cPM 12/cPM 8

Patient Monitor

Operator's Manual

Service

Mindray maintains a network of service representatives and factory-trained distributors. Prior to requesting service, perform a complete operational check of the instrument to verify proper control settings. If operational problems continue to exist, contact Mindray Service.
In North America contact the Service Department at (800) 288-2121, ext: 8116 for Technical Support or (201) 995-8000 for assistance in determining the nearest field service location.

Please include the instrument model number, the serial number, and a description of the problem with all requests for service.

Any questions regarding the warranty should be directed to your local sales or service representative.

Company Contact

Manufacturer:	Shenzhen Mindray Bio-Medical Electronics Co., Ltd.
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Distributor:	Mindray DS USA, Inc.
Address:	800 MacArthur Boulevard, Mahwah, New Jersey, 07430 USA
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Website:	www.mindray.com

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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

WARNINGS

- **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 a properly grounded power outlet is not available, operate the monitor on battery power.**
- **The equipment is not intended to be used within the Magnetic Resonance (MR) environment.**
- **To avoid an explosion hazard, do not use the equipment in the presence of oxygen-rich atmospheres, flammable anesthetics, or other flammable agents (such as gasoline).**
- **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.**
- **Do not open the equipment housings. All servicing or future upgrades must be carried out by Mindray trained and authorized personnel.**
- **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.**

WARNINGS

- **PATIENTS WITH A PACEMAKER – On ventricular paced patients, episodes of Ventricular Tachycardia may not always be detected. Do not rely entirely upon the system's automated arrhythmia detection algorithm. Keep pacemaker patients under close surveillance.**
- **The physiological data and alarm messages displayed on the equipment should be reviewed by a clinician before being used for diagnostic interpretation and treatment.**
- **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 by patients or personnel.**
- **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.**
- **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.**
- **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.**

1.1.2 Cautions

CAUTIONS

- **Only use parts and accessories specified in this manual.**
- **Disposable accessories are not designed to be reused. Reuse may cause a ris11 Tw 2.7ec iauserfual (t)22.9 ( )0 (t)-3.4 (o)-3.9**

	Gas outlet		Serial number
	DATE OF MANUAFACTURE		Symbol for "MANUFACTURER"
	Catalog number	**IPX1**	Protected against vertically falling water drops per IEC 60529
	Electrostatic sensitive devices		Plastics identification symbol
	DEFIBRILLATION-PROOF TYPE CF APPLIED PART		
	DEFIBRILLATION-PROOF TYPE BF APPLIED PART		
	The presence of this label indicates the machine was certified by ETL with the statement: Conforms to AAMI Std. ES 60601-1, IEC Std. 60601-1-6, IEC Std. 60601-1-8, IEC Std. 60601-2-25, IEC Std. 60601-2-26, IEC Std. 60601-2-27, IEC Std. 60601-2-34, IEC Std. 60601-2-49, IEC Std. 80601-2-30, ISO Std. 80601-2-55, ISO Std. 80601-2-56, ISO Std. 80601-2-61 Certified to CSA Std. C22.2 NO. 60601-1, NO. 60601-6, NO. 60601-1-8, NO. 60601-2-25, NO. 60601-2-26, NO. 60601-2-27, NO. 60601-2-34, NO. 60601-2-49, NO. 80601-2-30, NO. 80601-2-55, NO. 80601-2-56, NO. 80601-2-61		

2 The Basics

2.1 Intended Use

The cPM Series Patient Monitors (cPM 8 and cPM 12) are intended to be used for monitoring, displaying, reviewing, storing and alarming of multiple physiological parameters including ECG (3-lead, or 5-lead), arrhythmia detection and QT analysis, heart rate (HR), respiration (Resp), temperature (Temp), pulse oxygen saturation (SpO2), pulse rate (PR), non-invasive blood pressure (NIBP), invasive blood pressure (IBP), cardiac output (C.O.), carbon dioxide (CO2), and anesthetic gas (AG).

All the parameters can be applied to single adult, pediatric or neonatal patients with the exception of the following:

- C.O. monitoring is restricted to adult patients only;
- PAWP monitoring is not intended for neonatal patients;
- The ECG Algorithm arrhythmia detection is intended for adult and pediatric patients.
- AG monitoring is available for cPM 12 Patient Monitor only.

The monitors are to be used in healthcare facilities by clinical physicians or appropriate medical staff under the direction of physicians.

WARNING

z 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.

2.2 Applied Parts

The applied parts of the cPM 8/12 patient monitors are:

- ECG electrodes and leadwires,
- SpO_2 sensor
- NIBP cuff
- Temp probes
- IBP transducer
- C.O. sensor
- CO_2 sampling line/nasal sampling cannula, and water trap
- AG sampling line, water trap, and airway adapter

2.3 Main Unit

2.3.1 Front View

1. Alarm lamp

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

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

5. 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 malfunctioning, or no AC source is connected when the monitor is powered off.
   - Flashing: when the monitor operates on battery power.
6. **Alarm Reset**: Press to reset the alarms.
7. **Alarm Pause**: Press to pause or restore alarms.
8. **Freeze**: Press to freeze or unfreeze waveforms.
9. **Record**: When a recording task is not started, pressing this button starts recording. When a recording task is in progress, pressing this button stops recording.
10. **NIBP**: Press to start or stop NIBP measurements.
11. **Menu**

    If no menu is currently displayed on the screen, pressing it enters the main menu. If a menu is currently displayed on the screen, pressing it closes that menu.
12. Knob
    - Rotate the knob clockwise or counter-clockwise to move the cursor.
    - Press the knob to select one item, such as accessing a menu or confirming the selection.

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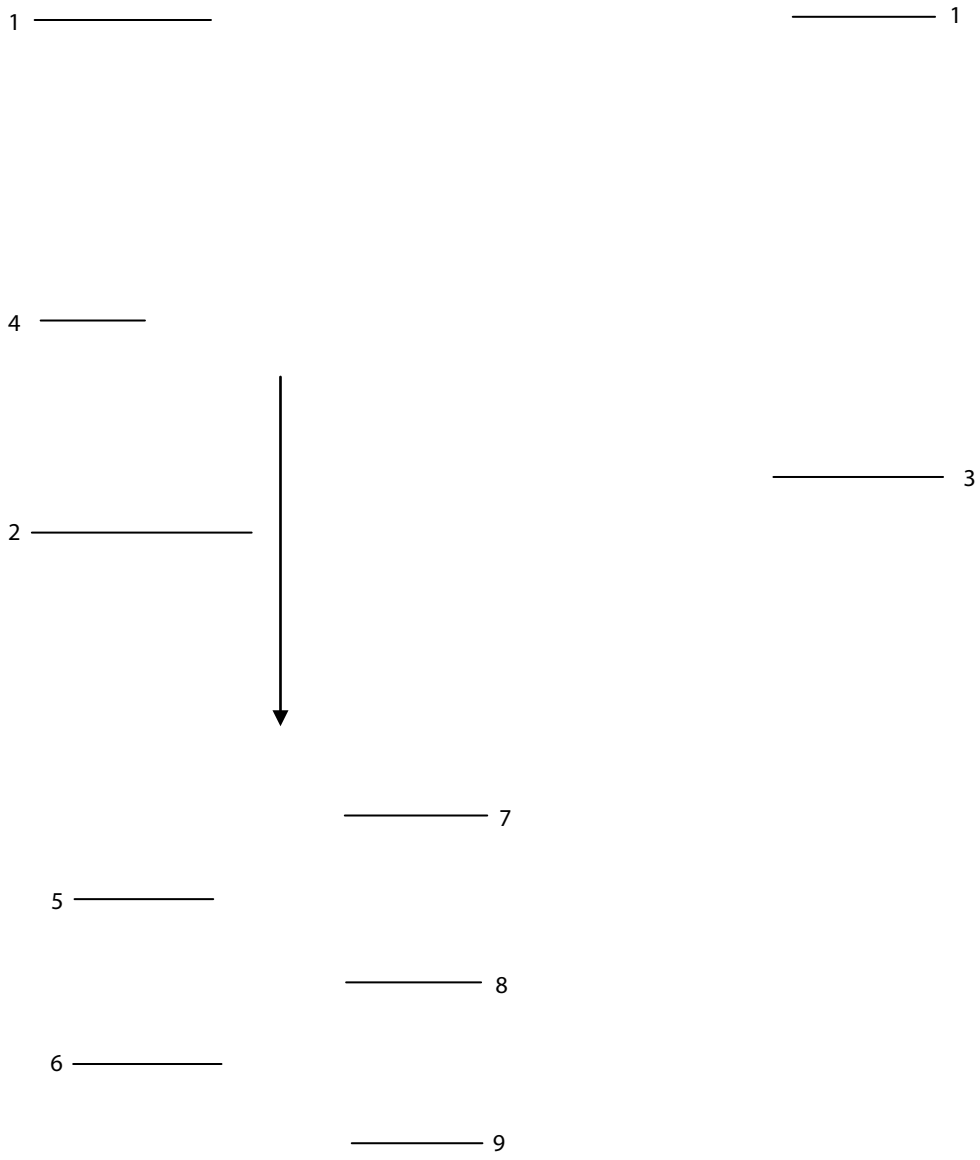
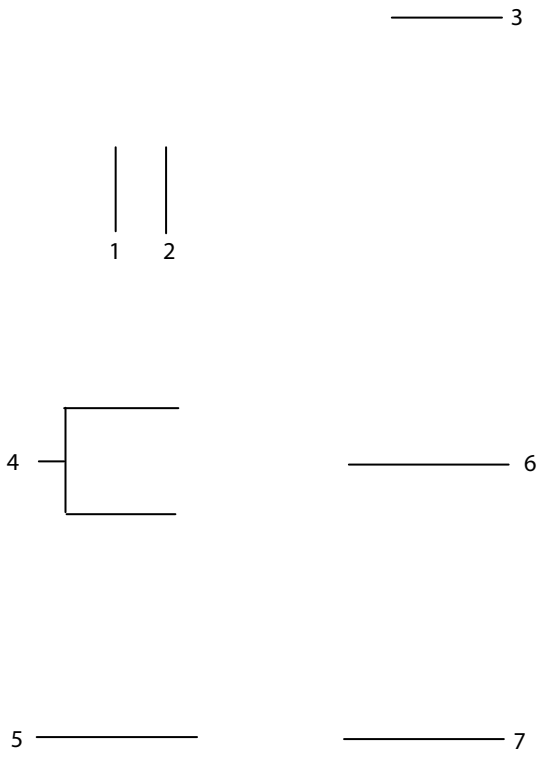


1. Handle
2. Battery compartment
3. Recorder
4. Parameter module slot
5. Temp probe 1 connector
6. Temp probe 2 connector
7. SpO_2 cable connector for
8. ECG cable connector
9. NIBP cuff connector

2.3.3 Rear View

cPM 12



1. AC Power Input
2. Equipotential Grounding Terminal

   When using the monitor together with other devices, connect their equipotential grounding terminals together to eliminate the potential differences between them.
3. Parameter Module Slot

   Used for connecting the parameter modules.
4. USB Connectors

   Connects a USB drive for data or configuration transfer.
5. Multifunctional Connector:
   - Connects the monitor to external devices and outputs defibrillator synchronization signals, nurse call signals, analog output signals, measurement numerics, and alarm limits of parameter modules.
   - Communicates with external devices via Datascope Improved ASCII Protocol (DIAP) protocol.

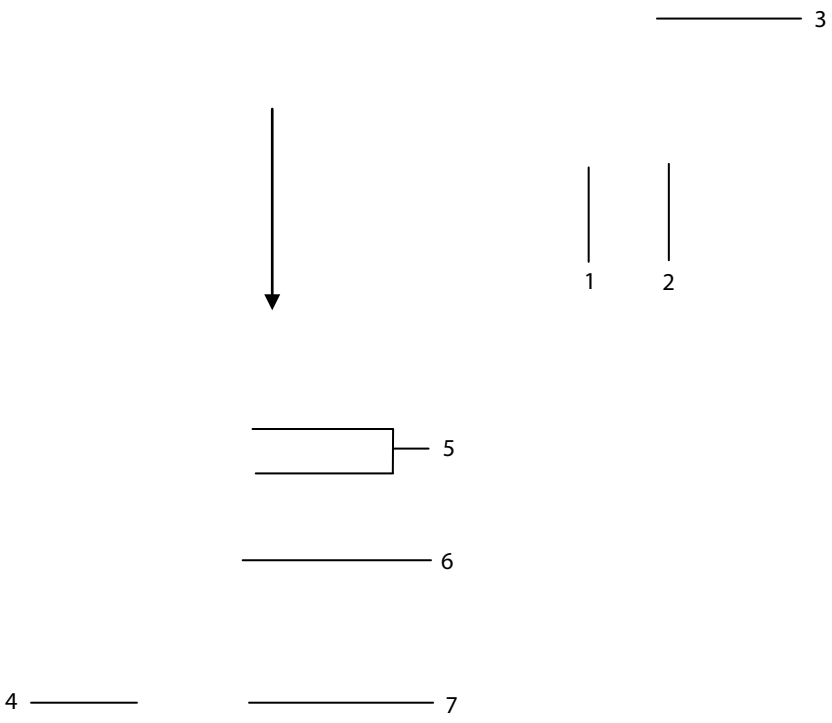
6. Network Connector

   A standard RJ45 connector which connects the monitor to another monitor for remote viewing. It also connects the monitor to a PC for a system upgrade.

7. VGA Connector

   Connects a secondary display, which extends the display capability of your monitor. The contents displayed on the secondary display screen matches what displays on the monitor screen.

cPM 8



1. Equipotential Grounding Terminal

   When using the monitor together with other devices, connect their equipotential grounding terminals together to eliminate the potential differences between them.

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   - ◆ Communicates with external devices via Datascope Improved ASCII Protocol (DIAP) protocol.
5. USB Connectors

   Connects a USB disk for data or configuration transfer.
6. Network Connector

   A standard RJ45 connector which connects the monitor tor other monitor for remote view. It also connects the monitor to PC for system upgrade.
7. VGA Connector

   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.

2.4 Modules

1 2 3

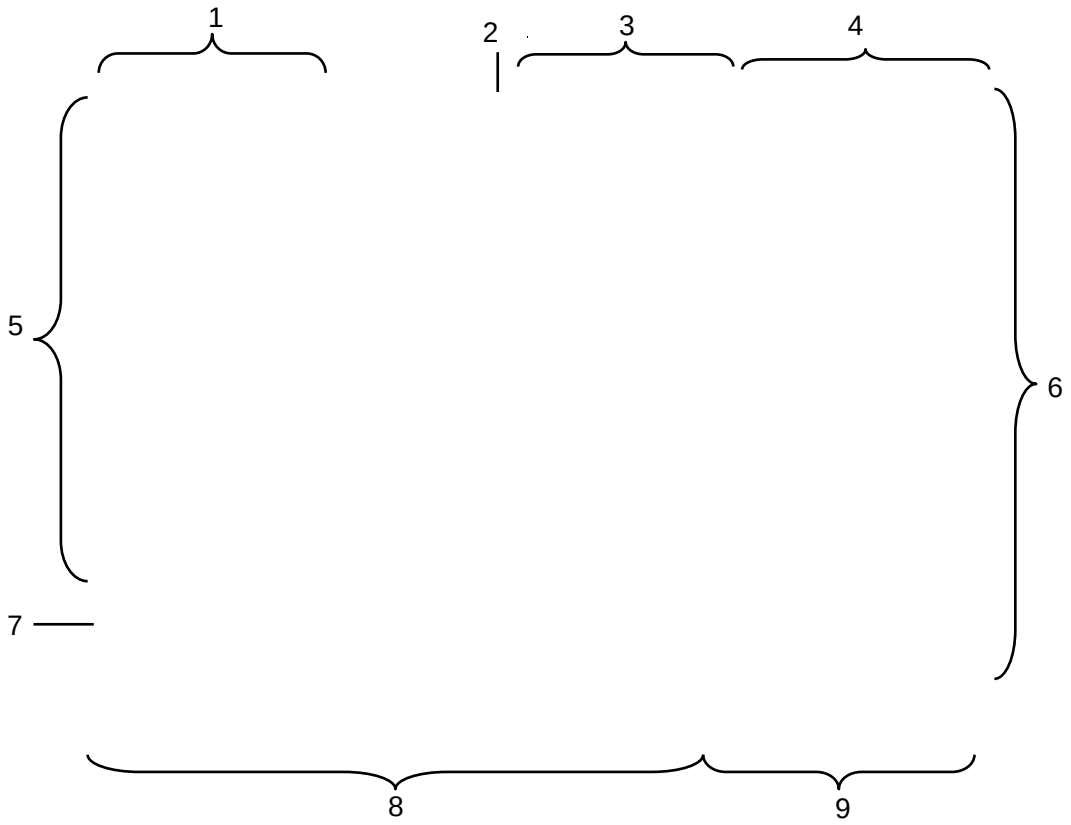
1. Sidestream CO_2 module: contains CO_2 watertrap connector, and CO_2 gas outlet.
2. IBP+C.O. + microstream CO_2 module: contains IBP cable connector, C.O. cable connector, CO_2 sampling line connector, and CO_2 gas outlet.
3. IBP+C.O.+AG module (with O_2): contains IBP cable connector, C.O. cable connector, AG watertrap slot, and AG gas outlet. This module is for cPM 12 only.

NOTE

- **The above modules with IBP connectors support two invasive blood pressures through an IBP extended cable (PN: 040-001029-00).**

2.5 Display Screen

This patient monitor adopts a high-resolution LED screen to display patient parameters and waveforms. A typical display screen is shown below.



1. Patient Information Area

   - This area shows date, time, and 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 enters the [**Patient Setup**] menu. For admitted patients, selecting this area enters the [**Patient Demographics**] menu.

2. Alarm Symbols

   - indicates alarms are paused.
   - indicates alarms are reset.
   - indicates alarm sounds are turned off.
   - indicates the system is in alarm off status.

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 your monitor configuration.

To configure QuickKeys:

1. Select [**Main Menu**] [**Maintenance** >>] [**Manage Configuration** >>] enter the required password [**Ok**].
2. In the [**Manage Configuration**] menu, select [**Edit Config.**>>].
3. In the pop-up menu, select the desired configuration and then select [**Edit**].
4. In the pop-up menu, select [**Screen Setup** >>].
5. Select the [**Select QuickKeys**] tab, and then configure your desired QuickKeys and the order of them.

The following QuickKeys are available:

	Scroll left to display more QuickKeys.		Scroll right to display more QuickKeys.
	[**Main Menu**] QuickKey Enter the [Main Menu]		[**Standby**] QuickKey Enter standby mode
	[**Alarm Setup**] QuickKey Enter the [Alarm Setup] menu		[**Review**] QuickKey Enter the [Review] menu
	[**NIBP Measure**] QuickKey Enter the [NIBP Measure] menu		[**Stop All**] QuickKey Stop all NIBP measurement
	[**Zero IBP**] QuickKey Enter the [Zero IBP] menu		[**Alarm Reset**] QuickKey Reset the alarm system
	[**Alarm Pause**] QuickKey Pause or restore alarms		[**Screens**] QuickKey Enter the [Screens] menu
	[**Patient Setup**] QuickKey Enter the [Patient Setup] menu		[**Manual Event**] QuickKey Trigger a manual event
	[**Realtime Print**] QuickKey Start the realtime print		[**Print Setup**] QuickKey Enter the [Print Setup] menu
	[**Minitrends**] QuickKey Have a split-screen view of minitrends		[**Volume Setup**] QuickKey Enter the [Volume Setup] menu
	[**Load Config**.] QuickKey Enter the [**Load configuration**] menu		[**Start C.O.**] QuickKey Enter the C.O. measurement window
	[**Calculations**] QuickKey Enter the [**Calculations**] menu		[**Others**] QuickKey Enter the [View Other Patient] window
	[**Parameters**] QuickKey Enter the [Parameters] menu		[**OxyCRG**] QuickKey Enter the [oxyCRG] window
	[**NIBP STAT**] QuickKey Start NIBP STAT measurement		[**PAWP**] QuickKey Enter the PAWP measurement screen
	[**Night Mode**] QuickKey Enter the [Night Mode] menu		[**Unit Setup**] QuickKey Enter the [Unit Setup] menu

	[**Privacy Mode**] QuickKey Enter the privacy mode		[**CPB Mode**] QuickKey Enter the CPB mode
	[**7-Lead ECG**] QuickKey Enter the 7-lead ECG full screen		[**Discharge Patient**] QuickKey Enter the [**Discharge Patient**] menu

NOTE

- **There is space for only 10 user configurable Quickkeys on the cPM 12/cPM 8 patient monitor.**

3 Basic Operations

3.1 Installation

WARNING

- **Connect only approved devices to this equipment. 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 questions, please contact Mindray.**
- **If it is not evident from the equipment specifications whether a particular combination with other devices is hazardous, for e**

CAUTION

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

NOTE

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

3.1.2 Environmental Requirements

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

The equipment operating environment should be reasonably free from noises, vibration, dust, corrosive, flammable and explosive substances. To maintain good ventilation, the equipment should be at least 2 inches (5 cm) away from surrounding objects.

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.

CAUTION

- **Make sure that the equipment operating environment meets the specific requirements. Otherwise unexpected consequences, e.g. damage to the equipment, could result.**
- **Put the equipment in a location where you can easily see the screen, access the operating controls, and disconnect the equipment from AC power.**

3.2 Getting Started

3.2.1 Connecting to Power Source

Using AC Power Source

To use the AC power source, connect one end of the power cord with the AC power input on the equipment's back panel and the other end with a wall AC mains outlet.

WARNING

- **Always use the accompanying power cord with the monitor.**
- **Use the battery if the integrity of the protective earth conductor or the protective earthing system in the installation is in doubt.**

Using a Battery

This monitor can be equipped with rechargeable lithium-ion battery. If a battery is installed, the monitor system automatically switches to the battery for power if AC power is interrupted.

NOTE

- **When a battery has been stored for a long time, or the battery is depleted, recharge the battery at once. Otherwise, the low battery may not be sufficient to power the monitor if the AC power is unavailable.**

Refer to Chapter ***24 Batteries*** for detail.

Connecting Accessories

Insert the connector of accessory cables necessary for the measurements to be performed by your monitor to the corresponding connector on the monitor. For details about the parameter connectors, refer to ***2.3.2 Side View***

3.2.2 Turning Power On

Once the monitor is installed, before beginning measurements:

1. Check the monitor and plug-in modules for any mechanical damage, and make sure that all external cables, plug-ins and accessories are properly connected.
2. Check the power supply specification is met if mains power is used. Only use a power outlet that is properly grounded.
3. Plug the power cord into the AC power source. If you run the monitor on battery power, ensure that the battery is sufficiently charged.
4. Press the power on/off switch on the monitor's front panel.

The monitor will perform alarm system self-test during start-up. After pressing the power on/off button, the system shows a "**Loading…**" screen, sounds a beep and the alarm lamp simultaneously turns yellow, then red, and then turns off, followed by the start-up screen being shown. Then the start-up screen disappears. The alarm system self-test succeeds. The monitor enters the normal monitoring screen.

