary ammonium chloride 0.5% Isopropyl alcohol 55%

To clean your equipment, follow these rules:

1. Clean the display screen using a soft, clean cloth dampened with a glass cleaner, making sure that no cleanser is dripping from the cloth.

2. Clean the exterior surface of the equipment using a soft cloth dampened with the cleaner, making sure that no cleanser is dripping from the cloth.

3. Wipe off all the cleaning solution with a dry cloth after cleaning if necessary.

4. Dry your equipment in a ventilated, cool place.

24.3 Disinfection

Disinfect the equipment as required in your hospital's servicing schedule. Cleaning equipment before disinfecting is recommended.

24.4 Sterilization

Sterilization is not recommended for this monitor, related products, accessories, or supplies unless otherwise indicated in the Instructions for Use that accompany the products, accessories or supplies.

FOR YOUR NOTES

25 Maintenance

⚠**WARNING**

- **Failure on the part of the responsible individual hospital or institution employing the use of this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.**
- **The safety checks or maintenance involving any disassembly of the equipment should be performed by professional servicing personnel. Otherwise, undue equipment failure and possible health hazards could result.**
- **No modification of this equipment is allowed.**
- **Do not open the equipment housings. All servicing and future upgrades must be carried out by the service personnel.**
- **If you discover a problem with any of the equipment, contact your service personnel or us.**
- **The service personnel must be properly qualified and thoroughly familiar with the operation of the equipment.**

25.1 Regular Inspection

Before the first use, after your patient monitor has been used for 6 to 12 months, or whenever your patient monitor is repaired or upgraded, a thorough inspection should be performed by qualified service personnel to ensure the reliability.

Follow these guidelines when inspecting the equipment:

- Make sure that the environment and power supply meet the requirements.
- Inspect the equipment and its accessories for mechanical damage.
- Inspect all power cords for damage, and make sure that their insulation is in good condition.
- Make sure that only specified accessories are applied.
- Inspect if the alarm system functions correctly.
- Make sure that the recorder functions correctly and the recorder paper meets the requirements.
- Make sure that the batteries meet the performance requirements.
- Make sure that the patient monitor is in good working condition.

In case of any damage or abnormity, do not use the patient monitor. Contact the hospital's biomedical engineers or your service personnel immediately.

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25.2 Maintenance and Testing Schedule

The following maintenance and tests, except for visual inspection, power on test, touchscreen calibration, battery check, and recorder check, shall be carried out by the service personnel only. Contact your service personnel if any maintenance is required. Make sure to clean and disinfect the equipment before any test and maintenance.

Check/Maintenance Item		Recommended Frequency
Preventative Maintenance Tests		
Visual inspection		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.
	Leakage test	
CO_2 tests	Leakage test	
	Performance test	
	Calibration	
Performance Tests		
ECG test and calibration	Performance Test	1. If the user suspects that the measurement is incorrect. 2. Following any repairs or replacement of relevant module. 3. At least once every two years. At least once a year is recommended for NIBP and CO_2.
	Calibration	
Resp performance test		
SpO_2 test		
NIBP test	Pressure check	
	Leakage test	
Temp test		
IBP test and calibration	Performance test	
	Pressure calibration	
C.O. test		
CO_2 tests and calibration	Leakage test	
	Performance test	
	Calibration	
Nurse call function test		If the user suspects that the nurse call or analog output does not work well.
Analog output performance test		
Electrical Safety Tests		
Electrical Safety Tests		At least once every two years.
Other Tests		
Power-on test		1. When first installed or reinstalled. 2. Following any repairs or replacement of any main unit parts.

Touchscreen calibration		1. When the touchscreen appears abnormal.
		2. After the touchscreen is replaced.
Recorder check		Following any repair or replacement of the recorder.
Network print test		1. When first installed.
		2. Whenever the printer is serviced or replaced.
Battery check	Functionality test	1. When first installed.
		2. Whenever a battery is replaced.
	Performance test	Once every six months or if the battery run time reduced significantly.

25.3 Checking Monitor and Module Information

To view the information about system start time, selftest, etc., select [**Main Menu**]→[**Maintenance >>**]→[**Monitor Information >>**]. You can print out the information for the convenience of troubleshooting. The information will not be saved during shut down.

You can also view the information about the monitor configuration and system software version by selecting [**Main Menu**]→[**Maintenance >>**]→[**Software Version >>**].

25.4 Calibrating ECG

The ECG signal may be inaccurate due to hardware or software problems. As a result, the ECG wave amplitude becomes greater or smaller. In that case, you need to calibrate the ECG module.

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

2. Select [**Main Menu**]→[**Maintenance >>**]→[**User Maintenance >>**]→enter the required password→[**Module Maintenance >>**]→[**Calibrate ECG**]. A square wave appears on the screen and the message [**ECG Calibrating**] is displayed.

3. Compare the amplitude of the square wave with the wave scale. The difference should be within 5%.

4. After the calibration is completed, select [**Stop Calibrating ECG**]

You can print out the square wave and wave scale and then measure the difference between them if necessary. If the difference exceeds 5%, contact your service personnel.

25.5 NIBP Tests

25.5.1 NIBP Leakage Test

The NIBP leakage test checks the integrity of the system and of the valve. It is required at least once a year or when you doubt the measured NIBP. If the test failed, corresponding prompt messages will be given. If no message is displayed, it means no leakage is detected.

Tools required:

■ An adult cuff

■ An air tubing

■ A correct sized cylinder

Follow this procedure to perform the leakage test:

1. Set the patient category to [**Adu**].

2. Connect the cuff to the NIBP connector on the monitor.

3. Wrap the cuff around the cylinder as shown below.
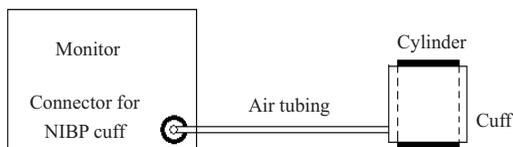
4. Select [**Main Menu**]→[**Maintenance >>**]→[**User Maintenance >>**]. Enter the required password and then select [**OK**].

5. Select [**Module Maintenance >>**]→[**NIBP Leakage Test**]. The NIBP display shows [**Leakage Testing…**].

After about 20 seconds, the monitor will automatically deflate. This means the test is completed. If the message [**NIBP Pneumatic Leak**] is displayed, it indicates that the NIBP airway may have leakages. Check the tubing and connections for leakages. If you ensure that the tubing and connections are all correct, perform a leakage test again.

If the problem persists, contact your service personnel.

25.5.2 NIBP Accuracy Test

The NIBP accuracy test is required at least once a year or when you doubt the measured NIBP.

Tools required:

- T-piece connector
- Approprating tubing
- Balloon pump
- Metal Vessel (volume 500±25 ml)
- Reference manometer (calibrated with accuracy higher than 0.75 mmHg)

Follow this procedure to perform the accuracy test:

1. Connect the equipment as shown.
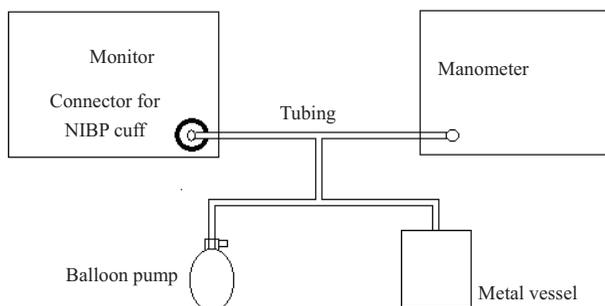
2. Before inflation, check that the reading of the manometer should be 0. If not, open the valve of the balloon pump to let the whole airway open to the atmosphere. Close the valve of the balloon pump after the reading is 0.

3. Select [**Main Menu**]→[**Maintenance >>**]→[**User Maintenance >>**]. Enter the required password and then select [**OK**].

4. Select [**Module Maintenance >>**]→[**NIBP Accuracy Test**].

5. Check the manometer values and the monitor values. Both should be 0mmHg.

6. 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.

7. Compare the manometer values with the monitor values. The difference should be 3 mmHg. If it is greater than 3 mmHg, contact your service personnel.

8. 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.

25.6 CO$_2$ Tests

25.6.1 CO$_2$ Leakage Test

For the CO$_2$ module, leakage test is needed every year or when you suspect the measurement. Follow this procedure to perform the test:

1. Connect the CO$_2$ module with the patient module.

2. Wait until CO$_2$ warmup is finished and then use your hand or other objects to completely block the gas inlet of the module or watertrap. The CO$_2$ module will behave as follows:

    Sidestream: The alarm message [CO2 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.

25.6.2 CO$_2$ Accuracy Test

For the CO$_2$ module, leakage test is needed every year or when you suspect the measurement. Tools required:

- A steel gas cylinder with 6±0.05% CO$_2$ and balance gas N$_2$
- T-shape connector
- Tubing

Follow this procedure to perform the test:

1. Connect the CO$_2$ module with the patient module.

2. Wait until the CO$_2$ 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. Select [**Main Menu**]→[**Maintenance >>**]→[**User Maintenance >>**]→enter the required password→[**Module Maintenance >>**]→[**Maintain CO2 >>**]→[**Calibrate CO2 >>**].

4. Connect the test system as follows:
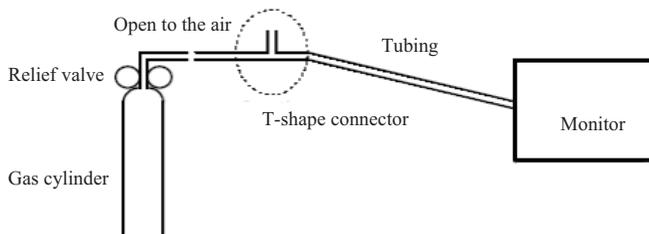
5. Open the relief valve to vent standard CO_2 and make sure that there is an excess gas flow through the T-shape connector to air.

6. Check the realtime CO_2 value is within 6.0±0.3% in the [**Calibrate CO2**] menu.

25.6.3 Calibrating CO_2

For the CO_2 module, a calibration is needed every year or when the measured values have a great deviation. For maintream CO_2 module, no calibration is needed. Calibration for the CO_2 module can be performed only when the module enters the full accuracy mode.

⚠ **WARNING**

● **Connect an exhaust tube to the gas outlet connector of the monitor to remove the calibration gases to a scavenging system.**

Tools required:

■ A steel gas cylinder with 6±0.05% CO_2 and balance gas N_2

■ T-shape connector

■ Tubing

Follow this procedure to perform a calibration:

1. Make sure that the CO_2 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→[**Module Maintenance >>**]→ [**Maintain CO$_2$ >>**]→ [**Calibrate CO$_2$ >>**].

4. In the [**Calibrate CO$_2$**] menu, select [**Zero**].

5. After the zero calibration is finished successfully, connect the equipment as follows:
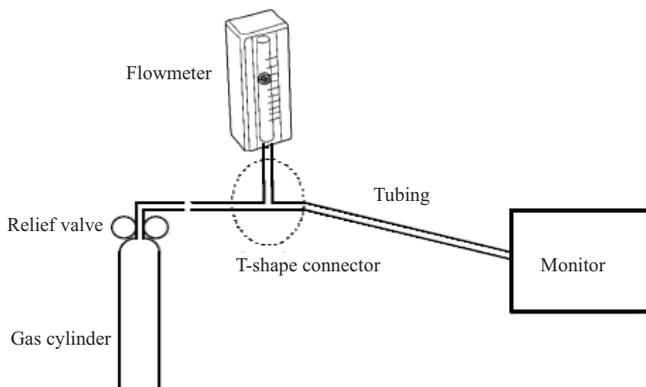
6. Turn on and adjust the relief valve to make the flowmeter reads within 10-50 mL/min and keeps stable as well.

