BeneVision N1

Patient Monitor

Operator’s Manual

CE 0123

Release time: June 2019

Revision: 10.0

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- the electrical installation of the relevant room complies with the applicable national and local requirements;
- the product is used in accordance with the instructions for use.

WARNING

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

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Preface

Manual Purpose

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

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

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

Intended Audience

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

Illustrations

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

Conventions

- *Italic text* is used in this manual to quote the referenced manuals, chapters, sections and formulas.
- **Bold text** is used to indicate the screen texts and names of hard keys.
- → is used to indicate operational procedures.

Contents

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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

WARNING

- **This equipment is used for single patient at a time.**
- **To avoid explosion hazard, do not use the equipment in the presence of oxygen-rich atmospheres, flammable anesthetics, or other flammable agents.**
- **Use and store the equipment in specified environmental condition. The monitor and accessories may not meet the performance specification due to aging, stored or used outside the specified temperature and humidity range.**
- **The equipment is not intended to be used within the Magnetic Resonance (MR) environment.**
- **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.**
- **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, the equipment must only be connected to mains power with protective earth. If a protective earth conductor is not provided, operate it on battery power, if possible.**
- **Do not use the multiple portable socket outlets (MPSO) or AC mains extension cords. Insure that the sum of the individual ground leakage currents does not exceed the allowable limits.**
- **Do not touch the patient and live parts simultaneously. Otherwise patient injury may result.**
- **Do not come into contact with the patient during defibrillation. Otherwise serious injury or death could result.**
- **Do not open the equipment housings. All servicing and future upgrades must be carried out by trained and authorized personnel.**
- **Do not rely exclusively on the audible alarm system for patient monitoring. Turning the 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 patient situations. Always keep the patient under close surveillance.**
- **Do not place the equipment or accessories in any position that might cause it to fall on the patient.**
- **Do not start or operate the equipment unless the setup was verified to be correct.**

- **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.**
- **The equipment should not be used as the sole basis for medical decisions. It must be used in conjunction with clinical signs and symptom.**
- **If any measurement seems questionable, first check the patient's vital signs by alternate means and then check the equipment for proper functioning.**
- **The physiological data and alarm messages displayed on the equipment are for reference only and cannot be directly used for diagnostic interpretation.**
- **Route, wrap and secure the cables to avoid inadvertent disconnection, stumbling and entanglement.**
- **The equipment should not be used as the sole basis for medical decisions. It must be used in conjunction with clinical signs and symptom. If any measurement seems questionable, first check the patient's vital signs by alternate means and then check the equipment for proper functioning.**
- **The software equipment copyright is solely owned by Mindray. No organization or individual shall resort to modifying, copying, or exchanging it or to any other infringement on it in any form or by any means without due permission.**

1.1.2 Cautions

CAUTION

- **Use only parts and accessories specified in this manual.**
- **Ensure that the equipment is supplied with continuous electric power during work. Sudden power failure may cause data loss.**
- **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.**
- **Always install or carry the equipment properly to avoid damage caused by drop, impact, strong vibration or other mechanical force.**
- **Dry the equipment immediately in case of rain or water spray.**
- **Some settings are password protected and can only be changed by authorized personnel. Contact your department manager or biomedical engineering department for the passwords used at your facility.**
- **Do not loop the patient cabling into a tight coil or wrap around the device, as this can damage the patient cabling.**
- **Dispose of the package material as per the applicable waste control regulations. Keep it out of children's reach.**
- **At the end of its service life, the equipment, as well as its accessories, must be disposed of in compliance with the guidelines regulating the disposal of such products. If you have any questions concerning disposal of the equipment, please contact us.**

1.1.3 Notes

NOTE

- **Put the equipment in a location where you can easily view and operate the equipment.**
- **The equipment use a mains plug as isolation means to the mains power. Do not locate the equipment in a place difficult to operate the mains plug.**
- **The typical operator's position is in front of the monitor.**
- **The software was developed in compliance with IEC62304. The possibility of hazards arising from software errors is minimized.**
- **This manual describes all features and options. Your equipment may not have all of them.**

- **Keep this manual in the vicinity of the equipment so that it can be obtained conveniently when needed.**

1.2 Equipment Symbols

Symbol	Description	Symbol	Description
	General warning sign		Refer to instruction manual/booklet
	Serial number	REF	Catalogue number
	Date of manufacture		Manufacturer
	USB connector	IPX1	Protected against vertically falling water drops per IEC 60529
IP44	IP44: protected against ingress of foreign objects no less than 1.0 mm, and against access to hazardous parts with wire; protect against harmful effects of splashing water	IP22	IP22: protected against ingress of foreign objects no less than 12.5 mm and against access to hazardous parts with finger; protected against harmful effects of vertically falling water drops with the device tilted at any angle up to 15°
	Battery indicator		Computer network
	Direct current		Alternating current
	DEFIBRILLATION-PROOF TYPE CF APPLIED PART		DEFIBRILLATION-PROOF TYPE BF APPLIED PART
	Lock; tighten		Zero key
	Locking		Unlocking
	Direction and angle off rotation		Calibration
	Start		Stop
	Equipotentiality		Polarity of d.c. power connector

Symbol	Description	Symbol	Description
	Menu		Video output
	Gas outlet		Gas inlet
	Stand-by		Input/output
	Humidity limitations		Atmospheric pressure limitations
	Temperature limitations		Non-ionizing electromagnetic radiation
	Dispose of in accordance to your country's requirements	EC REP	Authorised representative in the European Community
CE 0123	The product bears CE mark indicating its conformity with the provisions of the Council Directive 93/42/EEC concerning medical devices and fulfil the essential requirements of Annex I of this directive. Note: The product complies with the Council Directive 2011/65/EU.		Plastic identification symbol

2 Equipment Introduction

2.1 Intended Use

The BeneVision N1 Patient Monitor is intended for monitoring, displaying, reviewing, storing, alarming, and transferring of multiple physiological parameters including ECG (3-lead, 5-lead, 6-lead or 12-lead selectable, Arrhythmia Detection, ST Segment Analysis, QT/QTc Analysis, and Heart Rate (HR)), Respiration (Resp), Temperature (Temp), Pulse Oxygen Saturation (SpO_2), Pulse Rate (PR), Non-invasive Blood Pressure (NIBP), Invasive Blood Pressure (IBP), Pulmonary Artery Wedge Pressure (PAWP), Carbon Dioxide (CO_2), Oxygen (O_2), and Continuous Cardiac Output (CCO). The monitor also provides an interpretation of resting 12-lead ECG.

All the parameters can be monitored on single adult, pediatric, and neonatal patients except for the following:

- The CCO is intended for adult and pediatric patients only.

The BeneVision N1 monitor is to be used in healthcare facilities. It can also be used during patient transport with road, rotary and fixed-wing ambulances. It should be used by clinical professionals or under their guidance.

2.2 Equipment Features

The monitor is intended to be used in a hospital environment including, but not limited to, ICU, CCU, PICU, Neonatology, RICU, emergency room, operating room, postoperative observation ward, etc.

The monitor can be used in two ways:

- As a stand-alone patient monitor, or
- As a multi-parameter module (MPM) for the Mindray BeneVision N22, BeneVision N19, BeneVision N17, BeneVision N15, BeneVision N12, or BeneVision N12C patient monitor, hereafter referred to as "the host monitor".
- As a multi-parameter module (MPM) for the Mindray BeneView T5, BeneView T5 OR, BeneView T6, BeneView T8, BeneView T9 or BeneView T9 OR patient monitor, hereafter referred to as "the host monitor".

In this manual, the N1 is generally referred to as "the monitor" except in the situation describing its use with a host monitor, where it is referred to as "the N1" to distinguish it from the host monitor.

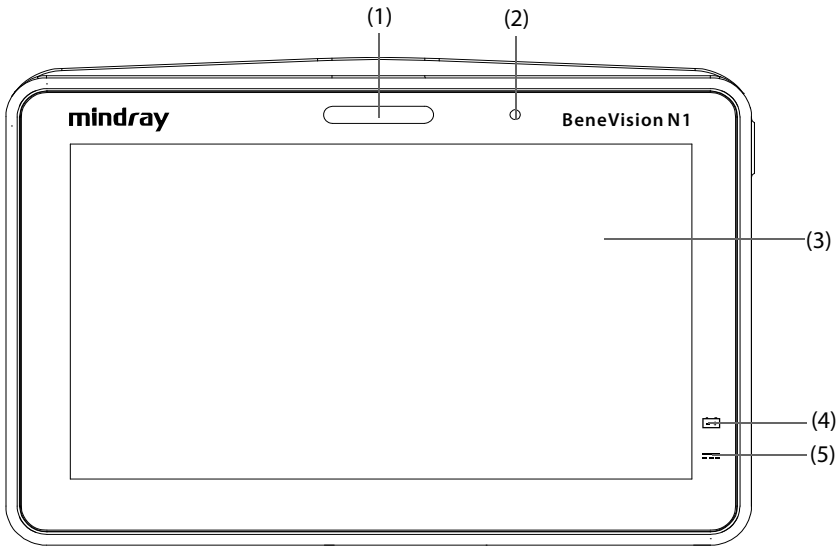
2.3 Applied Parts

The applied parts of the monitor are:

- ECG electrode and leadwire
- SpO_2 sensor
- Temp probe
- NIBP cuff
- IBP transducer
- PiCCO sensor
- CO_2 sampling line/nasal sampling cannula, water trap, and mask

2.4 Main Unit

2.4.1 Front View



(1) Alarm lamp:

When a physiological alarm or technical alarm occurs, this lamp lights and flashes corresponding with the alarm priority:

- High priority alarms: the lamp quickly flashes red.
- Medium priority alarms: the lamp slowly flashes yellow.
- Low priority alarms: the lamp lights in cyan without flashing.

(2) Ambient light sensor

When screen brightness is set to auto, the system automatically adjusts screen brightens according to the strength of ambient light.

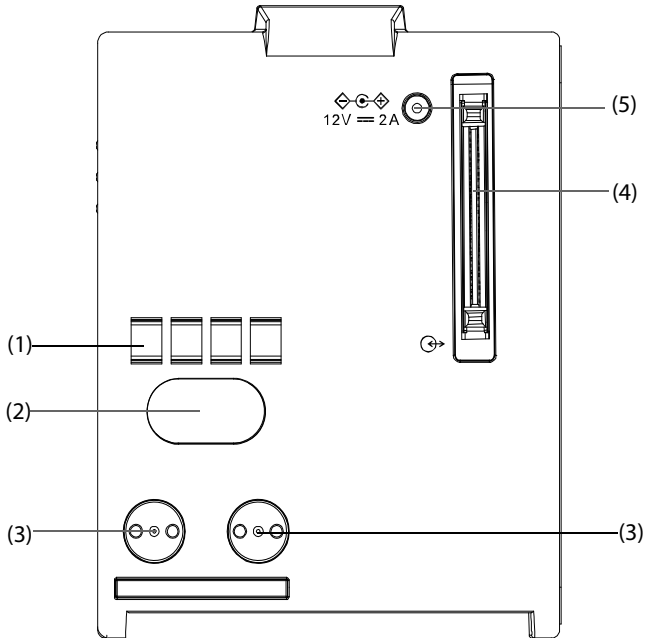
(3) Display

(4) Battery LED

(5) External power LED

- On: when external power supply is connected.
- Off: when external power supply is not connected.

2.4.2 Left View



(1) Communication interface: used for communication between the N1 and host monitor (BeneVision N series monitor).

(2) Infrared filter: used for communication between the N1 and BeneView T series monitor; used for communication between the N1 and N series monitor if the communication interface does not work.

(3) Contact: used for receiving power supply from the host monitor (BeneView T series monitor or BeneVision N series monitor).

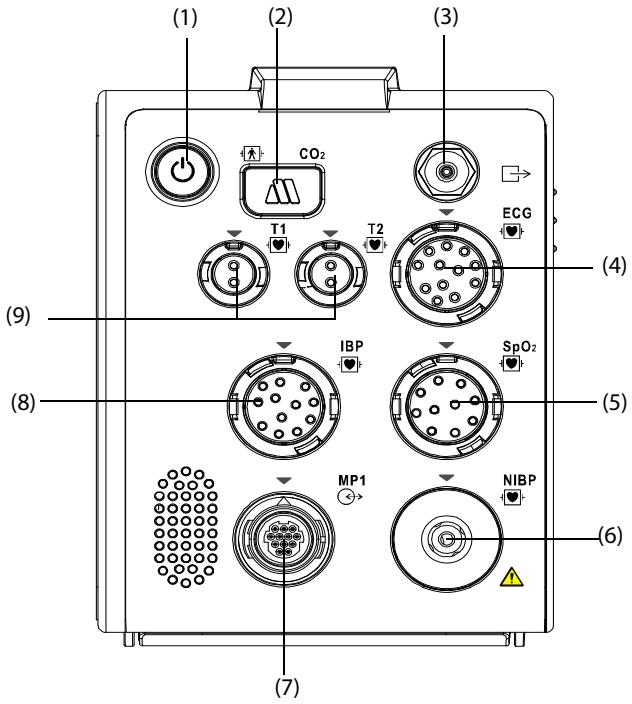
(4) Multi-pin connector: connects the N1 to the Modular Rack or Dock.

(5) External DC power input connector: connects the N1 to the AC adapter

NOTE

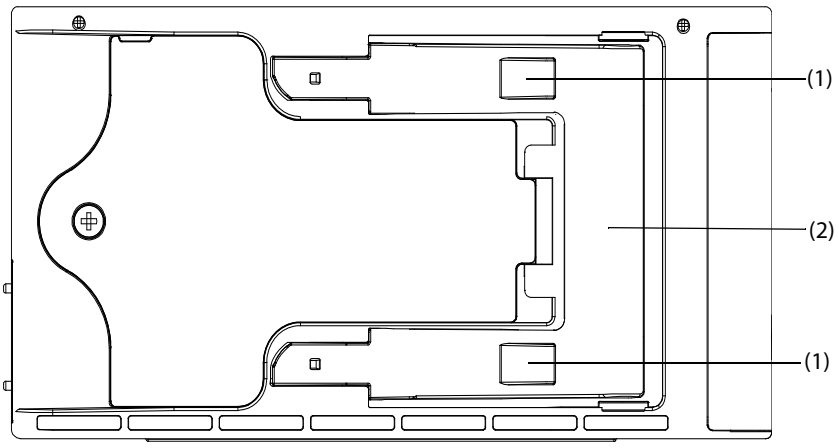
- **Dry the Multi-pin connector of the N1 before connecting the N1 to the Modular Rack or Dock in case of water spray.**

2.4.3 Right View



(1)	Power switch	(2)	Sample line connector of the sidestream CO_2	(3)	Gas outlet
(4)	ECG cable connector	(5)	SpO_2 sensor connector	(6)	NIBP cuff connector
(7)	Multifunctional connector: outputting analog and defib synchronization signal.			(8)	IBP cable connector
(9)	Temperature probe connector				

2.4.4 Bottom View



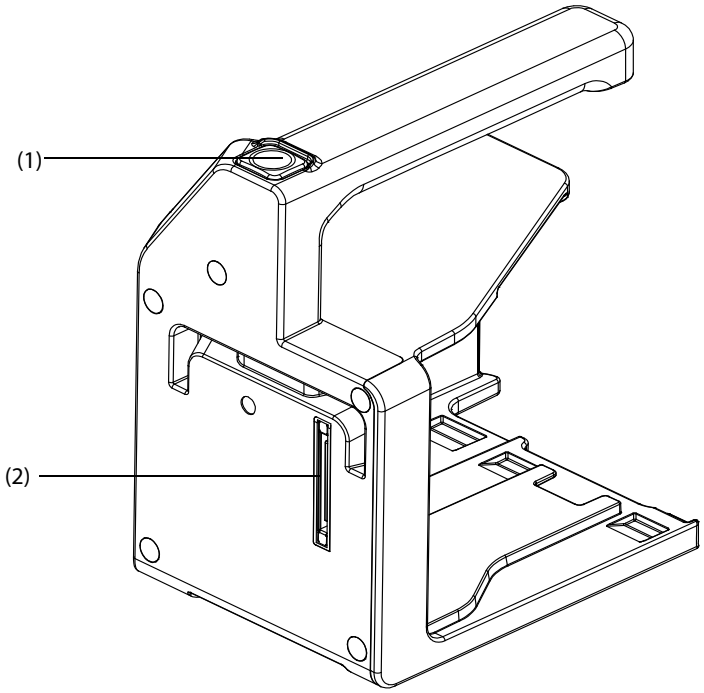
(1) Clip: fasten the N1 when N1 is in use with the host monitor, Dock or Modular Rack.

(2) Latch: locks the N1 when the N1 is in use with the host monitor, Dock or Modular Rack. Pressing here releases the N1 so that you can remove the N1 from the host monitor, Dock or Modular Rack.

2.5 Modular Rack

Modular Rack is used for connecting a N1 and an external parameter module.

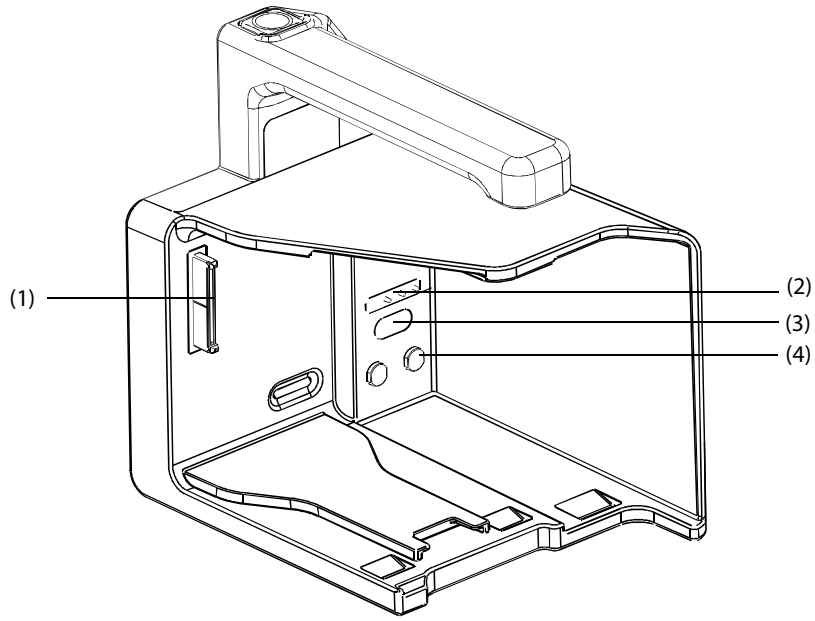
2.5.1 Left View



(1) Release button: pressing this button releases the Modular Rack from the Dock.

(2) Multi-pin connector: connects the Modular Rack and Dock.

2.5.2 Right View



(1) Multi-pin connector: connects the Modular Rack and N1.

(2) Pogo pin: used for communication between the Modular Rack and external parameter module.

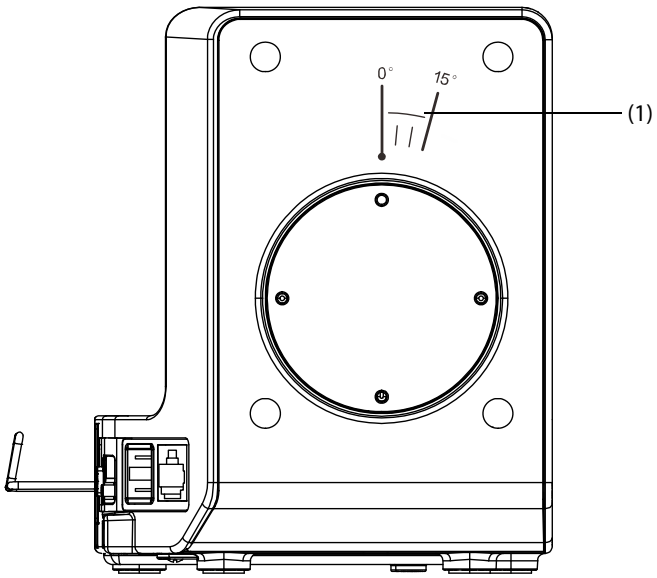
(3) Infrared filter: used for communication between the Modular Rack and external parameter module.

(4) Contact: power input connector of the external parameter module.