NOTE

- **Carefully check if the system performs the self-test as described above. Contact your service personnel or Mindray if the self-test is abnormal.**

WARNING

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

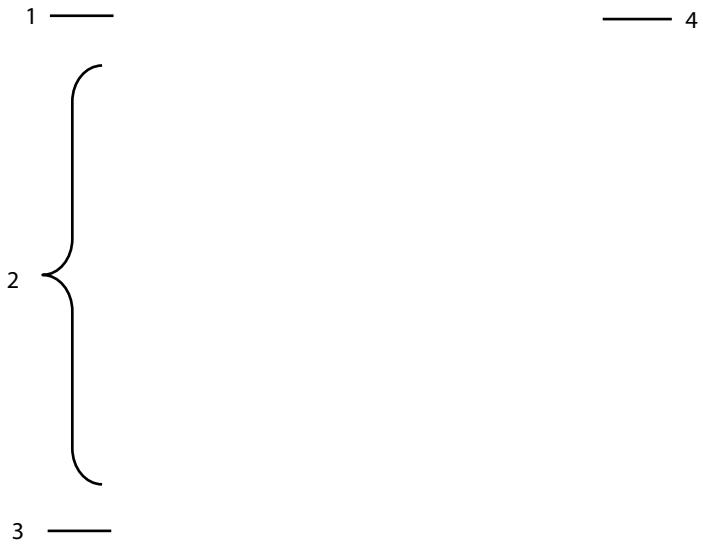
3.2.3 Starting Monitoring

1. Decide which measurements you want to take.
2. Connect the required modules, patient cables and sensors.
3. Make sure that the patient cables and sensors are correctly connected.
4. Make sure 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 Turning Off the Monitor

3.8 Using the Main Menu

To enter the [**Main Menu**], select the [**Main Menu**] on-screen QuickKey or the [**Menu**] hardkey on the monitor's front panel. Most of monitor operations and settings can be performed through this [**Main Menu**].



Other menus are similar to the [**Main Menu**] and contain the following parts:

1. Heading: displays the title for the current menu.
2. Main body: displays options, buttons, prompt messages, etc. The menu buttons with ">>" open 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. If changes are made in the menu, they take effect after selecting this button.

3.9 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 arrange the positions of the parameters and waveforms. Unselected parameters or waveforms will not display.

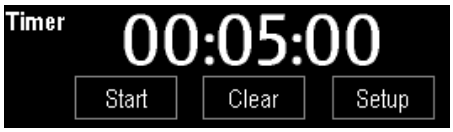
The ECG parameter and the first ECG waveform always display in the first row. The configurable areas can be classified as Area A, Area B, and Area C.

- In Area A, you can choose to display the parameter windows and their waveforms

3.10 Displaying the Timer

To display the timer in the main screen:

1. Select [**Main Menu**] [**Screen Setup>>**] [**Screen Layout >>**] to access the [**Screens**] window.
2. Select [**Screen Setup**] tab.
3. In Area C, select [**Timer**] from the drop-down list of the desired parameter area. Refer to section ***3.9 Setting the Screen***.
4. Select to exit the window. The main screen will display the timer.



- Select [**Start**] or [**Pause**] to start or pause timing.
- Select [**Clear**] to clear current timing result.
- Select [**Setup**] to access the [**Timer Setup**] window, in which you can set the [**Direction**] to [**Up**] or [**Down**]. If you select [**Down**], you should set:
  - [**Run Time(h:min:s)**]: The available time range is 0 to 100 hours, and the default time is 5 minutes.
  - [**Reminder Vol**]: During the last 10 seconds of the countdown, the system issues reminder tone. The available volume range is 0 to 10. 0 means off, and 10 the maximum volume.

3.11 Changing General Settings

This chapter covers only general settings such as language, brightness, date and time, etc. Refer to measurement and other settings in their respective sections.

3.11.1 Setting up a Monitor

To install a monitor or change its location:

1. Select [**Main Menu**] [**Maintenance >>**] [**User Maintenance >>**] enter the required password.
2. In the [**User Maintenance**] menu, set [**Monitor Name**], [**Department**] and [**Bed No.**], or edit their settings.

3.11.2 Changing Language

To change the 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 monitor.

NOTE

- **The changed language is applied only after the monitor is restarted.**

3.11.3 Adjusting the Screen Brightness

To adjust the screen brightness: g teen-1 (een32 739.3</MCMC 9Tw (e053BDC 2.6 47/P <</MC053.6 478.561 0.4.12 88.56 673.68 Tm1r

Key Volume

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

To adjust the key volume:

1. Select the [**Volume Setup**] QuickKey, or [**Main Menu**] [**Screen Setup >>**].
2. Select [**Key Volume**] and then select the appropriate volume. 0 means off, and 10 is 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 tone pitch rises as the saturation level increases and falls as the saturation level decreases. The tone volume is user adjustable.

To adjust the QRS volume

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 is the maximum volume.

3.12 Setting Parameters

3.12.1 Switching the Parameters On/Off

To switch the parameters on or off, select [**Main Menu**] [**Screen Setup >>**] [**Screen Layout >>**] [**Parameters Switch**]. 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 can not switch it off.**

3.12.2 Accessing the Parameters Menu

3.13.1 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.

3.13.2 Night Mode

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

To activate the Night mode:

1. Select the [**Night Mode**] QuickKey or [**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 measurements 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 the [**Night Mode**] QuickKey or [**Main Menu**] [**Screen Setup >>**] [**Night Mode >>**].
2. Select [**Ok**] in the pop-up.

CAUTION

- **Before entering Night mode, confirm the brightness settings, alarm volume, QRS volume, and key volume. Consider the potential risk**

FOR YOUR NOTES

4 Managing Patients

4.1 Admitting a Patient

The monitor displays physiological data and stores it in trends as soon as a patient is connected. This allows you to monitor a patient that is not admitted yet. However, it is recommended that you admit a patient so that you can clearly identify them on recordings, reports and networking devices.

To admit a patient:

1. Select the [**Patient Setup**] QuickKey, or [**Main Menu**] [**Patient Setup >>**].
2. Select [**Discharge Patient**] to clear any previous patient data. If you do not erase data from the previous patient, the new patient's data is combined with the previous patient's data. The monitor makes no distinction between the old and the new patient data.
3. If [**Discharge Patient**] button appears dimmed, directly select [**Admit Patient**] and then select:
   - [**Yes**] to apply the data saved in the monitor to the new patient, or
   - [**No**] to clear the data saved in the monitor.
4. In the [**Patient Demographics**] menu, enter the demographic details, of which:
   - [**Patient Cat.**] allows the user to select patient size (Neo, Ped, Adu) which will determine the way your monitor processes and calculates some measurements, and what safety and alarm limits are applied for your patient.
   - [**Paced**] determines whether to show pace pulse marks on the ECG waveform. When the [**Paced**] is set to [**No**], pace pulse marks are not shown in the ECG waveform.
5. Select [**Ok**].

WARNING

- **The [Patient Cat.] and [Paced] fields always contain a value, regardless of whether the patient is fully admitted or not. If you do not specify settings for these fields, the monitor uses the default settings from the current configuration, which might not be correct for your patient.**
- **For paced patients, you must set [Paced] to [Yes]. If it is incorrectly set to [No], the 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 Quick Admitting a Patient

Use [**Quick Admit**] only 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 always displays in the patient information area.

1. Select the [**Patient Setup**] QuickKey, or [**Main Menu**] [**Patient Setup >>**].
2. Select [**Quick Admit**]. If a patient has been admitted, select [**Ok**] to discharge the current patient. If no patient is admitted, you can choose either:
   - [**Yes**] to apply the data in your monitor to the new patient, or
   - [**No**] to clear any previous patient data.
3. Enter the Patient Category and Paced Status for the new patient, and then select [**Ok**].

4.3 Setting the Monitor Location

To set the monitor location, follow this procedure:

1. Select [**Main Menu**] [**Maintenance >>**] [**User Maintenance >>**] enter the required password.
2. Input the following location of the monitor:
   - [**Facility**]: your facility name.
   - [**Department**]: your department name.
   - [**Room No.**]: room number.
   - [**Bed No.**]: bed number.

4.4 Editing Patient Information

To edit the patient information after a patient has been admitted, 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**].

You can also input the patient's visit number in the [**Patient Demographics**] menu, but the [**Visit Number**] option needs to be enabled.

To display the [**Visit Number**] option in the [**Patient Demographics**] menu:

1. Select [**Main Menu**] [**Maintenance >>**] [**User Maintenance >>**] enter the required password.
2. Set [**Visit Number**] to [**On >>**].

4.5 Discharging a Patient

To discharge a patient:

1. Select the [**Dicharge Patient**] QuickKey, or [**Main Menu**] [**Patient Setup >>**] [**Discharge Patient**].
2. In the pop-up menu, you can either:
   - Select [**Ok**] to discharge the current patient, or
   - Select [**Standby**] then [**Ok**]. The monitor enters the Standby mode after discharging the current patient, or
   - Select [**Cancel**] to exit without discharging the patient.

If you need to print the end case report, refer to section ***22.7 End Case Reports*** for instructions.

NOTE

- **After discharging an admitted patient, you can review the historical data of this patient by selecting [Main Menu] [Patient Data >>] [Historical Data >>]. When the SD card is full, the oldest patient data will be deleted automatically. Therefore, you cannot always view all the historical data.**

4.6 Transferring Patient Data

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 review the patient's condition history. The patient data that can be transferred includes: patient demographics, trend data, alarm events and parameter alarm limits.

From the [**User Maintenance**] menu, select [**Others >>**]. In the pop-up 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 enables the HR alarm and lethal arrhythmia alarm after transferring the patient data.**

4.6.1 Transferring Data from the Monitor to a USB Drive

To transfer data from the monitor to a USB drive:

1. Connect a USB drive into the monitor's USB port. Select [**Main Menu**] [**Patient Setup >>**].
2. Select [**Transfer to Storage Medium**]. In the pop-up menu, you can:
   - Select [**Ok**

5 Managing Configurations

5.1 Introduction

When performing continuous patient monitoring, 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 provides different sets of configurations to accommodate the varying patient categories and departments. You can change the settings from a default configuration and then save it as a user configuration.

The default configurations provided for your monitor are department-oriented. You can choose either from:

- General
- OR
- ICU
- NICU
- CCU

Each department has three different sets of configurations: one for each patient category [**Neo**], [**Ped**], and [**Adu**]. For the important configuration items and their default values and user maintenance items, see ***Appendix C Default Configurations***.

NOTE

- **The configuration management function is password protected. The configuration management tasks must be performed by authorized personnel. Please contact your depd3.4 ( )0nd3.021 Tc .7(d)15 (ep)-9emag(r)9.6 ((o)-3.9 (r)95d**

5.2 Entering the [Manage Configuration] Menu

To access the [**Manage Configuration**] menu:

1. Press the [**Menu**] hardkey on the monitor's front panel to enter the [**Main Menu**].
2. Select [**Maintenance >>**] [**Manage Configuration >>**]. Enter the required password and then select [**Ok**].

5.3 Changing Department

If the current department configuration is not the one you want to view, you can select [**Change Department >>**] in the [**Manage Configuration**] menu

5.4 Setting Default Configuration

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

- The monitor restarts after being switched off for more than 120 seconds.
- A patient is admitted.
- A patient is discharged.
- Patient data is cleared.
- Patient category is changed.

To set the 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 restored configuration is subject to the patient category (adult, pediatric or neonate). This configuration can be either factory configuration or a saved user configuration. As an example, select [**Default Adu Config.**] and then select [**Defaults**] or user configuration(s).

When you select [**Load the Latest Config**], the latest configuration is loaded when the monitor is started or a patient is admitted.

NOTE

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

5.5 Saving Current Settings

Current settings can be saved as a user configuration. Up to 5 user configurations can be saved.

To save current settings:

1. Select [**Save Current Settings As >>**] in the [**Manage Configuration**] menu.
2. In the pop-up dialog box, enter the configuration name and then select [**Ok**]. The current settings are saved as a user configuration with the name you entered.

5.6 Editing Configurations

To edit an existing configuration:

1. Select [**Edit Config. >>**] in the [**Manage Configuration**] menu. The following menu appears.

2. The pop-up menu shows the existing monitor configurations. 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 [**Parameters >>**] to enter the corresponding menu in which settings can be changed. The changed alarm setup items 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 as another file with another name.

FOR YOUR NOTES

6 User Screens

6.1 Configuring Your Screens

You can configure your monitor's screens by setting:

- Waveform line size
- The color in which each measurement's numerics and waveforms are displayed
- The parameter to monitor.

CAUTION

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

6.1.1 Changing the Waveform Line Size

To change the waveform line size:

1. Select [**Main Menu**] [**Maintenance >>**] [**User Maintenance >>**] enter the required password.
2. Select [**Others >>**].
3. Select [**Wave Line**] and select [**Thick**], [**Med**] or [**Thin**].

6.1.2 Changing Measurement Colors

To change the measurement colors:

1. Select [**Main Menu**] [**Screen Setup >>**] [**Measurement Color Setup >>**].
2. Select the color box next to your desired parameter and then select a color from the pop-up 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 ***3.9 Setting the Screen***.
- You can select the parameters you want to view on the big numerics screen in the [**Big Numerics Screen Setup**] window.
- You can switch the connected parameter modules on or off in the [**Parameters Switch**] window. If a parameter module is switched off, parameter values and waveforms will not display on the screen.

6.3 Viewing OxyCRG

To have a split screen view of oxyCRG:

- Select the [**OxyCRG**] QuickKey;
- Select the [**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 waveform (Resp or CO_2 waveform). At the bottom, there are controls:

1. Event

   You can enter the [**Review**] menu by selecting the [**Event**] button.

2. Trend length list box

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

3. 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.

4. Auto Scale

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

5. Print

   Select [**Print**] to print the real-time OxyCRG to a printer.

6. Record

   Select [**Record**] to print the currently displayed OxyCRG trends to the recorder.

6.4 Viewing Other Patients

6.4.1 Care Group

This function 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** [**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 monitors from the [**Connected Monitor List**], and then select the button. The selected monitors constitute a Care Group.

6.4.2 Viewing the Care Group Overview Bar

The Care Group overview bar is located 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. For telemetry, # is displayed before the department label. The color in which a Care Group bed appears matches its status:

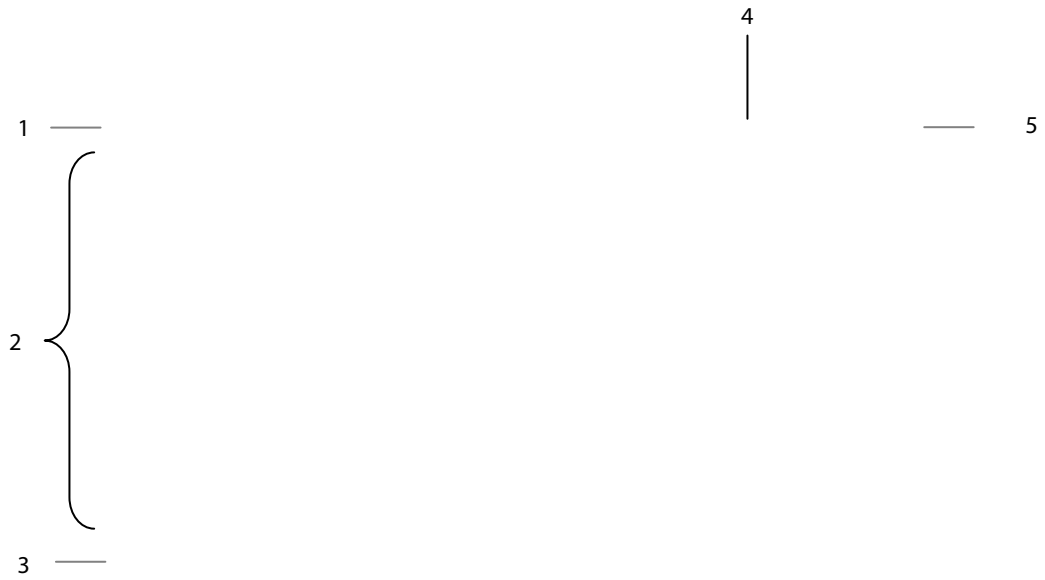
- Red: indicates the bed is having high-level physiological alarms or the telemetry is in alarm, such as nurse call or event.
- Yellow: indicates the bed is having medium-level or low-level physiological alarms, or medium-level technical alarms.
- Blue: indicates the bed is having low-level technical alarms.
- Light grey: indicates the bed fails to be networked.
- Dark grey: indicates the bed is in the Standby mode.

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

For more details about Care Group alarms, refer to the chapter ***24 Batteries***.

6.4.3 Understanding the View Other Patient Window

When you first open the [**View Other Patient**] window, the monitor automatically selects a device 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. See section ***6.4.2 Viewing the Care Group Overview Bar*** for information.
4. Message Area: shows physiological, technical and prompt messages from the currently viewed monitor. It also shows the alarm given by the device such as nurse call or event. 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: resets alarms from the currently viewed bed. Refer to section ***7.8 Resetting Alarms***.

   When the [**Reset Other Bed's Alarms**] is disabled, no button will appear here.

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 pop-up 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 pop-up menu.

WARNING

- **The data presented in the [View Other Patient] window has a delay. Do not rely on this window for realtime data.**
- **The icon indicates network disconnection. You cannot view other monitors when this icon is displayed.**

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 >>**].
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 to view. For parameters having a waveform, the waveform will also be displayed.

7 Alarms

Alarms, triggered by an abnormal vital sign or technical issue with the monitor, as visually and audibly indicated to the user.

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.**

For troubleshooting specific alarms, see appendix ***D Alarm Messages***.

7.1 Alarm Categories

The monitor's alarms can be classified into two categories: physiological alarms and technical alarms.

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 monitor will show some messages telling the system status or patient status. Messages of this kind are included in 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

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

	Physiological alarms	Technical alarms
High level	Indicate that the patient is in a life threatening situation, such as Asystole, Vfib/Vtac and so forth, and emergency treatment is required.	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 the patient's vital signs appear abnormal and 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 the patient's vital signs appear abnormal and 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 monitor will indicate it to the user through visual or audible alarm indications.

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

7.3.1 Alarm Lamp

If a technical alarm or physiological alarm occurs, the alarm lamp will flash. The color and flashing 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 alarms: the lamp lights yellow without flashing.

7.3.2 Alarm Messages

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 alarms: yellow

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 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

7.4 Alarm Tone Configuration

7.4.1 Setting the Minimum Alarm Volume

To set 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 then select a value 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 minimum alarm volume setting remains unchanged when the monitor shuts down and restarts.

7.4.2 Changing the Alarm Volume

To change 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 to 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 high priority alarm volume 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 in the alarm symbols area of 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 ie-11 (t)-132.5 ()15.3 (2:C ET/InlC/MCID 28 >>BD550 Tc 0 Tw 9.12 -03.3[(])0.5MC /P <</MCLBodyD 32 >>BD59/T

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 order and then select the appropriate settings.

WARNING

- **When the alarm sound is switched off, the 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 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 then select [**ISO**], [**Mode 1**] or [**Mode 2**].

NOTE

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

7.4.5 Setting the Reminder Tones

When the reminder tone is switched on and a physiological or technical alarm condition exists, the monitor gives a periodic reminder tone in the following cases:

- When the alarm volume is set to zero, a high, medium, low, or technical audible alarm indication will be generated at the set reminder interval until the alarm condition is cleared.
- When the alarm condition has been acknowledged (e.g. pressing the Alarm Reset button), a high, medium, or low audible alarm indication will be generated at the set reminder interval until the alarm condition is cleared.
- When the alarm system has been permanently paused (e.g. pressing the Alarm Pause button with the Alarm Pause Time set to Permanent), an Alarm Paused audible alarm indication will be generated at the set reminder interval until the alarm condition is cleared or the alarm system re-enabled.

To turn on 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 acknowledged 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 then select [**1min**], [**2min**] or [**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 then select [**High**], [**Medium**] or [**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 arrhythmia alarm settings.
- Set the threshold for some arrhythmia alarms.
- Change other settings.

Refer to the chapter ***8 Monitoring ECG*** for 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 limit 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. 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 [**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 guidelines:

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 40 bpm (whichever is greater)	(HR – 30) or 90 bpm (whichever is greater)	(HR × 1.25) or 240 bpm (whichever is smaller)	(HR + 40) or 200 bpm (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
SpO_2	SpO_2	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 45 mmHg (whichever is greater)	(SYS × 0.86 + 38) mmHg	(SYS + 15) or 105 mmHg (whichever is smaller)	Adult: 45 to 270 Pediatric: 45 to 185 Neonate: 35 to 115
	NIBP-D	(Dia × 0.68 + 6) mmHg	(Dia – 15) or 20 mmHg (whichever is greater)	(Dia × 0.86 + 32) mmHg	(Dia + 15) or 80 mmHg (whichever is smaller)	Adult: 25 to 225 Pediatric: 25 to 150 Neonate: 20 to 90
	NIBP-M	(Mean × 0.68 + 8) mmHg	(Mean – 15) or 35 mmHg (whichever is greater)	(Mean × 0.86 + 35) mmHg	(Mean + 15) or 95 mmHg (whichever is smaller)	Adult: 30 to 245 Pediatric: 30 to 180 Neonate: 25 to 105
Temp	T1	(T1 – 0.5)°C	(T1 – 0.5) °C	(T1 + 0.5)°C	(T1 + 0.5)°C	1 to 49°C
	T2	(T2 – 0.5)°C	(T2 – 0.5) °C	(T2 + 0.5)°C	(T2 + 0.5)°C	1 to 49°C
	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 45 mmHg (whichever is greater)	(SYS × 0.86 + 38) mmHg	(SYS + 15) or 105 mmHg (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 20 mmHg (whichever is greater)	(Dia × 0.86 + 32) mmHg	(Dia + 15) or 80 mmHg (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 35 mmHg (whichever is greater)	(Mean × 0.86 + 35) mmHg	(Mean + 15) or 95 mmHg (whichever is smaller)	Adult: 30 to 245 Pediatric: 30 to 180 Neonate: 25 to 105
PA	IBP-S	SYS × 0.75	SYS × 0.75	SYS × 1.25	SYS × 1.25	3 to 120 mmHg
	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	

Module	Parameter	Low alarm limit		High alarm limit		Auto alarm limits range
		Adult/ pediatric	Neonate	Adult/ pediatric	Neonate	
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
CO_2	$EtCO_2$	0 to 32 mmHg: remains the same	0 to 32 mmHg: remains the same	0 to 32 mmHg: remains the same	0 to 32 mmHg: remains the same	Same as the measurement range
		32 to 35 mmHg: 29 mmHg	32 to 35 mmHg: 29 mmHg	32 to 35 mmHg: 41 mmHg	32 to 35 mmHg: 41 mmHg	
		35 to 45 mmHg: ($etCO_2$-6) mmHg	35 to 45 mmHg: ($etCO_2$-6) mmHg	35 to 45 mmHg: ($etCO_2$+6) mmHg	35 to 45 mmHg: ($etCO_2$+6) mmHg	
		45 to 48 mmHg: 39 mmHg	45 to 48 mmHg: 39 mmHg	45 to 48 mmHg: 51 mmHg	45 to 48 mmHg: 51 mmHg	
		> 48 mmHg: remains the same	> 48 mmHg: remains the same	> 48 mmHg: remains the same	> 48 mmHg: 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
AG	$EtCO_2$ (AG)	Same as CO_2 module				
	$FiCO_2$ (AG)					
	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
	FiAA/ EtAA	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
	FiO_2/ $EtCO_2$	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
	FiN_2O/ EtN_2O	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
C.O.	BT	Adult: (BT – 1)°C	N/A	Adult: (BT – 1)°C	N/A	Same as the measurement range

7.5.3 Setting Alarm Delay Time

You can set the alarm delay time for alarms of continuously measured parameters. If the alarm condition is resolved within the delay time, the monitor will not sound the alarm.