7. In the [**Calibrate CO$_2$**] menu, enter the vented CO$_2$ concentration in the [**CO$_2$**] field.

8. In the [**Calibrate CO$_2$**] menu, the measured CO$_2$ concentration is displayed. After the measured CO$_2$ concentration becomes stable, select [**Calibrate CO$_2$**] to calibrate the CO$_2$ module.

9. If the calibration is finished successfully, the message [**Calibration Completed!**] is displayed in the [**Calibrate CO$_2$**] menu. If the calibration failed, the message [**Calibration Failed!**] is displayed. In this case, perform another calibration.

25.7 Calibrating the Touchscreen

1. Select [**Main Menu**]→[**Maintenance >>**]→[**Cal. Touchscreen**].

2. [+] will, in turn, appear at different positions of the screen.

3. Select each [+] as it appears on the screen.

4. After the calibration is completed, the message [**Screen Calibration Completed!**] is displayed. Select [**Ok**] to confirm the completion of the calibration.

25.8 Electrical Safety Tests

Refer to *E Electrical Safety Inspection*.

26 Accessories

The accessories listed in this chapter comply with the requirements of IEC 60601-1-2 when in use with the patient monitor. The accessory material that contacts the patients has undertaken the bio-compatibility test and is verified to be in compliance with ISO 10993-1. For details about the accessories, refer to the instructions for use provided with the accessory.

⚠ WARNING

- **Use accessories specified in this chapter. Using other accessories may cause damage to the patient monitor or not meet the claimed specifications.**
- **Single-use accessories are not designed to be reused. Reuse may cause a risk of contamination and affect the measurement accuracy.**
- **Check the accessories and their packages for any sign of damage. Do not use them if any damage is detected.**
- **Use the accessories before the expiry date if their expiry date is indicated.**
- **The disposable accessories shall be disposed of according to hospital's regulations.**

26.1 ECG Accessories

ECG Electrodes

Model	Quantity	Patient Category	Part No.
31499224	10 pieces	Adult	0010-10-12304
2245-50	50 pieces	Pediatric	9000-10-07469
H124SG	50 pieces	Neonate	900E-10-04880
SF06	5 pieces	Adult	040-002711-00

12-Pin Integrative Trunk Cables

Leadwire supported	Compatible with	Type	Patient Category	Model	Part No.
5-leadwire	AHA	Snap, Defibrillation-proof	Adult, pediatric	EA6251B	040-000961-00
5-leadwire	IEC			EA6252B	040-000963-00
3-leadwire	AHA			EA6231B	040-000965-00
3-leadwire	IEC			EA6232B	040-000967-00
5-leadwire	AHA	Clip, Defibrillation-proof		EA6251A	040-000960-00
5-leadwire	IEC			EA6252A	040-000962-00
3-leadwire	AHA			EA6231A	040-000964-00
3-leadwire	IEC			EA6232A	040-000966-00

12-Pin Separable Trunk Cables

Leadwire supported	Compatible with	Type	Patient Category	Part No.
3-leadwire	AHA, IEC	Defibrillation-proof	Infant, neonate	0010-30-42720
3-leadwire	AHA, IEC	ESU-proof		0010-30-42724
3/5-leadwire	AHA, IEC	Defibrillation-proof	Adult, pediatric	009-004728-00
3/5-leadwire	AHA, IEC	ESU-proof		0010-30-42723
12-leadwire	AHA	Defibrillation-proof	Adult	0010-30-42721
12-leadwire	IEC	Defibrillation-proof		0010-30-42722

Cable Sets

3-Electrode Cable Sets						
Type	Compatible with	Model	Patient Category	Part No.	Length	Remark
Clip	IEC	EL6304A	Adult, pediatric	0010-30-42732	1m	Long
		EL6306A	Infant, neonate	0010-30-42897	1m	Long
		EL6312A		040-000149-00	1m	Long
	AHA	EL6303A	Adult, pediatric	0010-30-42731	1m	Long
		EL6305A	Infant, neonate	0010-30-42896	1m	Long
		EL6311A		040-000148-00	1m	Long

3-Electrode Cable Sets						
Type	Compatible with	Model	Patient Category	Part No.	Length	Remark
Snap	IEC	EL6302B	Adult, pediatric	0010-30-42733	1m	Long
		EL6312B	Infant, neonate	040-000147-00	1m	Long
	AHA	EL6301B	Adult, pediatric	0010-30-42734	1m	Long
		EL6311B	Infant, neonate	040-000146-00	1m	Long

5-Electrode Cable Sets						
Type	Compatible with	Model	Patient Category	Part No.	Length	Remark
Clip	IEC	EL6504A	Adult, pediatric	0010-30-42730	1m to 1.4m	Long
	AHA	EL6503A		0010-30-42729	1m to 1.4m	Long
Snap	IEC	EL6502B		009-004730-00	1.4m for F and N; 1m for others	Long
	AHA	EL6501B		009-004729-00	1.4m for RL and LL; 1m for others	Long

12-Electrode Cable Sets (for uMEC12/uMEC15)						
Type	Compatible with	Model	Patient Category	Part No.	Length	Remark
Clip	IEC	EL6802A	Adult	0010-30-42903	0.8m	Limb
		EL6804A		0010-30-42905	0.6m	Chest
	AHA	EL6801A		0010-30-42902	0.8m	Limb
		EL6803A		0010-30-42904	0.6m	Chest
Snap	IEC	EL6802B		0010-30-42907	0.8m	Limb
		EL6804B		0010-30-42909	0.6m	Chest
	AHA	EL6801B		0010-30-42906	0.8m	Limb
		EL6803B		0010-30-42908	0.6m	Chest

26.2 SpO$_2$ Accessories

SpO$_2$ Sensors

The SpO$_2$ sensor material that patients or other staff will come into contact with has undertaken the bio-compatibility test and is verified to be in compliance with ISO 10993-1.

Mindray SpO$_2$ Module				
Type	**Model**	**Patient Category**	**Application site**	**Part No.**
Disposable	520A	Adult	Finger	009-005087-00
	521A			009-005091-00
	520P	Pediatric	Finger	009-005088-00
	521P			009-005092-00
	520I	Infant	Toe	009-005089-00
	521I			009-005093-00
	520N	Neonate	Foot	009-005090-00
	521N			009-005094-00
Reusable	562A	All	/	009-004600-00
	518B	Neonate	Foot	518B-30-72107
	518BLH	Neonate	Foot	115-020887-00
	512E	Adult	Finger	512E-30-90390
	512F			512F-30-28263
	512FLH			115-012807-00
	512G	Pediatric	Finger	512G-30-90607
	512H			512H-30-79061

- Wavelength emitted by the sensors is between 600 nm and 1000 nm.
- The maximum photic output consumption of the sensor is less than 18 mW.

The information about the wavelength range and maximum photic output consumption can be especially useful to clinicians, for example, clinicians performing photodynamic therapy.

26.3 NIBP Accessories

Tubing

Type	Patient Category	Part No.
Reusable	Adult, pediatric	040-002712-00
	Neonate	6200-30-11560

Reusable Cuff

Model	Patient Category	Measurement Site	Limb Circumference (cm)	Bladder Width (cm)	Part No.
CM1200	Small infant		7 to 13	5.8	115-002480-00
CM1201	Infant		10 to 19	9.2	0010-30-12157
CM1202	Pediatric	Arm	18 to 26	12.2	0010-30-12158
CM1203	Adult		24 to 35	15.1	0010-30-12159
CM1204	Large adult		33 to 47	18.3	0010-30-12160
CM1205	Large adult	Thigh	46 to 66	22.5	0010-30-12161
CM1300	Small infant		7 to 13	5.8	040-000968-00
CM1301	Infant		10 to 19	9.2	040-000973-00
CM1302	Pediatric	Arm	18 to 26	12.2	040-000978-00
CM1303	Adult		24 to 35	15.1	040-000983-00
CM1304	Large adult		33 to 47	18.3	040-000988-00
CM1305	Large adult	Thigh	46 to 66	22.5	040-000993-00
CM1306	Adult	Arm	24 to 35	15.1	115-015930-00
CM1307	Large adult	Arm	33 to 47	18.3	115-015931-00

Disposable Cuff

Model	Patient Category	Measurement Site	Limb Circumference (cm)	Bladder Width (cm)	Part No.
CM1500A			3.1 to 5.7	2.2	001B-30-70692
CM1500B			4.3 to 8.0	2.9	001B-30-70693
CM1500C	Neonate		5.8 to 10.9	3.8	001B-30-70694
CM1500D		Arm	7.1 to 13.1	4.8	001B-30-70695
CM1500E			8 to 15	/	001B-30-70696
CM1501	Infant		10 to 19	7.2	001B-30-70697
CM1502	Pediatric		18 to 26	9.8	001B-30-70698

CM1503	Adult		25 to 35	13.1	001B-30-70699
CM1504	Large adult		33 to 47	16.5	001B-30-70700
CM1505	Large adult	Thigh	46 to 66	20.5	001B-30-70701
CM1506	Adult	Arm	25 to 35	13.1	115-016969-00
CM1507	Adult	Arm	33 to 47	16.5	115-016709-00

26.4 Temp Accessories

Temp Cable

Type	Model	Remark	Part No.
Extension cable (reusable)	MR420B	Applicable to sensor MR411 and MR412	040-001235-00

Temp Probes

Type	Model	Patient Category	Measurement Site	Part No.
Reusable	MR401B	Adult	Esophageal/Rectal	0011-30-37392
	MR403B		Skin	0011-30-37393
	MR402B	Pediatric, infant	Esophageal/Rectal	0011-30-37394
	MR404B		Skin	0011-30-37395
Disposable	MR411	Adult, pediatric	Esophageal/Rectal	045-001860-00
	MR412	Adult, pediatric	Skin	045-001861-00
	MR413	Adult	Esophageal/Rectal	045-001863-00
	MR415	Neonate	Esophageal/Rectal	045-001854-00

26.5 IBP Accessories (for uMEC12/uMEC15)

Accessories Kit No.	Components	Part No.
6800-30-50876 (Hospira)	IM2201 12Pin IBP Cable	001C-30-70759
	Disposable Transducer	0010-10-42638
	Steady Rest for IBP Transducer and Clamp	M90-000133---
	Steady Rest for IBP Transducer and Clamp	M90-000134---
6800-30-50877 (BD)	IM2202 12Pin IBP Cable	001C-30-70757
	Disposable Pressure Transducer	6000-10-02107
	Transducer/Manifold Mount	0010-10-12156
115-020884-00 (Mindray)	Mounting background and clamp	040-001663-00
	12 Pin IBP cable	115-020486-00
	Disposable Pressure Transducer	045-001014-00
		045-001016-00
		045-001018-00
	2 Channel Pressure Transducer	045-001020-00
		045-001022-00
		045-001024-00

It is proved through tests that the following accessories are compatible with the patient monitor. Only the accessories proceeded by "*" are available from our company. If you want to purchase other accessories, contact respective manufacturers and make sure if these accessories are approved for sale in local.