2.6 Dock

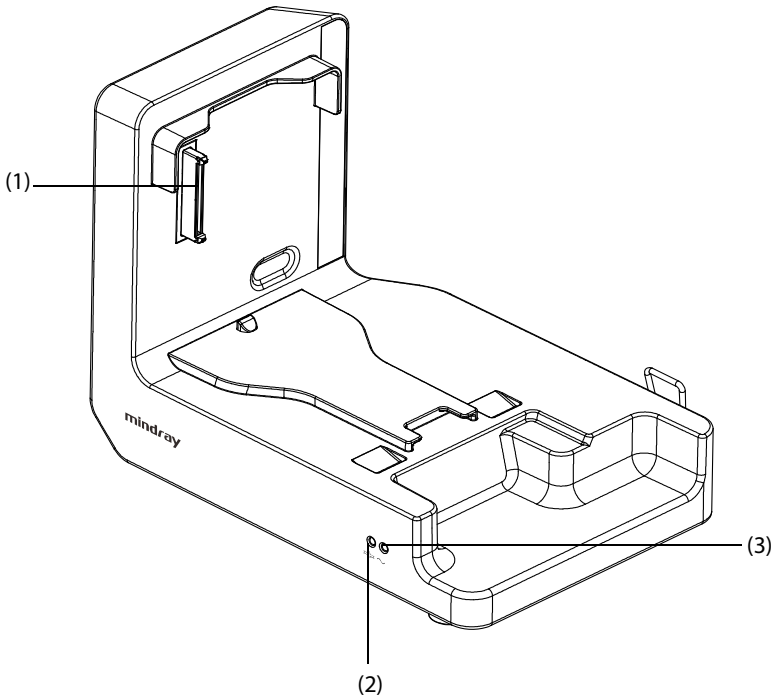
Dock is used to connect the N1 or Modular Rack.

2.6.1 Left View



(1) Symbol: indicates the direction and angle that Dock can rotate when Dock is fixed onto a transverse or a vertical rod.

2.6.2 Right View

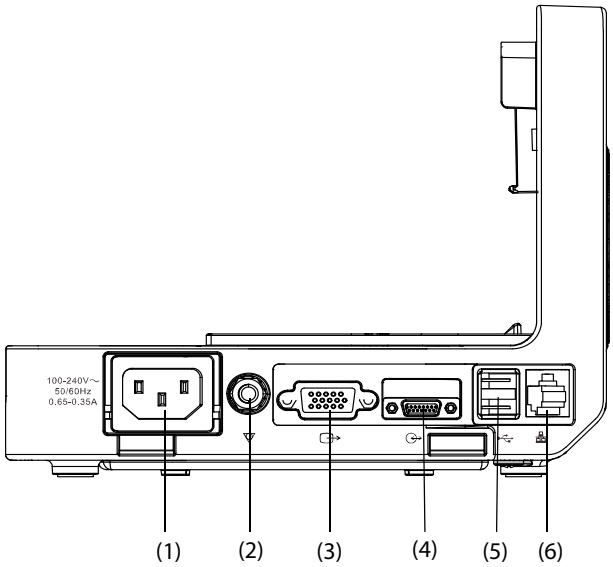


(1) Multi-pin connector: power input and communication connector of the N1.

(2) Connection status LED: it is on when the N1 is properly connected to the Dock.

(3) External power LED: it is on when the external AC power supply is connected.

2.6.3 Rear View



(1) AC Power input connector

(2) Equipotential grounding terminal: when using the monitor together with other devices, connect their equipotential grounding terminals together to eliminate the potential difference between them.

(3) VGA connector: connects the external display

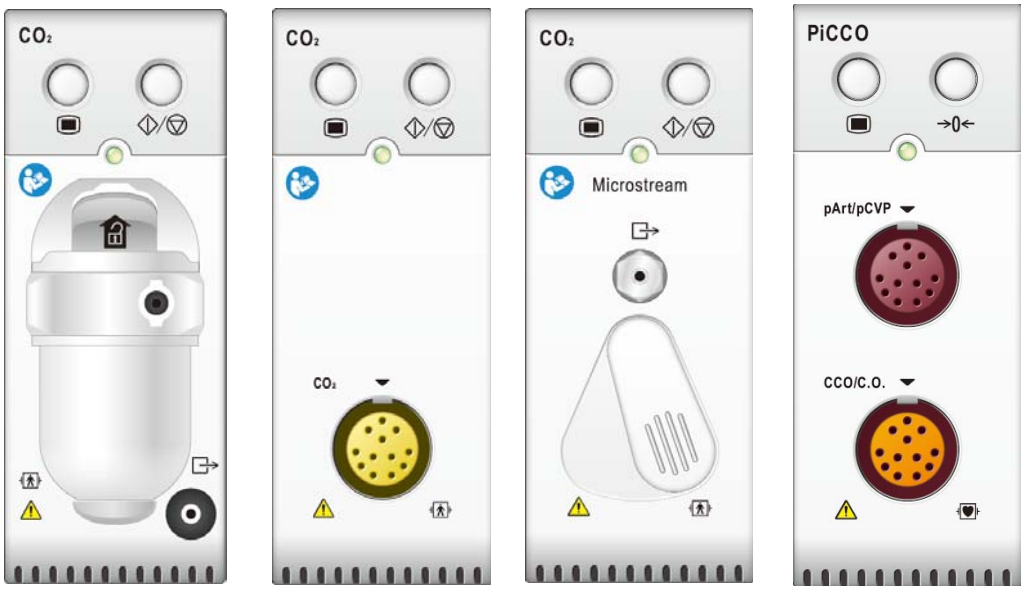
(4) Host monitor connector: connects the N1 to the host monitor.

(5) USB connector: connects USB devices.

(6) Network connector: a standard RJ45 connector.

2.7 External Parameter Modules

The monitor can connect the following external parameter modules to perform CO_2 monitoring and CCO monitoring through the Modular Rack.

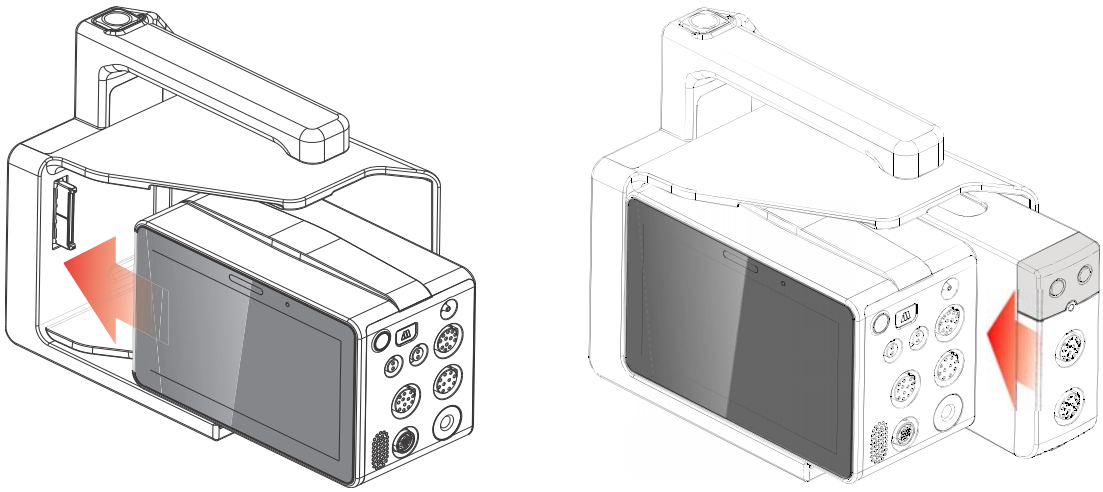


Sidestream CO_2 module Mainstream CO_2 module Microstream CO_2 module PiCCO module

2.8 Installation

2.8.1 Installing the N1 or External Parameter Module into the Modular Rack

You can install the N1 and an external parameter module, if needed, to the Modular Rack as indicated below:



Firmly push the N1 or the external module until you hear that the clip (refer to *2.4.4 Bottom View*) engages the Modular Rack. To ensure that the N1 or the external module is properly connected, try to pull the N1 or the external module outward. The N1 or the external module properly engages the Modular Rack if you cannot pull it out.

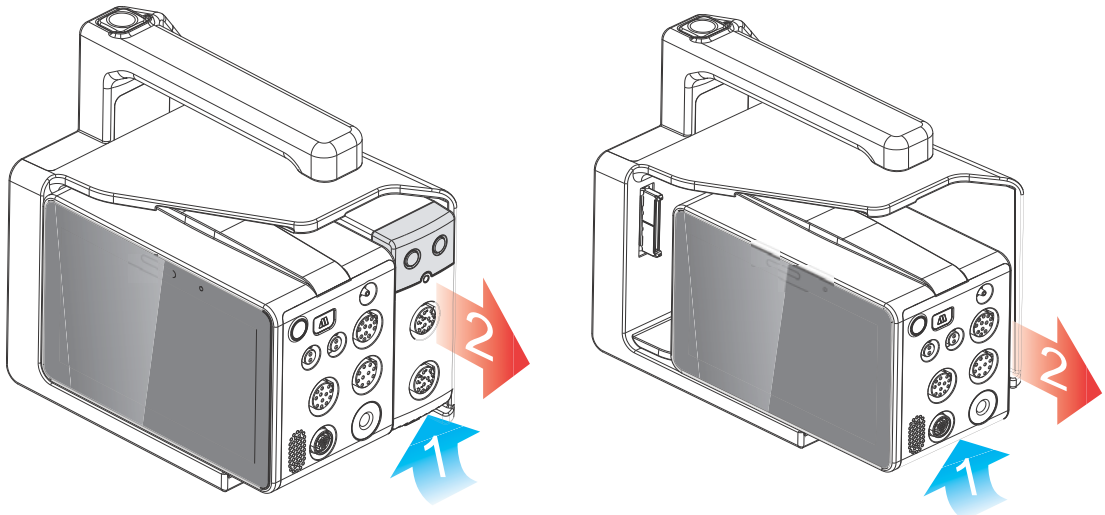
NOTE

- **To prevent N1 or the external module from falling off, after insert N1 or the external module into the Modular Rack, always check that N1 or the external module properly engages the Modular Rack.**
- **When the external module is properly installed, you should further fasten the module to the Modular Rack with the lock at the bottom of the module to ensure the engagement.**

2.8.2 Removing the N1 or External Parameter Module from the Modular Rack

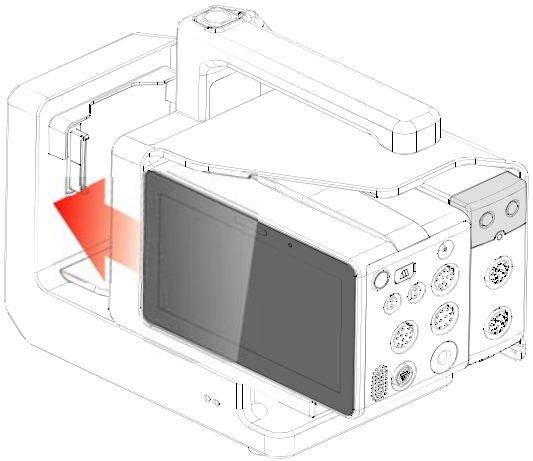
To remove the N1 or external parameter module, follow this procedure:

1. Press and hold the latch at the bottom of the N1 or parameter module. If the external module is locked to the Modular Rack, unlock it first.
2. Pull the N1 or parameter module out as indicated.



2.8.3 Installing the Modular Rack to the Dock

The Modular Rack can be installed to the Dock as indicated below:

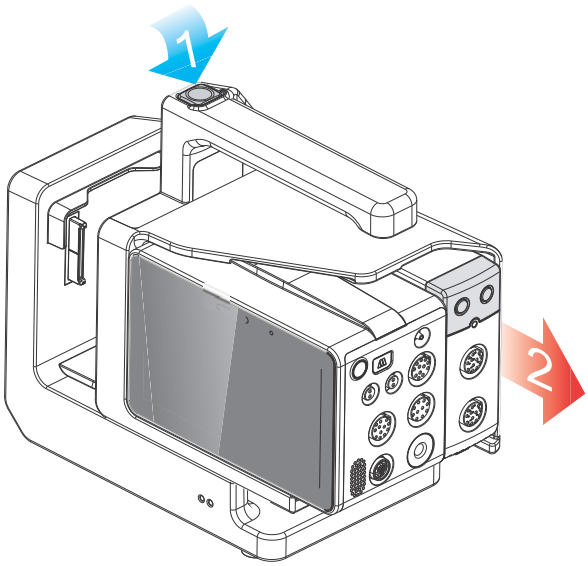


You hear a click when the Modular Rack is pushed into place.

2.8.4 Removing the Modular Rack from the Dock

To remove the Modular Rack from the Dock, follow this procedure:

1. Press and hold down the release button at the top of the Modular Rack.
2. Pull the Modular Rack out as indicated.

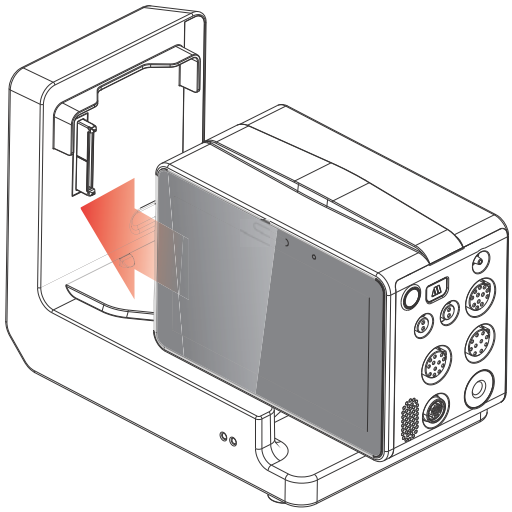


CAUTION

- **To prevent N1 from falling off, do not press the release button while transferring N1 with the Modular Rack and Dock.**

2.8.5 Installing the N1 to the Dock

You can also install N1 directly to the Dock as shown below:

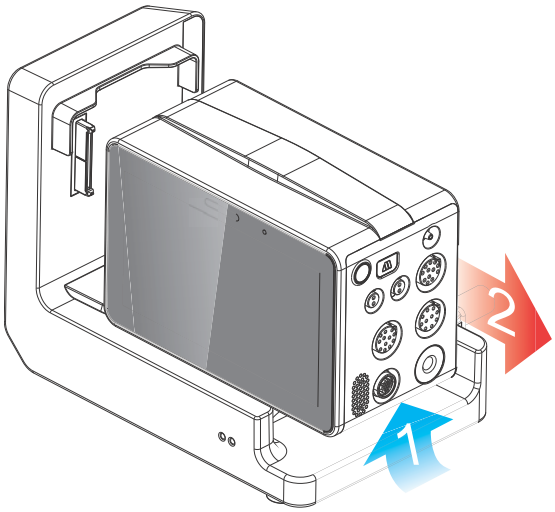


Firmly push N1 until you hear that the clip (refer to *2.4.4 Bottom View*) engages the Dock. To ensure that N1 is properly connected, try to pull N1 outward. N1 properly engages the Dock if you cannot pull it out.

2.8.6 Removing the N1 from the Dock

To remove the N1 from the Dock, follow this procedure:

1. Press and hold the latch at the bottom of N1.
2. Pull the N1 out as indicated.



2.9 N1 in Use with a Host Monitor

When the N1 is connected to the BeneVision N series monitor or BeneView T series monitor, the N1 works as the parameter module while BeneVision N series monitor or BeneView T series monitor works as the host monitor. For more information, see section *3.7.2 Module Mode*.

N1 can be connected to the host monitor through the following parts:

- The module rack of the host monitor
- The Satellite Module Rack (SMR)
- The Dock

BeneVision N series and BeneView T series monitor that can be used as N1 host monitor are as follows:

- BeneVision N22, BeneVision N19, BeneVision N17, BeneVision N15, BeneVision N12, and BeneVision N12C
- BeneView T5, BeneView T5 OR, BeneView T6, BeneView T8, BeneView T9, and BeneView T9 OR

CAUTION

- **If you need the analog signals, use the multifunctional connector of the N1 instead of the Micro-D connector of the BeneView T series monitor when the two monitors are connected.**

2.9.1 Connecting N1 to the Host Monitor through the Module Rack

To connect the N1 to the module rack of the host monitor, follow this procedure:

1. Insert N1 to the host monitor's module rack. Firmly push N1 until you hear that the clip (refer to *2.4.4 Bottom View*) engages the module rack.
2. To ensure that N1 is properly connected, try to pull N1 outward. N1 properly engages the module rack if you cannot pull N1 out.

To remove N1 from the module rack of the host monitor, lift the latch (refer to *2.4.4 Bottom View*) at the bottom of N1 and pull N1 out.

CAUTION

- **To prevent N1 from falling off, after inserting N1 into the module rack, always check that N1 properly engages the module rack.**
- **To prevent N1 from falling off, catch it with another hand while pulling it out from the module rack.**

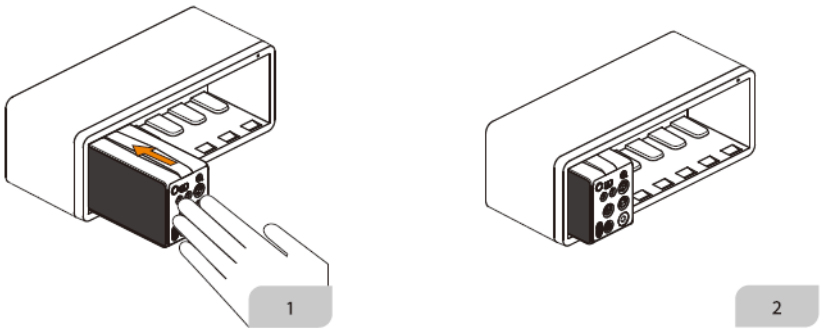
NOTE

- **There is no module rack for the BeneVision N22 or BeneVision N19 monitor. The N1 can be connected to the BeneVision N22 and BeneVision N19 monitor through the SMR or Dock.**

2.9.2 Connecting N1 to the Host Monitor through the Satellite Module Rack (SMR)

To connect the N1 to the host monitor through the SMR, follow this procedure:

1. Connect the SMR to the host monitor.
2. Insert N1 to the SMR. Firmly push N1 until you hear that the clip (refer to *2.4.4 Bottom View*) engages the SMR.
3. To ensure that N1 is properly connected, try to pull N1 outward. N1 properly engages the module rack if you cannot pull N1 out.



To remove N1 from the SMR, lift the latch (refer to *2.4.4 Bottom View*) at the bottom of N1 and pull N1 out.

CAUTION

- **To prevent N1 from falling off, after inserting N1 into the SMR, always check that N1 properly engages the SMR.**
- **To prevent N1 from falling off, catch it with another hand while pulling it out from the SMR.**

2.9.3 Connecting N1 to the Host Monitor through the Dock

To connect the N1 to the host monitor through the Dock, follow this procedure:

1. Connect the N1 to the Dock.
2. Connect the host monitor connector of the Dock with the SMR connector of the host monitor using the dock data cable.

NOTE

- **Use AC power source when the N1 is in use with the Dock.**

2.10 N1 in Use with the Transport Dock

N1can be used together with the Transport Dock to transport patient through road ambulance, airplane or helicopter. For the installation of the N1 and Transport Dock, refer to the *Transport Dock Indication for Use (PN: H-046-011365-00)*.

WARNING

- **The monitor must only be connected to mains power with protective earth, and the connection should be performed by qualified service personnel.**
- **Ensure that the external power system has secure protective earth when the monitor is used together with the Transport Dock.**
- **Verify that the connection of protective earth and the external power system is securely connected when installing the Transport Dock.**

2.11 Input Devices

The monitor allows data entry through touchscreen, keyboard, mouse, and barcode reader.

2.12 Printing Devices

You can use Mindray specified printer to output patient information and data.

3 Getting Started

3.1 Equipment Preparation Safety Information

WARNING

- **Use only installation accessories specified by Mindray.**
- **The equipment software copyright is solely owned by Mindray. No organization or individual shall resort to modifying, copying, or exchanging it or to any other infringement on it in any form or by any means without due permission.**
- **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 are 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 example, due to summation of leakage currents, please consult the manufacturer or an expert in the field. A determination must be made that the proposed combination will not negatively affect the devices themselves or the patient's safety.**
- **If the accuracy of any value displayed on the monitor, central station, or printed on a report is questionable, determine the patient's vital signs by alternative means. Verify that all equipment is working correctly.**

CAUTION

- **The equipment should be installed by authorized Mindray personnel.**
- **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, verify whether the packages are intact, especially the packages of single use accessories. In case of any damage, do not apply it to patients.**
- **Avoid rude handling during transport.**
- **Observance of this manual is a prerequisite for proper product performance and correct operation and ensures patient and operator safety.**

NOTE

- **Put the equipment in a location where you can easily view and operate the equipment.**
- **Keep this manual in the vicinity of the equipment so that it can be conveniently referenced when needed.**
- **Save the packing case and packaging material as they can be used if the equipment must be reshipped.**

3.2 Unpacking and Checking

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

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

NOTE

- **If your monitor contains the internal CO_2 module, connect the CO_2 adapter to the CO_2 receptacle soon after you unpack the monitor to avoid losing the CO_2 adapter.**

3.3 Environmental Requirements

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

The environment where the equipment is used shall be reasonably free from noises, vibration, dust, corrosive, flammable and explosive substances. Moreover, to maintain good ventilation, the equipment shall be at least 2 inches (5cm) away from around the cabinet.