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
- Arrhythmia alarms
- ECG Weak Signal
- Resp Artifact
- SpO_2 Desat
- No Pulse
- Nellcor SpO_2 over alarm limits
- FiO_2 Shortage
- Measurements of noncontinuous parameters over alarm limits
- HR over alarm limits
- Anesthetic Mixture's MAC > 3

You can set [**Apnea Delay**] separately.

7.5.4 Setting SpO_2 Technical Alarm Delay

You can set the [**Tech. Alarm Delay**] in the [**Others**] tab of the [**Alarm Setup**] menu. The options are [**Off**], [**5 s**], [**10 s**] and [**15 s**]. 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 then select [**8 s**], [**16 s**] or [**32 s**]:

- [**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.

7.5.6 Entering CPB Mode (Cardiopulmonary Bypass Mode)

When performing CPB, you can put the monitor in CPB mode in order to reduce unnecessary alarms. The CPB mode is activated only if you set the department to [**OR**]. To set the department to [**OR**]:

1. Press the [**Menu**]

7.7 Switching Off All Alarms

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

- For physiological alarms, no alarm lamps flash and no alarms are sounded.
- For physiological alarms, no numerics or alarm limits flash.
- No physiological alarm messages are shown.
- [**Alarm Off**] is displayed in the physiological alarm area with a red background.
-

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 appears in the alarm symbol area, indicating that the alarm is acknowledged. The indication of the alarm lamp depends on the alarm light setting.
- 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 appendix ***D.2 Technical Alarm Messages***.

7.9 Latching Alarms

The latching setting for physiological alarms defines how alarm indicators behave if you do not reset the alarms.

- If you do not "latch" the physiological alarms, their alarm indications disappear when the alarm condition ends.
- If you "latch" physiological alarms, all visual and audible alarm indications remain until you reset the alarms. For latched alarms the time when the alarm is last triggered is displayed beside the alarm message.

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

- 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. 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.
- The lethal alarms are latched by default. High, medium, and low priority alarms are unlatched by default.

NOTE

- **Changing of alarm priority may affect the latching status of corresponding alarms. Please determine if you need to adjust 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.**

You can separately configure the latching of the Vtac alarm. To do so, follow this procedure:

1. Select [**Main Menu**] [**Maintenance >>**] [**User Maintenance >>**] enter the required password.
2. Select [**Alarm Setup** >>] [**Latching Alarms>>**].
3. Set [**Vtac Latching Lock**] to [**Disable**].
4. Select [**Alarm Setup** >>] quick key to enter [**Alarm Setup**] menu.
5. Select [**Others**] tab.
6. Set [**Vtac Latching**] as desired.

NOTE

- **If the visual signal of lethal alarms is not latched, [**Vtac Latching Lock**] is not configurable and is automatically set to [Enable].**

7.10 Testing Alarms

When the monitor starts up, a self-test 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. Then adjust alarm limits and check that appropriate alarm behavior 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.

When a 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 monitor prompts you by sounding 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 alarm of the currently viewed bed in the View Other Patient window. This function can be set in the [**Alarm Setup**] menu from the [**User Maintenance**] menu only.

To enable this function:

1. Select [**Main Menu**] [**Maintenance>>**] [**User Maintenance>>**] enter the requ5 (M)28.2 Td(1r)10.7 Tw 7.926 0 Td[(])-23.8 (e)16

8.3 Preparing to Monitor ECG

8.3.1 Preparing the Patient and Placing the Electrodes

To prepare the patient and place the electrodes:

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

To choose 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**], 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 hospital standard.

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.

7

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.

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 pop-up menu and then select [**Yes**] or [**No**].

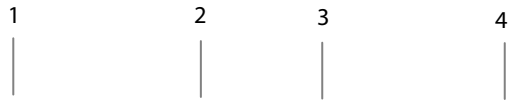
If you do not set the paced status, the monitor issues a prompt tone when pace pulse is detected. At the same time, the paced symbol flashes and the message [**Please confirm the pace of patient**] appears in the ECG waveform area. Then, please check and set the paced status of the patient.

WARNING

-

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

Besides, 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

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 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 monitor will automatically switch to PR as the alarm source.

8.5.3 Changing ECG Wave Settings

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

- You can select [**ECG**], [**ECG1**], or [**ECG2**] to select a lead to v6.3 (284w30.6 ( ) d(-)Tj0.39.7 (ew</MCID 12 >>BDC 0 Tc 6.635 0 Td(2.316 0

8.5.6 Choosing an ECG Display Screen

When monitoring with a 5-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 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 iw5Aoa ca-1.8 (a)7.3 (v)6.3 (ef)1.5 (o)-4.6 (r)36.5 (m)-9.1 (i

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 then select [**On**] or [**Off**] from the pop-up 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 pop-up 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 pop-up menu and select the appropriate setting. When a val

8.5.13 About the Defibrillator Synchronization

A defibrillator synchronization pulse (100 ms, +5V) is output through the Multifunctional connector every time the monitor detects an R-wave.

To use the defibrillator synchronization function, connect the monitor and the defibrillator with a synchronization cable.

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.**

8.6 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 ventricles. QT interval monitoring can assist in the detection of long QT syndrome.

The QT interval has an inverse relationship to heart rate. As heart rate increases, the QT interval shortens, while at lower heart rates QT interval gets longer. Several formulas are available to correct 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 neonate patients.

QT interval

CAUTION

- **For QT interval monitoring to be effective, basic or enhanced arrhythmia monitoring should be turned on.**

8.6.1 QT/QTc Monitoring Limitations

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

- R-wave amplitudes are too low
- The presence of frequent ventricular ectopic beats
- Unstable RR intervals
- P-waves tending to encroach on the end of the previous T-wave at high heart rates
- T-waves are very flat or not well defined
- The end of the T-wave is difficult to delineate 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.

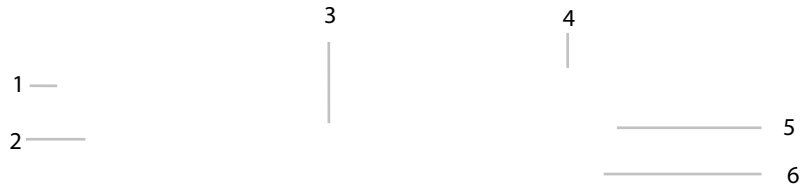
If the heart rate is extremely high (over 150bpm for adults and over 180bpm for pediatrics and neonat

8.6.3 Displaying QT/QTc Parameters and Waveform

To display QT numerics and waveform:

1. Select the [**Screens**] QuickKey or select [**Main Menu**] [**Screen Setup** >>] [**Screen Layout** >> to enter the [**Screens**] window.
2. Select the **[Screen Setup**] tab.
3. Select the parameter area where you want to display the QT parameters and select [**QT**].

The following picture shows the QT numeric area. Your monitor screen may look slightly different:



1: Parameter label

2: QTc alarm limit (if QTc alarm is off, the alarm off symbol is displayed)

3: QTc value

4: ΔQTc value (the difference between the current and reference QTc values. If ΔQTc alarm is off, the alarm off symbol is displayed on the right.)

5: QT value

6: QT-HR value

NOTE

- **QTc values are calculated based on the QT-HR, not the ECG HR.**

8.6.4 Accessing the QT View

QT View shows the current and reference QT parameter values and waveforms.

To accss the QT View:

1. Select the QT parameter area or waveform area to enter the [**QT Analysis**] menu.
2. Select [**QT View>>**].

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.	
Vtac	The consecutive PVCs ≥ Vtac PVCs limit, and the HR ≥ the Vtac rate limit.	
Vent. Brady	The consecutive PVCs ≥ the Vbrd threshold and the ventricular HR < the Vbrd Rate threshold.	
Extreme Tachy	The heart rate is equal to or greater than the extreme tachycardia limit.	
Extreme Brady	The heart rate is equal to or less than the extreme bradycardia limit.	
PVCs	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).	
Pacer Not Capture	No QRS complex detected for 300 milliseconds following a pace pulse (for paced patients only).	
PVC	One PVC detected in normal heartbeats.	
Couplet	Paired PVCs detected in normal heartbeats.	
Run PVCs	More than 2 consecutive PVCs within the last minute.	
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	No beat detected for 1.75 x average R-R interval for HR <120, or No beat for 1 second with HR > 120 (for non-paced patients only), or No beat detected for more than the set pause threshold.	
Brady	The average heart rate is equal to or less than the bradycardia limit.	
Tachy	The average heart rate is equal to or greater than the tachycardia limit.	
Vent. Rhythm	The consecutive PVCs ≥ the Vbrd PVCs limit, and the HR ≥ Vbrd Rate limit but < the Vtac Rate limit.	
Multif. PVC	Multiform PVCs detected in Multif. PVC's Window (which is adjustable).	
Nonsus. Vtac	The consecutive PVCs < the Vtac PVCs limit but > 2, and HR ≥ the Vtac Rate limit.	
Pause	No QRS detected within the set time threshold of pause.	
Irr. Rhythm	Consistently irregular rhythm.	
Afib	Absence of P-waves and/or variable RR intervals between normal beats.	

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.**

NOTE

- **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. When 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	5	bpm
Brady Low	15 to 120	Adult: 50 Pediatric: 75	5	bpm
Extreme Tachy	120 to 300	Adult: 160 Pediatric: 180	5	bpm
Extreme Brady	15 to 60	Adult: 35 Pediatric: 50	5	bpm
Multif. PVC's Window	3 to 31	15	1	/min
Vtac Rate	100 to 200	Adult, pediatric: 130	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 monitor does not analyze the extended arrhythmia events, and corresponding alarms are not given.

8.7.5 Reviewing Arrhythmia Events

Please refer to section ***19.4 Reviewing Events***.

8.8 ECG Relearning

8.8.1 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, and/or
- Inaccurate heart rate

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

WARNING

- **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.**

8.8.2 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 ECG calibration is completed, and [**Stop Calibrating ECG**] is selected.
- A switch happens between the options of screen type during 5-lead ECG monitoring.
- The paced status of the patient is changed.

8.9 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 section ***27.1 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 section ***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 section ***8.3.1 Preparing the Patient and Placing the Electrodes*** and apply fresh and moist electrodes.
	Cable or lead wires damaged	Change cable and lead wires.
Excessive alarms: heart rate, lead fault	Electrodes dry	Repeat skin preparation as described in section ***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.

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 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-configured 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 EN 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 Setup] menu.

NOTE

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

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 section ***9.4.4 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 Respiration Rate 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 impedance respiration if you press the [**Alarm Reset**] key 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, CO_2, and AG module 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 pop-up menu, you can set alarm properties for this parameter.

FOR YOUR NOTES

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 chapter ***14 Monitoring IBP***). The displayed pulse numeric is color-coded to match its source.

1. PR: detected beats per minute.
2. PR Source

NOTE

- **A functional tester or SpO_2 simulator can be used to determine pulse rate accuracy.**

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;

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 pop-up menu.

The pop-up 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 pop-up 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 pop-up 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 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**] or [**SpO2 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 [**SpO2 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 the following 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 9 (o61.3 ( )e)19.3ves

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.**
- **The equipment is not intended for use in an MRI environment.**
- **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 Identifying SpO_2 Modules

To identify which SpO_2 module is incorporated into your monitor, see the color of the SpO_2 connector and the company logo located at the monitor. The color of the cable connector matches the company as shown below:

- Masimo SpO_2 module: a purple connector with a logo of Masimo SET.
- Nellcor SpO_2 module: a grey connector with a logo of Nellcor.

The connectors for these three SpO_2 sensors are mutually exclusive.

11.4 Applying the Sensor

To apply the sensor:

1. Select an appropriate sensor according to the module type, patient category and weight.
2.

11.5 Changing SpO_2 Settings

11.5.1 Accessing SpO_2 Menus

By selecting the SpO_2 parameter window or waveform area, you can access the [**SpO2 Setup**] menu.

11.5.2 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 [**SpO2 Setup**] menu. From the pop-up 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 [**SpO2 Desat**] is displayed.

11.5.3 Setting SpO_2 Sensitivity

For Masimo SpO_2 module, you can set [**Sensitivity**] to [**Normal**] or [**Maximum**] in the [**SpO2 Setup**] menu. When the [**Sensitivity**] is set to [**Maximum**], the monitor is more sensitive to minor signals. When monitoring critically ill patients whose pulsations are very weak, it is strongly recommended that the sensitivity is set to [**Maximum**]. When monitoring neonatal or non-critically ill patients who tend to move a lot, noise or invalid signals may be caused. In this case, it is recommended that the sensitivity is set to [**Normal**] so that the interference caused by motion can be filtered and therefore the measurement stability can be ensured.

11.5.4 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 monitor responds to changes in the patient's oxygen saturation level. Contrarily, the longer the averaging time is, the slower the 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 for Masimo SpO_2 module:

,1. Select [**Averaging**] in the [**SpO2 Setup**] menu.

2. Then select [**2-4 s**], [**4-6 s**], [**8 s**], [**10 s**], [**12 s**], [**14 s**] or [**16 s**].

11.5.5 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 [**SpO2 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.

11.5.6 Sat-Seconds Alarm Management

With traditional alarm management, high and low alarm limits are set for monitoring oxygen saturation. During monitoring, as soon as an alarm limit is violated, an audible alarm immediately sounds. When the patient % SpO_2 fluctuates near an alarm limit, the alarm sounds each time the limit is violated. Such frequent alarms can be distracting. Nellcor's Sat-Seconds alarm management technique is used to reduce these nuisance alarms.

The Sat-Seconds feature is available with the Nellcor SpO_2 module to decrease the likelihood of false alarms caused by motion artifacts. To set the Sat-Seconds limit, select [**Sat-Seconds**] in the [**SpO2 Setup**] menu and then select the appropriate setting.

With Sat-Seconds alarm management, high and low alarm limits are set in the same way as traditional alarm management. A Sat-Seconds limit is also set. The Sat-Seconds limit controls the amount of time that SpO_2 saturation may be outside the set limits before an alarm sounds. The method of calculation is as follows: the number of percentage points that the SpO_2 saturation falls outside the alarm limit is multiplied by the number of seconds that it remains outside the limit. This can be stated as the equation:

Sat-Seconds= Points × Seconds

Only when the Sat-Seconds limit is reached, the monitor gives a Sat-Seconds alarm. For example, the figure below demonstrates the alarm response time with a Sat-Seconds limit set at 50 and a low SpO_2 limit set at 90%. In this example, the patient % SpO_2 drops to 88% (2 points) and remains there for 2 seconds. Then it drops to 86% (4 points) for 3 seconds, and then to 84% (6 points) for 6 seconds. The resulting Sat-Seconds are:

% SpO_2	Seconds	Sat-Seconds
2×	2=	4
4×	3=	12
6×	6=	36
Total Sat-Seconds=		52

After approximately 10.9 seconds, a Sat-Second alarm would sound, because the limit of 50 Sat-Seconds would have been exceeded.

Saturation levels may fluctuate rather than remaining steady for a period of several seconds. Often, the patient % SpO_2 may fluctuate above and below an alarm limit, re-entering the non-alarm range several times. During such fluctuation, the monitor integrates the number of %SpO_2 points, both positive and negative, until either the Sat-Seconds limit is reached, or the patient %SpO_2 re-enters the non-alarm range and remains there.

NOTE

- **pCThe "SpO2 Too Low" or "SpO2 Too High" alarm is presented in the case that SpO_2 value violates [(ppO(2)]TJ0 TtitrmCTd[(ET**

- 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.

11.7 Masimo Information

- Masimo Patents

This posting serves as notice under 35 U.S.C.§287(a) for Masimo patents: http://www.masimo.com/patents.htm.

- No Implied License

Possession or purchase of this device does not convey any express or implied license to use the device with unauthorized sensors or cables which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device.

11.8 Nellcor Information

- Nellcor Patents
- This posting serves as notice under 35 U.S.C. 287(a) for Covidien patents: http://www.covidien.com/patents.

- No Implied License

Possession or purchase of this device does not convey any express or implied license to use the device with unauthorized replacement parts which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device.

11.9 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.

NOTE

- **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. Do not see SpO_2	Measurement is invalid.	Check that the sensor is properly applied. Change the application site if necessary.

FOR YOUR NOTES

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 on the limb where skin damage has occurred or is expected.**
- **Use clinical judgment 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.**
- **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.**
- **Do not apply cuff on the arm on the side of a mastectomy.**
- **Do not modify or replace connectors of the NIBP air hose except with mindray-approved connectors. Use o f p o b u b m!b o e!j o g b o u!d v g g t!x j u i!DN2 : 1 2!i p t f t!p o mz/!V t f!q f e j b u s j d 0 b e v m u!d v g g**
- **Never connect intra-arterial or intra-venous lines, or any other incompatible connectors to the NIBP hose. U i j t!d b o!d b v t f!t f s j p v t!j o k v s z!p s!e f b u i /!**
- **Avoid placing cuff on patient in a manner that can lead to a hose becoming kinked (hose kinking may cause inaccurate readings).**

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
-

12.4 Measurement Methods

There are three methods of measuring NIBP:

- Manual: measurement on demand.
- Auto: continually repeated measurements at set intervals.
- STAT: continual 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; and,
- Middle of the cuff at the level of the right atrium of the heart.

NOTE

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

12.5.2 Preparing to Measure NIBP

To prepare for the NIBP measurement:

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 the patient's upper arm or leg and make sure the Φ marking on the cuff matches the artery location. Do not wrap the cuff too tightly around the limb. Otherwise, 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. Avoid compression or restriction of pressure tubes. Air must pass unrestricted through the tubing.

WARNING

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

NOTE

- **Equipment use 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 [**NIBP**] 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

To enable the NIBP auto cycling and set 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.

12.5.6 Enabling Measurement on Clock

In auto measurement mode, if the clock is enabled, the monitor automatically synchronizes NIBP automatic measurements with the real time clock. For example, if [**Interval**] is set to [**20 min]**, and you start NIBP auto measurement at 14: 03, the next measurement will be taken at 14: 20, and then at 14:40, 15:00, and so on.

To enable measurement on clock:

1. Select the NIBP parameter window to enter the [**NIBP Setup**] menu.
2. Set [**Clock**] to [**On**].

NOTE

- **Measurement on clock is effective only when NIBP Interval is set to [5min] or an option greater than 5 min.**

12.5.7 Starting a STAT Measurement

To start a STAT measurement:

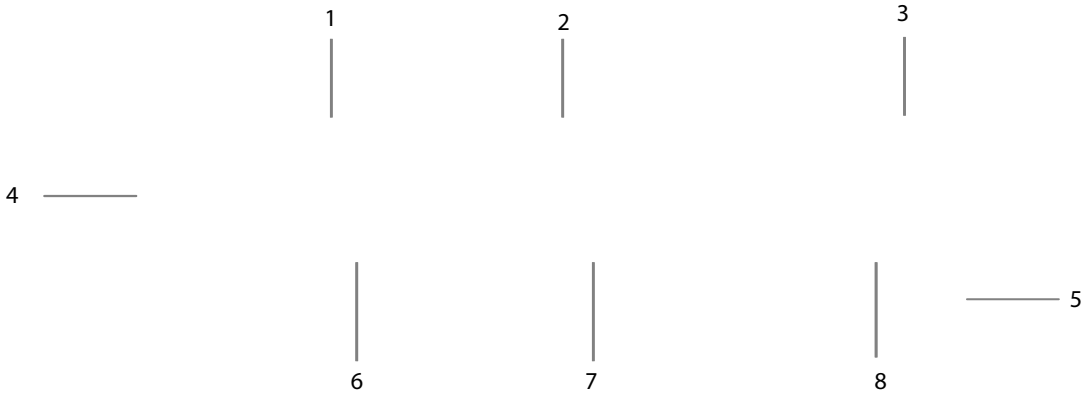
1. Select the NIBP parameter window to enter the [**NIBP Setup**] menu.
2. Select [**NIBP STAT**]. The STAT mode initiates 5 minutes of continuous, sequential, automatic NIBP measurements.

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 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. Prompt message area: shows NIBP-related prompt messages
6. Systolic pressure
7. Diastolic pressure
8. 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 Changing NIBP Settings

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

12.7.1 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

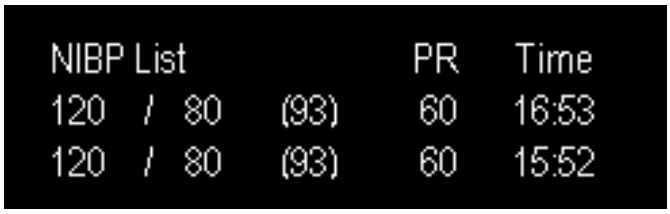
- **For known hypertensive patients, you need to set initial cuff pressure to a higher value to reduce the measurement time.**

12.7.2 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.

12.7.3 Displaying NIBP List

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



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

12.7.4 Setting the Pressure Unit

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

12.7.5 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.

12.8 Assisting Venous Puncture

You can use the NIBP cuff to cause sub-diastolic pressure to block the venous blood vessel and therefore help venous puncture.

1. Select [**VeniPuncture >>**] from the [**NIBP Setup**] menu. In the popup menu, verify that the [**Cuff Press.**] value is appropriate. Change it if necessary.
2. Select [**VeniPuncture**].
3. Puncture vein and draw blood sample.
4. Select the [**NIBP**] hardkey on the monitor's front panel, or the [**Stop All**] QuickKey to deflate the cuff. The cuff deflates automatically after a set time if you do not deflate it.

During measurement, the NIBP display shows the inflation pressure of the cuff and the remaining time in venous puncture mode.

FOR YOUR NOTES

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 monitor.

13.2 Safety

WARNING

- **Verify that the probe detection program works correctly before monitoring. Remove 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

The equipment is intended for monitoring skin temperature and core temperature.

1. Select an appropriate probe for your patient according to patient type and measuring site.

13.5 Setting the Temperature Unit

Select [**Unit Setup >>**] from the [**User Maintenance**] menu. In the pop-up menu, select [**Temp Unit**] and then select [**°C**] or [**°F**].

14 Monitoring IBP

14.1 Introduction

The cPM 12 monitor can monitor 2 invasive blood pressures (using an external module). The monitor can display the systolic, diastolic and mean pressures and a waveform for each pressure.