26.6 C.O. Accessories (for uMEC12/uMEC15)

Model	Material	Part No.
CO7702	12Pin C.O. cable.	0010-30-42743
SP4042	IT Sensor	6000-10-02079
SP5045	IT Sensor Housing	6000-10-02080
MX387	12CC Control Syringe W/1CC Stop W/Rotator	6000-10-02081
131HF7	Thermodilution catheter	6000-10-02183

26.7 CO$_2$ Accessories (for uMEC12/uMEC15)

Material	Patient Category	Remark	Part No.
DRYLINE™ PRIME Receptacle Adapter	/	Reusable	100-000152-00
DRYLINE II watertrap	Adult, pediatric		100-000080-00
DRYLINE II watertrap	Neonate		100-000081-00
DRYLINE™ PRIME Gas Sampling Line With Airway Adapter	Adult/Pediatric	Disposable	100-000138-00
DRYLINE™ PRIME Gas Sampling Line With Airway Adapter	Neonate		100-000139-00
DRYLINE™ PRIME Nasal Gas Sampling Line	Adult		100-000142-00
DRYLINE™ PRIME Nasal Gas Sampling Line	Pediatric		100-000143-00
DRYLINE™ PRIME Nasal Gas Sampling Line	Neonate		100-000144-00
DRYLINE™ PRIME+ Gas Sampling Line With Airway Adapter	Adult/Pediatric		100-000140-00
DRYLINE™ PRIME+ Gas Sampling Line With Airway Adapter	Neonate		100-000141-00
DRYLINE™ PRIME+ Nasal Gas Sampling Line	Adult		100-000145-00
DRYLINE™ PRIME+ Nasal Gas Sampling Line	Pediatric		100-000146-00
DRYLINE™ PRIME+ Nasal Gas Sampling Line	Neonate		100-000147-00
DRYLINE™ PRIME+ Gas Watertrap Mini	/		100-000151-00
Adult Nasal CO2 Sample Cannula	Adult		M02A-10-25937
Pediatric Nasal CO2 Sample Cannula	Pediatric		M02A-10-25938
Infant Nasal CO2 Sample Cannula	Neonate		M02B-10-64509
Sampling Line, Adult 2.5m	Adult, pediatric		9200-10-10533
Sampling Line, Neonate, 2.5m	Neonate		9200-10-10555
DRYLINE Airway Adapter	Neonate		040-001187-00
DRYLINE Airway Adapter	/	Straight, disposable	9000-10-07486

| DRYLINE Airway Adapter | / | Elbow, disposable | 9000-10-07487 |

26.8 Others

Material	Part No.
Lithium battery	LI23S005A, 022-000273-00
	LI13S001A, 022-000122-00
Three-wire power cord (Europe)	DA8K-10-14454
Grounding cable	1000-21-00122
Nurse call cable	009-003116-00
Analog output external cable	009-003117-00
Defibrillator synchronization cable	009-003118-00
LCD display, 19"	023-001129-00
USB drive, 4G	023-000217-00
	023-000218-00
Recorder	115-001290-00
Thermal paper	A30-000001---
Wall mounting bracket for external display	045-000931-00
Trolley mounting bracket	045-000924-00
	045-000921-00
Hook mounting kit	115-037484-00
	115-037909-00
Bedrail Hook	8000-30-90169
Cable protecting tube	009-003648-00
Accessories management tape	009-003903-00
Cable management straps	0010-10-42667
Barcode scanner	115-008393-00

FOR YOUR NOTES

A Product Specifications

A.1 Monitor Safety Specifications

A.1.1 Classifications

The patient monitor is classified, according to IEC60601-1:

Type of protection against electrical shock	Class I, equipment energized from an external and internal electrical power source.
Degree of protection against electrical shock	Type BF defibrillation proof for CO_2 monitoring. Type CF defibrillation proof for ECG, RESP, TEMP, SpO_2, NIBP, IBP and C.O.
Mode of operation	Continuous
Degree of protection against harmful ingress of water	IPX1 (Protected against vertically falling water drops)

A.1.2 Environmental Specifications

⚠ **WARNING**

- **The equipment may not meet the performance specifications if stored or used outside the specified temperature and humidity ranges.**

Main unit		
Item	Operating conditions	Storage conditions
Temperature (℃)	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

CO_2 module		
Item	Operating conditions	Storage conditions
Temperature (℃)	5 to 40	-20 to 60
Relative humidity (noncondensing)	15% to 95%	10% to 95%
Barometric (mmHg)	430 to 790	430 to 790

NOTE

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

A.2 Power Supply Specifications

AC power	
Line voltage	100 to 240 VAC (±10％)
Current	1.5 A
Frequency	50/60 Hz (±3Hz)
Battery (standard configuration)	
Battery Type	Chargeable Lithium-Ion, 11.1DVC, 2.5 Ah
Run time	uMEC15: ≥ 2.5 h uMEC10/uMEC12: ≥ 4 h when powered by a new fully-charged battery (25℃, display brightness set to default value, SpO$_2$ cable connected, ECG cable and Temp cable not connected, auto NIBP measurements at an interval of 15 minutes)
Charge time	When the monitor is powered off, less than 3.5 hours to 90% less than 4 hours to 100% When the monitor is in use, less than 5.5 hours to 90% less than 6 hours to 100%
Shutdown delay	at least 5 min (after a low battery alarm first occurs)
Battery (optional configuration)	
Battery Type	Chargeable Lithium-Ion, 11.1DVC, 5 Ah
Run time	uMEC15: ≥ 6 h uMEC10/uMEC12: ≥ 8 h when powered by a new fully-charged battery (25℃, display brightness set to default value, SpO$_2$ cable connected, ECG cable and Temp cable not connected, auto NIBP measurements at an interval of 15 minutes)
Charge time	When the monitor is powered off, Less than 7 hours to 90% Less than 8 hours to 100%

	When the monitor is in use, less than 11 hours to 90% less than 12 hours to 100%
Shutdown delay	at least 5 min (after a low battery alarm first occurs)

A.3 Physical Specifications

Model	Size	Weight	Remark
uMEC15	405×165×305 mm	≤5.0 kg	Standard configuration, standard battery, without accessories，recorder, and other modules
uMEC12	345×160×255 mm	≤4.0 kg	
uMEC10	315×155×220 mm	≤3.5 kg	

A.4 Hardware Specifications

A.4.1 Display

Host display			
Model	**Screen Size (diagonal)**	**Screen type**	**Resolution**
uMEC15	15 inches	color LED backlight LCD	at least 1024 × 768 pixels
uMEC12	12.1 inches		at least 800×600 pixels
uMEC10	10.4 inches		
External display			
Screen type	Medical-grade LED backlight LCD		

A.4.2 Recorder

Method	Thermal dot array
Paper width	50 mm±1 mm
Paper speed	12.5 mm/s, 25 mm/s, 50 mm/s with accuracy within ±5%
Number of waveform channels	Maximum 3

A.4.3 LEDs

Alarm lamp	1 (two color coded: yellow and red)
Power on LED	1 (green)
AC power LED	1 (green)
Battery LED	1 (green)

A.4.4 Audio Indicator

Speaker	Give alarm tones (45 to 85 dB), key tones, QRS tones; support PITCH TONE and multi-level tone modulation; alarm tones comply with IEC60601-1-8.

A.4.5 Monitor Interface Specifications

Power	1 AC power input connector
Wired network	1 RJ45 connector, 100 Base-TX,IEEE 802.3
USB	2 connector, USB 2.0
Equipotential Grounding Terminal	1
Multifunctional connector	1
VGA connector	1

A.4.6 Outputs

Analog Output	
Standard	Meets the requirements of IEC60601-1 for short-circuit protection and leakage current
ECG Analog Output	
Bandwidth (-3dB; reference frequency: 10Hz)	Diagnostic mode: 0.05 to 150 Hz Monitor mode: 0.5 to 40 Hz Surgical mode: 1 to 20 Hz ST mode: 0.05 to 40 Hz
QRS delay	≤ 25 ms (in diagnostic mode, and with Paced off)
Sensitivity	1V/mV ±5%

PACE rejection/enhancement	Pace enhancement Signal amplitude: Voh≥2.5V Pulse width: 10ms±5% Signal rising and falling time: ≤100μs
Nurse Call Signal	
Amplitude	High level: 3.5 to 5 V, providing a maximum of 10 mA output current; Low level: < 0.5 V, receiving a maximum of 5 mA input current.
Rising and falling time	≤1 ms
Defib Sync Pulse	
Output impedance	≤100 Ω
Max time delay	35 ms (R-wave peak to leading edge of pulse)
Amplitude	High level: 3.5 to 5 V, providing a maximum of 10 mA output current; Low level: < 0.5 V, receiving a maximum of 5 mA input current.
Pulse width	100 ms ±10%
Rising and falling time	≤1 ms
Alarm output (Network connector)	
Alarm delay time from the patient monitor to remote equipment	The alarm delay time from the patient monitor to remote equipment is ≤2 seconds, measured at the monitor's signal output connector.

A.5 Data Storage

Trends	Trends: 120 hours, at 1 min resolution Mid-length trends: 4 hours, at 5 s resolution Long-trends: 1200 hours, at 10 min resolution
Parameter alarms	1800 physiological alarms and manual events and related parameter waveforms.
Arrh. events	128 arrhythmia events and relate waveforms and parameters.
NIBP measurements	1600 sets
Full-disclosure waveforms	48 hours at maximum. The specific storage time depends on the waveforms stored and the number of stored waveforms.

A.6 Wireless Network

Standards	MSD45N Wireless Module: IEEE 802.11a/b/g/n, support Wi-Fi

A.7 Measurement Specifications

The adjustable range of alarm limits is the same with the measurement range of signals unless otherwise specified.

A.7.1 ECG

ECG	
Standards	IEC60601-2-27
Lead set	3-lead: I, II, III 5-lead: I, II, III, aVR, aVL, aVF, V 12-lead: I, II, III, aVR, aVL, aVF, V1 to V6 (for uMEC12/uMEC15)
ECG standard	AHA, IEC
Display sensitivity	1.25 mm/mV (X0.125), 2.5 mm/mV (X0.25), 5 mm/mV (X0.5), 10 mm/mV (X1), 20 mm/mV (X2), 40 mm/mV (X4) Accuracy: ±5%
Sweep speed	6.25 mm/s, 12.5 mm/s, 25 mm/s, 50 mm/s Accuracy: ±5%
Bandwidth (-3dB)	Diagnostic mode: 0.05 to 150 Hz Monitor mode: 0.5 to 40 Hz Surgical mode: 1 to 20 Hz ST mode: 0.05 to 40 Hz
Common mode rejection ratio (with Notch off)	Diagnostic mode: ≥90 dB Monitor mode: ≥105 dB Surgical mode: ≥105 dB ST mode: >105 dB(with Notch on)
Notch	on/off
Differential input impedance	≥5 MΩ
Input signal range	±8 mV (peak-to-peak value)
Electrode offset potential tolerance	±500 mV
Lead-off detection current	Measuring electrode: <0.1 μA Drive electrode: <1 μA

Defibrillation Protection	Enduring 5000V (360 J) charge without data loss or corruption Baseline recovery time: <5 s (after defibrillation) Polarization recovery time: <10 s Defibrillation energy absorption: <10% (100Ω load)
Calibration signal	1mV (peak-to-peak value) Accuracy: ±5%
ESU protection	Cut mode: 300 W Coagulate mode: 100 W Recovery time: ≤10 s In compliance with the requirements in clause 202.6.2.101 of IEC 60601-2-27
Pace Pulse	
Pace pulse markers	Pace pulses meeting the following conditions are labelled with a PACE marker: Amplitude: ±2 to ±700 mV Width: 0.1 to 2 ms Rise time: 10 to 100 μs
Pace pulse rejection	When tested in accordance with the IEC60601-2-27: 201.12.1.101.13, the heart rate meter rejects all pulses meeting the following conditions. Amplitude: ±2 to ±700 mV Width: 0.1 to 2 ms Rise time: 10 to 100 μs
HR	
Measurement range	Neonate: 15 to 350 bpm Pediatric: 15 to 350 bpm Adult: 15 to 300 bpm
Resolution	1 bpm
Accuracy	±1 bpm or ±1%, whichever is greater.
Sensitivity	200μV (lead II)
HR averaging method	In compliance with the requirements in Clause 201.7.9.2.9.101 b) 3) of IEC60601-2-27, the following method is used: If the last 3 consecutive RR intervals are greater than 1200 ms, the 4 most recent RR intervals are averaged to compute the HR. Otherwise, heart rate is computed by subtracting the maximum and minimum ones from the most recent 12 RR intervals and then averaging them. The HR value displayed on the monitor screen is updated every second.