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

CAUTION

- **Make sure that the equipment operating environment meets the specific requirements. Otherwise unexpected consequences, e.g. damage to the equipment, could result.**

3.4 Setting Up the Equipment

Observance of this manual is a prerequisite for proper product performance and correct operation. It ensures patient and operator safety.

3.4.1 Connecting the AC Mains

The monitor can be powered by AC power supply when it is connected to the AC adapter or Dock. Before connecting the equipment to the AC mains, check that the voltage and frequency ratings of the power line are the same as those indicated on the AC adapter or Dock.

3.4.1.1 Connecting the AC Mains through the AC Adapter

To connect the N1 to the AC power source through the AC adapter, follow this procedure:

1. Connect the N1 to the AC adapter.
2. Connect the female end of the power cord to the AC adapter, and the male end of the power cord to a wall AC outlet.
3. Check that the external power supply indicator is on.

The external power supply indicator lies in the lower right corner of the display. When the AC mains is not connected, the external power supply indicator is off. When AC mains is connected, the external power supply indicator is illuminated in green.

3.4.1.2 Connecting the AC Mains through the Dock

To connect the N1 to the AC power source through the Dock, follow this procedure:

1. Connect the N1 to the Dock.
2. Connect the female end of the power cord to the AC power input of the Dock, and the male end of the power cord to a wall AC outlet.
3. Check that the external power supply indicator of the N1 and Dock are on.

WARNING

- **Always use the accompanying power cord delivered with the monitor.**
- **Always use the AC adapter specified by Mindray.**
- **Before connecting the equipment to the AC mains, check that the voltage and frequency ratings of the power line are the same as those indicated on the AC adapter and Dock.**

- **Use the cable retainer to secure the power cord to prevent it from falling off.**
- **Use AC power source when the N1 is in use with the Dock.**
- **Use the battery if the integrity of the protective earth conductor or the protective earthing system in the installation is in doubt.**

3.4.2 Connecting the Input Devices

Connect the mouse, keyboard, and barcode scanner if necessary.

3.4.3 Installing the External Parameter Module

If external parameter module is needed, refer to section *2.8.1Installing the N1 or External Parameter Module into the Modular Rack* for installation.

3.4.4 Turning on the Monitor

Before turn on the monitor, perform the following inspections:

1. Check the monitor for any mechanical damage. Make sure that all external cables, plug-ins and accessories are properly connected.
2. Connect the monitor to the AC power source using AC adapter or Dock. Make sure the battery power is sufficient if the monitor is powered by the battery.
3. Press the power switch to turn on the monitor.

The monitor automatically performs a self test at startup. Check that the alarm tone is heard and the alarm lamp illuminates, one after the other, in red, yellow, and cyan. This indicates that the visible and audible alarm indicators functions correctly.

CAUTION

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

NOTE

- **For first use, connect the monitor to the AC power source for a while and then turn on the monitor to activate the battery.**
- **The time for the monitor to warm from the minimum storage temperature between uses until the monitor is ready for its intended use is 10 minutes when the ambient temperature is 20 °C.**
- **The time for the monitor to cool from the maximum storage temperature between uses until the monitor is ready for its intended use is 10 minutes when the ambient temperature is 20 °C.**

3.5 Operation and Navigation

Everything you need to operate the monitor is on its screen. Almost every element on the screen is interactive. Screen elements include parameter values, waveforms, quick keys, information fields, alarms fields and menus. Often you can access the same element in different ways. For example, you can access a parameter menu by selecting corresponding numeric area or waveform area, or by selecting the **Main Menu** quick key → from the **Parameters** column select **Setup**.

3.5.1 Using the Touchscreen

You can use the touchscreen to select a screen element by pressing directly on the monitor's screen. To avoid misuse, the touchscreen is locked in the following situation:

- The touchscreen is not used in 60 seconds when the N1 runs on battery and is not connected to an external display.
- Select the **Unlock** quick key , and swipe the slider up as instructed.

When the touchscreen is locked, the quick key changes to . To unlock the touchscreen, touch anywhere of the touchscreen and swipe the slider up as instructed.

NOTE

- **Wipe off the water on the touchscreen in case of rain or water spray.**

3.5.2 Using the Mouse

You can use the mouse to select a screen element by moving the cursor on the element and then click on it.

3.5.3 Using the On-Screen Keyboard

The on-screen keyboard enables you to enter information:

- Enter the information by selecting one character after another.
- Select the Backspace key to delete single characters or select to delete the entire entry.
- Select the Caps Lock key to access uppercase letters.
- Select the Enter key to confirm the entry and close the on-screen keyboard.

3.5.4 Using the Barcode Reader

The monitor supports both linear (1D) barcode reader and two-dimension (2D) barcode reader. The barcode reader is connected to the monitor through the USB connector on the Dock.

NOTE

- **You can use the Mindray custom barcode reader to scan both the 2D and 1D barcodes. Using other barcode readers can only output the patient's medical record number (MRN) and visit number.**

3.5.4.1 Clearing Old Data Formats (for the Mindray Custom 2D Barcode Reader)

If you are using the Mindray custom 2D barcode reader (Model HS-1R or HS-1M), before using the it for the first time, clear old data formats and configure the barcode reader.

Before configuring the Mindray custom barcode reader, clear old data formats. To do so, follow this procedure:

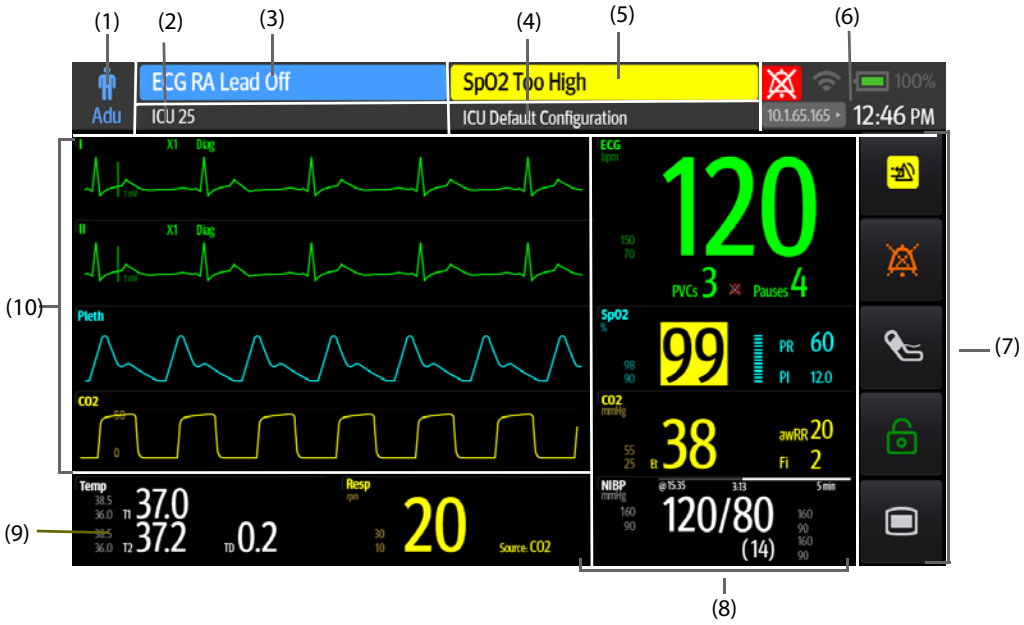
1. Scan the engineering barcode to clear the previous data format.
2. Scan the 2D engineering barcode which contains your hospital's data format.

NOTE

- **Contact the scanner manufacturer or Mindray to obtain the engineering barcodes for clearing data formats and containing the hospital's data format.**

3.6 Screen Display

The following figure shows the normal screen:



(1) Patient information area: displays patient category and gender. The displayed patient information is configurable. Selecting this area enters the **Patient Management** menu. For more information, see *5.3Managing Patient Information*.

(2) Patient information area: displays patient information, including department, room number, bed number, and so on. The displayed patient information is configurable. Selecting this area enters the **Patient Management** menu. For more information, see *5.3Managing Patient Information*.

(3) Technical alarm information area: displays technical alarm message or prompt message.

(4) The current configuration

(5) Physiological alarm information area: displays physiological alarm message.

(6) System status information area: displays alarm symbol, battery status, network status, currently connected CMS, and system time. For more information, see *3.6.1On-screen Symbols*.

(7) Quick key area: displays quick keys.

(8) Parameter numerics area: displays parameter values, alarm limits, and alarm status. Selecting a parameter numeric block enters corresponding parameter menu. For more information, see *3.11.4Accessing Parameter Setup Menus*.

(9) Parameter waveform/ numerics area: displays parameter waveforms or parameter values, alarm limits, and alarm status. Selecting a parameter waveform of numeric block enters corresponding parameter menu. For more information, see *3.11.4Accessing Parameter Setup Menus*.

(10) Parameter waveform area: displays parameter waveforms. Select a waveform enters corresponding parameter menu. For more information, see *3.11.4Accessing Parameter Setup Menus*.

3.6.1 On-screen Symbols

The following table lists the on-screen symbols displayed on the system status information area:

Symbol	Description	Symbol	Description
	Adult, male		Adult, female
	Pediatric, male		Pediatric, female

Symbol	Description	Symbol	Description
	Neonate, male		Neonate, female
	Wireless network is connected. The solid part indicates network signal strength.		Wireless network is not connected.
	Wired network is connected.		Wired network is not connected.
	All the alarms are paused.		Individual physiological alarms are turned off or the monitor is in the alarm off status.
	Audible alarm tones are paused.		Audible alarm tones are turned off.
	Alarms are acknowledged and the alarm system is reset.		The battery works correctly. The green portion represents the remaining charge.
	The battery has low power and needs to be charged.		The battery has critically low charge and needs to be charged immediately. Otherwise, the monitor will soon automatically shut down.
	The battery is being charged.		No battery is installed.
	Battery fault, battery communication fault, or battery charging fault. Contact service personnel for help.		

3.6.2 Menus

All menus have similar style and structure, see the figure below:

(1) Menu heading

(2) Submenu tabs

(3) Operation buttons

(4) Exit button: closes the current menu page.

(5) Switch:

- Green: the switch is on.
- Gray: the switch is off.

(6) Main body area: includes menu items and options.

3.6.3 Quick Keys of the N1

The monitor provides quick keys for you to quickly access some functions. The quick key area is located at the right of the screen. The quick key area displays 5 quick keys. You can also swipe down on the quick key area for more quick keys.The following table shows available quick keys.

Symbol	Label	Function	Symbol	Label	Function
	Alarm Reset	Acknowledges the ongoing alarms.		Screen Setup	Enters the **Screen Setup** menu.
	Alarm Pause	Pauses the current alarms.		Print	Starts printing a real-time report.
	Audio Pause	Pauses alarm tone.		Standby	Enters the Standby mode.
	NIBP Start/ Stop	Starts an NIBP measurement or stops the current NIBP measurement.		Manual Event	Manually triggers and saves an event.
	Lock	Selects and operates as instructed to unlock the touchscreen		NIBP Measure	Enters the **NIBP Measure** menu.
	Unlock	Selects and operates as instructed to lock the touchscreen		Main Menu	Enters the main menu.

3.7 Operating Modes

The monitor provides different operating modes. This section describes the monitoring mode and the standby mode.

3.7.1 Monitoring Mode

The monitoring mode is the most frequently used clinical mode for patient monitoring. When the monitor is turned on, it automatically enters the monitoring mode.

3.7.2 Module Mode

When the N1 is connected to the host monitor, the N1 enters the module mode. For connection of the N1 and the host monitor, see section *2.9N1 in Use with a Host Monitor*. The N1 monitor has the following features when it enters the module mode:

- The patient information, parameter setup, and alarm setup of the N1 and the host monitor will be synchronized. For data transfer strategy, see the operator's manual of the host monitor.
- The N1 can still store the parameter data and the alarm events.
- The N1 receives and stores the parameter trends data from the host monitor.
- All audible sounds of the N1 are off.
- Wired and wireless network of the N1 are not available.
- The alarm indications of the battery related alarms of the N1 are given by the host monitor.
- Turning on or off the host monitor simultaneously powers on or off the N1.
- The main screen of the N1is off when it is connected to the host monitor through the SMR or the module rack of the host monitor.

The N1 resumes to monitor mode when it is disconnected from the host monitor.

3.7.3 Privacy Mode

The privacy mode is a special clinical monitoring mode. In the privacy mode, the monitor does not display patient information and monitoring data. This provides controlled access to patient data and ensures confidentiality.

The privacy mode is only available when the patient admitted by the monitor is also monitored by the CMS. The monitor continues monitoring the patient, but patient data is only visible at the CMS.

3.7.3.1 Entering the Privacy Mode

To enter the privacy mode, select the **Main Menu** quick key → from the **Display** column select **Privacy Mode** → select **Ok**.

The monitor has the following features after entering the privacy mode:

- The screen turns blank.
- Except for the low battery alarm, the monitor inactivate alarm tone and alarm light of all other alarms.
- The monitor suppresses all system sounds, including heart beat tone, pulse tone, and prompt tone.

WARNING

- **In Privacy mode, all audible alarms are suppressed and the alarm light is deactivated at the monitor. Alarms are presented only at the CMS. Pay attention to potential risk.**

NOTE

- **The privacy mode is not available if the Department is set to OR.**
- **You cannot enter the privacy mode if a low battery alarm occurs.**

3.7.3.2 Exiting the Privacy Mode

The monitor automatically exit the privacy mode in any of the following situations:

- The monitor disconnects from the CMS.
- The low battery alarm occurs.

You can also operate the touchscreen, mouse, or keyboard to manually exit the privacy mode.

3.7.4 Night Mode

The night mode is a special clinical monitoring mode. To avoid disturbing the patient, you can use the night mode.

3.7.4.1 Entering the Night Mode

To enter the night mode, follow this procedure:

1. Select the **Main Menu** quick key → from the **Display** column select **Night Mode**.
2. Change the night mode settings if necessary.
3. Select **Enter Night Mode**.

The night mode settings are as follows by default:

- Brightness: 1
- Alarm Volume: 2
- QRS Volume: 1
- Key Volume: 0
- NIBP End Tone: Off
- Stop NIBP: Off

CAUTION

- **Verify the night mode settings before entering the night mode. Pay attention to the potential risk if the setting value is low.**

3.7.4.2 Exiting the Night Mode

To cancel the night mode, follow this procedure:

1. Select the **Main Menu** quick key → from the **Display** column select **Exit Night Mode**.
2. Select **Ok**.

NOTE

- **If your monitor is connected to the CMS, it automatically exits the night mode when being disconnected from the CMS.**
- **The monitor resumes the previous settings after exiting the night mode.**

3.7.5 Standby Mode

You can temperately stops patient monitoring without switching off the monitor by entering the standby mode.

3.7.5.1 Entering the Standby Mode

1. Select the **Standby** quick key, or select the **Main Menu** quick key → from the **Patient Management** column select **Standby**.
2. Define where the patient is by selecting a location in the drop down list when the monitor enters the standby mode.
3. Select **Ok**.

The monitor behaves as follows after entering the standby mode:

- Stops all parameter measurements.
- Disables all the alarms and prompt messages, except for the battery low alarm.
- Turns screen brightness to the dimmest after entering the standby mode for 30 seconds.

WARNING

- **Pay attention to the potential risk of placing the monitor to standby. In the standby mode, the monitor stops all parameter measurements and disable all the alarm indications, except for the battery low alarm.**

3.7.5.2 Changing the Patient Location at Standby

If you need to change the patient's location, select patient location from the standby screen.

3.7.5.3 Exiting the Standby Mode

To exit the standby mode, choose any of the following ways:

- Select **Resume Monitor** to exit the standby mode and resume monitoring the current patient.
- Select **Discharge Patient** to discharge the current patient.

3.7.6 Outdoor Mode

The outdoor mode is intended for transferring patients outdoors. The monitor behaves as follows after entering the outdoor mode:

- The parameter color is white and unchangeable.
- The screen brightness is automatically changed to 10.

3.7.6.1 Entering the Outdoor Mode

If configured to manually enter the outdoor mode, follow this procedure:

1. Select the **Main Menu** quick key.
2. From the **Display** column select **Enter Outdoor Mode**.

If configured to auto, the monitor can enter the outdoor mode automatically if the strength of ambient light is greater than the threshold. For more information, see *22.11The Other Settings*.

3.7.6.2 Exiting the Outdoor Mode

When **Enter Outdoor Mode** is set to **Manual**, select the **Main Menu** quick key → from the **Display** column select **Exit Outdoor Mode**.

The monitor automatically exits the outdoor mode in the following situation:

- The monitor is connected to a host monitor.
- The strength of ambient light is lower than the threshold when **Enter Outdoor Mode** is set to **Auto**.

3.8 Configuring Your Monitor

Configure your monitor before putting it in use.

3.8.1 Setting the Date and Time

To set the system time, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Time**.
2. Set **Date** and **Time**.
3. Set **Date Format**.
4. If you want to use the 12-hour mode, switch off **24 Hour Time**.
5. If you want to use daylight savings time, switch on **Daylight Savings Time**. You can manually switch on or off the daylight savings time only when the auto daylight savings time function is disabled. For more information, see *22.10The Time Settings*.

If your monitor is connected to a central monitoring system (CMS) or hospital clinical system (HIS), the date and time are automatically taken from the CMS. In this case, you cannot change the date and time from your monitor.

CAUTION

- **Changing the date and time affects the storage of trends and events and may result in loss of data.**

3.8.2 Adjusting the Screen Brightness

To adjust the screen brightness, follow this procedure:

1. Access **Display** in either of the following ways:
   - Select the **Screen Setup** quick key → select the **Display** tab.
   - Select the **Main Menu** quick key → from the **Display** column select **Display**.
2. Set the **Brightness**. If **Brightness** is set to **Auto**, the monitor automatically adjust the screen brightness according to the ambient light.

3.8.3 Adjusting the Key Volume

To adjust the key volume, follow this procedure:

1. Select the **Main Menu** quick key → from the **Display** column select **Display**.
2. Set the **Key Volume**.

3.9 Starting Monitoring a Patient

After turning on your monitor, follow this procedure to monitor a patient:

1. Admit the patient.
2. Check patient settings. Make sure that alarm limits, patient category and paced status, and so on, are appropriate for your patient. Change them if necessary.
3. Perform desired measurements. For more information, see corresponding measurement chapters.

3.10 Stopping a Parameter Measurement

To stop monitoring a parameter, follow this procedure:

1. Remove corresponding sensor from the patient.
2. Disconnect the sensor from the patient cable.
3. Disconnect the patient cable from the parameter connector.
4. If you are using the disposable sensor, discard it.

3.11 General Operation

This section describes the operations that are generally used when monitoring a patient.

3.11.1 Switching On or Off a Parameter

You can manually switch on or off a parameter when its module is connected. To do so, follow this procedure:

1. Access **Parameters On/Off** by any of the following ways:
   - Select the **Screen Setup** quick key → select the **Parameters On/Off** tab.
   - Select the **Main Menu** quick key → from the **Parameters** column select **Parameters On/Off**.
2. Switch on or off desired parameters.

If setting parameter switches is password protected, to set parameter switches, switch on **Parameters On/Off Protected**, see *22.11The Other Settings*.

When a parameter is switched off, the monitor stops data acquisition and alarming for this measurement.

NOTE

- **When a parameter is manually switched off, you cannot monitor this parameter even if the related accessories of this parameter are connected.**

3.11.2 Displaying Parameter Numerics and Waveforms

You can configure the parameter numerics, waveforms, and their sequence displayed on the normal screen. To do so, follow this procedure:

1. Access **Tile Layout** in either of the following ways:

- Select the **Screen Setup** quick key → select the **Tile Layout** tab.
- Select the **Main Menu** quick key → from the **Display** column select **Tile Layout**.

2. Select a parameter numeric area or waveform area, and then from the popup list select an element you want to display in this area. The parameters and waveforms you did not select will not displayed.