14.2 Safety

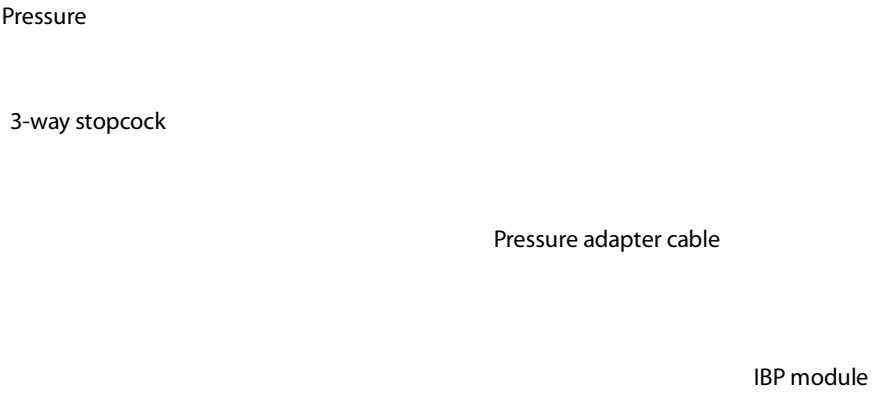
WARNING

- **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

To zero the transducer:

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**] hotkey, and then select [**Zero All Channels**] in the pop-up 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

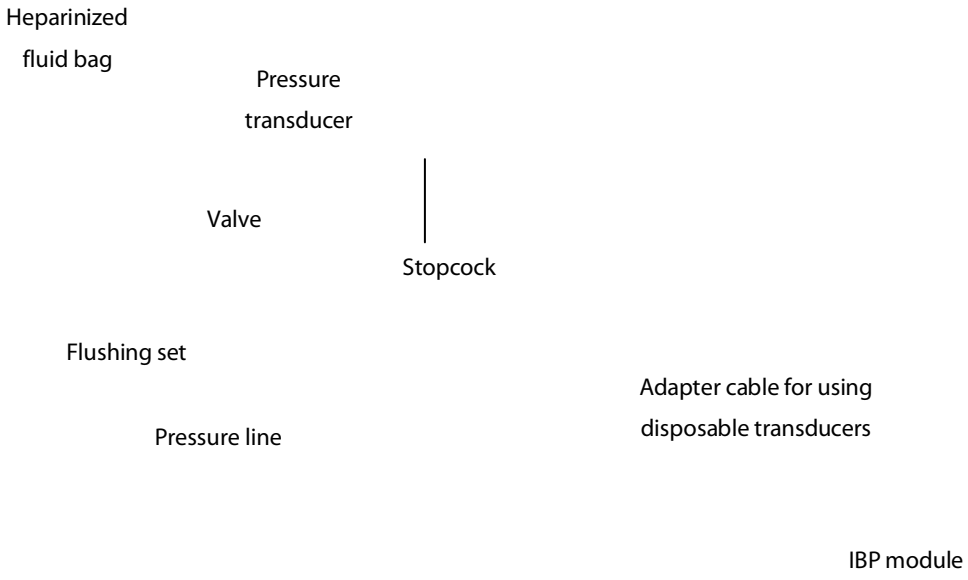
To set up the pressure measurement:

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 air 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. Pressure label
2. Waveform
3. Systolic pressure
4. Diastolic pressure
5. Mean pressure
6. PPV measurement

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

To change 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. Labels already used 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 detected having the same label, the monitor changes one pressure label to a currently unused one.**

14.6.2 Setting Alarm Properties

Select [**Alarm Setup >>**] from the parameter setup menu. You can set alarm properties for this parameter in the pop-up menu.

14.6.3 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 monitor responds to changes in the patient's blood pressure. Contrarily, the longer the averaging time is, the slower the 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 then select [**High**], [**Med**] or [**Low**], the corresponding averaging time is about 1 s, 8 s and 12 s respectively.

14.6.4 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.

14.6.5 Setting the Pressure Unit

Select [**Unit Setup >>**] from the [**User Maintenance**] menu. In the pop-up menu, select [**Press. Unit**] and then select [**mmHg**] or [**kPa**]. Select [**CVP Unit**] and then select [**mmHg**], [**cmH2O**] or [**kPa**].

14.6.6 Enabling PPV Measurement and Setting PPV Source

PPV indicates pulse pressure variation. To enable PPV measurement, set [**PPV Measurement**] to [**On**].

You can select PPV source by enabling the PPV measurement.

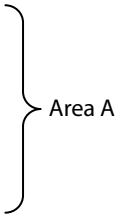
WARNING

- **This monitor can calculate PPV from beat-to-beat values of any arterial pulsatile pressure. The circumstances under which the calculation of a PPV value is clinically meaningful, appropriate and reliable must be determined by a physician.**
- **The clinical value of the derived PPV information must be determined by a physician. According to recent scientific literature, the clinical relevance of PPV information is restricted to sedated patients receiving controlled mechanical ventilation and mainly free from cardiac arrhythmia.**
- **PPV calculation may lead to inaccurate values in the following situations:**
  - at respiration rates below 8 rpm
  - during ventilation with tidal volumes lower than 8 ml/kg
  - for patients with acute right ventricular dysfunction ("cor pulmonale").
- **The PPV measurement has been validated only for adult patients.**

14.7 Overlapping IBP Waveforms

The IBP waveforms can be displayed together. To combine IBP waveforms,

1. Select [**Main Menu**] [**Screen Setup>>**] [**Screen Layout>>**] to access the [**Screens**] window.
2. Select the [**Screen Setup**] tab.
3. In Area A, select [**IBP Overlap**] from the drop-down list, and then select the IBP waves to be overlapped on the left side of the same line.



4. Select to save the setting and exit the window. The main screen will display the overlapped IBP waves.

Selecting the overlapped IBP waveforms on the main screen opens the [**Overlapping Waveform Setup**] menu, where you can:

- Set [**Left Scale**] and [**Right Scale**] and then set the scales for the overlapped waveforms. The left scale is for Art, LV, Ao, FAP, BAP, UAP, and the arterial waveforms of P1~P4; the right scale is for CVP, ICP, LAP, RAP, UVP, and the venous waveforms of P1~P4.
- Set [**CVP Scale**] individually if the CVP waveform is combined and CVP unit is different from IBP unit.
- Set [**PA Scale**] individually if PA waveform is combined.
- Set [**Gridlines**] to [**On**] or [**Off**] to show gridlines or not in the overlapped waveform area.
- Select [**Sweep**] and then set the sweep speed for the overlapped waveforms.
- Select [**Filter**] and then set the filter for the overlapped waveforms.

You can also change above settings from corresponding IBP setup menu.

Note

- **The CVP scale changes simultaneously with right scale. The unit of CVP scale is consistent with CVP parameter unit.**

14.8 Measuring PAWP

Pulmonary Artery Wedge Pressure (PAWP) values, used to assess cardiac function, are affected by fluid status, myocardial contractility, and valve and pulmonary circulation integrity.

Obtain the measurement by introducing a balloon-tipped pulmonary artery flotation catheter into the pulmonary artery. When the catheter is in one of the smaller pulmonary arteries, the inflated balloon occludes the artery allowing the monitor to record changes in the intrathoracic pressures that occur throughout the respiration cycle.

The pulmonary wedge pressure is the left ventricular end diastolic pressure when the airway pressure and valve function are normal. The most accurate PAWP values are obtained at the end of the respiration cycle when the intrathoracic pressure is fairly constant and the artifact caused by respiration is minimal.

WARNING

- **PAWP monitoring is not intended for neonatal patients.**

14.8.1 Preparing to Measure PAWP

To prepare for the PAWP measurement:

1. Prepare the same accessories as in the C.O. measurement. Connect the parts such as catheter, syringe, etc. following the C.O. measurement steps and use the balloon inflation port. Refer to section ***15.4 Setting Up the C.O. Measurement*** for more information.
2. Connect the PAWP cable into the IBP connector on the monitor. Since PAWP is measured on PA, selecting [**PA**] as the IBP label is recommended.
3. Select the PA parameter window or waveform area to enter its setup menu. Then, select [**PAWP**] to enter the PAWP measurement window. You can also enter the PAWP measurement window from the P1-P4 parameter window.

NOTE

- **After entering the PAWP measurement window, the monitor will turn off the PA alarm automatically.**

14.8.2 Setting Up the PAWP Measurement

To setup the PAWP measurement:

1. Wedge the flotation catheter into the pulmonary artery. Then inflate the balloon and pay attention to the PA waveform changes on the screen.

2. After obtaining a stable PAWP waveform, press the [**Freeze**] key to freeze the waveform and deflate the balloon.
3. You can adjust the PAWP scale to an appropriate position by adjusting or beside the [**Adjust**] button. Press the [**Confirm**] key to save one PAWP measurement.
4. If you need to start a new measurement, select [**Next Measure**].

WARNING

- **Prolonged inflation can cause pulmonary hemorrhage, infarction or both. Inflate the balloon for the minimum time necessary to get an accurate measurement.**
- **If the PAWP is greater than the PA (systolic), deflate the balloon and report the incident in accordance with hospital policy. Because the pulmonary artery could be accidentally ruptured, and the PAWP value derived will not reflect the patient's hemodynamic state, but will merely reflect the pressure in the catheter or balloon.**

14.8.3 Understanding the PAWP Setup Menu

Select [**Setup**] to enter the [**PAWP Setup**] menu. In this menu, you can:

- Select an ECG lead wave as the first reference wave.
- Select a respiration wave as the second reference wave.
- Select a sweep speed for the displayed waveform.
- Change the size of the PA waveform by adjusting the scale height.

14.9 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 section ***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 section ***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.
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.
PAWP button disabled	One IBP channel must be labeled PA	Label an IBP channel as PA. (Also Label an IBP channel as P1/P2/P3/P4, it will automatically change to PA)

FOR YOUR NOTES

15 Monitoring Cardiac Output

15.1 Introduction

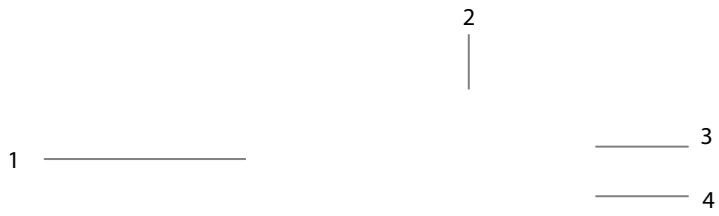
The cardiac output (C.O.) measurement invasively measures cardiac output and other hemodynamic parameters using the right heart (atria) thermodilution method. A cold solution of known volume and temperature is injected into the right atrium through the proximal port of a pulmonary artery (PA) catheter. 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 technical suggestions to obtain accurate C.O.:

- Injectate solution must be cooler than the patient's blood.
- Inject solution rapidly and smoothly.
- Inject at end of 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.**

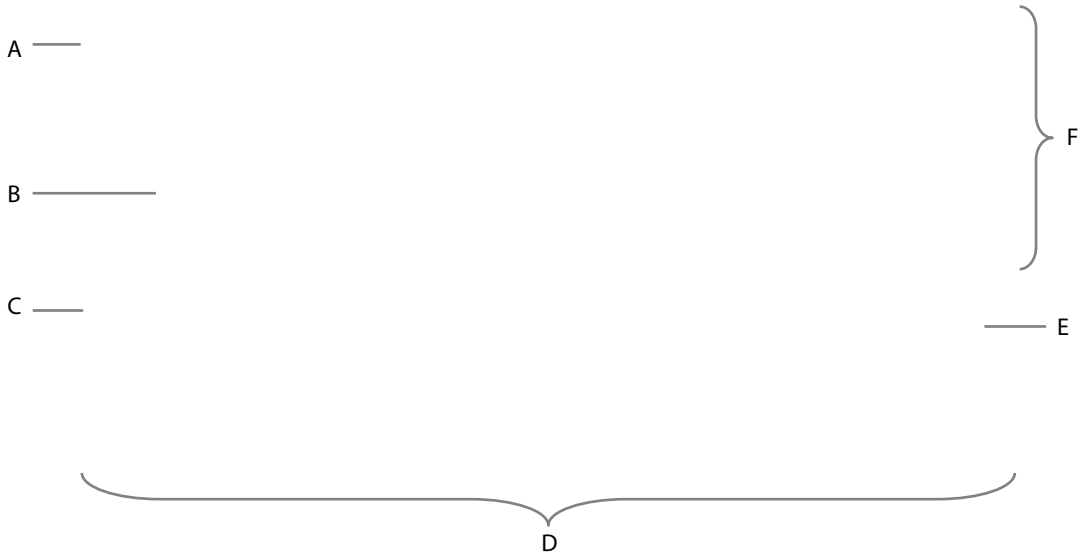
To set up the C.O. measurement:

1. Connect the C.O. cable to the C.O. connector on the monitor.
2. Interconnect the C.O. module, catheter and syringe as

NOTE

- **The above picture illustrates when using a TI sensor (PN 6000-10-02079). 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. Setuh 21 Tf0.7581-0.028 T170.001 Tw 4.579 0 Td (u(f)1.5 ( )m.1 (7-11.40 T(t)1.8 (p7-1:.7 (.)]TJ0 Tc 0 Tw 3.105 0 T**



A. Currently measured numeric

B. Currently measured C.O. curve

C. Prompt message area

D. Buttons

E. Averaged values

F. 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 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°C, 1.0°C, or 2.0°C.

CAUTION

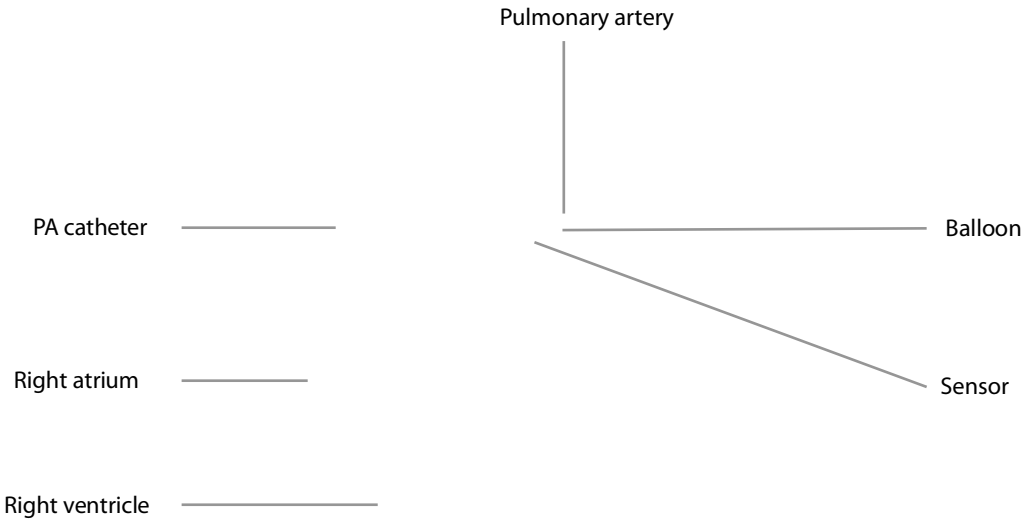
- **Starting a measurement without blood temperature being stable may cause measuring failure.**

NOTE

- **During a cardiac output measurement, blood temperature alarms are inactive.**
- **Please refer to the Instructions for Use of the pulmonary artery catheter 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 pop-up menu, select [**Temp Unit**] and then select [**°C**] or [**°F**].

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 pop-up menu.

16 Monitoring CO_2

16.1 Introduction

CO_2 monitoring is a continuous, non-invasive technique for determining the concentration of CO_2 in the patient's 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 passes 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.

Sidestream/Microstream measurement samples expired patient gas at a constant sample flow from the patient's airway and analyzes it with a CO_2 sensor built into the CO_2 module.

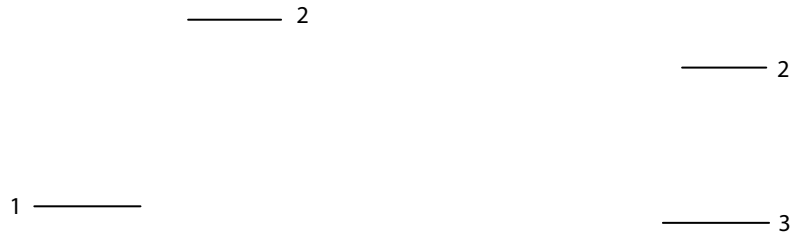
The sidestream and microstream CO_2 measurement can be used, with specified accessories, with intubated and non-intubated adult, pediatric, and neonatal patients. With intubated patients, a sample of the respiratory gas is drawn from the patient's breathing circuit through an airway adapter and a gas sampling line. With non-intubated patients, the gas sample is drawn through a nasal cannula.

The measurement provides:

1. A CO_2 waveform.
2. End tidal CO_2 value ($EtCO_2$): the CO_2 value measured at the end of the expiration phase.
3. Fraction of inspired CO_2 ($FiCO_2$): the smallest CO_2 value measured during inspiration.
4. Airway respiration rate (awRR): the number of breaths per minute, calculated from the CO_2 waveform.

16.2 CO_2 Module

This monitor uses an external module to perform CO_2 monitoring.



1. CO_2 watertrap seat
2. Gas outlet
3. Connector for sampling line

16.3 Preparing to Measure CO_2

WARNING

- **Check that the alarm limit settings are appropriate before taking measurement.**
- **Eliminate the exhausted gas before performing the measurement.**

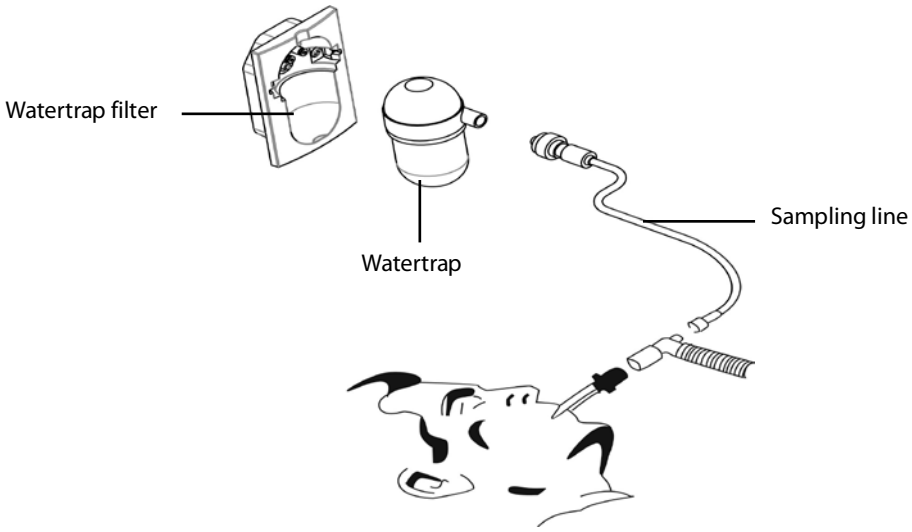
NOTE

- **Perform the measurement in a well-ventilated environment.**

16.3.1 Making a Sidestream CO_2 Measurement

To make a sidestream CO2 measurement:

1. Attach the watertrap to the module and then connect the CO_2 components as shown below.



2. The CO_2 module needs time to warm up to reach operating temperature. The message [**CO2 Sensor Warmup**] is displayed during warm-up.
3. After warm-up is finished, you can perform CO_2 measurements.

CAUTION

- **The watertrap collects water drops condensed in the sampling line and therefore prevents them from entering the module. To avoid blocking the airway, empty the watertrap container whenever half full. Dispose of accumulated fluids in accordance with hospital policy or your local regulations.**
- **The watertrap has a filter preventing bacterium, water and secretions from entering the module. After long-term use, dust or other substances may compromise the performance of the filter or even block the airway. In this case, replace the watertrap. It is recommended that you replace the watertrap once a month, or when the watertrap is found leaky, damaged or contaminated.**
- **Do not apply adult watertrap to the neonate patient. Otherwise, patient injury could result.**

NOTE

- **To extend the life of the watertrap and module, disconnect the watertrap and set the CO_2 module operating mode to the Standby mode when CO_2 monitoring is not required.**

16.3.2 Making a Microstream CO_2 Measurement

Connect the sampling line to the module and then connect the CO_2 components as shown below. After warm-up is finished, you can perform CO_2 measurements.

16.4 Changing CO_2 Settings

16.4.1 Accessing CO_2 Menus

By selecting the CO_2 parameter window, you can access the [**CO2 Setup**] menu.

16.4.2 Entering the Standby Mode

The Standby mode of the CO_2 module relates to the Standby mode of the monitor as follows:

- If the monitor enters the Standby mode, the CO_2 module will also enter the

For the microstream CO_2 module, you can also

For the sidestream and microstream CO_2 module, you can set the humidity compensation on or off according to the actual condition. To set the humidity compensation:

1. Select the CO_2 parameter window to access the [**CO2 Setup**] menu, and then select [**BTPS Compen**].
2. Select either [**On**] for BTPS or [**Off**] for ATPD, depending on which compensation applies.

16.4.6 Setting the Apnea Alarm Delay

To set the apnea alarm delay:

1. Select the CO_2 parameter window to access the [**CO2 Setup**] menu.
2. Select [**Apnea Delay**] and then select the appropriate setting.

The monitor will alarm if the patient has stopped breathing for longer than the selected apnea time. The setting of [**Apnea Delay**] takes effect simultaneously to the Resp, CO_2, and AG modules.

WARNING

- **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.**

16.4.7 Choosing a Time Interval for Peak-Picking

For microstream modules, you can select a time interval for picking the highest CO_2 as the $EtCO_2$ and the lowest as the $FiCO_2$.

To set the time interval:

1. Select the CO_2 parameter window to access the [**CO2 Setup**] menu.
2. Select [**Max Hold**]
3. Select [**Single Breath**], [**10 s**], [**20 s**] or [**30 s**]
   - [**Single Breath**]: $EtCO_2$ and $FiCO_2$ are calculated for every breath.
   - [**10 s**], [**20 s**] or [**30 s**]: $EtCO_2$ and $FiCO_2$ are calculated using 10, 20 or 30 seconds of data.

16.4.8 Setting the Flow Rate

For the sidestream CO_2 module, you can change the sampling rate of respiratory gas in the patient's airway by setting the flow rate.

To set the flow rate:

1. Select the CO_2 parameter window to access the [**CO2 Setup**] menu.
2. Select an appropriate setting from [**Flow Rate**].

WARNING

- **Please consider the patient's actual bearing capability and select the appropriate flow rate when setting the flow rate.**

16.4.9 Setting up the CO_2 Wave

Select the CO_2 parameter window to access the [**CO2 Setup**] menu, in which you can:

- Select [**Wave Type**] and then select [**Draw**] or [**Fill**]:
  - [**Draw**]: The CO_2

16.7 Measurement Limitations

Some adverse effects can influence the CO_2 performance.

CAUTION

- **The following factors may influence the accuracy of measurement:**
  - Leaks or internal venting of sampled gas
  - Mechanical shock
  - Cyclic pressure up to 10 kPa (100 cmH_2O)
  - Other sources of interference, if any
- **Measurement accuracy may be affected by the breath rate and I/E ratio as follow:**
  - $etCO_2$ is within specification for breath rate ≤ 60 bpm and I/E ratio ≤ 1:1;
  - $etCO_2$ 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.**

16.8 Leakage test

When the sidestream CO_2 module needs maintenance, the monitor displays the message in the CO_2 waveform window: [**Need maintenance. Enter CO2 setup menu.**] Then:

1. Select [**Main Menu**] [**Maintenance >>**] [**User Maintenance >>**] enter the required password [**Maintain CO2 >>**].
2. Perform leakage test according to the prompt messages on the menu.

16.9 Troubleshooting the Sidestream CO_2 Sampling System

When the sampling system of the sidestream CO_2 module does not work correctly, check to see if the sampling line is kinked. If the sampling line is not kinked, remove it from the watertrap. If the monitor gives a message indicating the sampling system still does not work correctly, it indicates that the watertrap is blocked and should be replaced with a new one. Otherwise, the sampling line is blocked and should be replaced with a new one.