Response to irregular rhythm	In compliance with the requirements in Clause 201.7.9.2.9.101 b) 4) of IEC60601-2-27, the heart rate after 20 seconds of stabilization is displayed as follows: Ventricular bigeminy (3a): 80±1 bpm Slow alternating ventricular bigeminy (3b): 60±1 bpm Rapid alternating ventricular bigeminy (3c): 120±1 bpm Bidirectional systoles (3d): 90±2 bpm
Response time to heart rate change	Meets the requirements of IEC60601-2-27: Clause 201.7.9.2.9.101 b) 5). From 80 to 120 bpm: less than 11 s From 80 to 40 bpm: less than 11 s
Time to alarm for tachycardia	Meets the requirements of IEC60601-2-27: Clause 201.7.9.2.9.101 b) 6). Waveform 4ah - range: < 11 s 4a - range: < 11 s 4ad - range: < 11 s Waveform 4bh - range: < 11 s 4b - range: < 11 s 4bd - range: < 11 s
Tall T-wave rejection capability	When the test is performed based on Clause 201.7.9.2.9.101 b) 2)of IEC60601-2-27, the heart rate meter will reject all 100 ms QRS complexes with less than 1.2 mV of amplitude, and T waves with T-wave interval of 180 ms and those with Q-T interval of 350 ms.
Arrhythmia Analysis Classifications	Asystole, VFib/VTac, Vtac, Vent. Brady, Extreme Tachy, Extreme Brady, PVCs/min, PNP, PNC, PVC, Couplet, Run PVCs, Bigeminy, Trigeminy, R on T, Missed Beats, Brady, Tachy, Vent. Rhythm, Multif. PVC, Nonsus. Vtac, Pause, Irr. Rhythm., Afib, Pauses/min

ST Segment Analysis		
Measurement range	-2.0 to 2.0 mV RTI	
Accuracy	-0.8 to 0.8 mV: ±0.02 mV or ±10%, whichever is greater. Beyond this range: Not specified.	
Refreshing rate	10 s	
Resolution	0.01 mV	
Alarn limit	**Range (rpm)**	**Step (rpm)**
ST High	(low limit + 0.2 mV) to 2.0 mV -2.0 to 2.0 mV	0.1 mV

| ST Low | -2.0 mV to (high limit - 0.2 mV) | |
| | -2.0 mV to 2.0 mV | |

A.7.2 Resp

Technique	Trans-thoracic impedance	
Lead	Options are lead I and II. The default is lead II.	
Respiration excitation waveform	<300 µA RMS, 64 kHz (±10%)	
Baseline impedance range	200 to 2500Ω (using an ECG cable with 1kΩ resistance)	
Bandwidth	0.2 to 2.5 Hz (-3 dB)	
Sweep speed	3 mm/s, 6.25 mm/s, 12.5 mm/s, 25 mm/s, or 50 mm/s Accuracy: ±5%	
Respiration Rate		
Measurement range	Adult: 0 to 120 rpm Pediatric, neonate: 0 to 150 rpm	
Resolution	1 rpm	
Accuracy	7 to 150 rpm: ±2 rpm or ±2%, whichever is greater 0 to 6 rpm: Not specified.	
Apnea alarm time	10 s, 15 s, 20 s, 25 s, 30 s, 35 s, 40 s	
Alarm limit	**Range (rpm)**	**Step (rpm)**
RR High	Adult, pediatric: (low limit + 2) to 100 Neonate: (low limit + 2) to 150	1
RR Low	0 to (high limit – 2)	

A.7.3 SpO$_2$

Standards	Meet standards of ISO80601-2-61

*Measurement accuracy verification: The SpO$_2$ accuracy has been verified in human experiments by comparing with arterial blood sample reference measured with a CO-oximeter. Pulse oximeter measurement are statistically distributed and about two-thirds of the measurements are expected to come within the specified accuracy range compared to CO-oximeter measurements.

SpO$_2$ measurement range	0 to 100%
Resolution	1%
Response time	≤ 30 s (PI > 0.3, no disturbance, SpO$_2$ value sudden change within 70% - 100%)
Accuracy	70 to 100%: ±2% (adult/pediatric mode) 70 to 100%: ±3% (neonate mode) 0% to 69%: Not specified.

*Studies were performed to validate the accuracy of Pulse Oximeter with neonatal SpO$_2$ sensors by contrast with a CO-Oximeter. Some neonates aged from 1 day to 30 days with a gestation age of 22 weeks to full term were involved in this study. The statistical analysis of data of this study shows the accuracy (Arms) is within the stated accuracy specification. Please see the following table.

Sensor type	Totally neonates	Data	Arms
518B	97 (51 male & 46 female)	200 pairs	2.38%
520N	122 (65 male & 57 female)	200 pairs	2.88%

The Pulse Oximeter with neonatal SpO$_2$ sensors was also validated on adult subjects.

Refreshing rate	1 s
PI measurement range	0.05% to 20%

Alarm limit	Range (%)	Step (%)
SpO$_2$ High	(low limit + 2) to 100	
SpO$_2$ Low	Desat to (high limit – 2)	1
Desat	0 to (high limit – 2)	

Information of the Test Subjects of the Clinical Study Report:

Skin color	Gender	Number	Age(years)	Health
Black	Male	1	28.2±9.19	Healthy
	Female	1		
yellow	Male	3		
	Female	9		

A.7.4 PR

Alarm limit	Range (bpm)	Step (bpm)
PR High	(low limit +2) to 300	1
PR Low	15 to (high limit-2)	

PR from SpO$_2$ Module

Measurement range	20 to 300 bpm
Resolution	1 bpm
Response time	< 30 s (PI > 0.3, no disturbance, PR value sudden change within 25 – 240 bpm)
Accuracy	±3 bpm
Refreshing rate	1 s
SpO$_2$ averaging time	7 s (when sensitivity is set to High) 9 s (when sensitivity is set to Medium) 11 s (when sensitivity is set to Low)

PR from IBP Module

Measurement range	25 to 350 bpm
Resolution	1 bpm
Accuracy	±1 bpm or ±1%, whichever is greater
Refreshing rate	1 s

A.7.5 NIBP

Standards	Meet standards of IEC80601-2-30,			
Technique	Oscillometry			
Mode of operation	Manual, Auto and STAT			
Auto mode repetition intervals	1 min, 2 min, 2.5 min, 3 min, 5 min, 10 min, 15 min, 20 min, 30 min, 1 h, 1.5 h, 2 h, 3 h, 4 h, 8 h			
STAT mode cycle time	5 min			
Max measurement time	Adult, pediatric: 120 s Neonate: 90 s			
Measurement ranges (mmHg)		Adult	Pediatric	Neonate
	Systolic:	25 to 290	25 to 240	25 to 140

	Diastolic:	10 to 250	10 to 200	10 to 115
	Mean:	15 to 260	15 to 215	15 to 125
Accuracy	Max mean error: ±5 mmHg Max standard deviation: 8 mmHg			
Resolution	1mmHg			
Initial cuff inflation pressure range (mmHg)	Adult: 80 to 280 Pediatric: 80 to 210 Neonate: 60 to 140			
Default initial cuff inflation pressure (mmHg)	Adult: 160 Pediatric: 140 Neonate: 90			
Software overpressure protection	Adult, pediatric: 297±3 mmHg Neonate: 147±3 mmHg			
Static pressure measurement range	0 mmHg to 300 mmHg			
Static pressure measurement accuracy	±3 mmHg			
PR				
Measurement range	30 to 300 bpm			
Resolution	1 bpm			
Accuracy	±3bpm or ±3%, whichever is greater			

Alarm limit	Range (mmHg)	Step (mmHg)
Sys High	Adult: (low limit+5) to 290 Pediatric: (low limit+5) to 240 Neonate: (low limit+5) to 140	NIBP ≤ 50: 1 NIBP > 50: 5
Sys Low	25 to (high limit-5)	
Mean High	Adult: (low limit+5) to 260 Pediatric: (low limit+5) to 215 Neonate: (low limit+5) to 125	
Mean Low	15 to (high limit-5)	
Dia High	Adult: (low limit+5) to 250 Pediatric: (low limit+5) to 200 Neonate: (low limit+5) to 115	
Dia Low	10 to (high limit-5)	

*Measurement accuracy verification: In adult and pediatric modes, the blood pressure measurements measured with this device are in compliance with the Standard for Non-invasive sphygmomanometers (ISO 81060-2) in terms of mean error and stardard deviation by comparing with intra-arterial or auscultatory measurements (depending on the configuration) in a typical patient population. For auscultatory reference, the 5th Korotkoff sound was used to determine the diastolic pressure.

In neonatal mode, the blood pressure measurements measured with this device are in compliance with the American National Standard for Non-invasive sphygmomanometers (ISO 81060-2) in terms of mean error and stardard deviation by comparing with intra-arterial measurements (depending on the configuration) in a typical patient population.

A.7.6 Temp

Standards	Meet standard of ISO 80601-2-56
Technique	Thermal resistance
Operating mode	Direct mode
Measurement range	0 to 50 ℃ (32 to 122 ℉)
Resolution	0.1 ℃
Accuracy	±0.1 ℃(without probe)
Refreshing rate	1 s
Minimum time for accurate measurement	Body surface: <100 s Body cavity: <80 s
Transient response time	Body surface probe : <45 s Body cavity probe: <45 s

Alarm limit	Range	Step
T1/T2 High	(low limit +1) to 50 ℃	
T1/T2 Low	0.1 to (high limit -1) ℃	0.1 ℃
TD High	0.1 to 50 ℃	

A.7.7 IBP (for uMEC12/uMEC15)

Standards	Meet standard of IEC60601-2-34.
Technique	Direct invasive measurement
IBP	
Measurement range	-50 to 300 mmHg
Resolution	1 mmHg
Accuracy	±2% or ±1 mmHg, whichever is greater (without sensor)
Refreshing rate	1 s
Pressure transducer	
Excitement voltage	5 VDC, ±2%
Sensitivity	5 μV/V/mmHg
Zero adjustment range	±200 mmHg
Impedance range	300 to 3000Ω

Alarm limit	Range (mmHg)	Step (mmHg)
Sys High		
Mean High	(low limit + 2) to 300	
Dia High		1
Sys Low		
Mean Low	-50 to (high limit – 2)	
Dia Low		

A.7.8 C.O. (for uMEC12/uMEC15)

Measurement method	Thermodilution method	
Measurement range	C.O.:	0.1 to 20 L/min
	TB:	23 to 43 ℃
	TI:	0 to 27 ℃
Resolution	C.O.:	0.1 L/min
	TB, TI:	0.1 ℃
Accuracy	C.O.:	±5% or ±0.1 L /min, whichever is greater
	TB, TI:	±0.1 ℃ (without sensor)
Repeatability	C.O.:	±2% or ±0.1 L/min, whichever is greater
Alarm range	TB:	23 to 43 ℃

Alarm limit	Range	Step
TB High	(low limit + 1) to 43 ℃	0.1 ℃
TB Low	23 to (high limit - 1) ℃	

A.7.9 CO_2 (for uMEC12/uMEC15)

Technique	Infrared absorption
Standard	Meet standard of ISO 80601-2-55
CO_2 Measurement range	0 to 20%
Accuracy*	CO_2 concentration<1%: ±0.1% 1%≤CO_2 concentration<5% ±0.2% 5%≤CO_2 concentration<7% ±0.3% 7%≤CO_2 concentration<12% ±0.4% 12%≤CO_2 concentration≤13% ±0.5% 13%<CO_2 concentration≤20% ±(0.43%+8%rel) 20%<CO_2 concentration unspecified ±0.3%ABS increase in error for ISO accuracy mode
Accuracy drift	Meet the requirement for measurement accuracy within 6 hours
Resolution	1 mmHg
Sample flowrate	Connecting the DRYLINE II watertrap for adult and pediatric patient: 120 ml/min Connecting the DRYLINE II watertrap for neonatal patient: 90 ml/min Connecting the DRYLINE PRIME watertrap: 50 ml/min
Sample flowrate tolerance	±15% or ±15 ml/min, whichever is greater.
Start-up time	<90 s
Rise time	Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line: <330 ms @ 90 ml/min Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line: <300 ms @ 120 ml/min Measured with a DRYLINE PRIME watertrap and sampling line: <200 ms @ 50 ml/min
Response time	Measured with a neonatal watertrap and a 2.5-meter neonatal sampling line: <4.5 s @ 90 ml/min Measured with an adult watertrap and a 2.5-meter adult sampling line: <5.5 s @ 120 ml/min Measured with a DRYLINE PRIME watertrap and sampling line: <5 s @ 50 ml/min

awRR measurement range	0 to 150 rpm
awRR measurement precision	<60 rpm: ±1 rpm 60 to 150 rpm: ±2 rpm
Apnea time	10 s, 15 s, 20 s, 25 s, 30 s, 35 s, 40 s

Note: The response time is the sum of the rise time and the delay time.