NOTE

- **ECG parameters and waveform are always displayed on the first line of the parameter numeric area and waveform area.**

3.11.3 Displaying the Parameter List

You can display trends of HR, SpO_2, RR, and NIBP/IBP in the parameter numerics area. To do so, follow this procedure:

1. Access **Tile Layout** in either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select the **Main Menu** quick key → from the **Display** column select **Tile Layout**.
2. Select the parameter numerics area where you want to display the parameter list, and then from the popup list select **Parameter List**.

3.11.4 Accessing Parameter Setup Menus

Each parameter has a setup menu in which you can adjust the alarm and parameter settings. You can enter a parameter setup menu by using any of the following methods:

- Select the parameter numeric area or waveform area.
- Press the setup hard key on the module front of the CO_2 module or PiCCO.
- Select the **Parameter Setup** quick key, and then select the desired parameter.
- Select the **Main Menu** quick key → from the **Parameters** column select **Setup** → select the desired parameter.

NOTE

- **In this manual, we always use the first method to enter the setup menu. But you can use any method you prefer.**

3.11.5 Choosing a Screen

The monitor enters the normal screen after it is powered on. The normal screen is most frequently used for patient monitoring. You can also select other screens. To do so, follow this procedure:

1. Access **Choose screen** in either of the following ways:
   - Select the **Screen Setup** quick key.
   - Select the **Main Menu** quick key → from the **Display** column select **Choose screen**.
2. Select the desired screen.

3.11.6 Selecting the Big Numerics Screen

The big numerics screen displays parameter numerics in big font size. You can configure the parameters and their layout on the big numeric screen. You can quickly switch the normal screen and the big numeric screen by swiping left or right on the touchscreen with two fingers. You can also select the big numeric screen by proceeding as follows:

1. Access **Choose screen** in either of the following ways:
   - Select the **Screen Setup** quick key.
   - Select the **Main Menu** quick key → from the **Parameter** column select **Choose screen**.
2. Select **Big Numerics**.
3. Select **Big Numerics** tab.

4. Select a parameter numeric area or waveform area, and then from the popup list select an element you want to display in this area.

3.11.7 Changing Measurement Colors

You can set the color of measurement values and waveforms for each parameter. To do so, follow this procedure:

1. Select **Main Menu** quick key → from the **Display** column select **Parameter Color**.
2. Select the **Current** tab and set the colors of the currently monitoring measurement values and waveforms.
3. Select the **All** tab and set the colors of measurement values and waveforms for all parameters.

3.12 Using the On-Screen Timers

The monitor has a Timer function to notify you when a preset time period is expired. You can simultaneously display up to two timers.

3.12.1 Displaying Timers

To display a timers, follow this procedure:

1. Access **Tile Layout** in either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select the **Main Menu** quick key → from the **Display** column select **Tile Layout**.
2. Click the parameter area where you want to display the timer, and then select a timer from the popup list.

3.12.2 Setting the Timer

You can set each timer independently. To set the timer, follow this procedure:

1. Select the timer area to enter the **Timer Setup** menu.
2. Set **Timer Type**:
   - **Normal**: The timer has a single and defined run time, and stops when the run time is reached.
   - **Advanced**: The timer has a single and defined run time. When the run time is reached, the timer continuously displays the time beyond the end of run time.
   - **Cycled**: The timer has a single and defined run time. When the run time is reached, the timer restarts automatically. The cycles is also displayed.
   - **Unlimited**: The timer displays the time elapsed since the timer was started.
   - **Clock**: The timer displays the system time.
3. Set **Direction**.
   - **Down**: the timer counts down.
   - **Up**: the timer counts up.
4. Set **Run Time**.
5. Set **Reminder Volume**. A progress bar is shown with the run time. When the remaining time is 10 seconds, the monitor issues a reminder tone and the timer flashes in red, prompting you that the run time is to expire.

NOTE

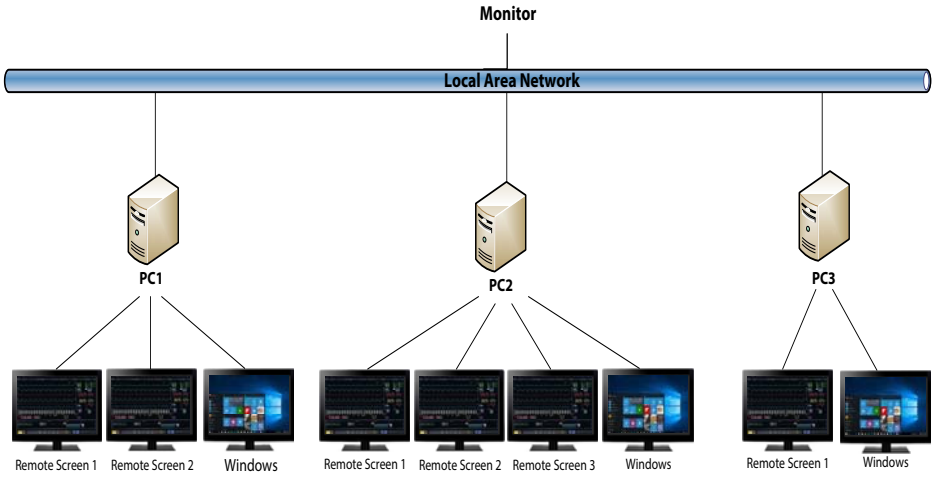
- **You cannot change timer settings when a timer is running.**
- **You can set Direct, Run Time, and Reminder Volume only for normal, advanced, and cycled timers.**

3.13 Using the nView Remote Displays

By using the nView, you can remotely view an independent monitor screen on a PC-based display.

The nView consists of PC-based hardware platform, application software (nView tool), and an local area network (LAN) connecting PCs and the monitor. Each PC can start three remote screens at most. A monitor supports six remote screens in total.

The remote screen is displays independently. you can operate the monitor via the remote screen. The following figure shows the nView connection:



WARNING

- **The remote screen is not a primary alarming device and cannot be relied upon for alarm notification.**
- **There are no audible or visible indications apart from what is shown on the screen and the measurement data from the monitor may be delayed.**

NOTE

- **A license is required for the nView.**

3.13.1 Recommended Hardware and Network Requirements

3.13.1.1 Hardware Requirements

Recommended requirements for PCs and nView displays are as follows:

PC	Display
• Hard disk: minimum 20 G • Memory: 600 M (for one remote screen), 1200M (for two remote screens), 1400 M (for three remote screens) • CPU: i5, dual-core (for one remote screen), quad-core (for two or three remote screens)	Resolution: supports 1280×720 pixel

3.13.1.2 Network Requirements

Recommended requirements for the LAN connecting the monitor and PCs are as follows:

- Bandwidth: 100 M
- Supports multicast
- Requirements for ports are listed in the following table:

Protocol	nView Port	Monitor Port	Function
TCP	Any	6600	Communicates with the monitor.

Protocol	nView Port	Monitor Port	Function
TCP	Any	6602	Communicates with the monitor.
TCP	Any	6603	Communicates with the monitor.
TCP	Any	6604	Communicates with the monitor.
TCP	Any	6587	Communicates with the monitor.
TCP	Any	6588	Communicates with the monitor.
UDP	6678	Any	Discovers the monitor via multicast.
TCP	6606	Any	Communicates with the monitor. 6606 is the default nView port. You can modify the port via the nView tool.

3.13.2 Installing the nView Tool

The nView tool is a Windows-based PC application. It supports Windows 7 and Windows 10 operating system.

To install the nView tool, follow this procedure:

1. Extract the installation package.
2. Run nViewSetup.exe.
3. Follow installation instructions. Check the **Import Power Policy** box if necessary.

At the completion of installation, the nView tool icon displays on the desktop.

The nView tool automatically starts when the PC is power on.

CAUTION

- **The PC for nView may have a power policy of turning off or putting into sleep after a preset time. If you need the PC always on and not sleep when running the nView, check the Import Power Policy box when installing the nView tool.**

3.13.3 Manually Starting Remote Screen

You can only start remote screens from the PC. To start a remote screen, follow this procedure:

1. Double-click the nView tool icon to run the nView tool.
2. If you are starting the remote screen for the first time, configure it first. For more information, see *3.13.4Configuring the Remote Screen*.
3. Select the desired monitor:
   a Select the **Select Device** tab.
   b Select **Refresh Device List**.
   c From the monitor list, select the desired monitor.
4. Select the **nView Tool** tab → **Start Remote Screen**.

After the remote screen is started, the remote screen icon displays on the taskbar.

3.13.4 Configuring the Remote Screen

To configure the remote screen, follow this procedure:

1. Double-click the nView tool icon to run the nView tool.
2. Select the **Setup** tab to set the following parameters:
   - **Language**: the UI language of the remote screen and nView tool software user interface.
   - **Local IP Address**: the IP address of the PC. The PC must be connected to the same LAN as the monitor.

- **Remote Screen Port**: used as the port for TCP service and shall not conflict with other applications runs on the PC.
- **Monitor Multicast Address**: usded to discover the monitor.
- **Start nView Screen When Monitor Online**: If this switch is on, the remote screen automatically starts when the monitor is connected to the network.
- **Shut Down PC When Monitor Shutdown**: If this switch is on, the PC automatically shuts down when the monitor shuts down.
- **Number of Remote Screens**: selects the number of displays used for nView. When the PC connects multiple displays, the maximum number of displays for nVeiw is 3.
- **Screen X Position**: selects where the remote screen is displayed. For example, if **Remote Screen 1 Position** is set to **Display 3**, remote screen 1 will be on display 3. To identify the displays, select **Identify Display**.
- **Full Screen**: if this switch is on, the remote screen displays in full size. If this switch is off, you can zoom in or out the remote screen. To achieve optimal full screen, setting the display resolution to 1280×720 is recommended.
- **Remote Screen Always on Top**: if this switch is on, the remote screen is always on the front ground.

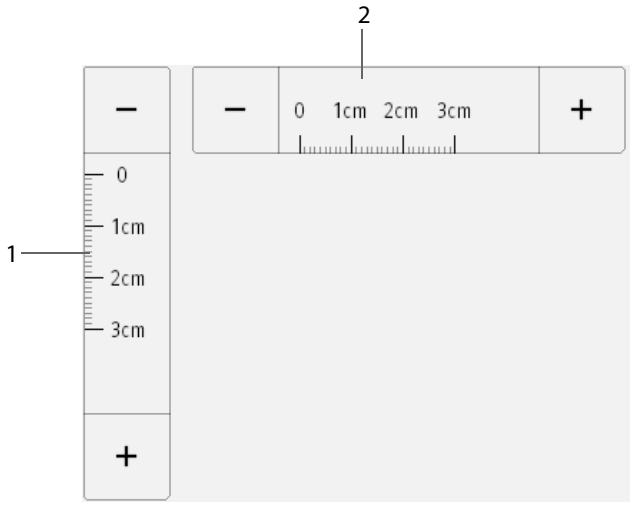
WARNING

- **If the Remote Screen Always on Top switch is off, the remote screen may be covered by other applications. If you need constant access to the patient data, make sure the remote screen is always in the foreground.**

3.13.5 Setting the ECG Waveform Size for the Remote Screen

For displays of different dimensions, you can set the speed and amplitude of the ECG waveforms for the remote screen to achieve the best display effect. To do so, follow this procedure:

1. From the remote screen, select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select.
2. Select **Display** → select the **Screen Size** tab.
3. Set the speed and amplitude of the ECG waveform corresponding to one centimeter.



(1) the amplitude ECG waveform corresponding to one centimeter
(2) the speed of the ECG waveform corresponding to one centimeter

NOTE

- **The setting of Screen Size takes effect only after the remote screen restarts.**

3.13.6 Selecting a Different Monitor for nView

To switch the monitor you want to view remotely, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **nView Tool**.
2. Select the **Select Device** tab.
3. Select **Refresh Device List**.
4. From the monitor list, select the desired monitor.
5. From the popup dialog box, select **OK** to restart the remote screen.

3.13.7 Restarting a remote screen

If you changed the settings for a remote screen, restart it for the changes to take effect. To do so, follow this procedure:

1. On the remote screen, select the **Main Menu** quick key → from the **System** column select **nView Tool** to call out the nView Tool.
2. Select the **Remote Screen** tab.
3. Select **Restart Remote Screen**.

3.13.8 Closing remote screens

Remote screens automatically close if the monitor is turned off or disconnected from the network for one minute. To manually close remote screens, follow this procedure:

1. On the remote screen,select the **Main Menu** quick key → from the **System** column select **nView Tool** to call out the nView Tool.
2. Select the **Remote Screen** tab.
3. Select the **Exit Remote Screen**. This will exit all remote screens.

- If you started multiple remote screens, you can close any of them separately.
- If the remote screen is not in full screen, select the close button at the top right corner. From the popup dialog box, select **Close This Screen**.
- If the remote screen is in full screen, select the Windows key to call out the taskbar. Right-click the remote screen icon and select **Close Window**. From the popup dialog box, select **Close This Screen**.

3.14 Turning Off the Monitor

Before turn off the monitor, perform the following check:

1. Ensure that the monitoring of the patient has been completed.
2. Disconnect the cables and sensors from the patient.
3. Make sure to save or clear the patient monitoring data as required.

To turn off the monitor, press and hold the power switch for 3 seconds.

CAUTION

- **Press and hold the power switch for no less than 10 seconds to forcibly shut down the monitor if it could not be shut down normally. This may cause loss of patient data.**

NOTE

- **Turning off the monitor does not disconnect the monitor form the AC mains. To completely disconnect the power supply, unplug the power cord.**
- **In case of a temporary power failure, if the power is restored within 30 minutes, monitoring will resume with all active settings unchanged; if the monitor is without power for more than 30 minutes, the monitor behaves the same as it is normally turned off.**

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4 Using the External Display

4.1 Using the External Display

The N1 can be connected to an external display through the VGA connector of the Dock. When the external display is connected, you can monitor a patient either through the N1 or through the external display. The external display configured as independent display can display differently with the N1. For the configuration of the independent external display, see section *4.1.2Setting the External Display*.

The following screens or functions can only be viewed and operated on the independent external display:

- Minitrends Screen
- OxyCRG Screen
- Remote View Screen
- ECG Half-Screen
- BoA Dashboard
- PAWP Screen
- Calculations
- EWS
- GCS
- CPR Dashboard
- ST Graphic
- SpO2 Screen

NOTE

- **The external display can share the mouse or keyboard with the monitor. If you need to use the mouse or keyboard, connect the mouse or keyboard to the USB connector of the Dock.**

4.1.1 Connecting the N1 to the External Display

To connect the external display, follow this procedure:

1. Connect the Dock and the external display using the VGA cable.
2. Connect the Dock and the external display using the USB cable accompanying the external display.
3. Connect the external display to the AC mains and turn on the display.
4. Connect the N1 to the Dock.

4.1.2 Setting the External Display

To set the external display, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select ↵.
2. Select the **Dock Setup** tab.
3. Set **External Screen Contents**.
   - **Mirrored**: the contents of the external display is exactly the same with the monitor.
   - **Independent**: you can separately configure the contents and layout of the monitor and external display.

NOTE

- **The N1 and the independent display cannot display simultaneously. To switch the display, gently press the power switch of the N1, or double click the display you want to use.**
- **In the situation that the Screen Content is set to Independent and you switch the display to the N1, if there is no operation on the monitor within one minute, the display will automatically switch back to the external display.**
- **When the N1 is connected to the Dock, the N1 can use the external screen setting of the Dock. For more information, see section *22.17The Dock Setup Settings*.**

4.1.3 External Display Troubleshooting

Problem	Corrective Actions
Image offset	Adjust the external display by using the auto adjust function or adjust the external display manually.
No image or the image displays abnormally	• Check that the external display is properly connected to the AC mains and is powered on. • Check that the VGA cable is properly connected. • Remove the N1 from the Dock and reconnect it if the problem persists.
Touchscreen failure	Check that both ends of the USB cable accompanying the external display are connected properly to the Dock and the external display.

CAUTION

- **Use only specified display. Using unspecified display may result in unknown problem.**

4.1.4 Quick keys of the independent external display

The following table displays the quick keys that are available for the independent external display.

Symbol	Label	Function	Symbol	Label	Function
	Alarm Reset	Acknowledges the ongoing alarms.		Screen Setup	Enters the **Screen Setup** menu.
	Alarm Pause	Pauses the current alarms.		Print	Starts printing a real-time report.
	Audio Pause	Pauses alarm tone.		Standby	Enters the Standby mode.
	NIBP Start/ Stop	Starts an NIBP measurement or stops the current NIBP measurement.		Manual Event	Manually triggers and saves an event.
	NIBP Measure	Enters the **NIBP Measure** menu.		Main Menu	Enters the main menu.
	Alarm Setup	Enters the **Alarm** menu.		More	Shows more quick keys.

Symbol	Label	Function	Symbol	Label	Function
	Discharge Patient	Enters the **Discharge Patient** dialog box.		Patient Management	Enters the **Patient Management** menu.
	Review	Enters the **Review** menu.		Parameters Setup	Enters the **Parameters Setup** menu.
	NIBP STAT	Starts a five-minutes continuous NIBP measurement.		Stop All	Stops all NIBP measurements.
	Zero IBP	Starts IBP zero calibration.		PAWP	Enters the **PAWP** screen.
	Venipuncture	Opens the Venipuncture window.		ECG Lead/Gain	Enters the **ECG Lead/ Gain** menu.
	Remote View	Opens the **Remote View** window.		Minitrends	Enters the Minitrends screen.
	OxyCRG	Opens the **OxyCRG** window.		ECG Full-Screen	Enters the 12-lead ECG full screen.
	Privacy Mode	Enters the privacy mode.		Night Mode	Enters the night mode.
	CPB Mode	Enters the CPB mode.		Intubation Mode	Enters the intubation mode.
	Volume	Enters the **Volume** menu.		Freeze	Freezes waveforms.
	Calculations	Enters the **Calculations** menu.		Load Configuration	Enters the **Load Config** menu.
	BoA Dashboard	Enters the **BoA Dashboard** screen.		EWS	Enters the **EWS** screen.
	GCS	Enters the **GCS** menu.		Rescue Mode	Enters the rescue mode.
	C.O. Measure	Opens the **C.O. Measure (CCO)** window.		Discharged Patients	Enters the **Discharged Patients** dialog box.
	End Case Report	Prints the selected end case reports			

4.1.5 Configuring the Displayed Quick Keys

To select the quick keys you want to display, follow this procedure:

1. Access **Quick Key** in either of the following ways:
   - Select the **Screen Setup** quick key → the **Select Quick Keys** tab.
   - Select the **Main Menu** quick key → from the **Display** column select **Quick Keys**.
2. Select the **Current** tab to configure the quick keys you want to display on the screen: From the top of this page, select a block where you want to show a certain quick key, and then select the quick key from the quick key list. For example, if you want to show the **Screen Setup** quick key at the first block, select the first block, and then select **Screen Setup** from the list.
3. Select the **More** tab to configure the quick keys you want to display when the **More** quick key is selected.

4.2 Minitrends Screen

The Minitrends screen shows the recent graphic trends of parameters.

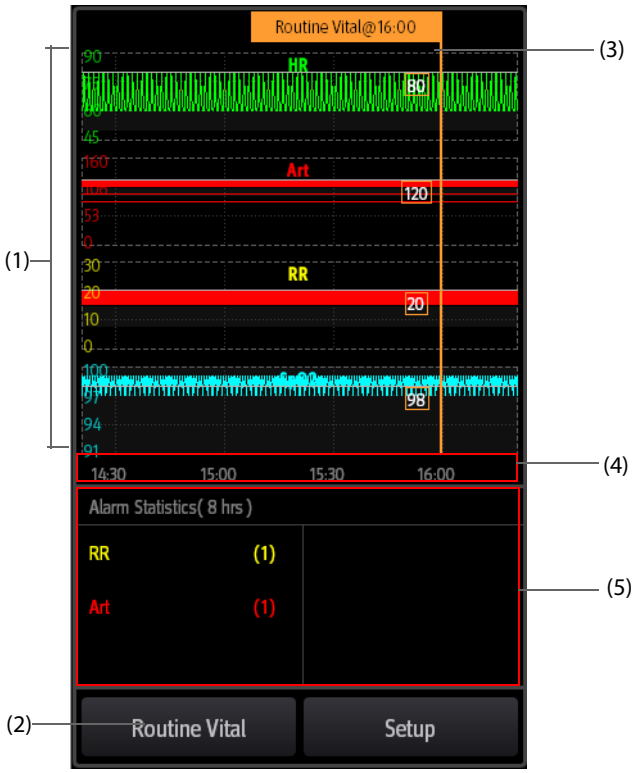
4.2.1 Entering the Minitrends Screen

Choose one of the following methods to enter the Minitrends screen:

- Swipe left or right on the touchscreen with two fingers to switch among the Minitrends screen, normal screen, and the big numerics screen.
- Select the **Minitrends** quick key.
- Select the **Screen Setup** quick key → Select the **Choose Screen** tab→ select **Minitrends**.
- Select the **Main Menu** quick key → from the **Display** column select **Choose Screen** → select **Minitrends**.