16.10 Removing Exhaust Gases from the System

WARNING

16.11 Zeroing the Sensor

Zero calibration eliminates the effect of baseline drift during CO_2 measurement exerted on the readings and therefore maintains the accuracy of the CO_2 measurements.

For sidestream and microstream CO_2 modules, a zero calibration is carried out automatically when necessary. You can also start a manual zero calibration if necessary.

To manually start a zero calibration:

1. Select [**Main Menu**] [**Maintenance >>**] [**User Maintenance >>**] enter the required password [**Maintain CO2 >>**].
2. Select [**Calibrate CO2 >>**] [**Start Zero Cal.**].

Disconnecting the patient airway is not required when performing a zero calibration.

WARNING

- **Do not rely on the readings during zeroing.**

16.12 Calibrating the Sensor

For sidestream or microstream CO_2 modules, a calibration should be performed once every year or when the readings go far beyond the range. For details, refer to the chapter ***26 User Maintenance***.

16.13 Oridion Information

Oridion Patents

This posting serves as notice under 35 U.S.C.§287(a) for Covidien patents: http://www.covidien.com/patents.

No Implied License

Possession or purchase of this device does not convey any express or implied license to use the device with unauthorized CO_2 sampling consumables which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device and/or CO_2 sampling consumable.

17 Monitoring AG (For cPM 12 Only)

17.1 Introduction

The anasthetic gas (AG) module measures the patient's anesthetic and respiratory gases by connecting to the airway of intubated patients or collecting the gases with specified accessories. It also incorporates the features of the O_2 module and BIS module. The AG measurement is applicable for adult, pediatric and neonatal patients. AG monitoring is for cPM 12 patient monitors only.

The AG module determines the concentration of certain gases using the infrared (IR) light absorption measurement. The gases that can be measured by the AG module absorb IR light. Each gas has its own absorption characteristic. The gas is transported into a sample cell, and an optical IR filter selects a specific band of IR light to pass through the gas. For multiple gas measurements, there are multiple IR filters. The higher the concentration of gas in a given volume the more IR light is absorbed. This means that higher concentration of IR absorbing gas cause a lower transmission of IR light. The amount of IR light transmitted after it has been passed through an IR absorbing gas is measured. From the amount of IR light measured, the concentration of gas present can be calculated.

Oxygen does not absorb IR light as other breathing gases and is therefore measured relying on its paramagnetic properties. Inside the O_2 sensor are two nitrogen-filled glass spheres mounted on a strong rare metal taut-band suspension. This assembly is suspended in a symmetrical non-uniform magnetic field. In the presence of paramagnetic oxygen, the glass spheres are pushed further away from the strongest part of the magnetic field. The strength of the torque acting on the suspension is proportional to the oxygen concentration. From the strength of the torque, the concentration of oxygen is calculated.

AG module can identify two anesthetic gases in a mixture automatically and distinguish between them according to their contributions to the MAC value for display as the primary and secondary anesthetic agents.

NOTE

- **The AG module is configured with automatic barometric pressure compensation function.**
- **Perform the measurement in a well-ventilated environment.**

17.2 Understanding the AG Display

The AG module can send waves and numerics for all measured anesthetic gases for display on the monitor, including:

- CO_2, O_2, N_2O and AA waves
- awRR: airway respiratory rate
- MAC: minimum alveolar concentration
- End tidal (Et) and fraction of inspired (Fi) numerics for CO_2, O_2, N_2O and AA

Where AA represents Des (desflurane), Iso (isoflurane), Enf (enflurane), Sev (sevoflurane), or Hal (halothane).
The AA waveform area displays the primary anesthetic gas's waveform. The O_2 waveform will be displayed only when the O_2 waveform is currently switched on.

WARNING

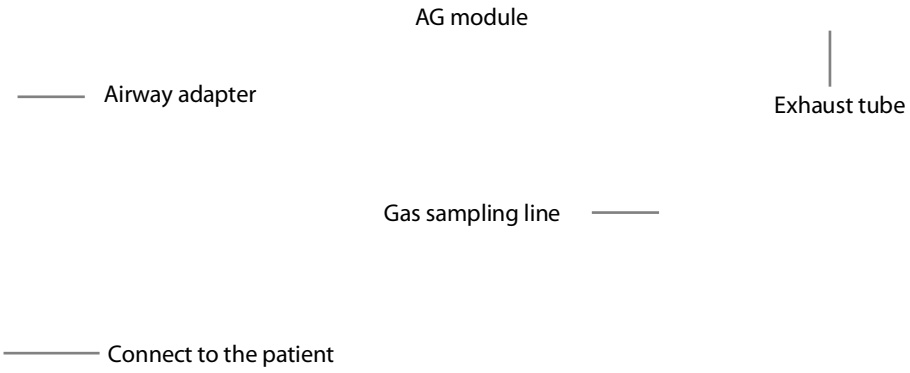
- **To avoid explosion hazard, do not use flammable anesthetic agent such as ether and cyclopropane with this equipment.**

17.3 MAC Values

Minimum alveolar concentration (MAC) is the minimum concentration of the agent in the alveoli. It is a basic index to indicate the depth of anesthesia. The standard ISO 21647 defines MAC as this: alveolar concentration of an inhaled anesthetic agent that, in the absence of other anesthetic agents and at equil

17.4 Preparing to Measure AG

1. Select an appropriate watertrap according to patient category and attach it to the module.
2. Connect the gas sample line to the watertrap connector.
3. Connect the other end of the gas sampling line to the patient via the airway adapter.
4. Connect the gas outlet to a scavenging system using an exhaust tube.



5. Insert the AG module to the monitor and the monitor will prompt [**AG Startup**]. Then the AG module starts to warmup and at the same time the monitor prompts [**AG Warmup**]. After 45 seconds, the AG module enters the iso accuracy mode. After 10 minutes, the module enters the full accuracy mode.

WARNING

- **Perform the AG leakage test every time before the AG measurement. For instructions on how to perform the leakage test, see*26.7.1AG Leakage Test*.**
- **Make sure that the connections are tight. Any leak in the system can result in erroneous readings due to ambient air mixing with patient gases.**
- **Do not apply adult watertrap to the neonate patient. Otherwise, patient injury could result.**
- **Using high-frequency electrosurgical units may increase the risk of skin burn. In this case, do not use antistatic or conductive respiratory tubing.**
- **Check that the alarm limit settings are appropriate before taking measurement.**

CAUTION

- **Position the airway adapter so that the part connecting to the gas sample line is pointing upwards. This prevents condensed water from passing into the gas sample line and causing an occlusion.**
- **The watertrap collects water drops condensed in the sampling line and therefore prevents them from entering the module. To avoid blocking the airway, empty the watertrap container whenever half full. Dispose of accumulated fluids in accordance with the hospital policy or your local regulations.**
- **The watertrap has a filter preventing bacterium, water and secretions from entering the module. After long-term use, dust or other substances may compromise the performance of the filter or even block the airway. In this case, replace the watertrap. Replacing the watertrap once a month is recommended.**

17.5 Changing AG Settings

17.5.1 Setting Gas Unit

For N2O and AA, the unit of the me

To set the gas unit:

1. Select [**Main Menu**] [**Maintenance >>**] [**User Maintenance**] enter the required password [**Unit Setup >>**].
2. In the Unit Setup menu, you can select [**CO2 Unit**] or [**O2 Unit**] and then select [**mmHg**], [**%**] or [**kPa**].

17.5.2 Setting the Apnea Alarm Delay

To set the apnea alarm delay:

1. Select the AG parameter area to access the [**AG Setup**] menu.
2. Select [**Apnea Delay**] and select the appropriate setting.

The monitor alarms if the patient has stopped breathing for longer than the preset apnea time. The [**Apnea Delay**] setting is universally applied to the Resp, CO_2, and AG modules.

WARNING

- **The respiration measurement does not recognize the cause of apneas. It only indicates an alarm if no breath is detected when a preset time has elapsed since the last detected breath. Therefore, it cannot be used for diagnostic purposes.**

17.5.3 Changing the Sample Flow Rate

In the setup menu for any gas, select [**Flow Rate**] and then choose either:

- [**High**]: 200 ml/min for adult and pediatric patients, and 120 ml/min for neonatal patients.
- [**Med**]: 150 ml/min for adult and pediatric patients, and 90 ml/min for neonatal patients.
- [**Low**]: 120 ml/min for adult and pediatric patients, and 70 ml/min for neonatal patients.

17.5.4 Entering the Standby Mode

For the AG module, the default operating mode is measure. When you set the AG module to the Standby mode, the AG gas sample intake pump automatically sets the sample flow rate to zero. When exiting the Standby mode, the AG module continues to work at the previously set sample flow rate with no need to warm up again. After nearly 1 minute, the module enters the full accuracy mode. The AG module Standby mode relates to the Standby mode of the monitor as follows:

- If the monitor enters the Standby mode, the AG module also enters the Standby mode.
- If the monitor exits the Standby mode, the AG module also exits the Standby mode.
- If the AG module enters or exits the Standby mode, it does not affect the monitor.

To enter or exit the Standby mode manually, in the agent's setup menu, select [**Operating Mode**] and then select [**Standby**] or [**Measure**]. You can also set a period of time after which the AG module enters the Standby mode automatically if no breath is detected since the last detected breath. To set the Standby time, in the agent's setup menu, select [**Auto Standby (min)**] and then select the appropriate setting.

17.5.5 Setting up the AG Wave

Select the AG parameter area to access the [**AG Setup**] menu, in which you can:

- Select [**CO2 Wave Type**] and then select [**Draw**] or [**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 waveform by adjusting the scale.

17.5.6 Setting RR Source

To set RR source:

1. Select the AG parameter area to access the [**AG Setup**] menu.
2. Select [**RR Source**] and then select a source or [**Auto**] from the dropdown list.

The [**RR Source**] setting is universally applied to the Resp, CO_2, and AG modules. For details, please refer to the section ***9.9 Setting Respiration Rate Source***.

17.6 Changing the Anesthetic Agent

When the anesthetic agent used on the patient is changed, the AG module detects the mixed anesthetic gas during the transition of two anesthetic agents. The time required for completing the replacement of anesthetic agent depends on anesthesia type (low flow or high flow) and the characteristics of anesthetic agents (pharmacokinetics).

The AG module can identify two anesthetic agents automatically. When the proportion of the primary and secondary anesthetic agents in the mixture changes, the AG module can distinguish between them according to their contributions to the MAC value. Then the primary and secondary anesthetic agents will be exchanged for display.

CAUTION

- **During the transition of two anesthetic agents, the monitor gives no prompt messages and the MAC value displayed may be inaccurate.**

17.7 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_2O)
- Other sources of interference, if any

17.8 Troubleshooting

17.8.1 When the Gas Inlet is Blocked

If the gas inlet (including watertrap, sampling line and airway adapter) is occluded by condensed water, the message [**AG Airway Occluded**] appears.

To remove the occlusion:

- Check the airway adapter for an occlusion and replace if necessary.
- Check the sampling line for an occlusion or kinking and replace if necessary.
- Check the watertrap for a build up of water. Empty the watertrap. If the problem persists, replace the watertrap.

17.8.2 When an Internal Occlusion Occurs

Condensed water may enter the module and cause contamination and/or internal occlusions. In this case, the message [**AG Airway Occluded**] displays.

To remove the occlusion:

- Check for any occlusion in the gas inlet and/or outlet system.
- If the problem persists, internal occlusions may exist. Contact your service personnel.

17.9 Removing Exhaust Gases from the System

WARNING

- **Anesthetics: When using the AG measurement on patients who are receiving or have recently received anesthetics, connect the outlet to a scavenging system to avoid exposing medical staff to anesthetics.**

To remove the sample gas to a scavenging system, connect an exhaust tube to the gas outlet connector of the module.

FOR YOUR NOTES

18 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. Additionally, you can select any frozen waveform for recording.

18.1 Freezing Waveforms

To freeze waveforms, select the [**Freeze**] hardkey on the monitor's front panel.

- The system closes the displayed menu (if any), and opens the [**Freeze**] menu.

- All displayed waveforms are frozen, i.e. the waveforms stop being refreshed.

NOTE

- **The freeze feature does not affect the split-screen view of minitrends, OxyCRG and other patients.**

18.2 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 the touchscreen.

The frozen waveforms will scroll left or right accordingly. And meanwhile, at the lower right corner of the last waveform, there is an upward arrow. The freeze time displays 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.

18.3 Unfreezing Waveforms

To unfreeze the frozen waveforms, you can either:

- Select the button at the upper right corner of the [**Freeze**] menu,
- Select the [**Freeze**] hardkey on the monitor's front panel, or
- Perform any other action that causes the screen to be readjusted or opens a menu, such as inserting or removing a module, pressing the [**Menu**] hardkey, etc.

18.4 Recording Frozen Waveforms

To record the frozen waveforms:

1. In the [**Freeze**] menu, select, in order, [**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.

19 Review

19.1 Accessing Respective Review Windows

1. Select the [**Review**] QuickKey, or [**Main Menu**] [**Review >>**].
2. Select [**Graphical Trends**], [**Tabular Trends**], [**Events**:

- 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 displays above the parameter area. Numeric measurement values corresponding to the cursor location change as the cursor is moved. The meas area

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.
- Select [**Interval**] to change the resolution of the trend data and then select 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 a high level alarm has a red background. The one that triggered a medium/low level alarm has a yellow background.

- Select or beside [**Event**] to position the cursor to a different event time.
- Select the [**Record**] button to 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 patient's history. By further selecting [**Record**], you can print the displayed tabular trends to the recorder.
- Select the [**Record (All)**] button to print all of the tabular trends to the recorder. The trends will be printed in reverse chronological order from the current time to the last time a patient was admitted to the patient monitor.
- Select the [**Print**] button to set and print the tabular trends report with the printer. For how to configure the tabular trends report, refer to chapter ***22 Printing***.

19.4 Reviewing Events

19.4.1 Marking Events

During monitoring, some events may affect the patient and change the displayed waveforms or numerics displayed on the monitor. To help analyze these waveforms or numeric changes, you can mark these events.

Select [**Main Menu**] [**Mark Event >>**]. In the popup menu, you can select the waves to store after triggering a manual event. You can select [**Trigger Manual Event**] from the [**Mark Event**] menu or the [**Manual Event**] QuickKey to trigger a manual event and store it at the same time.

When you are reviewing graphic trends, tabular trends or full-disclosure waveforms, the manual event symbol is displayed at the time the event is triggered.

19.4.2 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.

You can review the parameter alarm events, arrhythmia alarm events and manual events. When an event occurs, the system stores all the measurement numerics at the event triggering time and related waveforms 4 seconds, 8 seconds, or 16 seconds before and after the event triggering time, as per the setting of recording length.

NOTE

- **Pausing or switching off alarms will not be recorded as events. The time of these operations will not be recorded in the system log.**
- **Earlier-recorded events might be overwritten by later ones if the events log reaches capacity.**

In this window:

- Select [**Event**] to view the desired events.
- Selecting [**Level**] to view the desired events according to the alarm priority .

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

- **A total loss of power has no impact on the saved events.**

- You can set the desired [**Gain**] for ECG waveform.
- You can set the desired [**Sweep**].
- By selecting the [**Record**] button, you can print the displayed alarm events with the recorder.
- Select [**Print**] to print the displayed alarm event to the pre-connected laser printer.
- Select [**Events List**] to view the events list.

19.5 Reviewing Waveforms

In the [**Review**] menu, select [**Full Disclosure**] to access the following window.

20 Calculations

20.1 Introduction

The calculation feature is available with your 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
- Oxygenation calculations
- Ventilation calculations
- Hemodynamic calculations
- Renal calculations

To perform a calculation, select [**Main Menu**] [**Calc >>**], or the [**Calculations**] QuickKey and then select the calculation you want to perform.

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.**

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 wind( )0.5 ()0. -0 0 9.114.3 (e)-.8 (w)-(r)93.4 (a)l12 - (f)-3.1**

20.2 Dose Calculations

20.2.1 Performing Calculations

PTc 9.1LBody -0 0 9.137 88.56 71C2 (er)-8 7P 6 (1 0 7P 6 297P8406186.83Tj<-7 B>[(P)-T(er)-8 Td[(s)- (e)- T7 -0.008.52 Tm[((f)-73.002-4.6 (

20.2.3 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 the displayed titrated values by the recorder.

20.2.4 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

20.3 Oxygenation Calculations

20.3.1 Performing Calculations

To perform an oxygenation calculation:

1. Select [**Main Menu**] [**Calc >>**] [**Oxygenation >>**], or select [**Calculations**] QuickKey [**Oxygenation >>**].
2. Enter values for calculation.
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 [**Oxygenation Calculation**] window, you can:

- Change the pressure unit, Hb unit and oxygen content unit by selecting [**Press. Unit**], [**Hb Unit**] and [**OxyCont Unit**] and then selecting the appropriate settings. The changes take effect automatically.
- Trigger a recording by selecting the [**Record**] button. The displayed oxygenation calculations are printed out by the recorder.
- Review the previously performed calculations by selecting [**Review**].

20.3.2 Entered Parameters

Abbreviation	Unit	Full spelling
C.O.	L/min	cardiac output
FiO_2	%	percentage fraction of inspired oxygen
PaO_2	mmHg	partial pressure of oxygen in the arteries
$PaCO_2$	mmHg	partial pressure of carbon dioxide in the arteries
SaO_2	%	arterial oxygen saturation
PvO_2	mmHg	partial pressure of oxygen in venous blood
SvO_2	%	venous oxygen saturation
Hb	g/L	hemoglobin
CaO_2	ml/L	arterial oxygen content
CvO_2	ml/L	venous oxygen content
VO_2	ml/min	oxygen consumption
RQ	None	respiratory quotient
ATMP	mmHg	atmospheric pressure
Height	cm	height
Weight	kg	weight

20.3.3 Calculated Parameters and Formulas

Abbreviation	Unit	Full spelling	Formula
BSA	m^2	body surface area	$Wt^{0.425} \times Ht^{0.725} \times 0.007184$
VO_2 calc	ml/min	oxygen consumption	$C(a\text{-}v)O_2 \times$ C.O.
$C(a\text{-}v)O_2$	ml/L	arteriovenous oxygen content difference	CaO_2 CvO_2
O_2ER	%	oxygen extraction ratio	$100 \times C(a\text{-}v)O_2 / CaO_2$
DO_2	ml/min	oxygen transport	C.O. $\times$ CaO_2
PAO_2	mmHg	partial pressure of oxygen in the alveoli	$FiO_2 / 100 \times$ (ATMP 47) $PaCO_2 \times [FiO_2 /100$ (1 $FiO_2 /100$) / RQ]
$AaDO_2$	mmHg	alveolar-arterial oxygen difference	PAO_2 PaO_2
CcO_2	ml/L	capillary oxygen content	Hb $\times$ 1.34 $0.031 \times PAO_2$
Qs/Qt	%	venous admixture	$100 \times [1.34 \times Hb \times (1 \; SaO_2 /100) \; 0.031 \times (PAO_2 \; PaO_2)] / [1.34 \times Hb \times (1 \; SvO_2 /100) \; 0.031 \times (PAO_2 \; PvO_2)]$
C.O. calc	L/min	calculated cardiac outpu4 0.481 ref5435.3 (en)1.4 (o)-4.7 (u.3 (i6 Tm35C.48 15.6 ref186.72 288.73 (r)10.2 (o)21.7 (u	

20.4 Ventilation Calculations

20.4.1 Performing Calculations

To perform a ventilation calculation:

1. Select [**Main Menu**] [**Calc >>**] [**Ventilation >>**], or select [**Calculations**] QuickKey [**Ventilation >>**].
2. Enter values for calculation. If the monitor is connected to an anesthesia machine or a ventilator, the system automatically loads the supported parameter values to the [**Ventilation Calculation**] window.
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 [**Ventilation Calculation**] window, you can:

- ■ Change the pressure unit by selecting [**Press. Unit**] and then selecting the appropriate setting. Corresponding pressure values shall convert and update automatically.
- ■ Trigger a recording by selecting the [**Record**] button. The displayed ventilation calculations are printed out by the recorder.
- ■ Review the previously performed calculations by selecting [**Review**].

20.4.2 Entered Parameters

Abbreviation	Unit	Full spelling
FiO_2	%	percentage fraction of inspired oxygen
RR	rpm	respiration rate
$PeCO_2$	mmHg	partial pressure of mixed expiratory CO_2
$PaCO_2$	mmHg	partial pressure of carbon dioxide in the arteries
PaO_2	mmHg	partial pressure of oxygen in the arteries
TV	ml	tidal volume
RQ	None	respiratory quotient
ATMP	mmHg	atmospheric pressure

20.4.3 Calculated Parameters and Formulas

Abbreviation	Unit	Full spelling	Formula
PAO_2	mmHg	partial pressure of oxygen in the alveoli	(ATMP 47) × FiO_2 /100 $PaCO_2$ × [FiO_2 /100 (1 FiO_2 /100) / RQ]
$AaDO_2$	mmHg	alveolar-arterial oxygen difference	PAO_2 PaO_2
Pa/FiO_2	mmHg	oxygenation ratio	100 × PaO_2 / FiO_2
a/AO_2	%	arterial to alveolar oxygen ratio	100 × PaO_2 / PAO_2
MV	L/min	minute volume	(TV × RR) / 1000
Vd	ml	volume of physiological dead space	TV × (1 $PeCO_2$ / $PaCO_2$)
Vd/Vt	%	physiologic dead space in percent of tidal volume	100 × Vd/TV
VA	L/min	alveolar volume	(TV Vd) × RR / 1000

20.5 Hemodynamic Calculations

20.5.1 Performing Calculations

To perform a hemodynamic calculation:

1. Select [**Main Menu**] [**Calc >>**] [**Hemodynamic >>**], or select [**Calculations**

Abbreviation	Unit	Full spelling	Formula
SVR	DS/cm^5	systemic vascular resistance	79.96 × (AP MAP CVP) / C.O.
SVRI	DS·m^2/cm^5	systemic vascular resistance index	SVR × BSA
PVR	DS/cm^5	pulmonary vascular resistance	79.96 × (PAMAP PAWP) / C.O.
PVRI	DS·m^2/cm^5	pulmonary vascular resistance index	PVR × BSA
LCW	kg·m	left cardiac work	0.0136 × APMAP × C.O.
LCWI	kg·m/m^2	left cardiac work index	

Abbreviation	Unit	Full spelling
UCr	μmol/L	urine creatinine
BUN	mmol/L	blood urea nitrogen
Height	cm	height
Weight	kg	weight

20.6.3 Calculated Parameters and Formulas

Abbreviation	Unit	Full spelling	Formula
URNaEx	mmol/24h	urine sodium excretion	Urine × URNa / 1000
URKEx	mmol/24h	urine potassium excretion	Urine × URK / 1000
Na/K	%	sodium potassium ratio	100 × URNa / URK
CNa	ml/24h	clearance of sodium	URNa × Urine / SerNa
Clcr	ml/min	creatinine clearance rate	Ucr × Urine / Cr / (BSA / 1.73) / 1440
FENa	%	fractional excretion of sodium	100 × URNa × Cr) / (SerNa × Ucr)
Cosm	ml/min	osmolar clearance	Uosm × Urine / Posm / 1440
CH_2O	ml/h	free water clearance	Urine × (1 Uosm / Posm) / 24
U/P osm	None	urine to plasma osmolality ratio	Uosm / Posm
BUN/Cr	None*	blood urea nitrogen creatinine ratio	1000 × BUN / Cr
U/Cr	None	urine-serum creatinine ratio	Ucr / Cr

*: BUN/Cr is a ratio under the unit of mol.