Effect of interference gases on CO_2 measurements		
Gas	**Concentration (%)**	**Quantitive effect***
N_2O	≤60	±1 mmHg
Hal	≤4	
Sev	≤5	
Iso	≤5	
Enf	≤5	
O_2	≤100	
Des	≤15	±2 mmHg

*: means an extra error should be added in case of gas interference when CO_2 measurements are performed between 0-40mmHg.

Inaccuracy specifications are affected by the breath rate and I: E change. The end-tidal gas reading is within specification for breath rate below 15BPM and I: E ratio smaller than 1: 1 relative to the gas readings without breath.

Alarm limit	Range	Step
EtCO$_2$ High	(low limit + 2) to 99 mmHg	1 mmHg
EtCO$_2$ Low	1 to (high limit - 2) mmHg	
FiCO$_2$ High	1 to 99 mmHg	
awRR High	Adult, pediatric: (low limit + 2) to 100 rpm Neonate: (low limit + 2) to 150 rpm	1 rpm
awRR Low	0 to (high limit - 2) rpm	

B EMC and Radio Regulatory Compliance

B.1 EMC

The device meets the requirements of IEC 60601-1-2.

NOTE

- Using accessories, transducers and cables other than those specified may result in increased electromagnetic emission or decreased electromagnetic immunity of the patient monitoring equipment.

- The device or its components should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the device or its components should be observed to verify normal operation in the configuration in which it will be used.

- The device needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided below.

- Other devices may interfere with this device even though they meet the requirements of CISPR.

- When the inputted signal is below the minimum amplitude provided in technical specifications, erroneous measurements could result.

- Portable and mobile communication equipment may affect the performance of this monitor.

- Other devices that have RF transmitter or source may affect this device (e.g. cell phones, PADs, PCs with wireless function).

Guidance and Declaration - Electromagnetic Emissions		
The device is intended for use in the electromagnetic environment specified below. The customer or the user of the device should assure that it is used in such an environment.		
Emission tests	**Compliance**	**Electromagnetic environment - guidance**
Radio frequency (RF) emissions CISPR 11	Group 1	The device uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The device is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes
Harmonic emissions IEC61000-3-2	Class A	
Voltage Fluctuations/Flicker Emissions IEC 61000-3-3	Complies	

⚠ WARNING

- **This device is intended for use by healthcare professionals only. This equipment/ system may cause radio interference or may disrupt the operation of nearby equipment. It may be necessary to take mitigation measures, such as re-orienting or relocating the [ME EQUIPMENT or ME SYSTEM] or shielding the location.**

If the system is operated within the electromagnetic environment listed in Table **Guidance and Declaration —Electromagnetic Immunity**, the system will remain safe and provide the following essential performance,

- Operating mode
- Accuracy
- Function
- Accessories identification
- Data stored
- Alarm
- Detect for connection

Guidance and Declaration - Electromagnetic Immunity			
The device is intended for use in the electromagnetic environment specified below. The customer or the user of the device should assure that it is used in such an environment.			
Immunity test	**IEC60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV line(s) to line(s) ±2 kV line(s) to earth	±1 kV line(s) to line(s) ±2 kV line(s) to earth	
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5 % U_T (>95 % dip in U_T) for 0.5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 s	<5 % U_T (>95 % dip in U_T) for 0.5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 s	Mains power quality should be that of a typical commercial or hospital environment. If the user of our product requires continued operation during power mains interruptions, it is recommended that our product be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 HZ) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
Note: U_T is the AC mains voltage prior to application of the test level.			

Guidance and Declaration - Electromagnetic Immunity			
The device is intended for use in the specified electromagnetic environment. The customer or the user of the device should assure that it is used in such an environment as described below.			
Immunity test	**IEC60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Conduced RF IEC61000-4-6	3 Vrms 150 kHz to 80 MHz	3Vrms	Portable and mobile RF communications equipment should be used no closer to any part of the system, including cables, than the recommended separation distance calculated from the equation appropriate for the frequency of the transmitter. Recommended separation distances: $d = 1.2\sqrt{P}$
Radiated RF IEC61000-4-3	3V/m 80MHz to 2.5GHz	3V/m	Recommended separation distances: 80 MHz～800 MHz $d = 1.2\sqrt{P}$ 800MHz-2.5GHz $d = 2.3\sqrt{P}$ Where, P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).[b] Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey [a],should be less than the compliance level in each frequency range [b]. Interference may occur in the vicinity of equipment marked with the following symbol:
Note 1: At 80 MHz to 800 MHz, the separation distance for the higher frequency range applies.			
Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			
Note 3: The device that intentionally receives RF electromagnetic energy at the **exclusion band** (2395.825MHz-2487.645MHz) is exempt from the ESSENTIAL PERFORMANCE requirements, but remains safe.			
[a] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless)			

telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the [ME EQUIPMENT or ME SYSTEM] is used exceeds the applicable RF compliance level above, the [ME EQUIPMENT or ME SYSTEM] should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the [ME EQUIPMENT or ME SYSTEM].

b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3V/m.

⚠ **WARNING**

- **The device is configured with a wireless network connector to receive wireless signal. Other devices may interfere with this device even though they meet the requirements of CISPR.**

Recommended separation distances between portable and mobile RF communications equipment and the device			
The device is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the device can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the device as recommended below, according to the maximum output power of the communications equipment.			
Rated maximum output power of transmitter（W）	Separation distance in meters (m) according to frequency of the transmitter		
	150 kHz ∼ 80 MHz $d = 1.2\sqrt{P}$	80 MHz ∼ 800 MHz $d = 1.2\sqrt{P}$	800 MHz ∼ 2.5 GHz $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.20	1.20	2.30
10	3.80	3.80	7.30
100	12.00	12.00	23.00
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in metres (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.			
Note 1: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.			
Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

B.2 Radio Regulatory Compliance

RF parameters (For MSD45N Wireless Module)

Item	IEEE 802.11b/g/n	IEEE 802.11a/n
Operating Frequency Band (MHz)	2412~2472	5180~5240 5260~5320 5500~5700
Modulation	802.11b: DSSS（DBPSK/DQPSK/CCK） 802.11g/n: OFDM（BPSK/QPSK/16QAM/64QAM）	OFDM（BPSK/QPSK/16QAM/64QAM）
Transmitter Output Power (dBm)	<20 (Average) <30 (Peak)	<23 (Average) <30 (Peak)

CE

The radio module MSD45N is complied with the essential requirements and other relevant provisions of Directive 1999/5/EC (Radio Equipment and Telecommunications Terminal Equipment Directive).

The device, including the MSD45N wireless module, complies with part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

Operation of this equipment requires the prior coordination with a frequency coordinator designated by the FCC for the Wireless Medical Telemetry Service.

This device complies with Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada.

The device, including the MSD45N wireless module, FCC and Industry Canada Radio Compliance: This device complies with Part 15 of the FCC Rules and RSS-210 of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Any changes or modifications to this equipment not expressly approved by Mindray may cause harmful radio frequency interference and void your authority to operate this equipment.

The maximum antenna gain permitted complies with the e.i.r.p. limits as stated in RSS-210.

The maximum antenna gain permitted complies with the e.i.r.p. limits specified for point-to-point operation, as stated in RSS-210.

⚠ WARNING

- **Keep a distance of at least 20cm away from the monitor when Wi-Fi function is in use.**

FOR YOUR NOTES

C Default Configurations

This chapter lists some of the most important factory default settings in configuration management. You cannot change the factory default configuration itself. However, you can make changes to the settings from the factory default configuration and then save the changed configuration as a user configuration. The last column of the following tables is for your notes and review.

Note: In this chapter, O.M means the monitor's operating mode. Column C refers to the settings that can be changed in configuration management. Column M refers to the settings that can be changed in monitoring mode.

C.1 Parameters Configuration

C.1.1 ECG

ECG Setup

Item Name		O.M		General	User Defaults
		C	M		
Lead Set		*	*	Auto	
Alm Source		*	*	HR	
Alarm		*	*	On	
Alm Lev		*	*	Med	
HR/PR High	Adu	*	*	120	
	Ped			160	
	Neo			200	
HR/PR Low	Adu	*	*	50	
	Ped			75	
	Neo			100	
Sweep		*	*	25 mm/s	
Beat Vol		*	*	2	
Paced			*	No	
Notch Filter		*	*	On	
Gain		*	*	X1	
Filter		*	*	Monitor	
ECG Display		*	*	Normal	

Item Name	O.M		General	User Defaults
	C	M		
Smart Lead Off	*	*	On	

ST Analysis

Item Name	O.M		General	User Defaults
	C	M		
ST Analysis	*	*	Off	
Alarm	*	*	Off	
Alm Lev	*	*	Med	
ST-X High	*	*	when ST Unit is mV: 0.20	
			when ST Unit is mm: 2.0	
ST-X Low	*	*	when ST Unit is mV: -0.20	
			when ST Unit is mm: -2.0	
ISO	*	*	-80 ms	
J			48 ms	
ST			J + 60 ms	

X represents I, II, III, aVR, aVL, aVF, V, V1, V2, V3, V4, V5 or V6.

Arrh. Analysis

Item Name	O.M		General	User Defaults
	C	M		
Arrhythmia Threshold Settings				
PVCs/min	*	*	Adu, Ped: 10	
			Neo: 10	
Tachy	*	*	Adu: 120	
			Ped: 160	
			Neo: 180	
Brady	*	*	Adu: 50	
			Ped: 75	
			Neo: 90	
Asys. Delay	*	*	Adu, Ped: 5	
			Neo: 5	
Vtac Rate	*	*	Adu, Ped: 130	
			Neo: 160	

| Item Name | O.M | | General | | User Defaults |
	C	M			
Vtac PVCs	*	*	Adu, Ped:	6	
			Neo:	6	
Multif. PVC's Window	*	*	Adu, Ped:	15	
			Neo:	15	
Extreme Tachy	*	*	Adu:	160	
			Ped:	180	
			Neo:	200	
Extreme Brady	*	*	Adu:	35	
			Ped:	50	
			Neo:	60	
Vbrd Rate	*	*	Adu, Ped:	40	
			Neo:	40	
Vbrd PVCs	*	*	Adu, Ped:	5	
			Neo:	5	
Pause Time	*	*	Ad, Ped:	2	
			Neo:	2	
Pause/min	*	*	Ad, Ped:	8	
			Neo:	8	
Arrhythmia Alarm Settings					
PVCs/min Alarm	*	*	Off		
R on T Alarm	*	*	Off		
Nonsus. Vtac Alarm	*	*	Off		
Vent. Rhythm Alarm	*	*	Off		
Bigeminy Alarm	*	*	Off		
Trigeminy Alarm	*	*	Off		
Afib Alarm	*	*	Off		
Asystole Alarm	*	*	On		
VFib/VTac Alarm	*	*	On		
Vtac Alarm	*	*	On		
Vent. Brady Alarm	*	*	On		
Extreme Tachy Alarm	*	*	On		

Item Name	O.M		General	User Defaults
	C	M		
Extreme Brady Alarm	*	*	On	
Multif.PVC Alarm	*	*	Off	
Tachy Alarm	*	*	Off	
Brady Alarm	*	*	Off	
Asystole Alm Lev	*	*	High	
VFib/VTac Alm Lev	*	*	High	
Vtac Alm Lev	*	*	High	
Vent. Brady Alm Lev	*	*	High	
Extreme Tachy Alm Lev	*	*	High	
Extreme Brady Alm Lev	*	*	High	
Pause Alarm	*	*	Off	
Couplet Alm Lev	*	*	Prompt	
PVC Alm Lev	*	*	Prompt	
Irr. Rhythm Alm Lev	*	*	Prompt	
PNP Alm Lev	*	*	Prompt	
PNC Alm Lev	*	*	Prompt	
Missed Beats Alm Lev	*	*	Prompt	
Afib Alm Lev	*	*	Prompt	
X Alarm	*	*	Off	
X Alm Lev	*	*	Med	
X Alm Rec	*	*	Off	

X represents a certain arrhythmia event. Refer to *A Product Specifications* for details. The X in "X Alm Lev" refers to all arrhythmia events except for those specially marked ones.