4.2.2 The Display of Minitrends Screen

The following figure shows the minitrends screen. Your display may be configured to look slightly different.



(1) Scale

(2) **Routine Vital** button. If the department is set to **OR**, then **Baseline** button is displayed.

(3) Routine Vital/Baseline

(4) Time line

(5) Alarm statistic area

4.2.3 Setting Minitrends Parameters

To set parameters, follow this procedure:

1. Enter the Minitrends screen.
2. Select the **Setup** button.
3. Set parameters. If you want to use the default parameters, select **Default Parameter**.

4.2.4 Setting the Minitrend Length

To set the Minitrend length, follow this procedure:

1. Enter the Minitrends screen.
2. Select the **Setup** button.
3. Set the **Minitrend Length**.

4.2.5 Setting the Alarm Statistics Switch

The Minitrends screen can be configured to display the statistic number of physiological alarm in its lower half screen. To set the alarm statistics switch, follow this procedure:

1. Enter the Minitrends screen.
2. Select the **Setup** button.
3. Switch on or off the **Alarm Statistics** switch.

4.2.6 Setting the Alarm Statistics Duration

The time length within which the alarms statistics are made is configurable. To set the alarm statistics length, follow this procedure:

1. Enter the Minitrends screen.
2. Select the **Setup** button.
3. Set **Alarm Statistics Duration**.

4.2.7 Routine Vital/Baseline

The Routine vital/Baseline function is used for marking the parameter measurements of certain moment for later reference. If the department is set to **OR**, then the Baseline button is available. For other departments, the **Routine Vital** button is available.

4.2.7.1 Manually Marking the Routine Vital/Baseline

To manually mark the Routine Vital/Baseline, follow this procedure:

1. Enter the Minitrends screen.
2. Select the **Routine Vital** button or **Baseline** button.

NOTE

- **If you do not see the Baseline button or Routine Vital button in the Minitrends screen, you can select the Setup button and switch on the Baseline switch, or set the Routine Vital to Manual or Auto.**

4.2.7.2 Configuring Automatic Routine Vital Settings

The monitor canautomatically mark the routine vital sign values. To enable this function, follow this procedure:

1. Enter the Minitrends screen.
2. Select the **Setup** button.
3. Select **Auto** from the dropdown list of **Routine Vital**.
4. Select **Time** to set the time for marking the first routine vital sign values.
5. Select **Interval** to set the interval for marking the routine vital sign values.

4.3 The OxyCRG Screen

The OxyCRG screen is the default user screen for neonatology. It displays 6-minute HR/btbHR, SpO_2 trends, CO_2/Resp compressed waveform, ABD parameters, and the latest ABD events.

The OxyCRG function is intended for neonatal patents only.

4.3.1 Entering the OxyCRG Screen

To enter the OxyCRG screen, choose any of the following ways:

- Swipe left or right on the touchscreen with two fingers to switch to the OxyCRG screen.
- Select the **OxyCRG** quick key.
- Select the **Screen Setup** quick key → select the **Choose Screen** tab → select **OxyCRG**.
- Select the **Main Menu** quick key → from the **Display** column select **Choose Screen** → select **OxyCRG**.

4.3.2 OxyCRG Events

The following table lists the ABD events and their criteria:

Event type	Description	Remarks
A	Apnea event: the apnea duration exceeds the threshold. • A20: the apnea duration is greater or equal to 20 seconds. • A15: the apnea duration is between 15 to 20 seconds (excluding 20 seconds). • A10: the apnea duration is between 10 to 15 seconds (excluding 15 seconds).	A20 is a red event
B	Bradycardia event: the duration of low heart rate, extreme bradycardia, or asystole exceeds the threshold.	/
D	Low SpO2 event: the SpO_2 value is lower than the SpO_2 Desat limit.	/
BD	Bradycardia and low SpO_2 happen at the same time.	/
AB	Apnea and bradycardia happens at the same time.	Red event
AD	Bradycardia and low SpO_2 happen at the same time.	Red event
ABD	Apnea, bradycardia, and low SpO_2 happen at the same time.	Red event

NOTE

- **The monitor records all ABD events for OxyCRG review, but only red events displays in the ABD list of the OxyCRG screen.**

4.3.3 The Display of the ABD Event Area

The ABD event area displays parameter values of currently active OxyCRG events and lists the latest red ABD events.

4.3.4 Setting OxyCRG Parameters

Select parameter trends or compressed waveform to set parameters and the compressed waveform you want to display. The selected parameters will be used for ABD event calculation.

4.3.5 Setting the Threshold of ABD Events

Select any parameter trend or the compressed waveform to perform the following setup:

- Set the threshold of ABD events.
- Set **Event Storage Format**:
  - **1 min+3 min**: stores data one minute before and three minutes after the event.
  - **3 min+1 min**: stores data three minutes before and one minute after the event.
  - **2 min+2 min**: stores data two minutes before and two minutes after the event.

The stored data includes the trends of the OxyCRG parameters, compressed waveform, alarm thresholds, NIBP, and Temp measurements.

4.3.6 Editing ABD Events

To edit ABD events, follow this procedure:

1. Select the **Mark** button to enter the **Mark** dialog box.
2. Drag the event list upwards and downwards to select the desired event.
3. Select the patient's status when the event happens.
4. Select **Save**.

4.4 The SpO_2 Screen

For neonatal patients, if you only concern the patient's SpO_2, you can use the SpO_2 screen.

The SpO_2 screen displays SpO_2 related data. It also displays realtime Temp and NIBP measurements.

NOTE

- **The SpO_2 screen is intended for neonatal patient only.**

4.4.1 Entering the SpO_2 Screen

To enter the SpO_2 screen, choose any of the following ways:

- Swipe left or right on the touchscreen with two fingers to switch to the SpO_2 screen.
- Select the **Screen Setup** quick key → select the **Choose Screen** tab → select **SpO2 Screen**.
- Select the **Main Menu** quick key → from the **Display** column select **Choose Screen** → select **SpO_2 Screen**.

4.4.2 The Display of SpO_2 Screen

The following figure shows the SpO_2 screen. Your display may be configured to look slightly different.

(1) Tabular trend: displays trends of SpO_2, PR, and PI.

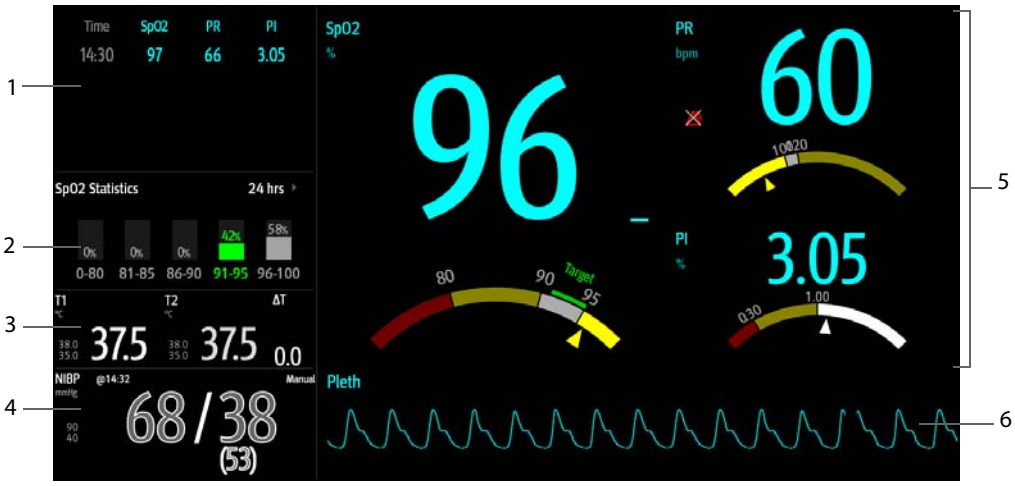
(2) SpO_2 statistics area: displays the statistics data of each SpO_2 section.

(3) Temp area: displays Temp measurements and alarm limits.

(4) NIBP area: displays NIBP measurements and alarm limits.

(5) SpO_2 area: displays measurements and alarm limits of SpO_2, PR, and PI. The dashboards show information of alarm limits. The △ pointers indicate the current measurement values.

(6) The Pleth waveform



4.4.3 Operating the SpO_2 Screen

You can access parameter setup and trends review from the SpO_2 screen. To do so, follow this procedure:

- Select the trend of SpO_2, PR, or PI to enter the **Tabular Trends** review page.
- Select the SpO_2 statistics area to enter the **SpO2 Statistics** setup menu. Set the range of each SpO_2 section and the target section.
- Select the value of SpO_2, PR, or PI, the dashboard, or Pleth waveform to enter the **SpO2** menu.
- Select the Temp area to enter the **Temp** menu.
- Select the NIBP area to enter the **NIBP** menu.

4.5 Viewing Other Patients

The patient alarm and real time physiological data of the N1 can be viewed by other networked monitors. When the external display is connected, you can also observe alarm conditions and view real time physiological data from patients on other networked monitoring devices.

A device from a remote site is called a remote device or bed, for example, a bedside monitor. You can simultaneously watch up to 12 remote devices. You can also view waveforms of one remote device on the external display.

You can watch the remote devices in the **Remote View** window, or the alarm watch tiles on the main screen.

NOTE

- **You can also view this monitor from remote devices. This monitor can be viewed by at most 32 remote devices at the same time, in which eight remote devices can watch this monitor's waveforms.**

4.5.1 Remote View

In the **Remote View** window, you can view real time parameters and waveforms from one specific device, and watch the alarms of other monitored devices at the same time.

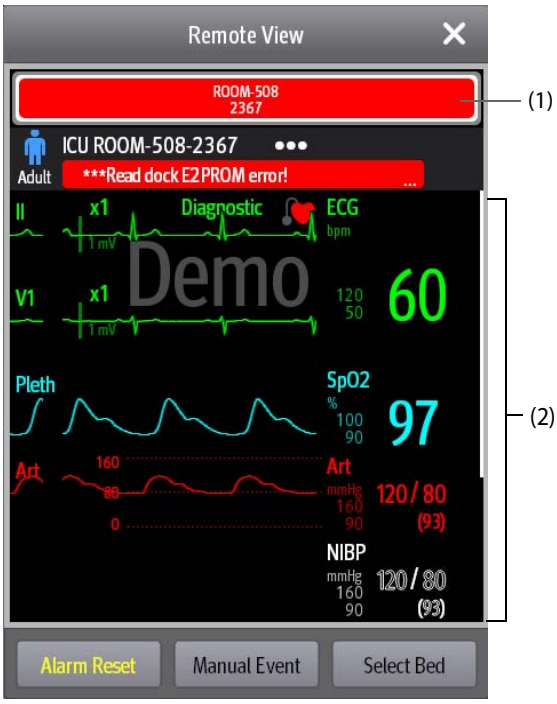
4.5.1.1 Entering the Remote View Window

To enter the **Remote View** window, choose one of the following ways:

- Select the **Remote View** quick key.
- Select the bed at the alarm watch tile on the main screen. For more information, see *4.5.2.2Displaying the Alarm Watch Tile on the Main Screen* for configuring to display the tile on the main screen.
- Select the **Screen Setup** quick key → select the **Choose Screen** tab → select **Remote View**.

4.5.1.2 About the Remote View

The following figure shows the **Remote View** window.



(1) Alarm watch area

- Display all the monitored remote beds.
- Each bed displays the room number, bed number, connection status and alarm status. The background color indicates the alarm status on the corresponding bed.

Background Color	Description
Green	No alarm is occurring to the bed.
Red	The remote device is disconnected or a high priority alarm is occurring. The high priority alarm currentlv is the highest alarm level on the bed. If the remote device is disconnected, the icon is displayed.
Yellow	The medium priority alarm is occurring. The medium priority alarm currently is the highest alarm level on the bed.
Cyan	The low priority alarm is occurring. The low priority alarm currently is the highest alarm level on the bed.
Grey	The bed is in the standby mode.

(2) Main body

Display the patient's information, alarm status and messages, waveforms, measurements, etc. of the selected bed. This bed is called main bed.

4.5.1.3 Adding a Bed

You need to add the desired remote devices, and then the alarms from these devices can be watched on your monitor. To add a remote device, follow this procedure:

1. Enter the **Select Bed** window. To do so, choose either of the following ways:
   - In the **Remote View** window, select **Select Bed**. For more information, see *4.5.1.1Entering the Remote View Window* for entering the **Remote View** window.
   - Select the icon at the alarm watch tile if the tile is configured to display on the main screen.

2. In the **Select Bed** window, select a desired department. All the beds under this department will be listed.
3. Select a desired tile at the A-W1, or A-W2 areas and then select a bed from the bed list. The selected bed will appear in the tile.

NOTE

- **The added bed is indicated by a √ check mark at the right of the bed list.**

4.5.1.4 Removing a Bed

If you do not want to monitor a remote device any longer, you can remove it. To remove a remote device, follow this procedure:

1. Enter the **Select Bed** window. Choose either of the following ways:
   - In the **Remote View** window, select **Select Bed**. For more information, see *4.5.1.1Entering the Remote View Window* for entering the **Remote View** window.
   - Select the  icon in the alarm watch tile if the tile is configured to display on the main screen.
2. In the **Select Bed** window, select a bed at the A-W1 or A-W2 area, and then select **Clear Bed**. If you want remove all beds, select **Clear All Beds**.

4.5.1.5 Displaying the Main Bed

In the **Remote View** window, you can select a bed at the alarm watch area, then the main body of the **Remote View** window will display the real time monitoring screen of the device.

4.5.1.6 Saving a Manual Event

You can initiate a manual event by selecting **Manual Event** in the **Remote View** window.

The manual event stores in the event review of the corresponding remote device.

4.5.1.7 Resetting Alarms for Remote Devices

To reset remote device alarms, from the **Remote View** window, select **Alarm Reset**.

NOTE

- **You can reset remote device alarms only if the Alarm Reset by Other Bed switch is on at the remote devices.**

4.5.1.8 Selecting Beds By Care Group

If configured, the monitor automatically selects beds in the same care group during the shift of care groups in the CMS. To enable this function, follow this procedure:

1. Enter the **Select Bed** window. Choose either of the following ways:
   - In the **Remote View** window, select **Select Bed**. For more information, see *4.5.1.1Entering the Remote View Window* for entering the **Remote View** window.
   - Select the  icon in the alarm watch tile if the tile is configured to display on the main screen.
2. In lower left corner of the **Select Bed** window, select **Select Beds By Care Group**.

4.5.2 Alarm Watch

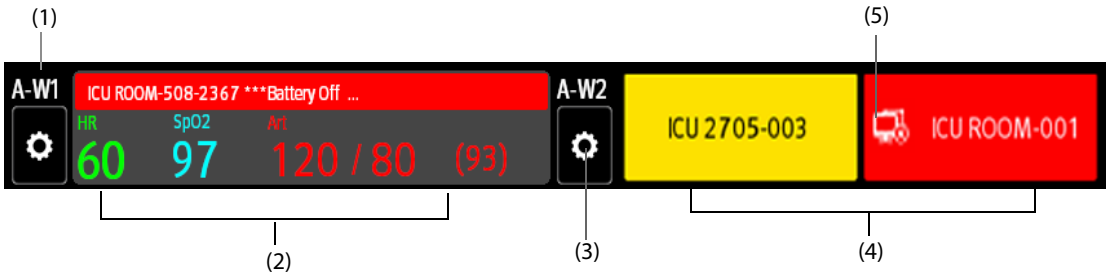
The alarm watch function provides the alarm notification by color and sound.

- The monitor sounds the highest priority alarm tone from all the monitored remote devices.
- The moitor displays the highest priority alarm in corresponding background color for each bed at following areas:
  - At the top of the **Remote View**. For more information, see *4.5.1.2About the Remote View* for details.
  - On the main screen. For more information, see *4.5.2.1About Alarm Watch Tile* for details.

4.5.2.1 About Alarm Watch Tile

The main screen can display up to two alarm watch tiles, namely A-W1 and A-W2. Each tile can accommodate up to six beds.

The following figure shows the alarm watch tiles.



(1) Alarm watch tile label

(2) One bed tile: when only one bed is assigned to a tile, the tile displays the parameter value and alarm message from this bed, etc.

(3) Select bed icon: select it to enter the **Select Bed** window.

(4) More than one bed tile: when more than one bed is assigned to a tile, the tile displays the alarm status, connection status, etc.

(5) Disconnection icon: when the remote device is disconnected, this icon displays at the tile, and the tile background color is red.

The alarm watch tile is similar to alarm watch area in the **Remote View.** For more information, see *4.5.1.2About the Remote View*.

4.5.2.2 Displaying the Alarm Watch Tile on the Main Screen

To configure the alarm watch tile to be displayed on the monitor's main screen, follow this procedure:

1. Select the **Main Menu** quick key → from the **Display** column select **Choose Screen** to enter the **Screen Setup** menu.
2. Select the **Tile Layout** tab.
3. Select the numeric area where you want to display the alarm watch tile, and then in the drop-down list, select **Alarm Watch** → **A-W1** or **A-W2**.

4.6 Freezing Waveforms

During patient monitoring, the freeze feature allows you to freeze the currently displayed waveforms on the screen so that you can have a close examination of the patient's status. Besides, you can select any frozen waveform for recording.

4.6.1 Freezing Waveforms

To freeze waveforms, select the **Freeze** quick key. Except waveforms of the following screens, all displayed waveforms stop refreshing and scrolling after you select the **Freeze** quick key:

- **Minitrends** screen
- **oxyCRG** screen
- **Remote View** screen
- **BoA Dashboard** screen
- **EWS** screen
- CQI waveform in the **Rescue Mode**

4.6.2 Viewing Frozen Waveforms

To view the frozen waveforms, follow this procedure:

- Select the < or > button in the **Freeze** window.
- Slide the frozen waveform leftward or rightward.

At the lower right corner of the bottommost waveform displays the freeze time. The initial frozen time is **0 s**. With the waveforms scrolling, the freeze time changes at an interval of 1 second. For example, **-2 s** means the two seconds before the frozen time. This change will be applied for all waveforms on the screen.

NOTE

- **You can view the frozen waveforms of up to 120 seconds.**
- **The frozen time is not displayed when the waveforms are frozen in the Rescue Mode.**

4.6.3 Unfreezing Waveforms

To unfreeze the frozen waveforms, select the button upper right corner of the **Freeze** window.

4.6.4 Printing Frozen Waveforms

To print the frozen waveforms, select the button at the upper left corner of the **Freeze** window.

5 Managing Patients

5.1 Discharging a Patient

Before monitoring a new patient, discharge the previous patient. After the patient is discharged, all patient data, including patient information, trend data, and physiological alarm information is be deleted from the monitor. The technical alarms is reset, and monitor settings returns to their defaults. For more information, see *6.4 Setting Default Configuration*.

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

WARNING

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

NOTE

- **Discharging a patient deletes all history data from the monitor.**

5.1.1 Auto Discharging a Patient after Monitor Power Off

You can let the monitor automatically discharge after the monitor has been switched off for a period of time. The configuration of this function is password protected. For more information, see *22.3.3 The Discharge Tab*.

5.1.2 Manually Discharging a Patient

Manually discharge a patient using any of the following methods:

- Swipe down the touchscreen with two fingers.
- Select the patient information area at the top left corner of the screen → **Discharge Patient**.
- Select the **Main Menu** quick key → from the **Patient Management** column select **Discharge**.

Select a desired item from the **Discharge Patient** dialog box:

- **Print End Case Report**: prints the end case report when the patient is discharged.
- **Discharge**: all patient data, including patient information, trend data, and physiological alarm information, is deleted from the monitor. The technical alarms is reset. The monitor loads the default configuration and goes to the standby mode.
- **Clear Patient Data**: all patient data is deleted from the monitor. The monitor still uses the current monitor settings.

5.2 Admitting a Patient

The monitor admits a new patient in the following situations:

- After a patient is manually discharged, the monitor automatically admit a new patient.
- After being switched off for the selected time period, the monitor automatically discharge the previous patient and admit a new patient at startup.
- If the monitor has not detected certain patient vital signs (ECG, SpO_2, PR, RR, NIBP) for 30 minutes, you will be prompted whether to start monitoring a new patient if any of the above vital signs are detected again.