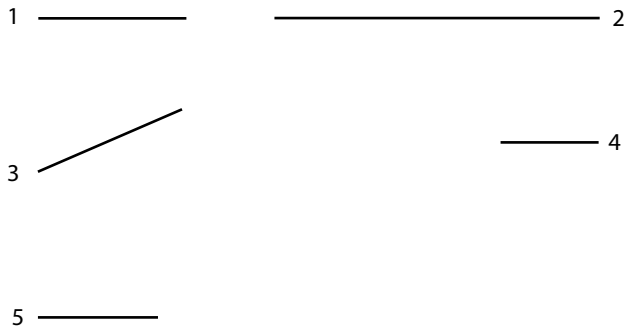
20.7 Understanding the Review Window

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] d amsuhen

21 Recording

21.1 Using a Recorder

The thermal recorder prints patient information, measurement numeric and 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

21.2 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 the chapter 7 Alarms.**
- **For details about task-related recordings, refer to respective sections of this manual.**

21.3 Starting and Stopping Recordings

To manually start a recording, you can either:

- Press the [**Record**] hardkey on the front of the monitor,
- Press the hardkey on the front of 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.

When a recording is in process, to manually stop the recording, you can either:

- Press the [**Record**] hardkey on the front of the monitor;
- Press the hardkey on the front of the recorder module; 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: prints two columns of '*' at the end of the report.
- Manually or abnormally stopp

21.4.3 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 then select [**8 s**] or [**Continuous**]. t

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 are reloading paper or resolving an issue.**

21.6 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.

21.7 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 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.**

22 Printing

22.1 Printer

The monitor can output patient reports via a connected printer. The monitor supports the following printer:

- HP LaserJet 1505n
- HP LaserJet P2035n
- HP LaserJet P4015n
- HP LaserJet Pro 400 M401n401dn
- HP LaserJet 600 M602
- HP LaserJet Enterprise M605
- HP LaserJet Enterprise M608n

The reports specifications are:

- Paper: A4, Letter
- Resolution: 300 dpi

For more details about the printer, see the document accompanying the printer. With product upgrades, the monitor may support more printers without prior notice will be given. If you have any questions or doubt about your printer, contact our company.

22.2 Connecting a printer

To print the reports or the trend data of a patient, you can connect the local printer and the monitor directly with a network cable.

22.3 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 search for all printers in the network.

- Set up the paper.

  Select [**Paper Size**] and and select [**A4**] or [**Letter**].

22.4 Starting Report Printouts

Reports	Contents	Procedures
ECG reports	ECG waveforms and relevant parameter values	Select [**Main Menu**] [**Print Setup >>**] [**ECG Reports >>**] [**Print**]
QT report	QT parameter values and waveforms	Select [**ECG Setup**] [**QT Analysis >>**] [**QT View >>**] [**Print**] Note: [**QT Analysis**] must be set to [**On**].
Tabular trends	Depends 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	Depends 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**]
Arrh. alarm review	ECG waveforms and relevant parameter values	Select [**Print**] in [**Arrh. Events**]
Parameter alarm review	Depends on the selected alarms	Select [**Main Menu**] [**Review >>**] [**Alarms**] [**Print**]
Realtime waves	Depends on the selected waveforms	Select [**Main Menu**] [**Print Setup >>**] [**Realtime Reports >>**] [**Print**]

22.5 Stopping Report Printouts

To stop report printouts, select [**Main Menu**] [**Print Setup >>**] [**Stop All Reports**].

22.6 Setting Up Reports

22.6.1 Setting Up ECG Reports

You can print ECG reports only from the full-screen or half-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.
- [**Gridlines**]: choose whether to show gridlines.

22.6.2 Setting Up Tabular Trends Reports

To set up tabular trends reports, select [**Main Menu**] [**Print Setup >>**] [**Tabular Trends Reports >>**].

- [**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**

22.8 Printer Statuses

22.8.1 Printer Out of Paper

When the printer is out of paper, the printer will not print until the paper is replaced. If there are too many print jobs that are not printed, a printer error may occur. In this case, you need to install paper and then re-send the print request. Restart the printer if necessary.

To avoid this, ensure that there is enough paper in the printer before sending a print request.

22.8.2 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.

23 Other Functions

23.1 Analog Output

The monitor provides analog output signals to accessory equipment via the multifunctional connector on the rear of the monitor. The analog output signals include analog ECG, IBP, and defibrillator synchronization signals, among which the ECG signals support pace pulses to be enhanced.

NOTE

- **The analog output feature is seldom applied in clinical applications. You can contact your service personnel for more details.**

23.2 Setting DIAP Baud Rate

The monitor can output measurement numerics and alarm limits of parameter modules at certain baud rate to external devices via the DIAP protocol. The parameter modules are ECG, RR, IBP, NIBP, SpO_2, PR, TEMP, CO_2, CO, and AG.

To set the desired baud rate:

1. Select [**Main Menu**] [**Maintenance >>**] [**User Maintenance >>**] enter the required password [**Others >>**].
2. Set [**DIAP Baud Rate**]. The higher the DIAP baud rate goes, the faster data is sent.

23.3 Nurse Call

The monitor provides a nurse call connector to output nurse call signal when a user-defined 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 then select [**Pulse**] or [**Continuous**].
  - [**Pulse**]: the nurse call signal is a pulse signal and each pulse lasts one second. When multiple alarms occur simultaneously, only one pulse signal is output. If an alarm occurs but the previous one is not cleared, a new pulse signal will also be output.
  - [**Continuous**]: the nurse call signal lasts until the alarm ends, i.e. the duration of a nurse call signal is equal to that of the alarm condition.
- Select [**Contact Type**] and then select [**Normally Open**] or [**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**

23.4.2 Setting the Multicast Parameters

Multicast parameters must be configured before use on a network.

To set the multicast parameters:

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

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

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

23.5 MLDAP

MLDAP refers to Mindray LDAP (Lightweight Directory Access Protocol). It is an independent process which can be installed on application server (Windows). MLDAP provides user authorization and authentication.

The MLDAP server is connected to the hospital's LDAP or ADT server. All monitoring devices are connected to the MLDAP server to perform authorization and authentication for the following operations:

- Changing alarm settings
- Changing arrhythmia settings
- Accessing the [**User Maintenance**] menu

23.5.1 Setting MLDAP

To access the MLDAP server, you should set your monitor as

- [**User Password**]: changing arrhythmia ON/OFF switch, alarm priority, and arrhythmia threshold is password protected. The user name and password saved in the MLDAP server are required to change arrhythmia settings.

4. Select [**User Maintenance**] to set password for changing user maintenance settings.
   - [**Local Password**]: changing user maintenance settings is password protected. The monitor's local password is required to change user maintenance settings.
   - [**User Password**]: changing user maintenance settings is password protected. The user name and password saved in the MLDAP server are required to change user maintenance settings.

To change the monitor's local password for changing alarm settings and arrhythmia settings, select [**Modify Local Alarm Password>>**], enter the new password, and select [**OK**].
To change the monitor's local password for accessing the [**User Maintenance**] menu, select [**Modify Local User Maintenance Password>>**], enter the new password, and select [**OK**].

24 Batteries

24.1 Overview

This monitor is designed to operate from rechargeable Lithium-ion battery power when AC power is not available. It is

24.2 Safety

CAUTION

- **Keep the battery out of children's reach.**
- **Use only specified batteries.**
- **Keep the batteries in their original package until you are ready to use them.**
- **Do not expose batteries to liquid.**
- **High ambient temperature shortens battery run time.**
- **Extremely high ambient temperature may cause battery overheat protection, and then the monitor will turn off.**
- **If the battery shows signs of damage or signs of leakage, replace it immediately. Do not use a faulty monitor battery.**
- **Do not crush, drop or puncture the battery. Mechanical abuse can lead to internal damage and internal short circuits. If a battery has been dropped or banged against a hard surface, whether damage is externally visible or not, remove the battery from use and dispose of it properly.**
- **Please replace your battery when it reaches the end of its service life. Failure to replace the battery may cause serious damage to your device from battery overheating.**

NOTE

- **Charge the batteries in the monitor.**

24.3 Battery Guidelines

Battery life expectancy depends on how frequent and how long it is used. For a properly maintained and stored lithium ion battery,

24.4 Installing or Replacing a Battery

When the cPM 12 patient monitor uses two battery packs, one battery pack can be easily exchanged while the monitor operates from the other. If the cPM 12 patient monitor uses one battery pack, you should insert a new battery pack before the old one depletes.

When the cPM 8 patient monitor is operating on battery power, make sure the monitor is powered off before replacing a battery.

To install or replace a battery:

1. Open the battery door.

cPM 12 **cPM 8**

2. Push aside the latch securing the battery and then remove the battery.
3. Place the new battery into the slot.
4. If necessary, replace the other battery following the steps above.
5. Restore the latch to the original position and close the battery door.

24.5 Charging a Battery

To optimize performance, a fully (or nearly fully) discharged battery should be charged as soon as possible. The battery is charged regardless of whether or not the monitor is currently turned on.

To charge the battery:

1. Install the battery in the monitor.
2. Connect the monitor with the AC power source.

When the battery is charging, the AC power indicator and battery .7 (r)]T.arntor anenwhe bhe002 Tc 0.002 Tw 0.579 0 T2(:)Tj0n Tc 0 Tw 0.

24.6 Conditioning a Battery

The performance of rechargeable batteries may deteriorate over time. If a battery is not conditioned for a prolonged time, its charge indication may not be accurate and you may wrongly evaluate the remaining battery runtime. Keeping the battery continuously fully charged without conditioning will speed up battery aging and shorten its life time. You should condition a battery every three months, before it is used for the first time, or when its run time becomes noticeably shorter.

A battery conditioning cycle is one uninterrupted charge of the battery, followed by an uninterrupted battery discharge and charge.

NOTE

- **The battery charge level indicator does not indicate the capacity or operating time of the battery. It only indicates the current battery charge level. The actual battery capacity decreases over time with the use of the battery. For an old battery, its capacity and operating time may not fulfill battery specifications even when the battery charge level indicates the battery is fully charged. Please replace the battery if its operating time is significantly lower than the specified time.**

To condition a battery:

1. Disconnect the monitor from the patient and stop all monitoring and measuring procedures.
2. Insert the battery to be conditioned in the monitor battery slots. For cPM 8, you need to turn it off before performing this step.
3. Apply AC power to the monitor and allow the battery to charge uninterruptedly for 10 hours.
4. Remove AC power and allow the monitor to run from the battery until it shuts off.
5. Apply AC power again to the monitor and allow the battery to charge uninterruptedly for 10 hours.
6. This battery is now conditioned and the monitor can be returned to service.

CAUTION

- **Do not use the monitor to monitor the patient during battery conditioning.**

NOTE

- **Do not interrupt battery conditioning.**

24.7 Checking Battery Performance

The performance of a rechargeable battery will deteriorate over time. The battery performance test should be performed every six months, before monitor repairs, or whenever the battery performance is diminished.

To check the battery performance:

1. Disconnect the monitor from the patient and stop all monitoring and measuring procedures.
2. Turn off the monitor.
3. Apply AC power to the monitor and allow the battery to charge uninterruptedly for 6 hours.
4. Remove AC power and allow the monitor to run from the battery until it shuts off.
5. Record the battery operating time.

The battery operating time directly reflects its performance. If the operating time of a battery is noticeably shorter than that stated in the specifications, replace the battery or contact the Mindray service personnel.

NOTE

- **Battery operating time depends on the device configuration and operation. For example, high display brightness or measuring NIBP repeatedly will shorten the battery operating time.**

24.8 Storing a Battery

When storing batteries, make sure that the battery terminals do not come into contact with metallic objects. If batteries are stored for an extended period of time, they should be placed in a cool place with a partial charge of 40% to 60% capacity.

Stored batteries should be conditioned every months. Refer to section ***24.6 Conditioning a Battery*** for details.

NOTE

- **Remove the battery from the equipment if the equipment is not used for a prolonged period of time (for example, several weeks). Otherwise the battery may be over discharged and damaged.**
- **Storing batteries at high temperature for an extended period of time will significantly shorten their life expectancy.**
- **Storing batteries in a cool place will slow the aging process. Ideally the batteries should be stored at 15 °C. Do not store the batteries in an environment above 60 °C or lower than -20 °C.**

24.9 Recycling a Battery

Remove the old battery from the monitor and recycle it properly. Follow local laws for proper battery disposal.

WARNING

- **Do not open batteries, heat above 60 °C, incinerate batteries, or short the battery terminals. They may ignite, explode, leak, or heat up, causing personal injury.**

25 Care and Cleaning

25.1 General Points

In this chapter we only describe cleaning and disinfection of the main unit, modules and certain accessories. For the cleaning and disinfection of other reusable accessories, refer to instructions for use of the corresponding accessories.

Keep your equipment and accessories clean. To avoid damage to the equipment, follow these guidelines:

- Always follow the manufacturer's instructions for each cleaning/disinfecting agent.
- Do not immerse part of the equipment or accessories 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

- **Be sure to turn off the system and disconnect all power cables from the outlets before cleaning the equipment.**

CAUTION

- **If you spill liquid on the equipment or accessories, contact Mindray or your service personnel.**
- **Avoid wetting the pins and metal parts of the main unit, modules or accessories during cleaning and disinfection.**
- **Use only Mindray approved cleaners and disinfectants 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.**
- **The responsible hospital or institution shall carry out all cleaning and disinfection procedures specified in this chapter.**
- **Refer to the respective instructions for use of the cleaning agents and disinfectants.**
- **Do not mix disinfecting solutions (such as bleach and ammonia) as hazardous gases may result.**

NOTES

- **To clean or disinfect reusable accessories, refer to the instructions delivered with the accessories.**

25.2 Cleaning

Your equipment should be cleaned on a regular basis. Before cleaning the equipment, consult your hospital's regulations for cleaning the equipment.

The following table lists approved cleaning agents:

Product Name	Product Type	Ingredients
Sodium hypochlorite bleach	Liquid	Sodium hypochlorite 10%
Hydrogen peroxide	Liquid	Hydrogen peroxide 3%
Isopropanol	Liquid	Isopropanol 70%
Rely+On™ Virkon®	Powder	Used as 1% solution* Biocidal active: Pentapotassium bis (peroxymonosulphate) bis (sulphate) (500g/kg) Contains dipotassium peroxodisulphate.
1-Propanol	Liquid	1-Propanol 50%
Perform®	Powder	Used as 1% solution* 100g contains 45g Pentapotassium bis (peroxymonosulphate) bis (sulphate). 5 % to 15% anionic surfactants; <5% non-ionic surfactants; <5% soap and phosphonates, perfumes

Note: The "*" symbol indicates a cleaning solution should be prepared according to the concentration directed by the accompanying instructions for use.

To clean your equipment, follow these rules:

1. Shut down the monitor and disconnect it from AC power.
2. Clean the display screen using a soft, clean cloth dampened with a cleaning agent listed above.
3. Clean the exterior surface of the equipment using a soft cloth dampened with a cleaning agent listed above.
4. Wipe off all the cleaning solution with a dry cloth after cleaning if necessary.
5. Dry your equipment in a ventilated, cool place.

25.3 Disinfecting

Disinfect the monitor as required in your hospital's servicing schedule. Cleaning equipment before disinfecting is recommended.

The following table lists approved disinfectants:

Product Name	Product Type	Ingredients
Sodium hypochlorite bleach	Liquid	Sodium hypochlorite 10%
Isopropanol	Liquid	Isopropanol 70%
Rely+On™ Virkon®	Powder	Used as 1% solution* Biocidal active: Pentapotassium bis (peroxymonosulphate) bis (sulphate) (500g/kg) Contains dipotassium peroxodisulphate.
1-Propanol	Liquid	1-Propanol 50%
Perform®	Powder	Used as 1% solution* 100g contains 45g Pentapotassium bis (peroxymonosulphate) bis (sulphate). 5 % to 15% anionic surfactants;<5% non-ionic surfactants; <5% soap and phosphonates, perfumes

Note: The "*" symbol indicates a disinfectant should be prepared according to the concentration directed by the accompanying instructions for use.

CAUTION

- **Never use EtO or formaldehyde for disinfection.**

25.4 Sterilization

Sterilization is not recommended for this equipment, related products, accessories, or supplies unless otherwise

26 User Maintenance

CAUTION

- **Failure on the part of the responsible individual hospital or institution using this equipment to implement a recommended 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 o3h-2i4 is3c (sd)-20.3-(e)26usn p** 2 e 2 1 1

, battery check,

26.3 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 >>**].

26.4 ECG Verification

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 verify 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 the square wave and wave scale and then measure the difference between them if necessary. If the difference exceeds 5%, contact your service personnel.

26.5 NIBP Leakage Test

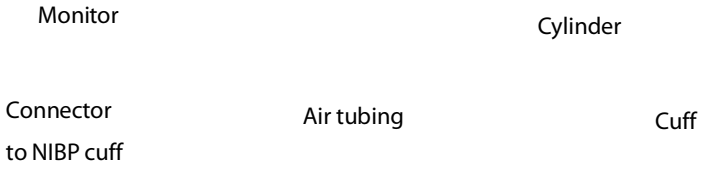
The NIBP leakage test checks the integrity of the system and of the valve. It is required at least once a year or when you doubt the measured NIBP. If the test failed, corresponding prompt messages will be given. If no message is displayed, it means no leakage is detected.

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.

NOTE

- **The leakage test is intended for use to simply determine whether there are leakages in the NIBP airway. It is not the same as that specified in the EN 1060-3 standard.**

26.6 CO_2 Leakage Test

For sidestream and microstream CO_2 modules, 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 sidestream and microstream CO_2 modules 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.
   - Microstream: The alarm message [**CO2 Purging**] is displayed on the screen after certain time. Block the gas inlet for another 30s. If alarm message [**CO2 FilterLine Err**] is shown, it indicates that the module does not leak.

FOR YOUR NOTES

27 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.**

CAUTION

- **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.**

NOTE

- **This manual describes all the accessories that are validated for use. Not all accessories are available in every market.**

27.1 ECG Accessories

ECG Electrodes

)MC

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		ESU-proof		0010-30-42724
3-leadwire		Defibrillation-proof		040-000754-00
3/5-leadwire		Defibrillation-proof	Adult, pediatric	0010-30-42719
3/5-leadwire		ESU-proof		0010-30-42723
3/5/6-leadwire		Defibrillation-proof	Adult, pediatric	009-005266-00
3/5/6-leadwire				009-005267-00
3/5/6-leadwire				009-005268-00
3/5/6-leadwire				009-005269-00
3/5-leadwire		Defibrillation-proof	Adult, pediatric	040-001416-00
3/5-leadwire		ESU-proof		009-003652-00

ECG Leadwires

3-Electrode Leadwires						
Type	**Compatible with**	**Model**	**Patient Category**	**Part No.**	**Length**	**Remark**
Clip	AHA	EL6303A	Adult, pediatric	0010-30-42731	1m	Long
		EL6305A	Infant, neonate	0010-30-42896	1m	Long
		/	Adult, pediatric	0012-00-1514-05	0.6m	24"
		/		0012-00-1514-06	0.9m	36"
		EY6316A		009-004771-00	0.6m	New telemetry, 24"
		EY6305A		009-004772-00	0.9m	New telemetry, 36"
		EL6301B	Adult, pediatric	0010-30-/	0010	

Snap AHA

5-Electrode Leadwires						
Type	**Compatible with**	**Model**	**Patient Category**	**Part No.**	**Length**	**Remark**
Clip	AHA	/	Adult, pediatric	0012-00-1514-01	0.45m	/
		/		0012-00-1514-02	0.6m	/
		/		0012-00-1514-03	0.9m	Long
		EL6501A		0010-30-42727	0.6m	/
		EL6503A		0010-30-42729	1m to 1.4m	Long
		EY6511A		009-004786-00	0.6m	New telemetry, 24"
		EY6512A		009-004787-00	0.9m	New telemetry, 36"
Snap	AHA	/		0012-00-1503-01	0.45m	/
		/		0012-00-1503-02	0.6m	/
		/		0012-00-1503-03	0.9m	Long
		EL6501B		0010-30-42735	1.4m for RL and LL; 1m for others	Long
	AHA	/		040-000746-01	0.6m	Disposable
		EY6511B		009-004782-00	0.6m	New telemetry, 24"
	AHA	EY6512B	Adult, pediatric	009-004783-00		009

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SpO_2 Sensors

Masimo SpO_2 Module				
Model	**PN**	**Description**	**Applicable patient**	**Application site**
LNCS DCI	0600-00-0126	Reusable SpO_2 sensor	Adult	Finger
LNCS DCIP	0600-00-0127	Reusable SpO_2 sensor	Pediatric	Finger
LNCS NeoPt	0600-00-0156	Disposable SpO_2 sensor	Neonate	Foot
LNCS Neo	0600-00-0157	Disposable SpO_2 sensor	Adult (> 40 kg) Neonate (< 3 kg)	Finger Foot
LNCS Inf	0600-00-0158	Disposable SpO_2 sensor	Infant neonate (3 to 20 kg)	Toe Foot
LNCS Pdtx	0600-00-0122	Disposable SpO_2 sensor	Pediatric	Finger
LNCS Adtx	0600-00-0121	Disposable SpO_2 sensor	Adult	Finger
4050	040-003376-00	RD SET DCI, Adult reusable sensor	Adult (> 30 kg)	Finger or toe
4051	040-003377-00	RD SET DCI-P, Pediatric reusable sensor	Pediatric (10 to 50 kg)	Finger or toe
4053	040-003380-00	RD Set TC-I SpO_2 reusable Tip-Clip ear sensor, 3ft	Adult (> 30 kg)	Ear
4000	040-003382-00	RD SET adhesive sensor	Adult (> 30 kg)	Finger or toe
4001	040-003383-00	RD SET PDT adhesive sensor	Pediatric (10 to 50 kg)	Finger or toe
4002	040-003384-00	RD Set Infant adhesive sensor	Infant (3 to 20 kg)	Thumb or great toe
4003	040-003385-00	RD Set Neo adhesive sensor	Adult (> 40 kg) Neonate (< 3 kg)	Finger or toe

27.3 NIBP Accessories

NIBP hoses

Model	Part No.	Description	Applicable patient
CM1901	6200-30-11560	Reusable NIBP hose	Neonate
CM1903	6200-30-09688	Reusable NIBP hose	Adult, pediatric, infant

Cuffs

Model	Part No.	Description	Applicable patient
CM1500A	001B-30-70692	NIBP cuff, single patient use, size 1, 3.1 to 5.7 cm arm circumference, 20 pcs/box	Neonate
CM1500B	001B-30-70693	NIBP cuff, single patient use, size 2, 4.3 to 8.0 cm arm circumference, 20 pcs/box	Neonate
CM1500C	001B-30-70694	NIBP cuff, single patient use, size 3, 5.8 to 10.9 cm arm circumference, 20 pcs/box	Neonate
CM1500D	001B-30-70695	NIBP cuff, single patient use, size 4, 7.1 to 13.1 cm arm circumference, 20 pcs/box	Neonate
/	115-027563-00	Disposable bladderless cuff, 10 - 19 cm, 10 pcs/box	Child
/	115-027564-00	Disposable bladderless cuff, 18 – 26 cm, 10 pcs/box	Small adult
/	115-027565-00	Disposable bladderless cuff, 24 – 35 cm, 10 pcs/box	Adult
/	115-027566-00	Disposable bladderless cuff, 33 – 47 cm, 10 pcs/box	Large adult
/	115-027567-00	Disposable bladderless cuff, 46 – 66 cm, thigh, 5 pcs/box	Adult
/	115-027568-00	Disposable bladderless long cuff, 24 – 35 cm, 10 pcs/box	Adult
/	115-027569-00	Disposable bladderless long cuff, 33 – 47 cm, 10 pcs/box	Large adult
/	115-027713-00	Reusable bladderless cuff, 10 - 19 cm	Child
/	115-027714-00	Reusable bladderless cuff, 18 – 26 cm	Small adult
/	115-027715-00	Reusable bladderless cuff, 24 – 35 cm	Adult
/	115-027716-00	Reusable bladderless cuff, 33 – 47 cm	Large adult
/	115-027717-00	Reusable bladderless cuff, 46 – 66 cm	Thigh
/	115-027718-00	Reusable bladderless long cuff, 24 – 35 cm	Adult
/	115-027719-00	Reusable bladderless long cuff, 33 – 47 cm	Large adult
/	115-031807-00	Starter kit, reusable bladderless cuff	/

27.4 Temp Accessories

Temp Cable

Type	Model	Remark	Part No.
Extension cable (reusable)	MR420B	Applicable to sensor MR411 and MR412	0011-30-37391
TEMP adapter cable (2-pin to audio)	MR421	/	0010-30-43056
Temperature adapter cable 2-pin plug	MR420B	Applicable for all patient categories	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, infant	Esophageal/Rectal	0011-30-37398
	MR412		Skin	0011-30-37397
	/	Adult	Esophageal Stethoscope	0206-03-0112-02
			Esophageal Stethoscope	0206-03-0118-02
			Esophageal/Rectal	0206-03-0209-02
			Esophageal/Rectal	0206-03-0212-02
			Skin	0206-03-0300-02

27.5 IBP/ICP Accessories

Material	Part No.
IBP adapter cable	0010-30-43055
IBP extended cable with dual-receptacle	040-001029-00
BD IBP Cable, 12 pin	001C-30-70757
Edwards IBP Cable, 12 pin	0010-21-12179
Hospira IBP Cable, 12 pin	001C-30-70759

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.