C.1.2 RESP

Item Name	O.M C	O.M M	General		User Defaults
Alarm	*	*	On		
Alm Lev	*	*	Med		
Sweep	*	*	6.25 mm/s		
Lead	*	*	II		
Gain	*	*	X2		
RR High	*	*	Adu, Ped:	30	
			Neo:	100	
RR Low	*	*	Adu, Ped:	8	
			Neo:	30	
Apnea Delay	*	*	Adu, Ped:	20	
			Neo:	15	
Detection Mode	*	*	Auto		
RR Source		*	Auto		

C.1.3 PR

Item Name		O.M C	O.M M	General	User Defaults
Alarm		*	*	On	
Alm Lev		*	*	Med	
HR/PR High	Adu	*	*	120	
	Ped			160	
	Neo			200	
HR/PR Low	Adu	*	*	50	
	Ped			75	
	Neo			100	
PR Source		*	*	SpO_2	
Beat Vol		*	*	2	

C.1.4 SpO$_2$

Item Name	O.M C	O.M M	General	User Defaults
Alarm	*	*	On	
Alm Lev	*	*	Med	
SpO$_2$ High	*	*	Adu, Ped: 100 Neo: 95	
SpO$_2$ Low	*	*	90	
Desat Limit	*	*	80	
Sweep	*	*	25 mm/s	
NIBP Simul		*	Off	
Sensivity	*	*	Med	
PI Zoom	*	*	No	

C.1.5 Temp

Item Name	O.M C	O.M M	General	User Defaults
Alarm	*	*	On	
Alm Lev	*	*	Med	
T1/T2 High（ºC）	*	*	38.0	
T1/T2 Low（ºC）	*	*	35.0	
TD High（ºC）	*	*	2.0	

C.1.6 NIBP

Item Name	O.M		General	User Defaults
	C	M		
Alarm	*	*	On	
Alm Lev	*	*	Med	
Interval	*	*	15 min	
NIBP End Tone	*	*	Off	
Cuff Press.（mmHg） Adu			80	
Cuff Press.（mmHg） Ped	*	*	60	
Cuff Press.（mmHg） Neo			40	
Initial Pressure（mmHg） Adu			160	
Initial Pressure（mmHg） Ped	*	*	140	
Initial Pressure（mmHg） Neo			90	
Alarm Limits				
NIBP-S High（mmHg） Adu			160	
NIBP-S High（mmHg） Ped	*	*	120	
NIBP-S High（mmHg） Neo			90	
NIBP-S Low（mmHg） Adu			90	
NIBP-S Low（mmHg） Ped	*	*	70	
NIBP-S Low（mmHg） Neo			40	
NIBP-M High（mmHg） Adu			110	
NIBP-M High（mmHg） Ped	*	*	90	
NIBP-M High（mmHg） Neo			70	
NIBP-M Low（mmHg） Adu			60	
NIBP-M Low（mmHg） Ped	*	*	50	
NIBP-M Low（mmHg） Neo			25	
NIBP-D High（mmHg） Adu			90	
NIBP-D High（mmHg） Ped	*	*	70	
NIBP-D High（mmHg） Neo			60	
NIBP-D Low（mmHg） Adu			50	
NIBP-D Low（mmHg） Ped	*	*	40	
NIBP-D Low（mmHg） Neo			20	

C.1.7 IBP (for uMEC12/uMEC15)

Item Name	O.M		General	User Defaults
	C	M		
IBP 1 Label	*	*	Art	
IBP 2 Label	*	*	CVP	
Alarm	*	*	On	
Alm Lev	*	*	Med	
P1 Measure	*	*	All	
P2 Measure	*	*	All	
P3 Measure	*	*	Mean	
P4 Measure	*	*	Mean	
Sensitivity	*	*	Med	
Sweep	*	*	25 mm/s	
Filter	*		12.5 Hz	
Gridlines	*	*	Off	
IBP Label Order Setup	*	*	Art, pArt, CVP, pCVP, ICP, PA, Ao, UAP, FAP, BAP, LV, LAP, RAP, UVP, P1, P2, P3, P4	
Art, Ao, UAP, BAP, FAP, LV, P1-P2 Arterial Pressure Alarm Limits				
IBP-S High （mmHg）	Adu			160	
	Ped	*	*	120	
	Neo			90	
IBP-S Low （mmHg）	Adu			90	
	Ped	*	*	70	
	Neo			55	
IBP-M High （mmHg）	Adu			110	
	Ped	*	*	90	
	Neo			70	
IBP-M Low （mmHg）	Adu			70	
	Ped	*	*	50	
	Neo			35	
IBP-D High （mmHg）	Adu			90	
	Ped	*	*	70	
	Neo			60	
IBP-D Low （mmHg）	Adu	*	*	50	
	Ped			40	

Item Name	O.M		General	User Defaults
	C	M		
Neo			20	
PA Alarm Limits				
PA-S High（mmHg） Adu			35	
PA-S High（mmHg） Ped	*	*	60	
PA-S High（mmHg） Neo			60	
PA-S Low（mmHg） Adu			10	
PA-S Low（mmHg） Ped	*	*	24	
PA-S Low（mmHg） Neo			24	
PA-M High（mmHg） Adu			20	
PA-M High（mmHg） Ped	*	*	26	
PA-M High（mmHg） Neo			26	
PA-M Low（mmHg） Adu			0	
PA-M Low（mmHg） Ped	*	*	12	
PA-M Low（mmHg） Neo			12	
PA-D High（mmHg） Adu			16	
PA-D High（mmHg） Ped	*	*	4	
PA-D High（mmHg） Neo			4	
PA-D Low（mmHg） Adu			0	
PA-D Low（mmHg） Ped	*	*	-4	
PA-D Low（mmHg） Neo			-4	
CVP, LAP, RAP, ICP, UVP, P3-P4 Venous Pressure Alarm Limits				
IBP-M High（mmHg） Adu			10	
IBP-M High（mmHg） Ped	*	*	4	
IBP-M High（mmHg） Neo			4	
IBP-M Low（mmHg） Adu			0	
IBP-M Low（mmHg） Ped	*	*	0	
IBP-M Low（mmHg） Neo			0	
Art, Ao, BAP, FAP, LV, P1-P2 Arterial Pressure Scale				
Scale（mmHg）	*	*	0-160	
PA Scale				
Scale（mmHg）	*	*	0-30	
CVP, LAP, RAP, ICP, UVP Scale				
Scale（mmHg）	*	*	0-20	

Item Name	O.M C	O.M M	General	User Defaults
UAP, P3-P4 Venous Pressure Scale				
Scale（mmHg）	*	*	0-80	
IBP Overlapping Left Scale				
Scale (mmHg)	*	*	0-160	
IBP Overlapping Right Scale				
Scale (mmHg)	*	*	0-20	

C.1.8 C.O. (for uMEC12/uMEC15)

Item Name	O.M C	O.M M	General	User Defaults
Alarm	*	*	On	
Alm Lev	*	*	Med	
TB High（ºC）	*	*	39.0	
TB Low（ºC）	*	*	36.0	
Comp. Const	*	*	0.542	
Auto TI	*	*	Auto	
Manual TI（ºC）	*	*	2.0	
Measuring mode	*	*	Manual	

C.1.9 CO_2 (for uMEC12/uMEC15)

Item Name	O.M C	O.M M	General	User Defaults
Alarm	*	*	On	
Alm Lev	*	*	Med	
Operating Mode	*	*	Measure	
Sweep	*	*	6.25 mm/s	
Scale（mmHg）	*	*	50	
Apnea Delay	*	*	Adu, Ped: 20 Neo: 15	
RR Source		*	Auto	

CO₂ Setup					
Apnea Delay	*	*	Adu: 20s Ped: 20s Neo: 15s		
BTPS Compen	*	*	Off		
N₂O Compen	*	*	0		
O₂ Compen	*	*	21		
Des Compen	*	*	0		
Operating Mode	*	*	Measure		
Wave Type	*	*	Draw		
Scale	*	*	50 mmHg		
Sweep	*	*	6.25 mm/s		
RR Source	*	*	Auto		
Alarm Limits					
EtCO₂ High（mmHg）	*	*	Adu, Ped: 50 Neo: 45		
EtCO₂ Low（mmHg）	*	*	Adu, Ped: 25 Neo: 30		
FiCO₂ High（mmHg）	*	*	Adu, Ped, Neo: 4		
RR High	*	*	Adu, Ped: 30 Neo: 100		
RR Low	*	*	Adu, Ped: 8 Neo: 30		

C.2 Routine Configuration

C.2.1 Alarm

| Item Name | O.M | | General | User Defaults |
	C	M		
Alm Volume	*	*	2	
Reminder Vol	*	*	Low	
Recording Length	*	*	16 s	
Apnea Delay	*	*	Adu, Ped: 20 s Neo: 15 s	
Alarm Delay	*	*	6 s	
ST Alarm Delay	*	*	30 s	

C.2.2 Screens

| Item Name | | O.M | | General | User Defaults |
		C	M		
Choose Screen		*	*	Normal Screen	
Display the ST segments on ECG screen		*	*	Unselected	
Select QuickKeys			*	NIBP Measure→Stop All→Review→Standby	
Select Wave Sequence for Normal Screen	1	*	*	ECG1	
	2			ECG2	
	3			SpO$_2$+PR	
	4			Any IBP	
	5			Any IBP	
	6			CO$_2$	
	11			Resp	
Select Parameters for Big Numerics Screen	Parameter 1	*	*	ECG	
	Parameter 2			SpO$_2$+PR	
	Parameter 3			Resp	
	Parameter 4			NIBP	

C.2.3 Parameter/Wave Color

Item Name		O.M		General	User Defaults
		C	M		
Parameter/ Wave Color	ECG			Green	
	NIBP			White	
	SpO$_2$			Cyan	
	PR			Cyan	
	TEMP			White	
	Art/Ao/UAP/FAP /BAP/LV/P1~P4 (arterial pressure)		*	Red	
	PA			Yellow	
	CVP/ICP/P1~P4 (venous pressure)			Blue	
	LAP			Purple	
	RAP			Orange	
	UVP			Cyan	
	CO$_2$			Yellow	
	RESP			Yellow	

X represents a waveform label, such as ECG, RESP, CO$_2$ and so forth. The ECG waveform cannot be set off.

C.2.4 Review

Item Name		O.M		General	User Defaults
		C	M		
Tabular Trends	Interval	*	*	30 min	
	Trend Group	*	*	Standard	
Graphic Trends	Trend Group	*	*	Standard	
Minitrend Length			*	2 h	
Full Disclosure	Save Waves	*	*	Save ECG1 by default.	