Always inputs patient information as soon as the patient is admitted. For more information, see *5.3.2 Editing Patient Information* for details.

WARNING

- **The settings of patient category and paced status always contain a default value, regardless of whether the patient is admitted or not. Check if the setting is correct for your patient.**
- **For paced patients, you must set Paced to Yes. If it is incorrectly set to No, the 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.**

5.3 Managing Patient Information

5.3.1 Entering the Patient Management Menu

Use any of the following methods to enter the **Patient Management** menu:

- Select the patient information area at the top left corner of the screen.
- Select the **Main Menu** quick key → from the **Patient Management** column select **Patient Management**.

5.3.2 Editing Patient Information

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

To edit patient information, follow this procedure:

1. Enter the **Patient Management** menu. For more information, see *5.3.1 Entering the Patient Management Menu*.
2. Edit patient information as required.

If you connect a barcode reader with your monitor, you can scan the patient's barcode to enter the patient's information.

NOTE

- **The monitor will reload the configuration if you changed the patient category.**

5.3.3 Loading Patient Information from the CMS

If the monitor is connected to the central monitoring system (CMS). You can load patient information from the CMS to the monitor. To do so, follow this procedure:

1. Enter the **Find Patient** menu in either of the following ways:
   - Select the **Main Menu** quick key → from the **Patient Management** column select **Find Patient**.
   - From the **Patient Management** menu select **Find Patient**.
2. Input query criteria. If your monitor is connected with the ADT server, input query criteria from the **Discharged Patient** page.
3. Select **Search**. Then a list pops up, including all the patients that meet the query criteria.

4. Select a patient from the patient list, and then select **Import**. Corresponding patient information in the monitor will be updated.

5.3.4 Loading Patient Information from the ADT Server

If the monitor is connected with the Admit-Discharge-Transfer (ADT) server through the eGateway. You can load patient information from ADT server to the monitor. To do so, follow this procedure:

1. Enter the **Find Patient** menu in either of the following ways:
   - Select the **Main Menu** quick key → from the **Patient Management** column select **Find Patient**.
   - Select **Find Patient** from the **Patient Management** menu.
2. Input query criteria.
3. Select **Search**. Then a list pops up, including all the patients that meet the query criteria.
4. Select a patient from the patient list, and then select **Import**. Corresponding patient information in the monitor will be updated.

NOTE

- **You can load patient information from the ADT server only when ADT Query is enabled. For more information, see *7.5 Disconnecting the Wireless Network*.**
- **Loading patient information from the ADT server updates only patient information in the monitor. The patient's monitoring data is not changed and the patient is not discharged.**

5.4 Transferring Patient Data

You can transfer the patient data between N1 and the host monitor without re-entering the patient demographic information or changing the settings. Transferring of patient data enables you to understand the patient's history condition. The patient data that can be transferred includes: patient demographics, trend data, event data, full disclosure waveform and parameters settings. The trends data and event data from the parameter modules of the host monitor can also be transferred.

For detailed information about patient data transfer, refer to the user manual of the host monitor. For the connection of N1 and the host monitor, refer to section *2.9 N1 in Use with a Host Monitor*.

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, alarm limits settings, and etc) on the monitor are appropriate for this patient.**

NOTE

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

5.5 Exporting Patient Data

To export the data of the current patient and discharged patients, follow this procedure:

1. Connect the N1 to the Dock.
2. Connect the USB drive to the Dock's USB connector.
3. Access the **Discharged Patients** dialog box by selecting the **Main Menu** quick key → from the **Patient Management** column select **Discharged Patients**.
4. From the patient list select desired patients.
5. Select **Export Data**.

5.6 Deleting Patient Data

To delete the data of discharged patients, follow this procedure:

1. Access the **Discharged Patients** dialog box by selecting the **Main Menu** quick key → from the **Patient Management** column select **Discharged Patients**.
2. From the patient list select desired patients.
3. Select **Delete**.

5.7 Connecting the CMS

You can connect the monitor to the BeneVision CMS. When connected to the CMS, the system provides the following function.

- The monitor can transmits parameter values, waveforms, alarm settings, and events to the CMS. From the CMS, you can check the patient's monitoring data and alarms.
- Patient information, alarm settings, and alarm status can be synchronized between the monitor and the CMS.
- You can start or stop NIBP measurements from the CMS.
- In case of network disconnection, the monitor can transmit the offline data to the CMS when network is reconnected.

For more information on the CMS, see *BeneVision Central Monitoring System Operator's Manual (PN: 046-007687-00)*.

6 Managing Configurations

6.1 Configuration Introduction

When performing continuous monitoring on a patient, the clinical professional often needs to adjust the monitor's settings according to the patient's condition. The collection of all these settings is called a configuration. The system configuration items can be classified as: parameter configuration items, conventional configuration items, and user maintenance items. 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 some settings from a certain set of configuration and then save the changed configuration as a user configuration.

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

- General
- OR
- ICU
- Neonatology
- CCU

WARNING

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

6.2 Changing the Department

If the current department configuration is not the one you want to view, you can change the department by following this procedure:

1. Select the **Main Menu** quick key → from the **Configuration** column select **Manage** → input the required password → select ↵.
2. Select **Change Department**.
3. Select a department.
4. Select **OK**.

CAUTION

- **Changing the department will delete all current user configurations.**

6.3 Setting Default Patient Category

To set the default patient category when admitting a new patient, follow this procedure:

1. Select the **Main Menu** quick key → from the **Configuration** column select **Manage** → input the required password → select ↵.
2. Set **Default Patient Category**.

6.4 Setting Default Configuration

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

- A patient is admitted.

- A patient is discharged.
- Patient category is changed.

To set the default configuration, follow this procedure:

1. Select the **Main Menu** quick key → from the **Configuration** column select **Manage** → input the required password → select ↵.
2. Select **Select Default Config.**
3. 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 Adult Config** and then select **Factory Default** 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.

6.5 Saving Current Settings

Current settings can be saved as a user configuration. Up to 25 user configurations can be saved.

To save current settings, follow this procedure:

1. Select the **Main Menu** quick key → from the **Configuration** column select **Manage** → input the required password → select ↵.
2. Select **Save Current Settings**.
3. Input the configuration name.
4. Select **OK** to save current settings as a user configuration.

6.6 Deleting a Configuration

To delete a configuration, follow this procedure:

1. Select the **Main Menu** quick key → from the **Configuration** column select **Manage** → input the required password → select ↵.
2. Select **Delete Configuration**.
3. Select the configuration you want to delete:
   - In the **Delete Configuration** menu, selecting **Local** tab shows the existing user configurations on the monitor.
   - In the **Delete Configuration** menu, selecting **USB Drive** tab shows the existing user configurations on the USB drive.
4. Select **Delete**.
5. Select **OK**.

6.7 Transferring a Configuration

When installing several monitors with identical user configurations, it is not necessary to set each unit separately. Use a USB drive to transfer the configuration from monitor to monitor.

6.7.1 Exporting a Configuration

To export the current monitor's configuration, follow this procedure:

1. Connect the monitor to the Dock.
2. Connect the USB drive to the Dock's USB port.
3. Select the **Main Menu** quick key → from the **Configuration** column select **Manage** → input the required password → select ↵.
4. Select **Export Configuration**.

5. Select the configurations and **User Maintenance Settings** to export.
6. Select **Export**.

6.7.2 Importing a Configuration

To import the configuration from the USB drive to the monitor, follow this procedure:

1. Connect the monitor to the Dock.
2. Connect the USB drive to the Dock's USB port.
3. Select the **Main Menu** quick key →from the **Configuration** column select **Manage** → input the required password → select ↵.
4. Select **Import Configuration**.
5. Select the configurations and **User Maintenance Settings** to import.
6. Select **Import**.

6.8 Printing Configurations

To print both factory configurations and user configurations, follow this procedure:

1. Select the **Main Menu** quick key →from the **Configuration** column select **Manage** → input the required password → select ↵.
2. Select **Print Configuration**.
3. Select desired configurations.
4. Select **Print**.

6.9 Loading a Configuration

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

To load a configuration, follow this procedure:

1. Select the **Main Menu** quick key → from the **Configuration** column select **Load**.
2. Select the desired configuration.
   - Select the configuration on this monitor in the **Local** page.
   - Select the configuration on the USB drive in the **USB Drive** page.
3. Select **Load**.

NOTE

- **The monitor may configure some settings by default when you load a configuration of different software version with the current configuration.**

6.10 Modifying Configuration Password

To modify the configuration password, follow this procedure:

1. Select the **Main Menu** quick key → from the **Configuration** column select **Manage** → input the required password → select ↵.
2. Select **Modify Password**.
3. Respectively input the old password and new password.
4. Select **OK**.

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7 Networked Monitoring

7.1 Network Introduction

You can connect the monitor to the central monitoring system (CMS), and eGateway through wired LAN or wireless LAN.

7.2 Network Safety Information

CAUTION

- **Wireless network designing, deploying, debugging, and maintenance should be executed by Mindray service personnel or authorized technicians.**
- **Always set the wireless network according to local wireless regulations.**
- **Data communication must be performed within a closed network or within a virtually isolated network provided by a hospital for all network functions. The hospital is responsible for ensuring the security of the virtually isolated network.**
- **Keep network authentication information, for example password, safe, protecting the network from being accessed by unauthorized users.**
- **Do not connect non-medical devices to the monitor network.**
- **If wireless network signal is poor, there may be a risk of CMS data loss.**
- **RF interference may result in wireless network disconnection.**
- **Disconnecting from the network may result in CMS data loss and function failure. Check the patient in case of network disconnection and solve the network problem as soon as possible.**
- **Ensure that the monitor IP address setting is correct. Changing the network settings may result in network disconnection. Contact your service personnel if you have any problems on setting the IP address.**

7.3 Connecting the Monitor to the CMS

To connect the monitor to the CMS, follow this procedure:

1. Set the **IP address**, **Subnet Mask**, and **Gateway.** For more information, see section *22.16 The Network Setup Settings*.
2. Connect the monitor to the CMS through either of the following methods:
   - Admit the monitor on the CMS. Refer to the *BeneVision Central Monitoring System Operator's Manual (PN: 046-010282-00)* for details of admitting a monitor.
   - If enabled, select a CMS from the system status information area at the top right corner of the screen. For how to enable the selection of a CMS, see section *22.16.3 The Central Station Setup Tab*.

7.4 Connecting the eGateway

You can connect the monitor to the eGateway to implement interaction between the monitor and external devices. When connected to the eGateway, the system provides the following functions:

- The monitor can transmit parameter values, waveforms, alarm settings, and events to the eGateway.
- Clock can be synchronized between the monitor and the eGateway.

7.5 Disconnecting the Wireless Network

To disconnect the wireless network manually, follow this procedure:

1. Swipe the screen from top down with a single finger.

2. Select  .

To reconnect the wireless network after it is disconnected manually, follow this procedure:

1. Swipe the screen from top down with a single finger.
2. Select  .

8 Alarms

8.1 Alarm Introduction

This chapter describes alarm functions and alarm settings.

8.2 Alarm Safety Information

WARNING

- **A potential hazard can exist if different alarm presets and default configuration settings are used for the same or similar equipment in the same care area, for example an intensive care unit or cardiac operating room.**
- **If your monitor is connected to the central monitoring system (CMS) or other monitors, alarms can be presented and controlled remotely. Remote suspension, inhibition, or reset of monitor alarms via the CMS or other monitors may cause a potential hazard. For more information, see the operator's manuals of the CMS and the other monitors.**
- **The monitors in your care area may each have different alarm settings to suit different patients. Always check that the alarm settings are appropriate for your patient before start monitoring. Always make sure that necessary alarm limits are active and set according to the patient's clinical condition.**
- **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 SpO_2 high alarm limit to 100%, which is equivalent to switching the alarm off.**
- **When the alarm sound is switched off, the monitor gives no alarm tones even if a new alarm occurs. Be careful about whether to switch off the alarm sound or not. When the alarms are off or while alarm audio is paused either temporarily or indefinitely, observe the patient frequently.**
- **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.**
- **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 make sure that the audio alarm volume level is adequate in your care environment. Always keep the patient under close surveillance.**

8.3 Understanding the Alarms

8.3.1 Alarm Categories

The monitor has two different types of alarms: physiological alarms and technical alarms.

- Physiological alarms are triggered by patient measurement exceeding the parameter limits, or by an abnormal patient conditions.
- Technical alarms are triggered by an electrical, mechanical, or other monitor failure, or by failure of a sensors or components. Technical alarm conditions may also be caused when an algorithm cannot classify or interpret the available data.

Apart from the physiological and technical alarms, the monitor can also prompt some messages telling the system status or patient status.

8.3.2 Alarm Priorities

By severity, the alarms are classified into the following priority levels:

- High priority alarms: indicates a life threatening situation or a severe device malfunction. High priority alarms require an immediate response.
- Medium priority alarms: indicates abnormal vital signs or a device malfunction. Medium priority alarms require a prompt response.
- Low priority alarms: indicates a discomfort condition, a device malfunction, or an improper operation. Low priority alarms require you to be aware of this condition.
- Messages: provides additional information on the patient or the equipment.

8.3.3 Alarm Indicators

When an alarm occurs, the monitor indicates it to you through visual or audible alarm indications. For more information, see the following table.

Alarm Indicator		High Priority Alarm	Medium Priority Alarm	Low Priority Alarm	Message	Comments
Alarm lamp		Red Flashing frequency: 1.4 - 2.8 Hz Duty cycle: 20 - 60% on	Yellow Flashing frequency: 0.4 - 0.8 Hz Duty cycle: 20 - 60% on	Cyan No flashing Duty cycle: 100% on	None	None
Audible tone pattern	ISO	Repeat pattern of triple + double + triple + double beeps	Repeat pattern of triple beeps	Single beep	None	None
	Mode 1	Repeat pattern of high-pitched single beep	Repeat pattern of double beeps	Low-pitched single beep	None	
	Mode 2	Repeat pattern of high-pitched triple beeps	Repeat pattern of double beeps	Low-pitched single beep	None	
Alarm message		White text inside a red box	Black text inside a yellow box	Black text inside a cyan box	White text	Alarm messages are displayed in the alarm information area at the top of the screen. You can select the alarm messages to show the alarm list.
Alarm priority indicator		***	**	*	None	The indicator shows in front of corresponding alarm message.
Parameter value		White text inside a flashing red box	Black text inside a flashing yellow box	Black text inside a flashing cyan box	None	None

NOTE

- **When multiple alarms of different priority levels occur simultaneously, the monitor select the alarm of the highest priority to light the alarm lamp and issue the alarm tone.**
- **When multiple alarms of different priority levels occur simultaneously and should be displayed in the same area, the monitor only displays the messages of the highest priority alarm.When multiple alarms of the same priority levels occur simultaneously and should be displayed in the same area, all the alarm messages are displayed circularly.**

8.3.4 Alarm Status Symbols

Apart from the alarm indicators as described in ***8.3.3 Alarm Indicators***, the monitor uses the following symbols to indicate the alarm status:

	Alarm pause:	indicates that all the alarms are paused.
	Alarm off:	indicates that individual measurement alarms are turned off or the system is in the alarm off status.
	Audio pause:	indicates that audible alarm tones are paused.
	Audio off:	indicates that audible alarm tones are turned off.
	Alarm reset:	indicates that alarms are acknowledged and the alarm system is reset.

8.4 Accessing On-screen Help for Technical Alarms (AlarmSight)

In the technical alarm list, alarm messages followed by **Detail** include help messages or pictures to help you identify the problem. This function is called AlarmSight. To access AlarmSight, follow this procedure:

1. Select the technical alarm information area to enter the **Alarms** window.
2. Select the **Technical Alarms** tab.
3. From the alarm list select the desired alarm.

8.5 Checking Physiological Alarm List

To check the physiological alarm list, follow this procedure:

1. Select the physiological alarm information area to enter the **Alarms** window.
2. Select the **Physiological Alarms** tab.

8.6 Changing Alarm Settings

From the **Alarm** column of the main menu select desired buttons to set alarm properties.

8.6.1 Setting Parameter Alarm Properties

To set parameter alarm properties, follow this procedure:

1. Select the **Main Menu** quick key → from the **Alarm** column select **Limits.** Enter the password if required.
2. Select a parameter tab and set alarm properties as desired.

You can also change the alarm properties of individual parameter from corresponding parameter menu.

8.6.2 Setting Alarm Tone Properties

8.6.2.1 Changing the Alarm Volume

To change the alarm volume, follow this procedure:

1. Select the **Main Menu** quick key → from the **Alarm** column select **Setup.**
2. Set **Alarm Volume**. The optional alarm volume is between X to 10, in which X is the minimum volume, depending on the setting of minimum alarm volume, and 10 is the maximum volume.
3. Select **High Alarm Volume** to set the volume of the high priority alarm.
4. Select **Reminder Volume** to set the volume of the reminder tone.

NOTE

- **When the alarm volume is set to 0, the alarm sound is turned off and the audio off symbol appears on the screen.**
- **You cannot set the volume of high priority alarms if Alarm Volume is set to 0.**

8.6.2.2 Password Protected Audio Alarm Settings

The following alarm settings are password protected:

- Minimum alarm volume
- Alarm sound pattern
- Alarm interval
- Alarm sound escalation switch and delay

For more information, see *22.4.1 The Audio Tab*.

8.6.3 Setting the Auto Limits for New Patient Switch

If the **Auto Limits for New Patient** function is enabled, a dialog box can pop up to ask you whether to set alarm limits based on the latest parameter measurements for a newly admitted patient. To set the **Auto Limits for New Patient** switch, follow this procedure:

1. Enter the alarm setup page in any of the following ways:
   - Select the **Alarm Setup** quick key → select the **Setup** tab.
   - Select the **Main Menu** quick key → from the **Alarm** column select **Setup**.
2. Set the **Auto Limits for New Patient** switch.

When **Auto Limits for New Patient** is switched on, the confirmation dialog box pops up if all of the following requirements are met:

- Within 10 minutes after the patient is admitted.
- Continuous measurements are stable.
- An NIBP measurement has been taken
- HR alarm switch is on.
- No fatal alarms are triggered.
- The patient is not in poor perfusion condition.
- Alarm limit of any parameter was not manually changed.
- The monitor is not in intubation mode, rescue mode, private mode, or CPB mode.

NOTE

- **The Auto Limits for New Patient function is intended for newly admitted patients only.**
- **The automatically set alarm limits take effect only after being confirmed.**

8.6.4 Initiating Auto Alarm Limits

The monitor provides the auto alarm limits function to automatically adjust alarm limits according to the patient's vital signs using. 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.

To initiate auto alarm limits, follow this procedure:

1. Select the **Main Menu** quick key → from the **Alarm** column select **Limits.**
2. From the **Limits** page, select **Auto Limits** at the left bottom.
3. Select **OK** from the popup dialog box.