Manufacturer	Accessories
Smith Medical (Medex)	MX961Z14 Logical Cable, to be used in connection with the Adapter Cable (0010-20-42795) MX960 Reusable Transducer Kit MX261 Logical Clamp For Transducer Bracket MX262 Logical Clamp For 2 Transducer Mount Plates MX960E6441 Logical Transducer Mounting Plate (More Logical Clamps are available from Medex. For detailed information, contact Medex.)
Braun	IBP Reusable Cable (REF: 5203511), to be used in connection with the Adapter Cable (0010-20-42795) Combitrans Monitoring Set (contact Braun for detailed information) Combitrans Attachment Plate Holder (REF:5215800) Combitrans Attachment Plate (contact Braun for detailed information)
Memscap	*Trunk cable (0010-21-43082) SP844 Physiological Pressure Transducer 844-26 Monitoring Line Set 84X-49 Mounting Bracket
Utah	Reusable Blood Pressure Monitor Interface Cable (REF: 650-206) Deltran Disposable Pressure Transducer System (More Deltran sensors are available from Utah. For detailed information, contact Utah.) Pole Mount Unit (ERF: 650-150) Deltran Three Slot Organizer, Attaches to I.V. Pole Mount (REF: 650-100) Deltran Four Slot Organizer, Attaches to I.V. Pole Mount (REF: 650-105)
Edwards	* IBP Truwave Reusable Cable (0010-21-12179) Pressure Monitoring Kit With Truwave Disposable Pressure Transducer. (More Truwave sensors are available from Edwards. For detailed information, contact Edwards.) DTSC IV Pole Clamp for Model DTH4 Backplate Holder DTH4 Disposable Holder for DPT

27.6 C.O. Accessories

Model	Material	Part No.
CO7702	12Pin C.O. cable.	0010-30-42743
SP4042	TI Sensor	6000-10-02079
SP5045	TI Sensor Housing	6000-10-02080
MX387	12CC Control Syringe W/1CC Stop W/Rotator	6000-10-02081
93522	In-line inject temperature Probe	0012-00-1520

27.7 CO_2 Accessories

Sidestream CO_2 module

Model	Part No.	Description	Applicable patient
4000	M02A-10-25937	Nasal CO_2 sample cannula	Adult
4100	M02A-10-25938	Nasal CO_2sample cannula	Pediatric
4200	M02B-10-64509	Nasal CO_2 sample cannula	Neonate
60-15200-00	9200-10-10533	Sampling line, 2.5m, disposable	Adult, pediatric
60-15300-00	9200-10-10555	Sampling line, 2.5m, disposable	Neonate
60-14100-00	9000-10-07486	Airway adapter, disposable, straight	Adult, pediatric
040-001187-00	040-001187-00	Airway adapter, disposable, elbow	Neonate
60-13100-00	125-000005-00	Watertrap, 10pcs/box	Adult, pediatric
60-13200-00	125-000006-00	Watertrap, 10pcs/box	Neonate

27.8 AG Accessories (for cPM 12 only)

Model	Part No.	Description	Applicable patient
60-13100-00	125-000005-00	Watertrap, 10pcs/box	Adult, pediatric
60-13200-00	125-000006-00	Watertrap, 10pcs/box	Neonate
60-14100-00	9000-10-07486	Airway adapter, disposable, straight	/
60-15200-00	9200-10-10533	Sampling line, 2.5m, disposable	Adult, pediatric
60-15300-00	9200-10-10555	Sampling line, 2.5m, disposable	Neonate
60-14200-00	9000-10-07487	Airway adapter, disposable,elbow	Adult, pediatric
/	115-052162-00	AG exhasust gas outlet assembly	Adult, pediatric

27.9 Micellaneous Accessories

Material	Part No.
Lithium battery, LI23S002A	022-000008-00
Power cord (America)	DA8K-10-14452
Grounding cable	1000-21-00122
Nurse call cable (≤60W, ≤2A, ≤36VDC, ≤25VAC)	009-003116-00
Analog output cable	009-003117-00
Synchronization cable	009-003118-00
DIAP cable	009-003436-00
Elo ET1929LM, 19-inch black LCD	023-001128-00
USB drive, 4G, USB 2.0 (TRANSCEND)	023-000217-00
USB drive, 4G, USB 2.0 (APACER)	023-000218-00
HP LaserJet Enterprise M608n	023-001566-00
Recorder	TR6F-30-67306
Thermal paper	A30-000001---

Material	Part No.
Wall mount bracket for external display	045-000936-00
Bedrail Hook subassembly (cPM 12)	115-012698-00
Bedrail Hook subassembly (cPM 8)	115-012697-00
Transition Plate Kit for rolling stand and wall mount	115-012695-00
cPM 12 rolling stand (Transport)	045-002147-00
Passport12 wall mount (VHM)	045-002148-00
iPM/iMEC rolling stand with quick release mount	045-003428-00
Transport stand for rolling stand (cPM 12)	115-002966-00
Quick Release for wall mount (cPM 8/cPM 12)/Quick release for cPM 12 rolling stand	045-003424-00
M series wall mount with Quick Release (cPM 8 and cPM 12)	045-003427-00
VHM wall mount (cPM 8 and cPM 12)	115-006911-00

A Product Specifications

A.1 Monitor Safety Specifications

A.1.1 Classifications

The 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 and AG 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 (Protection against vertically falling water drops)

A.1.2 Environmental Specifications

CAUTION

- **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 (°C)	0 to 40	cPM 8: -30 to 70 cPM 12: -20 to 60
Relative humidity (noncondensing)	15% to 95%	10% to 95%
Barometric (kPa)	57.0 to 107.4	16.0 to 107.4

Microstream CO_2 module		
Item	**Operating conditions**	**Storage conditions**
Temperature (°C)	0 to 40	-20 to 60
Relative humidity (noncondensing)	15% to 95%	10% to 95%
Barometric (kPa)	57.3 to 105.3	57.3 to 105.3

Sidestream CO_2 module		
Item	**Operating conditions**	**Storage conditions**
Temperature (°C)	5 to 40	-20 to 60
Relative humidity (noncondensing)	15% to 95%	10% to 95%
Barometric (kPa)	57.3 to 105.3	57.3 to 105.3

AG module		
Item	**Operating conditions**	**Storage conditions**
Temperature (°C)	10 to 40	-20 to 60
Relative humidity (noncondensing)	15% to 95%	10% to 95%
Barometric (kPa)	70 to 107.4	70 to 107.4

NOTE

- **The environmental specifications of unspecified parameters are the same as those of the main unit of cPM 12.**

A.2 Power Supply Specifications

AC power		
Line voltage		100 to 240 VAC (10)
Current		1.3 to 0.5 A
Frequency		50/60 Hz (3Hz)
Battery		
Battery Type		Chargeable Lithium-Ion, 11.1DVC, 4.5 Ah
Run time	cPM 12	≥ 4 hours when powered by one new fully-charged battery (25°C, SpO_2, ECG, disconnected from Temp cable, Auto NIBP measurements at intervals of 15 minutes) ≥ 8 hours when powered by two new fully-charged batteries (25°C, SpO_2 sensor and ECG cable connected, Temp cable not connected, Auto NIBP measurements at an interval of 15 minutes)
	cPM 8	≥ 6 hours when powered by a new fully-charged battery (25°C, SpO_2 sensor and ECG cable connected, Temp cable not connected, Auto NIBP measurements at an interval of 15 minutes
Charge time		Less than 3 hours to 90%, and less than 4 hours to 100% when the monitor is off. Less than 8 hours to 90%, and less than 12 hours to 100% when the monitor is on.
Shutdown delay		at least 20 min (after a low battery alarm first occurs)

A.4 Hardware Specifications

A.4.1 Display

Host display			
	Screen Size (diagonal)	**Screen type**	**Resolution**
cPM 12	12.1″	color TFT LCD	800×600 pixels
cPM 8	8.4″		
External display			
Screen type	Medical-grade TFT LCD		

A.4.2 Recorder

Method	Thermal dot array
Paper width	50 mm±1 mm
Paper speed	25 mm/s or 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 connectors, 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
QRS delay	≤ 25 ms (in diagnostic mode, and non-paced)
Sensitivity	1V/mV ±5%
PACE rejection/enhancement	Pace enhancement Signal amplitude: Voh≥2.5V Pulse width: 10ms±5% Signal rising and falling time: ≤100μs
IBP Analog Output (For cPM 12 only)	
Bandwidth (-3dB; reference frequency:1Hz)	DC to 40 Hz
Max transmission delay	30 ms
Sensitivity	1 V/100 mmHg ±5%
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 monitor to remote equipment	The alarm delay time is equal to or smaller than 2 s, measured from the time of the monitor alarm signal generation to the time of the remote equipment alarm signal generation.

A.5 Data Storage

Trends	Trends: 120 hours, at 1 min resolution Mid-length trends: 4 hours, at 5 s resolution Minitrends: 1 hour, at 1 s resolution
Parameter alarms	100 alarms and manual events and related parameter waveforms. The waveform recording length can be 8s, 16s, or 32s.
Arrh. events	100 arrhythmia events and relate waveforms and parameters. The waveform recording length can be 8s, 16s, or 32s.
NIBP measurements	1000 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 Measurement Specifications

Di7 (n)8e719.1 (i7 (n)8e)s1di7(()3Tdw(m)-5<1/8.5To 04(w8.w)210Td(.48348)w 1.4835 40 -73 (oTm( )TjE[(M)-1)8e)o

The adjustable range of ala543.6 611.52 0.001 50 /P A6.3 (cw 123 w)-1.8 4 0.48cw 1o >3 (e)26.3 (1 D5.52 576(a)0.5 (t).12 226.8 68y <</M

R44.1 (o)-16.6 ( )0.5 (-]TJ0 5--)15w 401 Td[161567 0 Td(d( )TjE

	Drive electrode: ≤1 μA
Baseline recovery time	<5 s (after defibrillation)
Patient leakage current	<10 uA
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 IEC 60601-2-27: Clause 202.6.2.101
ESU noise suppression	Based on the test method in clause 5.2.9.14 of EC 13, use ECG lead wires which are in compliance with AAMI. Compared with ECG baseline, the noise of peak to peak value ≤2 mV.

Pace Pulse		
Pace pulse markers	Pace pulses meeting the following conditions are labeled with a PACE marker: Amplitude: Width: Rise time:	 ±2 to ±700 mV 0.1 to 2 ms 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: Width: Rise time:	 ±2 tEe s

	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
	When the test is performed based on IEC60601-2-27: Clause 201.12.1.101.17, the 2mV.
	Extreme Brady, PVC, Couplet, ady, Missed Beats, Vent. PVC, Nonsus. Vtac, Pause, Irr.

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.6.3 SpO_2

Alarm limit	Range (%)	Step (%)
SpO_2 High	(low limit + 2) to 100	1
SpO_2 Low	Masimo: Desat to (high limit – 2) Nellcor: Desat or20 (whichever is greater) to (high limit – 2)	
Desat	0 to (high limit – 2)	

Masimo SpO_2 Module

Standards	Meet standards of ISO9919
SpO_2 measurement range	1 to 100%
Resolution	1%
Accuracy[1]	70 to 100%: ±2% (measured without motion in adult/pediatric mode) 70 to 100%: ±3% (measured without motion in neonate mode) 70 to 100%: ±3% (measured with motion) 1% to 69%: Not specified.
Refreshing rate	1 s
SpO_2 averaging time	2-4 s, 4-6 s, 8 s, 10 s, 12 s, 14 s, 16 s
Low perfusion conditions	Pulse amplitude: >0.02% Light penetration: >5%
Low perfusion SpO_2 accuracy	±2%
PI measurement range	0.02~20 %

[1] The Masimo pulse oximeter with sensors have been validated for no motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies in the range of 70% to 100% SpO_2 against a laboratory co-oximeter and ECG monitor. This variation equals plus or minus one standard deviation. Plus or minus one standard deviation encompasses 68% of the population. One percent was added to the accuracies for neonatal sensors to account for accuracy variation due to properties of fetal hemoglobin.

The Masimo pulse oximeter with sensors has been validated for motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies while performing rubbing and tapping motions at 2 to 4 Hz. At an amplitude of 1 to 2 cm and non-repetitive motion between 1 to 5 Hz. At an amplitude of 2 to 3 cm in induced hypoxia studies in the range of 70% to 100% SpO_2 against a laboratory co-oximeter and ECG monitor. This variation equals plus or minus one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.

PR from Nellcor SpO_2

Measurement range	20 to 300 bpm
Resolution	1 bpm
Accuracy	20 to 250 bpm: ±3 bpm 251 to 300 bpm, not specified
Refreshing rate	1 s

PR from NIBP

Measurement range	30 to 300 bpm
Resolution	1 bpm
Accuracy	±3bpm or ±3%, whichever is greater

PR from IBP

Measurement range	25 to 350 bpm
Resolution	1 bpm
Accuracy	±1 bpm or ±1%, whichever is greater
Refreshing rate	1 s

A.6.5 NIBP

Standards	Meet standards of EN60601-2-30/IEC60601-2-30, EN1060-1, EN1060-3, SP10 and EN1060-4			
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: 180 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			

A.6.7 IBP

Standards	Meet standard of EN60601-2-34/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
PPV	
Measurement range	0% to 50%
Pressure transducer	
Excitement voltage	5 VDC, ±2%
Sensitivity	5 μV/V/mmHg
Impedance range	300 to 3000Ω

Alarm limit	Range (mmHg)	Step (mmHg)
Sys High	(low limit + 2) to 300	1
Mean High		
Dia High		
Sys Low	-50 to (high limit – 2)	
Mean Low		
Dia Low		

A.6.8 C.O.

Measurement method	Thermodilution method	
Measurement range	C.O.:	0.1 to 20 L/min
	TB:	23 to 43 °C
	TI:	0 to 27 °C
Resolution	C.O.: TB, TI:	0.1 L/min 0.1 °C
Accuracy	C.O.: TB, TI:	±5% or ±0.1 L /min, whichever is greater ±0.1 °C (without sensor)
Repeatability	C.O.:	±2% or ±0.1 L/min, whichever is greater
Alarm range	TB:	23 to 43 °C

Alarm limit	Range	Step
TB High	(low limit + 1) to 43°C	0.1 °C
TB Low	23 to (high limit - 1) °C	

A.6.9 CO_2

Measurement mode	Sidestream, microstream, mainstream
Technique	Infrared absorption

Sidestream CO_2 Module

Standard	Meet standard of ISO 21647
CO_2 Measurement range	0 to 99 mmHg
Accuracy*	0 to 40 mmHg: ±2 mmHg 41 to 76 mmHg: ±5% of the reading 77 to 99 mmHg: ±10% of the reading
Accuracy drift	Meet the requirement for measurement accuracy within 6 hours
Resolution	1 mmHg
Sample flowrate	Adult: 70 ml/min, 100 ml/min, 120 ml/min, 150 ml/min Pediatric, neonate: 70 ml/min, 100 ml/min
Sample flowrate tolerance	15% or 15 ml/min, whichever is greater.
Warm-up time	Iso accuracy mode: ≤45s Full accuracy mode: ≤10 min
Rise time	Measured with a neonatal watertrap and a 2.5-meter neonatal sampling line, or an adult watertrap and a 2.5-meter adult sampling line: <400 ms @ 70 ml/min <330 ms @ 100 ml/min <300 ms @ 120 ml/min <240 ms @ 150 ml/min
Gas sampling delay time	Measured with a neonatal watertrap and a 2.5-meter neonatal sampling line: <4 s @ 100 ml/min <4.5 s @ 70 ml/min Measured with an adult watertrap and a 2.5-meter adult sampling line: <4.5 s @ 150 ml/min < 5 s @ 120 ml/min <5.5 s @ 100 ml/min <6.5 s @ 70 ml/min
awRR measurement range	0 to 120 rpm
awRR measurement precision	±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	
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.		

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	

Microstream CO_2 Module

Standard	Meer.96 0.4 refB76pm

A.6.10 AG (For cPM 12 only)

Standards	Meet standard of ISO 21647		
Technique	Infrared absorption		
Warm-up time	Iso accuracy mode:	≤ 45 s	
	Full accuracy mode:	≤ 10 min	
Sample flow rate	Adult, pediatric:	120, 150, 200 ml/min	
	Neonate:	70, 90, 120 ml/min	
	Accuracy:	±10 ml/min or ±10%, whichever is greater	
Measurement range	CO_2:	0 to 30%	
	O_2:	0 to 100%	
	N_2O:	0 to 100%	
	Des:	0 to 30%	
	Sev:	0 to 30%	
	Enf:	0 to 30%	
	Iso:	0 to 30%	
	Hal:	0 to 30%	
	awRR:	2 to 100 rpm	
Resolution	CO_2:	1 mmHg	
	awRR:	1 rpm	
Full accuracy	Gases	Range ($\%_{REL}$)	Accuracy ($\%_{ABS}$)
	CO_2	0 to 1	±0.1
		1 to 5	±0.2
		5 to 7	±0.3
		7 to 10	±0.5
		>10	Not specified
	N_2O	0 to 20	±2
		20 to 100	±3
	O_2	0 to 25	±1
		25 to 80	±2
		80 to 100	±3
	Des	0 to 1	±0.15
		1 to 5	±0.2
		5 to 10	±0.4
		10 to 15	±0.6
		15 to 18	±1
		>18	Not specified
	Sev	0 to 1	±0.15
		1 to 5	±0.2
		5 to 8	±0.4
		>8	Not specified
	Enf, Iso, Hal	0 to 1	±0.15
		1 to 5	±0.2
		>5	Not specified
	awRR	2 to 60 rpm	±1 rpm
		>60 rpm	Not specified

Accuracy drift	Meet the requirement for measurement accuracy within 6 hours			
Apnea alarm time	10 s, 15 s, 20 s, 25 s, 30 s, 35 s, 40 s			
Refreshing rate	1 s			
Response time	Using the DRYLINE™ water trap and neonatal DRYLINE™ sampling line (2.5m):			
		120 ml/min	90 ml/min	70 ml/min
	CO_2	≤4S s	≤ 4.5 s	≤5 s
	N_2O	≤4.2 s	≤5 s	≤5.5 s
	O_2	≤4 s	≤5 s	≤6 s
	Hal, Iso, Sev, Enf	≤4.4 s	≤5.2 s	≤6 s
	Des	≤4.4 s	≤5 s	≤6 s
	Using the DRYLINE™ water trap and adult DRYLINE™ sampling line (2.5m)			
		200 ml/min	150 ml/min	120 ml/min
	CO_2	≤4.2 s	≤4.8 s	≤5.5 s
	N_2O	≤4.3 s	≤5 s	≤5.8 s
	O_2	≤4 s	≤4.6 s	≤5.5 s
	Hal, Iso, Sev, Enf, Des	≤4.5 s	≤5.2 s	≤6 s
Anesthetic agent limit	Primary anesthetic agent In full accuracy mode: 0.15%,			
	Second anesthetic agent: In full accuracy mode: 0.3% or 5% REL (10% in ISO accuracy mode) of primary agent if primary agent is greater than 10%			

Effect of interference gases on AG measurements					
Gas	**Concentration(%)**	**Quantitive effect(%ABS)[3)]**			
		CO_2	**N_2O**	**Agent [1)]**	**O_2**
CO_2	/	/	0.1	0	0.2
N_2O	/	0.1	/	0.1	0.2
Agent [1) 2)]	/	0.1	0.1[5]	0.1[4]	1.0
Xenon	<100%	0.1	0	0	/
Helium	<50%	0.1	0	0	/
Ethanol	<0.1%	0	0	0	/
Acetone	<1%	0.1	0.1	0	/
Methane	<1%	0.1	0.1	0	/
Saturated Isopropanol vapour	/	0.1	0	0	/
O_2	/	0.1	0.1	0.1	/

1) Agent represents one of Des, Iso, Enf, Sev, and Hal.

2) Multiple agent interference on CO_2, N_2O and O_2 is typically the same as single agent interference.

3) For CO_2, N_2O and Agents, maximum interference from each gas at concentrations within specified accuracy ranges for each gas. The total interference of all gases is never larger than $5\%_{REL}$.

4) Applicable to type A AG module, representing the interference effect of secondary anesthetic agents on primary anesthetic agent.

5) Measurement interference to type M AG module originates from the applied anesthetic agent that is configured manually.