C.2.5 Event

Item Name	O.M		General	User Defaults
	C	M		
Waveform 1		*	II	
Waveform 2		*	I	
Waveform 3		*	Pleth	

C.2.6 Record

Item Name	O.M		General	User Defaults
	C	M		
Length		*	8 s	
Interval		*	Off	
Paper Speed		*	25 mm/s	
IBP Overlap		*	Off	
Alm Rec	X	*	Off	

X represents a parameter label.

C.2.7 Print

Item Name		O.M		General	User Defaults
		C	M		
Paper Size			*	A4	
ECG Reports	Amplitude		*	10 mm/mV	
	Sweep		*	25 mm/s	
	Auto Interval		*	Off	
	12-Lead Format		*	12X1	
Tabular Trends Reports	Set as End Case Report		*	Unselected	
	Back		*	Auto	
	Spacing		*	Auto	
	Report Layout		*	Parameter Oriented	
	Currently Displayed Trended Parameters		*	Selected	

Item Name		O.M		General	User Defaults
		C	M		
	Standard Parameter Group		*	Unselected	
	Custom		*	Unselected	
Graphic Trends Reports	Set as End Case Report		*	Unselected	
	Back		*	Auto	
	Zoom		*	Auto	
Realtime Report	Set as End Case Report		*	Unselected	
	Sweep		*	Auto	
	Select Wave		*	Current	

C.2.8 Others

Item Name		O.M		General	User Defaults
		C	M		
Brightness			*	5	
Key Volume			*	2	
View Other Patient	Auto Alarm		*	On	

C.3 User Maintenance Items

Item Name	O.M		General	User Defaults
	C	M		
Changing Bed No.		*	Protected	
Atmospheric Pressure		*	760 mmHg	
Height Unit		*	cm	
Weight Unit		*	kg	
ST Unit		*	mV	
Press. Unit		*	mmHg	
CVP Unit		*	cmH_2O	
CO_2 Unit		*	mmHg	
O_2 Unit		*	%	
Temp Unit		*	℃	

Item Name	O.M		General	User Defaults
	C	M		
Network Type		*	LAN	
Address Type		*	Manual	
Select CMS		*	On	
ADT Query		*	On	
Latching Alarms	*	*	No	
Alarm Pause Time	*	*	2 min	
High Alarm Interval (s)		*	10	
Med Alarm Interval (s)		*	20	
Low Alarm Interval (s)		*	20	
Alarm Light on Alarm Reset		*	On	
Reset Other Bed's Alarms		*	Off	
Alarm Reset By Other Bed		*	On	
Minimum Alarm Volume	*	*	2	
Alarm Sound		*	ISO	
Reminder Tone		*	On	
Reminder Interval		*	3 min	
Max. Alarm Pause 15min		*	Disable	
ECGLeadOff Lev.		*	Low	
SpO_2SensorOff Lev.		*	Low	
IBPSensorOff Lev.		*	Med	
Lethal Arrh. OFF		*	Disable	
Alarm Delay		*	6 s	
ST Alarm Delay		*	30 s	
Other Bed Disconnection Alm		*	On	
Extended Arrh.		*	Enable	
Wave Line		*	Mediate	
ECG Standard		*	AHA	
Notch Freq.		*	50 Hz	
Data Transfer Method		*	USB Drive	

Item Name	O.M		General	User Defaults
	C	M		
Transferred Data Length		*	4 h	
Para Switch Authority		*	Unprotected	
Parameter Switch	*	*	■ When [**Para Switch Authority**] is set to [**Protected**]: Unselected ■ When [Para Switch Authority] is set to [**Unprotected**]: Selected	
SpO$_2$ Tone		*	Mode 1	
Nurse Call	Signal Type		**	Continuous	
	Contact Type		*	Normally Closed	
	Alm Lev	*	*	High, Med, Low	
	Alarm Cat.	*	*	Phys., Tech.	

FOR YOUR NOTES

D Alarm Messages

This chapter lists only the most important physiological and technical alarm messages. Some messages appearing on your monitor may not be included.

In this chapter:

■ The "I" column indicates how indications of technical alarms perform after the alarm system is reset: "A" means that some technical alarms are cleared; "B" indicates that some technical alarms are changed to the prompt messages; and "C" indicates that a " √ " appears before the alarm message, ⚠ appears in the alarm symbol area, and the indication of the alarm lamp depends on the alarm light setting. Refer to **7.8 Resetting Alarms** for details.

■ The "L" field indicates the alarm level: H means high, M means medium and L means low. "*" means the alarm level is user-adjustable.

■ XX represents a measurement or parameter label, such as ECG, NIBP, HR, ST-I, PVCs, RR, SpO_2, PR, etc.

In the "Cause and Solution" column, corresponding solutions are given instructing you to troubleshoot problems. If the problem persists, contact your service personnel.

D.1 Physiological Alarm Messages

Measurement	Alarm messages	L	Cause and solution
XX	XX Too High	M*	XX value has risen above the high alarm limit or fallen below the low alarm limit. Check the patient's condition and check if the patient category and alarm limit settings are correct.
	XX Too Low	M*	
ECG	ECG Weak Signal	H	The ECG signal is so weak that the monitor can't perform ECG analysis. Check the patient's condition and the ECG connections.
	Asystole	H	Arrhythmia has occurred to the patient. Check the patient's condition and the ECG connections.
	VFib/VTac	H	
	Vtac	H	
	Vent. Brady	H	
	Extreme Tachy	H	

Measurement	Alarm messages	L	Cause and solution
	Extreme Brady	H	
	R on T	M*	
	Run PVCs	L*	
	PVCs/min	M*	
	Multif.PVC	M*	
	Bigeminy	M*	
	Trigeminy	M*	
	Tachy	M*	
	Brady	M*	
	Vent. Rhythm	M*	
	Multif. PVC	M*	
	Nonsus. Vtac	M*	
	Pause	L*	
Resp	Resp Apnea	H	The respiration signal was so weak that the monitor cannot perform respiration analysis. Check the patient's condition and the Resp connections.
	Resp Artifact	H	The patient's heartbeat has interfered with his respiration. Check the patient's condition and the Resp connections.
SpO_2	SpO_2 Desat	H	The SpO2 value has fallen below the desaturation alarm limit. Check the patient's condition and check if the alarm limit settings are correct.
	No Pulse	H	The pulse signal was so weak that the monitor cannot perform pulse analysis. Check the patient's condition, SpO_2 sensor and measurement site.
CO_2	CO_2 Apnea	H	The patient stops breathing, or the respiration signal was so weak that the monitor cannot perform respiration analysis. Check the patient's condition and the RM connections.

D.2 Technical Alarm Messages

Measurement	Alarm message	L	I	Cause and solution
XX	XX SelfTest Err	H	C	An error occurred to the XX module, or there is a problem with the communications between the module and the monitor. Re-plug the module and restart the monitor, or plug the module into another monitor.
	XX Init Err	H	A	
	XX Init Err N	H	A	
	N is within 1 to 8			
	XX Comm Err	H	A	
	XX Comm Stop	H	C	
	XX Limit Err	L	C	XX parameter limit is accidentally changed. Contact your service personnel.
	XX Overrange	L	C	The measured XX value is not within the specified range for XX measurement. Contact your service personnel.
ECG	ECG Lead Off	L*	B	The electrode has become detached from the patient or the lead wire has become disconnected from the adapter cable. Check the connections of the electrodes and leadwires.
	ECG YY Lead Off	L*	B	
	Note: YY represents the leadwires, V, LL, LA, RA, as per AHA standard, or C, F, L and R as per IEC standard.			
	ECG Noisy	L	A	The ECG signal is noisy. Check for any possible sources of signal noise around the cable and electrode, and check the patient for great motion.
	ECG Artifact	L	A	Artifacts are detected on the ECG analysis lead and as a result heart rate cannot be calculated and Asystole, Vfib and Vtac cannot be analyzed. Check the connections of the electrodes and leadwires and check for any possible source of interference around the cable and electrode. Check the patient's condition and check the patient for great motion.
	ECG High Freq. Noise	L	A	High frequency signals are detected on the ECG analysis lead. Check for any possible source of interference around the cable and electrode.

Measurement	Alarm message	L	I	Cause and solution
	ECG Low Freq. Noise	L	A	Low frequency signals are detected on the ECG analysis lead. Check for any possible source of interference around the cable and electrode.
	ECG Amplitude Too Small	L	C	The ECG amplitude didn't reach the detected threshold. Check for any possible source of interference around the cable and electrode.
	ECG Config. Err	L	C	ECG configuration is wrongly downloaded. Check the downloaded configuration and re-download the correct configuration.
Resp	Resp Disturbed	L	A	The respiration circuit is disturbed. Restart the monitor.
Temp	Temp Cal. Err	H	C	A calibration failed. Restart the monitor.
	T1 Sensor Off	L	A	The Temp sensor has become detached from the patient or the module. Check the sensor connections.
	T2 Sensor Off	L	A	
SpO$_2$	SpO$_2$ Sensor Off	L*	B	The SpO$_2$ sensor has become detached from the patient or the module, or there is a fault with the SpO$_2$ sensor, or an unspecified SpO$_2$ sensor has been used. Check the sensor application site and the sensor type, and make sure if the sensor is damaged. Reconnect the sensor or use a new sensor.
	SpO$_2$ Sensor Fault	L	C	
	SpO$_2$ No Sensor	L	B	
	SpO$_2$ Unknown Sensor	L	C	
	SpO$_2$ Sensor Incompatible	L	C	
	SpO$_2$ Too Much Light	L	C	There is too much light on the SpO$_2$ sensor. Move the sensor to a place with lower level of ambient light or cover the sensor to minimize the ambient light.
	SpO$_2$ Low Signal	L	C	The SpO$_2$ signal is too low or too weak. Check the patient's condition and change the sensor application site. If the error persists, replace the sensor.
	SpO$_2$ Weak Pulse	L	C	
	SpO$_2$ Interference	L	C	The SpO2 signal has been interfered. Check for any possible sources of signal noise around the sensor and check the patient for great motion.
	SpO$_2$ Board Fault	L	C	There is a problem with the SpO$_2$ measurement board. Do not use the module and contact your service personnel.

Measurement	Alarm message	L	I	Cause and solution
NIBP	NIBP Loose Cuff	L	A	The NIBP cuff is not properly connected, or there is a leak in the airway.
	NIBP Air Leak	L	A	
	NIBP Pneumatic Leak	L	A	Check the NIBP cuff and pump for leakages.
	NIBP Cuff Type Wrong	L	A	The cuff type applied mismatches the patient category. Verify the patient category and replace the cuff.
	NIBP Air Pressure Err	L	A	An error occurred to the air pressure. Verify that the monitor application site meets the environmental requirements and check if there is any source that affects the air pressure.
	NIBP Weak Signal	L	A	The patient's pulse is weak or the cuff is loose. Check the patient's condition and change the cuff application site. If the error persists, replace the cuff.
	NIBP Signal Saturated	L	A	The NIBP signal is saturated due to excess motion or other sources.
	NIBP Overrange	L	A	The measured NIBP value exceeds the module measurement range.
	NIBP Excessive Motion	L	A	Check the patient's condition and reduce the patient motion.
	NIBP Cuff Overpress.	L	A	The NIBP airway may be occluded. Check the airway and measure again.
	NIBP Equip Err	H	A	An error occurred during NIBP measurement and therefore the monitor cannot perform analysis correctly. Check the patient's condition and NIBP connections, or replace the cuff.
	NIBP Timeout	L	A	
	NIBP Measure Failed	L	A	
	NIBP Illegally Reset	L	A	An illegal reset occurred during NIBP measurement. Check if the airway is occluded.
IBP	YY Sensor Off	L*	A	Check the sensor connection and reconnect the sensor.
	YY Disconnected	H	C	The liquid way is disconneted from the patient, or the three-way valve is open to the air. Check the connection of the liquid way, or check the valve is open to the patient. If the problem remains, contact the Customer Services Dept. for help.