Then the monitor will automatically calculate alarm limits basing on the latest measured values. Before applying these automatically created alarm limits, confirm if they are appropriate for your patient from the **Limits** 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 auto limits basing on the following rules:

Module	Parameter	Lower Limit		Upper Limit		Auto Limit Range
		Adult/ pediatric	Neonate	Adult/ pediatric	Neonate	
ECG	HR/PR (bpm)	HR × 0.8 or 40 (whichever is greater)	(HR - 30) or 90 (whichever is greater)	HR × 1.25 or 240 (whichever is smaller)	(HR + 40) or 200 (whichever is smaller)	Adult/pediatric: 35 to 240 Neonate: 55 to 225
Resp	RR (rpm)	RR × 0.5 or 6 (whichever is greater)	(RR - 10) or 30 (whichever is greater)	(RR × 1.5) or 30 (whichever is smaller)	(RR + 25) or 85 (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 (mmHg)	(SYS × 0.68 + 10)	(SYS - 15) or 45 (whichever is greater)	(SYS × 0.86 + 38)	(SYS + 15) or 105 (whichever is smaller)	Adult: 45 to 270 Pediatric: 45 to 185 Neonate: 35 to 115
	NIBP-D (mmHg)	(Dia × 0.68 + 6)	(Dia - 15) or 20 (whichever is greater)	(Dia × 0.86 + 32)	(Dia + 15) or 80 (whichever is smaller)	Adult: 25 to 225 Pediatric: 25 to 150 Neonate: 20 to 90
	NIBP-M (mmHg)	(Mean × 0.68 + 8)	(Mean - 15) or 35 (whichever is greater)	(Mean × 0.86 + 35)	(Mean + 15 or 95) (whichever is smaller)	Adult: 30 to 245 Pediatric: 30 to 180 Neonate: 25 to105
Temp (xx refers to temperature site))	Txx(°C)	(Txx - 0.5)	(Txx - 0.5)	(Txx + 0.5)	(Txx + 0.5)	1 to 49
	ΔT (°C)	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

Module	Parameter	Lower Limit		Upper Limit		Auto Limit Range
		Adult/ pediatric	Neonate	Adult/ pediatric	Neonate	
IBP: ART/ Ao/UAP/ BAP/FAP/ LV/P1-P4 (Arterial pressure)	IBP-S (mmHg)	SYS × 0.68 + 10	(SYS - 15) or 45 (whichever is greater)	SYS × 0.86 + 38	(SYS + 15) or 105 (whichever is smaller)	Adult: 45 to 270 Pediatric: 45 to 185 Neonate: 35 to 115
	IBP-D (mmHg	(Dia × 0.68 + 6)	(Dia - 15) or 20 (whichever is greater)	(Dia × 0.86 + 32)	(Dia + 15) or 80 (whichever is smaller)	Adult: 25 to 225 Pediatric: 25 to 150 Neonate: 20 to 90
	IBP-M (mmHg)	Mean × 0.68 + 8	(Mean - 15) or 35 (whichever is greater)	Mean × 0.86 + 35	(Mean + 15) or 95 (whichever is smaller)	Adult: 30 to 245 Pediatric: 30 to180 Neonate: 25 to 105
IBP: PA	IBP-S (mmHg)	SYS × 0.75	SYS × 0.75	SYS × 1.25	SYS × 1.25	3 to 120
	IBP-D (mmHg	Dia × 0.75	Dia × 0.75	Dia × 1.25	Dia × 1.25	3 to 120
	IBP-M (mmHg)	Mean × 0.75	Mean × 0.75	Mean × 1.25	Mean × 1.25	3 to 120
IBP: CPP	CPP (mmHg)	CPP × 0.68 + 8	(CPP-15) or 35, (whicherver is greater)	CPP × 0.86 + 35	(CPP+15) or 95, (whichever is smaller)	Adult: 20 to 235 Pediatric: 25 to175 Neonate: 25 to 100
IBP: CVP/ LAP/ RAP/ UVP/P1-P4 (Venous pressure)	IBP-M	Mean × 0.75	Mean × 0.75	Mean × 1.25	Mean × 1.25	3 to 40
CO_2	$EtCO_2$ (mmHg)	0 to 32: remains the same	0 to 32: remains the same	0 to 32: remains the same	0 to 32: remains the same	Same as the measurement range
		33 to 35: 29	33 to 35: 29	33 to 35: 41	33 to 35: 41	Same as the measurement range
		36 to 45: ($EtCO_2$ - 6)	36 to 45: ($EtCO_2$ - 6)	36 to 45: ($EtCO_2$ + 6)	36 to 45: ($EtCO_2$ + 6)	Same as the measurement range
		46 to 48: 39	46 to 48: 39	46 to 48: 51	46 to 48: 51	Same as the measurement range
		>48: remains the same	>48: remains the same	>48: remains the same	>48: remains the same	Same as the measurement range
	$FiCO_2$	None	None	Same as the default alarm limit	Same as the default alarm limit	Same as the measurement range
	awRR (rpm)	awRR × 0.5 or 6 (whichever is greater)	(awRR - 10) or 30 (whichever is greater)	awRR × 1.5 or 30 (whichever is smaller)	(awRR+25) or 85 rpm (whichever is smaller)	Adult/pediatric: 6 to 55 Neonate: 10 to 90

8.6.5 Setting the Alarm Delay Time

For continuously measured parameters, you can set the alarm delay time. If the alarm condition is resolved within the delay time, the monitor does not present the alarm.

This setting is password protected. For more information, see *22.4.5 The Other Tab*.

The setting of **Alarm Delay** is not applied to the apnea alarms and the ST alarms. You can set **Apnea Delay** and **ST Alarm Delay** separately.

8.6.5.1 Setting the Apnea Delay Time

To set the apnea delay time, follow this procedure:

1. Select the **Main Menu** quick key → from the **Alarm** column select **Setup.**
2. Select **Apnea Delay** to set the apnea delay time.

8.6.6 Adjusting the Alarm Light Brightness

This setting is password protected. For more information, see *22.4.5 The Other Tab*.

NOTE

- **If you set alarm light brightness to Auto, the monitor automatically adjusts the alarm light brightness according to the ambient light. The stronger the ambient light is, the brighter the alarm light is.**

8.6.7 Restoring the Default Alarm Settings

To reset all alarm settings to the defaults, follow this procedure:

1. Select the **Main Menu** quick key → from the **Alarm** column select **Setup.**
2. Select the **Limits** tab.
3. On the **Limits** page, select **Defaults** at the bottom.

8.6.8 Setting the Length of Printed Waveforms

You can define the length of printed waveforms when an alarm is triggered. To do so, follow this procedure:

1. Select the **Main Menu** quick key → from the **Alarm** column select **Setup.**
2. Select the **Setup** tab.
3. Set **Printing Duration On Alarm**.

8.6.9 Setting the Switch of the SpO_2 Desat Alarm Off

You can choose whether switching off the SpO_2 Desat alarm is permissible or not. This setting is password protected. For more information, see *22.4.5 The Other Tab*.

WARNING

- **If you switch off the SpO2 Desat alarm, the monitor will not alarm when the patient's SpO_2 is extremely low. This may result in a hazard to the patient. Always keep the patient under close surveillance.**

8.6.10 Setting the Switch of the Apnea Alarm Off

You can choose whether switching off the apnea alarm is permissible or not. This setting is password protected. For more information, see *22.4.5 The Other Tab*.

WARNING

- **If you switch off the apnea alarm, the monitor will not issue the apnea alarm in case that apnea happens. This may result in a hazard to the patient. Keep the patient under close surveillance.**

8.7 Pausing Alarms/Pausing Alarm Tones

8.7.1 Defining the Pause Function

You can either pause alarms or pause alarm tones. This depends on the pause setting.This setting is password protected. For more information, see *22.4.2 The Pause/Reset Tab*.

8.7.2 Pausing Alarms

If the pause function is designated as pausing alarms, pressing the **Alarm Pause** quick key can temporarily disable alarm indicators. When alarms are paused, the following rules are followed:

- No physiological alarm will be presented.
- For technical alarms, alarm sounds are paused, but alarm lamps and alarm messages remain presented.
- The remaining alarm pause time is displayed in the physiological alarm information area.
- The alarm pause symbol is displayed in the system information area.

When the alarm pause time expires, the alarm paused status is automatically deactivated. You can also cancel the alarm paused status by pressing the **Alarm Pause** quick key.

The following alarm pause and alarm reset settings are password protected.

- Alarm pause time
- Priorities of paused alarms
- Alarm reset setting
- Reminder tone settings

For more information, see *22.4.2 The Pause/Reset Tab*.

8.7.2.1 Switching Off All Alarms

If **Pause Time** is set to **Permanent** (see *22.4.2 The Pause/Reset Tab*), pressing the **Alarm Pause** quick key permanently switches off all alarms. The alarm off status has the following features:

- Physiological alarms are switched off. The alarm lamp does not flash and alarm sound is not issued.
- Alarm sound of technical alarms is switched off, but alarm lamp flashes and alarm messages are presented.
- The message **Alarm Off** with red background is displayed in the physiological alarm information area.
- The alarm off symbol is displayed in the system status information area.

To exit the alarm off status, press the **Alarm Pause** quick key again.

WARNING

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

8.7.3 Pausing Alarm Sound

If the pause function is defined as **Audio Pause**, pressing the **Audio Pause** key pauses alarm tone. When alarm tones are paused, the following rules are followed:

- The sound of all physiological alarms and technical alarms are switched off.
- The remaining audio pause time is displayed in the physiological alarm information area.
- The audio pause symbol is displayed in the system information area.

When the audio pause time expires, the audio paused status is automatically deactivated. You can also cancel the audio paused status by pressing the **Audio Pause** quick key.

8.7.3.1 Setting the Alarm Tone Pause Time

The alarm tone pause time can be set to **1 min**, **2 min**, **3 min**, or **Permanent**. The default audio pause time is two minutes.

This function is password protected. For more information, see *22.4.2 The Pause/Reset Tab*.

8.7.3.2 Prolonging the Alarm Tone Pause Time.

You can temporarily prolong the alarm tone pause time after the monitor enters the alarm tone paused status. This function is password protected. For more information, see *22.4.2 The Pause/Reset Tab*.

NOTE

- **Prolonging alarm pause time does not affect the setting of alarm tone pause time.**

8.7.3.3 Setting the Priority of Audio Paused Alarms

You can select alarm sound of what priority can be paused. This function is password protected. For more information, see *22.4.2 The Pause/Reset Tab*..

8.7.3.4 Switching Off Alarm Sound

If **Pause Time** is set to **Permanent** (see *22.4.2 The Pause/Reset Tab*.), pressing the **Audio Pause** quick key permanently switches off all alarm sound. The audio off status has the following features:

- Alarm sound of both physiological alarms and technical alarms is switched off.
- The audio off symbol is displayed in the system information area.

To exit the audio off status, press the **Audio Pause** quick key again.

WARNING

- **Pausing or switching off alarm sound may result in a hazard to the patient.**

8.8 Resetting Alarms

Pressing the **Alarm Reset** quick key to acknowledge the ongoing alarms and reset the alarm system. When the alarm system is reset, the alarm reset symbol displays in the system status information area for alarm symbols.

NOTE

- **If a new alarm is triggered after the alarm system is reset, the alarm reset icon will disappear and the alarm light and alarm tone will be reactivated.**

8.8.1 Resetting Physiological Alarms

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

- The alarm sound is silenced.
- A √ appears before the alarm message, indicating that the alarm is acknowledged.
- The color of the parameter numeric background corresponds with the alarm priority, but the parameter numeric does not flash.

8.8.2 Resetting Technical Alarms

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

- Some technical alarms are cleared. The monitor gives no alarm indications.
- Some technical alarms are changed to the prompt messages.
- For some technical alarms, the alarm is silenced and a √ appears before the alarm message, indicating that the alarm is acknowledged.

For details about the indications of technical alarms when the alarm system is reset, see *D Alarm Messages*.

8.9 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" physiological alarms, their alarm indications disappear when the alarm condition ends.
- If you "latch" physiological alarms, all visual and audible alarm indications remains until you reset the alarms. For latched alarms the time when the alarm is last triggered is displayed behind the alarm message.

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

- When visual indications are latched, visual indications, including alarm lamp, alarm message and its background remains when the alarm condition ends and the time when the alarm last triggered is displayed behind the alarm message.
- When audible indications are latched, the monitor issues alarm sounds when the alarm condition ends.

The alarm latch settings is password protected. For more information, see *22.4.3 The Latching Tab*.

NOTE

- **Changing alarm priority may affect the latching status of corresponding alarm. Determine if you need to reset the alarm latching status if you changed the alarm priority.**
- **When the alarm system is reset, latched physiological alarms are cleared.**

8.10 CPB Mode

The CPB (Cardiopulmonary Bypass) mode is activated only if you set the department to **OR**.

In the CPB mode, all the physiological alarms and technical alarms are switched off. So when performing CPB, you can put the monitor in the CPB mode in order to inactivate unnecessary alarms.

8.10.1 Entering the CPB Mode

To enter the CPB mode, select the **Main Menu** quick key → from the **Alarm** column, select **CPB Mode**.

In the CPB mode, **CPB Mode** is displayed in the physiological alarm area with a red background color.

NOTE

- **When the CPB mode is entered, the monitor stops all NIBP measurements. You can restart NIBP measurements after entering the CPB mode.**

8.10.2 Exiting the CPB Mode

To exit the CPB mode, select the **Main Menu** quick key → from the **Alarm** column select **Exit CPB Mode**.

8.11 Intubation Mode

Intubation mode is available for Resp and CO_2 monitoring. When performing intubation during general anesthesia, you can put the monitor in the intubation mode in order to inactivate unnecessary alarms.

In the intubation mode, Resp and CO_2 related physiological alarms are switched off.

8.11.1 Entering the Intubation Mode

To enter the intubation mode, choose either of the following ways:

- From the bottom of the **Resp** or **CO2** menu, select **Intubation Mode**.
- Select the **Main Menu** quick key → from the **Alarm** column select **Intubation Mode**.

8.11.2 Exiting the Intubation Mode

To exit the intubation mode, choose either of the following ways:

- From the bottom of the **Resp** or **CO2** menu, select **Exit Intubation Mode**.

■ Select the **Main Menu** quick key →from the **Alarm** column select **Exit Intubation Mode**.

8.12 Testing Alarms

The monitor automatically performs a selftest at startup. Check that an alarm tone is heard, and the alarm lamp illuminates, one after the other, in red, yellow, and cyan. This indicates that the visible and audible alarm indicators functions correctly.

To further test individual measurement alarms, perform measurements on yourself or using a simulator. Adjust alarm limits and check that appropriate alarm behavior is observed.

8.13 Actions When an Alarm Occurs

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

1. Check the patient's condition.
2. Confirm the alarming parameter or alarm category.
3. Identify the source of the alarm.
4. Take proper action to eliminate the alarm condition.
5. Make sure the alarm condition is corrected.

For more information, see *D Alarm Messages*.

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9 Monitoring ECG, Arrhythmia, ST and QT

9.1 ECG Introduction

The electrocardiogram (ECG) measures the electrical activity of the heart and displays it on the monitor as waveforms and numerics. ECG monitoring provides 3-, 5-, 6-, and 12-lead ECG monitoring, ST-segment analysis, arrhythmia analysis, and QT/QTc measurements.

The ECG monitoring and arrhythmia detection is intended for adult, pediatric, and neonatal patients. .

9.2 ECG Safety Information

WARNING

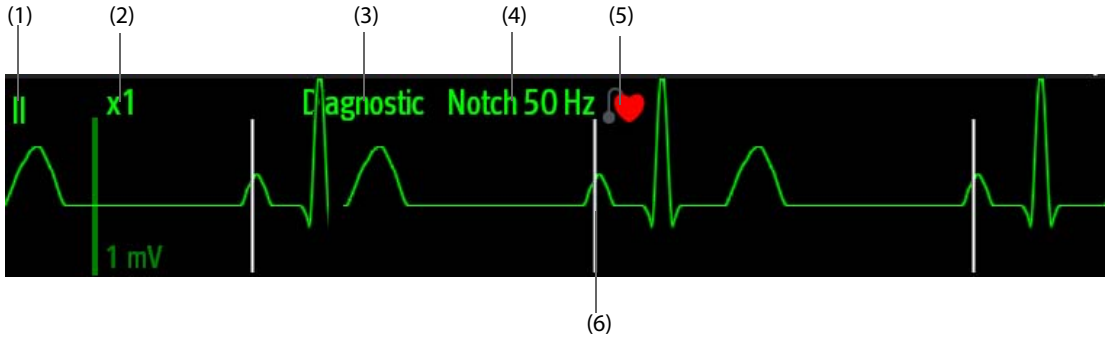
- **This equipment is not intended for direct cardiac application.**
- **Make sure the conductive parts of electrodes and associated connectors, including the neutral electrode, do not contact any other conductive parts including earth.**
- **Use defibrillation-proof ECG cables during defibrillation.**
- **Do not touch the patient or metal devices connected to the patient during 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 electrosurgery unit (ESU).**
- **To reduce the hazard of burns during use of high-frequency surgical unit (ESU), the ECG electrodes should not be located between the surgical site and the ESU return electrode.**

CAUTION

- **Only use parts and accessories specified in this manual. Follow the instructions for use and adhere to all warnings and cautions.**
- **Periodically inspect the electrode application site to ensure skin integrity. If the skin quality changes, replace the electrodes or change the application site.**
- **Interference from ungrounded instrument near the patient and electrosurgery interference can induce noise and artifact into the waveforms.**

9.3 ECG Display

The following figures show the ECG waveform and numeric areas. Your display may be configured to look slightly different.



(1) ECG lead label of the displayed waveform

(2) ECG waveform gain

(3) ECG filter mode

(4) Notch filter status

(5) Paced status: If **Paced** is set to **Yes**, is displayed. If **Paced** is set to **No**, is displayed.

(6) Pace pulse mark: If **Paced** is set to **Yes**, the pace pulse markers "|" are displayed corresponding to detected pace pulse on each ECG waveform.

(1) Parameter label

(2) HR unit

(3) HR alarm limits

(4) HR value

(5) ECG signal quality index (ECG SQI)

(6) Pleth signal quality index (Pleth SQI)

SQI with five highlighted bars indicates the best signal. SQI with one highlighted bar indicates the poorest signal. If the SQI is poor, check ECG electrodes or SpO_2 sensor application. Reposition the electrodes or sensor if necessary.

The CrozFusion™ function analyzes the ECG signal and the Pleth wave signal together to achieve more accurate arrhythmia analysis result and HR/PR measurements. To view the on-screen help for the CrozFusion™ function, select the **CrozFusion** tab from the **ECG** menu.

The ECG SQI, Pleth SQI, and signal fusion status are displayed when the CrozFusion™ function is enabled. The following table lists SQI indications of different signal fusion status:

	The quality of both ECG and Pleth signal is good. ECG signal and Pleth signal are independently analyzed.
	The quality of Pleth signal is poor. The PR value may be erroneous. The ECG signal is being used to correct the PR value.
	The quality of ECG signal is poor. The HR value and arrhythmia analysis may be erroneous. The Pleth signal is being used to correct the HR value and for arrhythmia analysis.

If the CrozFusion™ function is disabled, ECG signal and the Pleth wave signal will not be analyzed together, and the ECG SQI and Pleth SQI are not displayed. For more information, see *9.6.6 Disabling the CrozFusion™ Function*.

NOTE

- **The CrozFusion™ function uses ECG arrhythmia analysis leads according to the Analysis Mode setting. So the ECG SQI indicates the signal quality of the ECG arrhythmia analysis leads.**
- **The ECG numeric area and waveform area are configured to be different for different lead type and ECG settings.**

9.4 Preparing for ECG Monitoring

9.4.1 Preparing the Patient Skin

Proper skin preparation is necessary to ensure good signal quality at the electrode sites, as the skin is a poor conductor of electricity. To properly prepare the skin, choose flat areas and then follow this procedure:

1. Shave hair from skin at chosen electrode sites.
2. Gently rub skin surface at sites to remove dead skin cells.
3. Thoroughly cleanse the site with a mild soap and water solut6ion.
4. Dry the skin completely before applying electrodes.

9.4.2 Applying Electrodes

To connect ECG cables, follow this procedure:

1. Check that electrode packages are intact and the electrodes are not past the expiry date. Make sure the electrode gel is moist. If you are using snap electrodes, attach the snaps to the electrodes before placing electrodes on the patient.
2. Place the electrodes on the prepared sites. Make sure that all electrodes have good skin contact.
3. Connect the leadwires to the patient cable if not already connected.
4. Plug the patient cable into the ECG connector.

NOTE

- **Store the electrodes at room temperature.**
- **Only open the electrode package immediately prior to use.**
- **Never mix patient electrode types or brands. This may lead to problem due to impedance mismatch.**
- **When applying the electrodes, avoid bony area, obvious layers of fat, and major muscles. Muscle movement can result in electrical interference. Applying electrodes on major muscles, for example on muscles of the thorax, may lead to erroneous arrhythmia alarms due to excessive muscle movement.**

9.4.3 Lead Wire Color Code

The following table lists the color coding of leadwires for both AHA and IEC standards:

Lead	IEC		AHA	
	Label	Color	Label	Color
Right arm	R	Red	RA	White
Left arm	L	Yellow	LA	Black
Right leg (neutral)	N	Black	RL	Green
Left leg	F	Green	LL	Red

Lead	IEC		AHA	
	Label	Color	Label	Color
Chest 1	C1	White/Red	V1	Brown/Red
Chest 2	C2	White/Yellow	V2	Brown/Yellow
Chest 3	C3	White/Green	V3	Brown/Green
Chest 4	C4	White/Brown	V4	Brown/Blue
Chest 5	C5	White/Black	V5	Brown/Orange
Chest 6	C6	White/Violet	V6	Brown/Violet

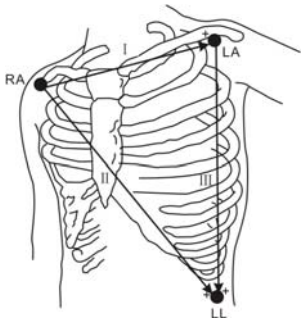
9.4.4 ECG Electrode Placements

In this section, electrode placement is illustrated using the AHA naming convention.