Alarm limit	Range		Step
$EtCO_2$ High	(low limit + 2) to 99 mmHg		1 mmHg
$EtCO_2$ Low	1to (high limit - 2)mmHg		
$FiCO_2$ High	1 to 99 mmHg		
awRR High	Adult, pediatric: Neonate:	(low limit + 2) to 100 rpm (low limit + 2) to 150 rpm	1 rpm
awRR Low	0 to (high limit - 2)rpm		
EtO_2 High	(low limit + 2) to 100 %		0.1%
EtO_2 Low	0 to (high limit - 2)%		
FiO_2 High	(low limit + 2) to 100 %		
FiO_2 Low	18 to (high limit - 2)%		
EtN_2O High	(low limit + 2) to 100 %		1%
EtN_2O Low	0 to (high limit - 2)%		
FiN_2O High	(low limit + 2) to 100 %		
FiN_2O Low	0 to (high limit - 2)%		
EtHal/Enf/Iso High	(low limit + 0.2) to 5.0 %		0.1%
EtHal/Enf/Iso Low	0 to (high limit - 0.2)%		
FiHal/Enf/Iso High	(low limit + 0.2) to 5.0 %		
FiHal/Enf/Iso Low	0 to (high limit - 0.2)%		
EtSev High	(low limit + 0.2) to 8.0 %		0.1%
EtSev Low	0 to (high limit - 0.2)%		
FiSev High	(low limit + 0.2) to 8.0 %		
FiSev Low	0 to (high limit - 0.2)%		
EtDes High	(low limit + 0.2) to 18.0 %		0.1%
EtDes Low	0 to (high limit - 0.2)%		
FiDes High	(low limit + 0.2) to 18.0 %		
FiDes Low	0 to (high limit - 0.2)%		

FOR YOUR NOTES

B 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 monitor 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.**

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		

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.			
[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 than3 V/m.			

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.			

C Default Configurations

This chapter lists some of the most important factory default settings for each department 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.

C.1 Parameters Configuration

C.1.1 ECG

ECG Setup

Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
Alm Source	Yes	Yes	HR
Alarm	Yes	Yes	On
Alm Lev	Yes	Yes	Med
HR/PR High	Yes	Yes	Adu: 120
			Ped: 160
			Neo: 200
HR/PR Low	Yes	Yes	Adu: 50
			Ped: 75
			Neo: 100
Gain	Yes	Yes	X1
Sweep	Yes	Yes	25 mm/s
Filter	Yes	Yes	General: Monitor OR: Surgery ICU, NICU: Monitor CCU: Diagnostic
QRS Volume	Yes	Yes	General, OR: 2 ICU, NICU, CCU: 1
QRS threhold	No	Yes	0.16 mV
Lead Set	Yes	Yes	Auto (if auto lead detection is available); 5-lead (if auto lead detection is not available)
ECG Display	Yes	Yes	Normal
Notch Filter	Yes	Yes	Weak
Paced	No	Yes	No
Pacer Reject	No	Yes	Off
Smart Lead Off	Yes	Yes	On

QT/QTc Analysis

Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
QT Analysis	Yes	Yes	Off
QTc Formula	Yes	Yes	Hodges
Analysis lead	Yes	Yes	All
QTc Alarm	Yes	Yes	Off
ΔQTc Alarm	Yes	Yes	Off
QTc Alarm Level	Yes	Yes	Med
ΔQTc Alarm Level	Yes	Yes	Med
QTc Record	Yes	Yes	Off
ΔQTc Record	Yes	Yes	Off

Arrh. Analysis

Arrhythmia Threshold Settings			
Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
PVCs High	Yes	Yes	10
Asys. Delay	Yes	Yes	5
Vtac Rate	Yes	Yes	130
Vtac PVC	Yes	Yes	6
Multif. PVC's Window	Yes	Yes	15
Tachy High	Yes	Yes	Adu: 120 Ped: 160
Brady Low	Yes	Yes	Adu: 50 Ped: 75
Extreme Tachy	Yes	Yes	Adu: 160 Ped: 180
Extreme Brady	Yes	Yes	Adu: 35 Ped: 50
Vbrd Rate	Yes	Yes	40
Vbrd PVCs	Yes	Yes	5
Pause Time	Yes	Yes	2

Arrhythmia Alarm Settings			
	Configurable		Default
	In Config Mode	In Monitor Mode	Alarm Switch

Arrhythmia Alarm Settings				
Item Name	**Configurable**		**Default**	
PVCs/min Alarm	Yes	Yes	General, OR, ICU, NICU: Off CCU: On	Med
R on T Alarm	Yes	Yes	General, OR, ICU, NICU: Off CCU: On	Med
Run PVCs Alm Lev Alarm	Yes	Yes	Off	Low
Couplet Alarm	Yes	Yes	Off	Message
Multif. PVC Alarm	Yes	Yes	Off	Med
PVC Alarm	Yes	Yes	Off	Message
Bigeminy Alarm	Yes	Yes		

C.1.3 PR

Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
Alarm	Yes	Yes	On
Alm Lev	Yes	Yes	Med
HR/PR High	Yes	Yes	Adu: 120
			Ped: 160
			Neo: 200
HR/PR Low	Yes	Yes	Adu: 50
			Ped: 75
			Neo: 100
PR Source	Yes	Yes	SpO_2
Alm Source	Yes	Yes	HR
Beat Vol	Yes	Yes	General, OR: 2 ICU, NICU, CCU: 1

C.1.4 SpO_2

Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
Alarm	Yes	Yes	On
Alm Lev	Yes	Yes	SpO_2: Med Desat: High
	Yes	Yes	Adu, Ped: 100
			Neo:95
SpO_2 Low	Yes	Yes	90
Desat	Yes	Yes	80
Sensitivity (Masimo)	Yes	Yes	Normal
Averaging (Masimo)	Yes	Yes	8 s
Sat-Seconds (Nellcor)	Yes	Yes	0 s
Sweep	Yes	Yes	25 mm/s
NIBP Simul	No	Yes	Off

C.1.5 Temp

Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
Alarm	Yes	Yes	On
Alm Lev	Yes	Yes	Med
T1/T2 High (°C)	Yes	Yes	38.0

C.1.6 NIBP

Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
Alarm	Yes	Yes	On
Alm Lev	Yes	Yes	Med

C.1.7 IBP

Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
Alarm	Yes	Yes	On
Alm Lev	Yes	Yes	Med
P1 Measure	Yes	Yes	All
P2 Measure	Yes	Yes	All
P3 Measure	Yes	Yes	Mean
P4 Measure	Yes	Yes	Mean
PPV Measurement	Yes	Yes	Off
PPV Source	Yes	Yes	Auto
Sensitivity	Yes	Yes	Med
Sweep	Yes	Yes	25 mm/s
Filter	Yes	Yes	12.5 Hz
Gridlines	Yes	Yes	Off
Art, Ao, UAP, BAP, FAP, LV, P1-P2 Arterial Pressure Alarm Limits			
IBP-S High (mmHg)	Yes	Yes	Adu: 160 Ped: 120 Neo: 90
IBP-S Low (mmHg)	Yes	Yes	Adu: 90 Ped: 70 Neo: 55
IBP-M High (mmHg)	Yes	Yes	Adu: 110 Ped: 90 Neo: 70
IBP-M Low (mmHg)	Yes	Yes	Adu: 70 Ped: 50 Neo: 35
IBP-D High (mmHg)	Yes	Yes	Adu: 90 Ped: 70 Neo: 60
IBP-D Low (mmHg)	Yes	Yes	Adu: 50 Ped: 40 Neo: 20
PA Alarm Limit			
PA-S High (mmHg)	Yes	Yes	Adu: 35 Ped, Neo: 60
PA-S Low (mmHg)	Yes	Yes	Adu: 10 Ped, Neo: 24

Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
PA-M High (mmHg)	Yes	Yes	Adu: 20 Ped, Neo: 26
PA-M Low (mmHg)	Yes	Yes	Adu: 0 Ped, Neo: 12
PA-D High (mmHg)	Yes	Yes	Adu: 16 Ped, Neo: 4
PA-D Low (mmHg)	Yes	Yes	Adu: 0 Ped, Neo: -4
CVP, LAP, RAP, ICP, UVP, P3-P4 Venous Pressure Alarm Limits			
IBP-M High (mmHg)	Yes	Yes	Adu: 10 Ped, Neo: 4
IBP-M Low (mmHg)	Yes	Yes	0
Art, Ao, BAP, FAP, LV, P1-P2 Arterial Pressure Scale			
Scale (mmHg)	Yes	Yes	0-160
PA Waveform Scale			
Scale (mmHg)	Yes	Yes	0-30
CVP, LAP, RAP, ICP, UVP Scale			
Scale (mmHg)	Yes	Yes	0-20
UAP, P3-P4 Venous Pressure Scale			
Scale (mmHg)	Yes	Yes	0-80
IBP Overlapping Left Scale			
Scale (mmHg)	Yes	Yes	0-160
IBP Overlapping Right Scale			
Scale (mmHg)	Yes	Yes	0-20

C.1.8 C.O.

Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
Alarm	Yes	Yes	On
Alm Lev	Yes	Yes	Med
TB High ℃	Yes	Yes	39.0
TB Low ℃	Yes	Yes	36.0
Comp. Const	Yes	Yes	0.542
Auto TI	Yes	Yes	Auto
Manual TI ℃	Yes	Yes	2.0
Measuring mode	Yes	Yes	Manual

Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
FiN_2O Low	Yes	Yes	0
EtHal/Enf/Iso High	Yes	Yes	3.0
EtHal/Enf/Iso Low	Yes	Yes	0.0
FiHal/Enf/Iso High	Yes	Yes	2.0
FiHal/Enf/Iso Low	Yes	Yes	0.0
EtSev High	Yes	Yes	6.0
EtSev Low	Yes	Yes	0.0
FiSev High	Yes	Yes	5.0
FiSev Low	Yes	Yes	0.0
EtDes High	Yes	Yes	8.0
EtDes Low	Yes	Yes	0.0
FiDes High	Yes	Yes	6.0
FiDes Low	Yes	Yes	0.0

C.2 Routine Configuration

C.2.1 Alarm

Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
Alm Volume	Yes	Yes	General: 2 2 OR: 1 ICU, NICU, CCU: 2
Reminder Vol	Yes	Yes	Low
Recording Length	Yes	Yes	16 s
Apnea Delay	Yes	Yes	Adu, Ped: 20s Neo: 15 s
Alarm Delay	Yes	Yes	6 s
VTac Latching	No	Yes	On

C.2.2 Screens

Item Name		Configurable		Default
		In Config Mode	In Monitor Mode	
Choose Screen		Yes	Yes	Normal Screen
Select Wave Sequence for Normal Screen	1	Yes	Yes	ECG1
	2			ECG2
	3			SpO_2+PR
	4			Any IBP
	5			Any IBP
	6			CO_2
	7			Resp
Select Parameters for Big Numerics Screen	Parameter 1	Yes	Yes	ECG
	Parameter 2			SpO_2+PR
	Parameter 3			Resp
	Parameter 4			NIBP

Item Name		Select QuickKeys
O.M	C	Yes
	M	No
General		NIBP Measure Stop All Zero IBP Review Standby Screens Patient Setup Manual Event Realtime Print Volume Setup
OR		
ICU		
NICU		NIBP Measure Stop All oxyCRG Review Standby Screens Patient Setup Manual Event Realtime Print Volume Setup
CCU		NIBP Measure Stop All Zero IBP Review Standby Screens Patient Setup Manual Event Realtime Print Volume Setup
User Defaults		

C.2.3 Parameter/Wave Color

Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
ECG			Green
NIBP			White

No Yes

Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
LAP			Purple
RAP			Orange
UVP			Cyan
CO_2			Yellow
RESP			Yellow
AA			Yellow
N_2O			Blue
O_2			Green
Hal			Red
Enf			Orange
Iso			Purple
Des			Cyan
Sev			Yellow
C.O.			White

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		Configurable		Default
		In Config Mode	In Monitor Mode	
Tabular Trends	Interval	No	Yes	General: 30 min OR: 5 min ICU, NICU, CCU: 30 min
	Trend Group	No	Yes	Standard
Graphic Trends	Trend Group	No	Yes	Standard
	Zoom	No	Yes	90 min
	Waves	No	Yes	2
Minitrend Length		No	Yes	2 h
Full Disclosure	Save Waves	No	Yes	Save ECG1 by default.
	Gain	No	Yes	x 1
	Sweep	No	Yes	25 mm/s

C.2.5 Event

Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
Waveform 1	No	Yes	II
Waveform 2	No	Yes	General, OR, ICU, CCU: I NICU Pleth
Waveform 3	No	Yes	General, OR, ICU, CCU: Pleth NICU Resp

C.2.9 Others

Item Name		Configurable		Default
		In Config Mode	In Monitor Mode	
Brightness		No	Yes	5
Key Volume		No	Yes	2
View Other Patient	Auto Alarm	No	Yes	On

C.3 User Maintenance Items

Item Name	Configurable		Default
	In Config Mode	In Monitor Mode	
		Yes	Protected
		Yes	[redacted]
		Yes	cm

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 section ***7.8 Resetting Alarms*** for details.
- The "Level" 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, 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 too weak for the monitor to 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	
	Extreme Brady	H	
	R on T	M*	
	Run PVCs	M*	
	Couplet	M*	
	PVCs/min	M*	
	Bigeminy	M*	
	Trigeminy	M*	

Measurement	Alarm messages	L	Cause and solution
	Tachy	M*	
	Brady	M*	
	Missed Beat	M*	

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-

Measurement	Alarm message	L	I	Cause and solution
	SpO_2 No Sensor	L	B	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 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 No Pulse	L	C	
	SpO_2 Interference	L	C	The SpO_2 signal has been interfered. Check for any possible sources of signal noise around the sensor and check the patient for great motion.
	SpO_2 Comm Abnormal	H	A	An error occurred to the SpO_2 measurement module, or there is a problem with the communications between the module and the monitor. Restart the monitor. If the error remains, contact your service personnel.
	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.
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 categor 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.

Measurement	Alarm message	L	I	Cause and solution
	NIBP Excessive Motion	L	A	Check the patient's condition and reduce thepatient 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	XX Sensor Off	M*	A	Check the sensor connection and reconnect the sensor.
	XX 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.
	XX Sensor Fault	M	C	Replace the sensor.
	XX No Pulse	L	A	The catheter may be occluded. Please flush the catheter.
	XX 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 Airway High Press.	L	C	An error occurred in the airway pressure. Check the patient connection and patient circuit, and then restart the monitor.
	CO_2 Airway Low Press.	L	C	
	CO_2 High Barometric Press.	L	C	Check the CO_2 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 Press.	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.

Measurement	Alarm message	L	I	Cause and solution
	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. Re-plug the module or restart the monitor.
	CO_2 Checking Sensor	L	C	
	CO_2 Replace Scrubber&Pump	L	C	
	CO_2 15V Overrange	H	C	
	CO_2 Hardware Err	H	C	
AG	AG No Watertrap	L	B	Check the connections of the watertrap and re-connect it.
	AG Change Watertrap	L	A	Wait until the change is completed.
	AG Watertrap Type Wrong	L	A	Make sure that a correct watertrap has been used.
	O_2 Accuracy Unspecified	L	A	The measured value has exceeded the specified accuracy range.
	N_2O Accuracy Unspecified	L	A	
	CO_2 Accuracy Unspecified	L	A	
	Enf Accuracy Unspecified	L	A	
	Iso Accuracy Unspecified	L	A	
	Sev Accuracy Unspecified	L	A	
	Hal Accuracy Unspecified	L	A	
	Des Accuracy Unspecified	L	A	
	awRR Accuracy Unspecified	L	A	
	AG Hardware Err	H	A	Remove the AG module. Stop using the module and contact your service personnel.
	AG Airway Occluded	L	A	Check the airway and remove the occlusion.
	AG Zero Failed	L	A	Re-plug the module or restart the monitor, and then perform a zero calibration again.
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	
	3.3 Too Low	H	C	

Measurement	Alarm message	L	I	Cause and solution
	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 Power 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 supply. Restart the monitor.
	Recorder Vlt Low	L	C	
	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	IP Address Conflict	L	A	Set a new IP address.
	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.
	Restoring Last Config. Failed	L	A	Restart the monitor. If the problem persists, there may be an EEPROM failure. Contact your service personnel.
	Loading Default Config. Failed.	L	A	Restart the monitor. If the problem persists, there may be an EEPROM failure. Contact your service personnel.
	USB Drive Err	M	A	1. Disconnect the USB memory and reconnect it properly. 2. If the problem persists, format the USB memory. If the problem still persists, replace the USB drive.
	Storage Card Err	M	C	Restart the monitor. If the problem persists, format the SD card.

E Symbols and Abbreviations

E.1 Symbols

µA	microampere
µV	microvolt
µs	Microsecond
A	ampere
Ah	ampere hour
bpm	beat per minute
bps	bit per second
ºC	centigrade
cc	cubic centimeter
cm	centimeter
dB	decibel
DS	dyne second
ºF	fahrenheit
g	gram
GHz	gigahertz
GTT	gutta
h	hour
Hz	hertz
in	inch
kg	kilogram
kPa	kilopascal
L	litre
lb	pound
m	meter
mAh	milliampere hour
Mb	mega byte
mcg	microgram
mEq	milli-equivalents
mg	milligram
min	minute
ml	milliliter
mm	millimeter
mmHg	millimeters of mercury
cmH2O	centimeters of water
ms	millisecond
mV	millivolt
mW	milliwatt
MΩ	megaohm
nm	nanometer

rpm	breath per minute
s	second
V	volt
VA	volt ampere
Ω	ohm
W	watt
–	minus, negative
%	percent
/	per; divide; or
+	plus
=	equal to
<	less than
>	greater than
≤	less than or equal to
≥	greater than or equal to
±	plus or minus
×	multiply

E.2 Abbreviations

$AaDO_2$	alveolar-arterial oxygen gradient
AAMI	Association for Advancement of Medical Instrumentation
AC	alternating current
ACI	acceleration index
Adu	adult
AG	anaesthesia gas
AHA	American Heart Association
ANSI	American National Standard Institute
Ao	aortic pressure
Art	arterial
aVF	left foot augmented lead
aVL	left arm augmented lead
aVR	right arm augmented lead
awRR	airway respiratory rate
BAP	brachial arterial pressure
BIS	bispectral index
BP	blood pressure
BPSK	binary phase shift keying
BSA	body surface area
BT	blood temperature
BTPS	body temperature and pressure, saturated
C.I.	cardiac index
CCI	Continuous Cardiac Index
C.O.	cardiac output

CCO	Continuous Cardiac Output
CaO_2	arterial oxygen content
CCU	cardiac (coronary) care unit
CFI	cardiac function index
CIS	Clinical Information System
CISPR	International Special Committee on Radio Interference
CMOS	complementary metal oxide semiconductor
CO_2	carbon dioxide
COHb	carboxyhemoglobin
CP	cardiopulmonary
CPI	cardiac power index
CPO	Cardiac Power Output
CVP	central venous pressure
DC	direct current
Des	desflurane
Dia	diastolic
DIAP	Datascope Improved ASCII Protocol
DPI	dot per inch
dPmx	left ventricular contractility
DVI	digital video interface
DO_2	oxygen delivery
DO_2I	oxygen delivery index
ECG	electrocardiograph
EDV	end-diastolic volume
EEC	European Economic Community
EEG	electroencephalogram
EMC	electromagnetic compatibility
EMG	electromyography
EMI	electromagnetic interference
Enf	enflurane
ESU	electrosurgical unit
Et	end-tidal
$EtCO_2$	end-tidal carbon dioxide
EtN_2O	end-tidal nitrous oxide
EtO	ethylene oxide
EtO_2	end-tidal oxygen
EVLW	extravascular lung water
ELWI	extravascular lung water index
FAP	femoral arterial pressure
FCC	Federal Communication Commission
FDA	Food and Drug Administration
FEV1.0%	first second forced expiratory volume ratio
Fi	fraction of inspired
$FiCO_2$	fraction of inspired carbon dioxide
FiN_2O	fraction of inspired nitrous oxide
FiO_2	fraction of inspired oxygen

FPGA	field programmable gate array
FV	flow-volume
GEDV	global end diastolic volume
GEDI	global end diastolic volume index
GEF	global ejection fraction
Hal	halothane
Hct	haematocrit
Hb	hemoglobin
Hb-CO	carbon mono-oxide hemoglobin
HbO_2	oxyhemoglobin
HIS	hospital information system
HR	heart rate
I:E	inspiratory-expiratory ratio
IBP	invasive brood pressure
ICG	impedance cardiography
ICP	intracranial pressure
ICT/B	intracranial catheter tip pressure transducer
ICU	intensive care unit
ID	identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
Ins	inspired minimum
IP	internet protocol
Iso	isoflurane
IT	injectate temperature
ITBI	Intrathoracic Blood Volume Index
ITBV	Intrathoracic Blood Volume
LA	left arm
LAP	left atrial pressure
Lat	lateral
LCD	liquid crystal display
LCW	left cardiac work
LCWI	left cardiac work index
LED	light emitting diode
LL	left leg
LVD	low voltage directive
LVDS	low voltage differential signal
LVET	left ventricular ejection time
LVSW	left ventricular stroke work
LVSWI	left ventricular stroke work index
MAC	minimum alveolar concentration
Art mean	mean arterial pressure
MDD	Medical Device Directive
MetHb	methemoglobin
MRI	magnetic resonance imaging
MRN	medical record number

MVe	expiratory minute volume
MVi	inspiratory minute volume
N/A	not applied
N_2	nitrogen
N_2O	nitrous oxide
Neo	neonate
NIBP	noninvasive blood pressure
O_2	oxygen
O_2CI	oxygen consumption index
O_2R	oxygen extraction ratio
OR	operating room
OxyCRG	oxygen cardio-respirogram
PA	pulmonary artery
pArt-D	diastolic artery pressure
pArt-M	mean artery pressure
pArt-S	systolic artery pressure
[redacted]	
PD	photodetector
[redacted]	9.8 (s)7.6 ((W)-81.1 (P)]TJ00 Tc 0 Tw 2.342 0 Td( )TjE

[redacted]

RSBI	rapid shallow breathing index
SaO_2	arterial oxygen saturation
SEF	spectral edge frequency
Sev	sevoflurane
SFM	self-maintenance
SI	stroke index
SMR	satellite module rack
SpO_2	arterial oxygen saturation from pulse oximetry
SQI	signal quality index
SR	suppression ratio
STR	systolic time ratio
SV	stroke volume
SVI	Stroke Volume Index
SVR	systemic vascular resistance
SVRI	systemic vascular resistance index
SVV	stroke volume variation
SvO_2	mixed venous oxygen saturation
$ScvO_2$	central venous oxygen saturation
Sync	synchronization
Sys	systolic pressure
Taxil	axillary temperature
TB	Blood Temperature
TD	temperature difference
Temp	temperature
TFC	thoracic fluid content
TFI	thoracic fluid index
TFT	thin-film technology
Toral	oral temperature
TP	total power
Trect	rectal temperature
TVe	expiratory tidal volume
TVi	inspiratory tidal volume
UAP	umbilical arterial pressure
UPS	uninterruptible power supply
USB	universal serial bus
UVP	umbilical venous pressure
VAC	volts alternating current
VEPT	volume of electrically participating tissue
VI	velocity index
VO_2	oxygen consumption
VO_2I	oxygen consumption index
WLAN	wireless local area network
WPA	Wi-Fi protected access

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