Measurement	Alarm message	L	I	Cause and solution
	YY Non-Pulsatile	L	A	The catheter may be occluded. Please flush the catheter.
	YY represents an IBP label.			
C.O.	TB Sensor Off	L	A	Check the sensor connection and reconnect the sensor.
CO_2	CO_2 Sensor High Temp	L	C	Check, stop using or replace the sensor.
	CO_2 Sensor Low Temp	L	C	Check, stop using or replace the sensor.
	CO_2 Temp Overrange	L	C	The operating temperature of the CO2 module goes beyond the specified range. After it restores within the specified range, the module will restart automatically.
	CO_2 High Airway Press.	L	C	An error occurred in the airway pressure. Check the patient connection and patient circuit, and then restart the monitor.
	CO_2 Low Airway Press.	L	C	
	CO_2 High Barometric	L	C	Check the CO2 connections, make sure that the monitor application site meets the requirements, and check for special sources that affect the ambient pressure. Restart the monitor.
	CO_2 Low Barometric	L	C	
	CO_2 FilterLine Occluded	L	C	The airway or watertrap was occluded. Check the airway and remove the occlusion.
	CO_2 No Watertrap	L	B	Check the watertrap connections.
	CO_2 Check Adapter	L	A	There is a problem with the airway adapter. Check, clean or replace the adapter.
	CO_2 FilterLine Err	L	C	Check if there is a leak in the CO_2 sample line or the CO_2 sample line has been occluded.
	CO_2 Zero Failed	L	A	Check the CO_2 connections. After the sensor's temperature becomes stabilized, perform a zero calibration again.
	CO_2 System Err	L	A	Re-plug the module or restart the monitor.
	CO_2 Check Cal.	L	C	Perform a calibration.
	CO_2 Check Airway	L	C	An error occurred to the airway.
	CO_2 No Filterline	L	A	Make sure that the filterline is connected.
	CO_2 No Sensor	L	A	Make sure that the sensor is connected.
	CO_2 Main Board Err	H	C	There is a problem with the CO_2 module.

Measurement	Alarm message	L	I	Cause and solution
	CO_2 Checking Sensor	L	C	Re-plug the module or restart the monitor.
	CO_2 Replace Scrubber&Pump	L	C	
	CO_2 15V Overrange	H	C	
	CO_2 Hardware Err	H	C	
	CO_2 Calibration Required	L	C	Perform a calibration.
	CO_2: Change Watertrap	L	C	Replace the watertrap.
	CO_2: Watertrap and Patient Mismatch	L	C	Check the patient category and use a correct watertrap.
Power	12V Too High	H	C	There is a problem with the system power supply. Restart the monitor.
	12V Too Low	H	C	
	5V Too High	H	C	
	5V Too Low	H	C	
	3.3V Too High	H	C	
	3.3V Too Low	H	C	
	Battery Too Low	H	C	Connect the monitor to an AC power source and allow the batteries to charge.
	Different Battery Voltages	M	C	The two batteries have different charge capacity, or the batteries unspecified have been used, or there is a problem with the batteries. Make sure that correct batteries are used and the batteries are not damaged, or replace the batteries.
	Battery Overload	H	C	The power consumption of the equipment is too high. Power the monitor using an AC power source.
	RT Clock Not Exist	H	C	Contact your service personnel.
Recorder	Recorder Init Err N	L	A	Restart the monitor.
	N is within 1 to 8.			
	Recorder SelfTest Err	L	A	Stop the recording and restart the monitor.
	Recorder Comm Err	L	A	
	Recorder S. Comm Err	L	A	
	Recorder Unavailable	L	A	
	Recorder Vlt High	L	C	An error occurred to the system power

Measurement	Alarm message	L	I	Cause and solution
	Recorder Vlt Low	L	C	supply. Restart the monitor.
	Recorder Head Hot	L	C	The recorder has been working for too long time. Stop the recording and resume the recording till the recorder's printhead cools down.
	Rec Paper Wrong Pos.	L	A	Re-load the recorder paper.
System	System Watchdog Err	H	C	An error occurred to the system. Restart the monitor.
	System Software Err	H	C	
	System CMOS Full	H	C	
	System CMOS Err	H	C	
	System FPGA Err	H	C	
	System Err N	H	C	
	N is within 2 to 12.			
	Other Bed Disconnected	L	A	Check network connection.
	PWR interrupted. Check meas. state	L	A	Power supply failed accidently. Check the measurements when the monitor restarts.
	No CMS	L	A	The monitor is disconnected from the CMS. Check network connection.

E Electrical Safety Inspection

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

All tests can be performed by using commercially available safety analyzer test equipment. These procedures assume the use of a 601PROXL International Safety Analyzer or equivalent safety analyzer. Other popular testers complying with IEC 60601-1 used in Europe, such as Fluke, Metron, or Gerb, may require modifications to the procedure. Please follow the instructions of the analyzer manufacturer.

The electrical safety inspection should be periodically performed every two years .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.

E.1 Power Cord Plug

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

E.2 Device Enclosure and Accessories

E.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.).

E.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.

E.3 Device Labelling

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

- Main unit label
- Integrated warning labels

E.4 Protective Earth Resistance

1. Plug the probes of the analyzer into the device's protective earth terminal and protective earth terminal of the AC power cord.

2. Test the earth resistance with a current of 25 A.

3. Verify the resistance is less than limits.

LIMITS

For all countries, R = 0.2 Ω Maximum

E.5 Earth Leakage Test

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

The following outlet conditions apply when performing the Earth Leakage test:

■ normal polarity (Normal Condition)

■ reverse polarity (Normal Condition)

■ normal polarity with open neutral (Single Fault Condition)

■ reverse polarity with open neutral (Single Fault Condition)

LIMITS

For UL60601-1,

◆ 300 μA in Normal Condition

◆ 1000 μA in Single Fault Condition

For IEC60601-1,

◆ 500 μA in Normal Condition

◆ 1000 μA in Single Fault Condition

E.6 Patient Leakage Current

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

The following outlet conditions apply when performing the Patient Leakage Current test.

- normal polarity (Normal Condition)
- reverse polarity (Normal Condition),
- normal polarity with open neutral (Single Fault Condition)
- reverse polarity with open neutral (Single Fault Condition)
- normal polarity with open earth (Single Fault Condition)
- reverse polarity with open earth (Single Fault Condition)

LIMITS

For CF ♥ applied parts

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

For BF ⚘ applied parts

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

E.7 Mains on Applied Part Leakage

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

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

- Normal Polarity
- Reversed Polarity

LIMITS

- For CF ♥ applied parts: 50 μA
- For BF ⚘ applied parts: 5000 μA

E.8 Patient Auxiliary Current

Patient Auxiliary currents are measured between any selected Applied Part connector and the remaining Applied Part connector s. All measurements may have a true RMS only response.

The following outlet conditions apply when performing the Patient Auxiliary Current test.

■ normal polarity (Normal Condition)

■ reverse polarity (Normal Condition)

■ normal polarity with open neutral (Single Fault Condition)

■ reverse polarity with open neutral (Single Fault Condition)

■ normal polarity with open earth (Single Fault Condition)

■ reverse polarity with open earth (Single Fault Condition)

LIMITS

For CF ♥ applied parts,

◆ 10μA in Normal Condition

◆ 50μA in Single Fault Condition

For BF 🖈 applied parts,

◆ 100μA in Normal Condition

◆ 500μA in Single Fault Condition

NOTE

● **Make sure the safety analyzer is authorized comply with requirement of IEC60601-1.**

● **Follow the instructions of the analyzer manufacturer.**

FOR YOUR NOTES

F Symbols and Abbreviations

Symbols and abbreviations that you may encounter while reading this manual or using the monitor are listed below with their meanings.

F.1 Symbols

A	ampere
Ah	ampere hour
bpm	beats per minute
BrPM	breaths per minute
℃	centigrade
cc	cubic centimeter
cm	centimeter
dB	decibel
℉	fahrenheit
g	gram
GTT	gutta
hr	hour
hPa	hundred pascal
Hz	hertz
inch	inch
kg	kilogram
kPa	kilopascal
l	litre
lb	pound
m	meter
mcg	micrograms
mEq	milli-equivalents
mg	milligrams
min	minute
ml	milliliter
mm	millimeters

mmHg	millimeters of mercury
ms	millisecond
mV	millivolt
mW	milliwatt
nm	nanometer
ppm	part per million
s	second
V	volt
VA	volt ampere
Ω	ohm
µA	microampere
µm	micron
µV	microvolt
W	watt
-	minus
%	percent
/	per; divide; or
^	power
+	plus
=	equal to
<	less than
>	greater than
≤	less than or equal to
≥	greater than or equal to
±	plus or minus
×	multiply
©	copyright

F.2 Abbreviations

AAMI	Association for Advancement of Medical Instrumentation
AC	altenating current
ADT	adult
AHA	American Heart Association
ANSI	American National Standard Institue
AP	access point
ARR	arrhythmia
ART	arterial
AUX	Auxiliary output
AwRR	Air way respiratory rate
BTPS	body temperature and pressure, saturated
CCU	critical care unit
CH	channel
CISPR	International Special Commmittee on Radio Interferennce
CMS	central monitoring system
cmos	Complementary Metal Oxide Semiconductor
CPU	central processing unit
CVP	central venous pressure
D	diastolic
DC	direct current
DIA	diastolic
e.g.	for example
ECG	electrocardiograph
EEC	European Economic Community
EMC	electromagnetic compatibility
ERR	error
ES	electrosuigical
ESU	electrosuigical unit
Et	end-tidal
EURO	European
Fi	fraction of inspired
$FiCO_2$	fraction of inspired carbon oxygen
FiN_2O	fraction of inspired nitrous oxide
FiO_2	fraction of inspired oxygen

fpga	Field Programmable Gate Array
Hb-CO	Carbonmono-xide hemoglobin
HR	heart rate
HT	height
IEC	International Electrotechnical Commission
ID	invasive diastolic brood pressure
IM	invasive mean brood pressure
IS	invasive systolic brood pressure
Ins, INS	Inspired Minimum
InsCO$_2$	Inspired Minimum carbon dioxide
ISO	International organization for standardization
LA (L)	left arm
LAP	left artria pressure
LCD	liquid crystal display
LED	light emitting diode
LL (F)	left leg
Loop	loop read-write test fail
M	mean
MAC	minimal alveolar concentration
MAP	mean arterial pressure
MDD	Medical Device Directive
MEAN	mean pressure
MetHb	methemoglobin
Mii	initialize MII registers fail
MRI	magnetic resonance imaging
N/A	not applied
NEO	neonate, neonatal
NIBP	noninvasive blood pressure
ND	non-invasive diastolic brood pressure
NM	non-invasive mean brood pressure
NS	non-invasive systolic brood pressure
O$_2$	oxygen
OxyCRG	Oxygen Cardio-respirogram
P	power
PA	pulmonary artery
PD	photodetector

PED	pediatric
PLETH	plethysmogram
PM	Patient Monitor
PPV	Pulse Pressure Variation
PR	pulse rate
PVC	premature ventricular complex
QRS	interval of ventricular depolarization
RA (R)	right arm
RAM	random access memory
RAP	right atrial pressure
Reg	test NE2000 registers fail
RESP	respiration
RL (N)	right leg
ROM	read-only memory
RR	respiration rate
S	systolic
SpO$_2$	arterial oxygen saturation from pulse oximetry
SYNC	synchronization
SYS	systolic
TEMP	temperature
TFT	Thin-Film Technology
V (C)	precordial lead (chest)
VGA	Video Graphice Array

FOR YOUR NOTES