9.4.4.1 3-leadwire Electrode Placement

The following is an electrode configuration when a 3-leadwire cable is used:

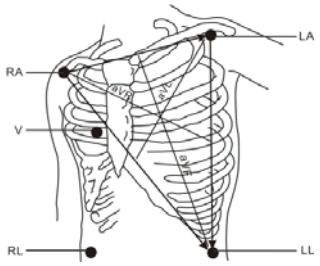
- RA placement: directly below the clavicle and near the right shoulder.
- LA placement: directly below the clavicle and near the left shoulder.
- LL placement: on the left lower abdomen.



9.4.4.2 5-leadwire and 6-leadwire Electrode Placement

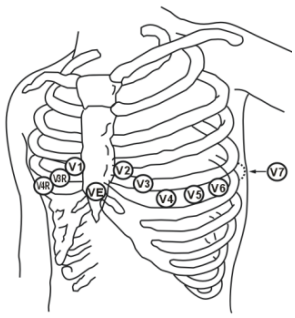
The following is an electrode configuration when when 5-leadwires is used:

- 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.



For 6-leadwire placement, you can use the position for the 5 -leadwire placement but with two chest leads. The two chest leads (Va and Vb) can be positioned at any two of the V1 to V6 positions. For more information, see *9.4.4.3 Chest Electrode Placement*. The Va and Vb lead positions are configurable. For more information, see *9.6.4.4 Changing Va and Vb Labels*.

9.4.4.3 Chest Electrode Placement



The chest electrode can be placed at the following positions:

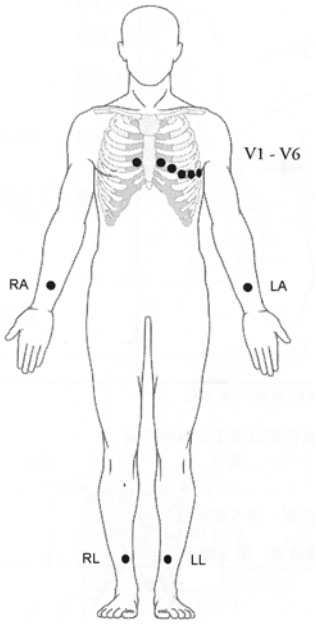
- V1 placement: on the fourth intercostal space at the right sternal border.
- V2 placement: on the fourth intercostal space at the left sternal border.
- V3 placement: midway between the V2 and V4 electrode positions.
- V4 placement: on the fifth intercostal space at the left midclavicular line.
- V5 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.

NOTE

- **For the 5-leadwire and 6-leadwire placement, place the precordial electrode according to the physician's preference.**

9.4.4.4 10-leadwire Electrode Placement

12-lead ECG uses 10 electrodes, which are placed on the patient's four limbs and chest. The limb electrodes should be placed on the limb extremities and the chest electrodes placed according to the physician's preference. The picture at the right shows the conventional 10-leadwire electrode placement.



9.4.4.5 Lead Placement for Surgical Patients

The surgical site should be taken into consideration when placing electrodes on a surgical patient. For example, 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

- **To reduce the hazard of burns during use of electrosurgical units (ESU), the ECG electrodes should not be located between the surgical site and the ESU return electrode.**
- **Never entangle the ESU cable and the ECG cable together.**
- **When using ESU, never place ECG electrodes near the grounding plate of the ESU, as this can cause a lot of interference on the ECG signal.**

9.4.5 Choosing the ECG Lead Type

To choose ECG lead type, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab.
3. Set **Lead Set** according to the lead type you are going to use. The default lead type is **Auto**. In this case, the monitor automatically detects the lead type.

9.4.6 Checking Paced Status

It is important to correctly set the paced status before you start monitoring ECG. The paced symbol is displayed when **Paced** is set to **Yes**. The pace pulse markers "|" are shown on each ECG waveform when the patient has a paced signal. If **Paced** is set to **No** or if the patient's paced status is not selected, the symbol will be shown in the ECG waveform area.

To change the paced status, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Pacer** tab.
3. Set **Paced** to **Yes** or **No**.

You can also change the patient's paced status from the Patient Management menu. For more information, see *5.3.1 Entering the Patient Management Menu*.

If you did 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 check if the patient has a pacemaker?** appears in the ECG waveform area. Check and set the patient's paced status.

WARNING

- **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 complex and fail to alarm when the ECG signal is too weak. 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.**
- **False low heart rate or false asystole alarms may result with certain pacemakers because of pacemaker artifacts, such as electrical overshoot of the pacemaker overlapping the true QRS complexes.**
- **Do not rely entirely on rate meter alarms when monitoring patients with pacemakers. Always keep these patients under close surveillance.**
- **The auto pacer recognition function is not applicable to pediatric and neonatal patients.**
- **For non-paced patients, you must set Paced to No.**

9.4.7 Enabling Pacer Rejection

The pace pulse rejection function is disabled by default. To enable this function, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Pacer** tab.
3. Switch on **Pacer Reject**.

NOTE

- **When pace pulses are detected, the pace pulse marks "|" are shown on the ECG waveforms. Pacer Rejection setting has no impact on the display of pace pulse marks "|".**
- **You can switch on pacer rejection only when Paced is set to Yes. If Paced is set to no, the setting of Pacer Reject is disabled.**

9.5 Using 6-lead Placement to Derive 12-lead ECG (D12L)

The monitor supports using the 6-lead placement to derive 12-lead ECG. This function is called D12L. When D12L is enabled, the monitor can derive four additional chest leads according to directly acquired ECG signals. D12L provides a non-diagnostic 12-lead view, including ECG waveforms and ST/QT measurements. D12L is intended for adult patients only.

The available Va and Vb combinations supporting D12L are:

- V1 and V3, V1 and V4, V1 and V5
- V2 and V4, V2 and V5
- V3 and V5, V3 and V6

D12L is disabled by default. To enable D12L, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab.
3. Select the positions of Va and Vb. You shall use an available Va and Vb combination.
4. Switch on **D12L**.

WARNING

- **D12L is not intended for pediatric and neonatal patients.**
- **The positions of Va and Vb shall be consistent with the settings of Va and Vb. Otherwise D12L does not work properly.**
- **The derived 12-lead ECGs and their measurements are approximations to conventional 12-lead ECGs. The derived leads cannot be used for heart rate calculation and arrhythmia analysis.**
- **The derived 12-lead ECGs should not be used for diagnostic interpretations.**

NOTE

- **You shall use the available Va and Vb combination supporting D12L. I f you choose other combinations, D12L does not work and the message "D12L not available" is prompted.**

9.6 Changing ECG Settings

9.6.1 Choosing an ECG Screen

When monitoring ECG, you can choose the screen as desired.

- For 3-lead ECG monitoring, only normal screen is available.
- For 5-lead or 6-lead ECG monitoring, besides the normal screen, you can also choose the full screen.
- For 12-lead ECG monitoring, besides the normal screen, you can also choose the full screen, and 12-lead full screen.

Taking the selection of the 12-lead screen for example, to choose the 12-lead screen, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab, and set the **Lead Set** to **12-Lead**.
3. From the bottom of the menu, select **12-lead**.

9.6.2 Setting ECG Alarm Properties

To set ECG alarm properties, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Alarm** tab.
3. Enter the password if required.
4. Set alarm properties as desired.

9.6.3 Setting the Analysis Mode

Multiple leads analysis enhances detection sensitivity and reduces false alarms. However, when most leads are noisy or with low amplitude, choosing the optimal lead as calculation lead and single lead analysis is recommended.

To set the ECG analysis mode, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab.
3. Set the **Analysis Mode**.
   - **Multiple Leads**: the monitor uses four leads (ECG1 to ECG 4) as calculation leads.
   - **Single Lead**: the monitor uses one lead (ECG1) as calculation lead.

NOTE

- **It is difficult for the monitor to differentiate an aberrantly conducted beat from a ventricular beat. An aberrantly conducted beat may be misclassified as a ventricular beat. In this case, choose the lead with a narrow R-wave for ECG1 and select Single Lead.**
- **When a 3-lead ECG cable is used, the monitor always uses single lead as calculation lead and the Analysis Mode option is not available.**

9.6.4 Changing ECG Wave Settings

9.6.4.1 Selecting the Leads of Displayed ECG Waveforms

To select the leads of displayed ECG waveforms, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab.
3. Select **ECG** to set the lead of each ECG waveform.
4. If more than three ECG waveforms are displayed, select the **More Leads** tab, and then select **ECG** to set leads of other ECG waveforms.

The waveform of selected lead should have the following characteristics:

- The QRS complex should be either completely above or below the baseline and it should not be biphasic.
- The QRS complex should be tall and narrow.
- The P waves and T waves should be less than 0.2mV.

CAUTION

- **Ensure that you have selected the optimal leads with the best waveform amplitude and the highest signal-to-noise ratio. Selecting the optimal leads is important for detecting beats, classifying beats, and detecting ventricular fibrillation.**

9.6.4.2 Setting the ECG Waveform Layout

To set the ECG waveform layout, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab.
3. Set **Waveform Layout**.
   - **Standard**: the waveform sequence is I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6.
   - **Cabrera**: the waveform sequence is aVL, I, -aVR, II, aVF, III, V1, V2, V3, V4, V5, V6.

For the Glasgow algorithm, the sequence of the chest leads depends on the setting of **V3 placement**. If **V3 placement** is set to **V4R**, the sequence of chest leads is V4R, V1, V2, V4, V5, V6.

9.6.4.3 Changing ECG Waveform Size

If the ECG waveform is too small or clipped, you can change its size by selecting an appropriate **Gain** setting. To do so, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab.
3. Select **ECG gain** to set the size of each ECG waveform.
4. If more than three ECG waveforms are displayed, select the **More Leads** tab, and then select **ECG Gain** to change the sizes of other ECG waveforms. If you select **Auto**, the monitor automatically adjusts the size of the ECG waveforms.

9.6.4.4 Changing Va and Vb Labels

When monitoring ECG with 6-leadwire. You can change the labels of Va and Vb leads. To do so, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab.
3. Set **Va** and **Vb** according to the Va and Vb electrode sites. Default settings are **Va** and **Vb**.

9.6.4.5 Changing ECG Waveform Speed

To change ECG waveform speed, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab.
3. Set **Speed**.

9.6.4.6 Setting the ECG Filter

To set the ECG waveform filter mode, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab.
3. Set **Filter**.
   - **Diagnostic**: use when diagnostic quality ECG is required. The unfiltered ECG waveform is displayed so that changes such as R-wave notching or discrete elevation or depression of the ST segment are visible.
   - **Monitor**: use under normal measurement conditions.
   - **Surgery**: use when the signal is distorted by high frequency or low frequency interference. High frequency interference usually results in large amplitude spikes making the ECG signal look irregular. Low frequency interference usually leads to wandering or rough baseline. The surgery filter reduces artifacts and interference from electrosurgical units. Under normal measurement conditions, selecting **Surgery** may suppress certain features or details of the QRS complexes.
   - **ST**: recommended for ST monitoring.

9.6.4.7 Switching On or Off the Notch Filter

The notch filter removes the line frequency interference. To switch on or off the notch filter, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab.
3. Switch on or off **Notch Filter**.

NOTE

- **The notch filter can only be switched on or off when ECG Filter is set to Diagnostic. In other filter modes, the notch filter is always on.**

9.6.5 Disabling the Smart Lead Off Function

The monitor provides the smart lead off function . When the lead of the first ECG wave is detached but another lead is available, the monitor automatically switches to the available lead to recalculate heart rate, and to analyze and detect arrhythmias. When you reconnect the detached leads, the monitor automatically switches back to the original lead.

The smart lead off function is enabled by default. To disable this function, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab.
3. Switch off **Smart Lead**.

9.6.6 Disabling the CrozFusion™ Function

The CrozFusion™ function is enabled by default. However, in some situations you may need to disable this function, or the CrozFusion™ function may not be able to work. You shall disable the CrozFusion™ function in the following situation:

- Administrating CPR
- Performing CPB
- Administrating IABP
- Other situations that the CrozFusion™ function is not applicable

To disable the CrozFusion™ function, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the ECG menu.
2. Select the **Setup** tab.
3. Switch off **CrozFusion**.

WARNING

- **The monitor is used for single patient at a time. Simultaneously monitoring more than one patient may result in a hazard to the patient.**
- **ECG signal and Pleth signal from different patient may result in incorrect signal fusion.**

9.6.7 Adjusting the QRS Volume

To adjust the QRS volume, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab.
3. Set **QRS Volume**.

When valid SpO_2 measurements are available, the monitor adjusts the pitch of QRS tone based on the SpO_2 value.

9.6.8 Adjusting the Minimum QRS Detection Threshold

To avoid false asystole alarm due to low R wave amplitude, and to avoid tall T waves and P waves being mistaken for QRS complexes, the monitor provides a means to manually adjust the minimum QRS detection threshold.

To adjust the minimum QRS detection threshold, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab and set **Filter** to **Monitor**.
3. Select the **QRS Threshold** tab.
4. Select up or down arrow buttons to adjust the minimum threshold for QRS detection. Selecting **Default** resets the QRS threshold to the default value (0.16 mV).

CAUTION

- **The setting of the QRS detection threshold can affect the sensitivity for arrhythmia, ST, QT/QTc detection, and heart rate calculation.**
- **If QRS amplitude is low, the monitor might not be able to calculate heart rate and false asystole calls may occur.**

NOTE

- **The minimum QRS detection threshold can only be adjusted when the ECG filter is set to Monitor.**

9.7 Monitoring Arrhythmia

Arrhythmia monitoring is intended for adult, pediatric, and neonatal patients.

9.7.1 Arrhythmia Safety Information

WARNING

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

CAUTION

- **Since the arrhythmia detection algorithm sensitivity and specificity are less than 100%, sometimes there may be some false arrhythmias detected and also some true arrhythmia events may not be detected. This is especially true when the signal is noisy.**
- **The ECG size and minimum QRS detection threshold settings affect arrhythmia detection and heart rate calculation sensitivity.**
- **If QRS amplitude is low, the monitor might not be able to calculate heart rate and false asystole calls may occur.During the learning phase of the algorithm, arrhythmia detection may not be available. So you should closely monitor patient condition during and for several minutes after the learning phase to allow the algorithm to reach optimal detection performance.**

9.7.2 Arrhythmia Events

This section lists all arrhythmia events and their criteria.

9.7.2.1 Lethal Arrhythmia Events

Arrhythmia message	Description
Asystole	No QRS complex detected within the set time interval in the absence of ventricular fibrillation or chaotic signal.
V-Fib/V-Tach	A fibrillatory wave for 6 consecutive seconds. A dominant rhythm of adjacent PVCs and the ventricular rate is greater than the V-tach rate limit.
V-Tach	The number of consecutive PVCs is greater than or equal to the V-Tach PVCs limit, and the ventricular rate is greater than or equal to the V-Tach rate limit.
Vent Brady	The number of consecutive PVCs is greater than or equal to V-brady PVC limit and the ventricular rate is less than the V-brady rate limit.
Extreme Tachy	The heart rate is greater than the extreme tachycardia limit.
Extreme Brady	The heart rate is less than the extreme bradycardia limit.

9.7.2.2 Nonlethal Arrhythmia Events

Arrhythmia message	Description
R on T	R on T PVC is detected.
Run PVCs	More than two consecutive PVCs, but lower than the V-Brady PVCs limit, and the ventricular rate is lower than the V-Tach rate limit.
Couplet	A Pair of PVCs detected in between normal beats.
Multiform PVC	Multiform PVCs detected in Multif. PVC's Window (which is adjustable).
PVC	One PVC detected in between normal beats.
Bigeminy	A dominant rhythm of N, V, N, V, N, V. N: normal beat V: ventricular beat
Trigeminy	A dominant rhythm of N, N, V,N, N, V, N, N, V. N: normal beat V: ventricular beat
Tachy	The heart rate is greater than the tachycardia limit.
Brady	The heart rate is lower than the bradycardia limit.
Pacer not Capture	No QRS complex detected for 300 ms following a pace pulse (for paced patients only).
Pacer not Pacing	No pace pulse detected for 1.75 x average R-to-R intervals following a QRS complex (for paced patients only).
Missed Beat	At least 3 consecutive Ns, and The current RR interval is greater than 1.5 x previous RR interval, and The next RR interval is lower than 1.5 x average RR interval, and HR lower than 100 and the current RR interval is greater than 1.75 x average RR interval , or HR is greater than or equal to 100 and the current RR interval is greater than 1000 ms.
Nonsus V-Tach	The number of consecutive PVCs is lower than the V-Tach PVCs limit but greater than 2, and the ventricular rate is greater than or equal to the V-Tach Rate limit.
Vent Rhythm	The number of consecutive PVCs is greater than or equal to the V-Brady PVCs limit, and ventricular rate is greater than or equal to the V-Brady Rate limit but lower than V-Tach Rate limit.
Pause	No QRS complex is detected within the set time threshold of pause.
Irr Rhythm	Consistently irregular rhythm (N, irregular RR interval change is greater than 12.5%)
Afib	P wave is absent and normal beat RR intervals are irregular.

Arrhythmia message	Description
PVCs/min	PVCs/min exceeds high limit.
Pauses/min	Pauses/min exceeds high limit.
Irr. Rhythm End	Irregular rhythm no longer detected for the irregular rhythm end delay time.
Afib End	Atrial fibrillation no longer detected for the Afib end delay time.

9.7.3 Displaying Arrhythmia Information

You can display the arrhythmia information in the numeric area. To do so, follow this procedure:

1. Access **Tile Layout** by either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select **Main Menu** quick key → from the **Display** column select **Tile Layout**.
2. Click the numeric area where you want to display the arrhythmia information, and then select ECG → **Arrhythmia**.

9.7.4 Changing Arrhythmia Settings

9.7.4.1 Changing Arrhythmia Alarm Settings

To set the arrhythmia alarm properties, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Arrhythmia** tab→ **Alarm** tab.
3. Enter the password if required. For more information, refer to *7.8.3 Selecting Password for User Authentication*.
4. Set alarm properties as desired.

NOTE

- **You can switch off lethal arrhythmia alarms only when you have enabled Lethal Arrhys Off. For more information, see *9.7.4.2 Setting the Lethal Arrhythmia Alarms Switch*.**
- **The priority of lethal arrhythmia alarms is always high. It cannot be altered.**

9.7.4.2 Setting the Lethal Arrhythmia Alarms Switch

You can choose whether switching off lethal arrhythmia alarms is permissible or not. This function is password protected. For more information, see *22.4.4 The Remote View Tab (Only available for the independent external display)*.

WARNING

- **If you switch off all arrhythmia alarms, the monitor will not alarm for any arrhythmia event. This may result in a hazard to the patient. Always keep the patient under close surveillance.**

NOTE

- **If any of the lethal arrhythmia alarms is switched off, the ECG waveform area displays the "Lethal Arrhys Off" message.**

9.7.4.3 Changing Arrhythmia Alarm Threshold Settings

You can change threshold settings for some arrhythmia alarms. When an arrhythmia violates its threshold, an alarm will be triggered. To do so, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.

2. Select the **Arrhythmia** tab → select the **Threshold** tab.
3. Enter the password if required. For more information, refer to *7.8.3 Selecting Password for User Authentication*.
4. Set the threshold of desired arrhythmia alarms.

NOTE

- **The asystole delay time relates to ECG relearning. When heart rate is less than 30 bpm, it is recommended to set Asystole Delay to 10 sec.**

9.7.4.4 Arrhythmia Threshold Range

Arrhythmia	Threshold Range
Asystole Delay	3 sec to 10 sec
Tachy (HR High)	60 bpm to 295 bpm
Brady (HR Low)	16 bpm to 120 bpm
Extreme Tachy	65 bpm to 300 bpm
Extreme Brady	15bpm to 115 bpm
Multif PVCs Window	3 beats to 31 beats
V-Tach Rate	100 bpm to 200 bpm
V-Brady Rate	15 bpm to 60 bpm
V-Tach PVCs	3 beats to 99 beats
V-Brady PVCs	3 beats to 99 beats
PVCs/min	1 to 100
Pauses/min	1 to 15
Pause Threshold	1.5sec, 2.0sec, 2.5sec, 3.0sec
AF/Irr Rhy End Time	0, 1 min, 2 min, 3 min, 4 min, 5 min, 10 min, 15 min, 30 min

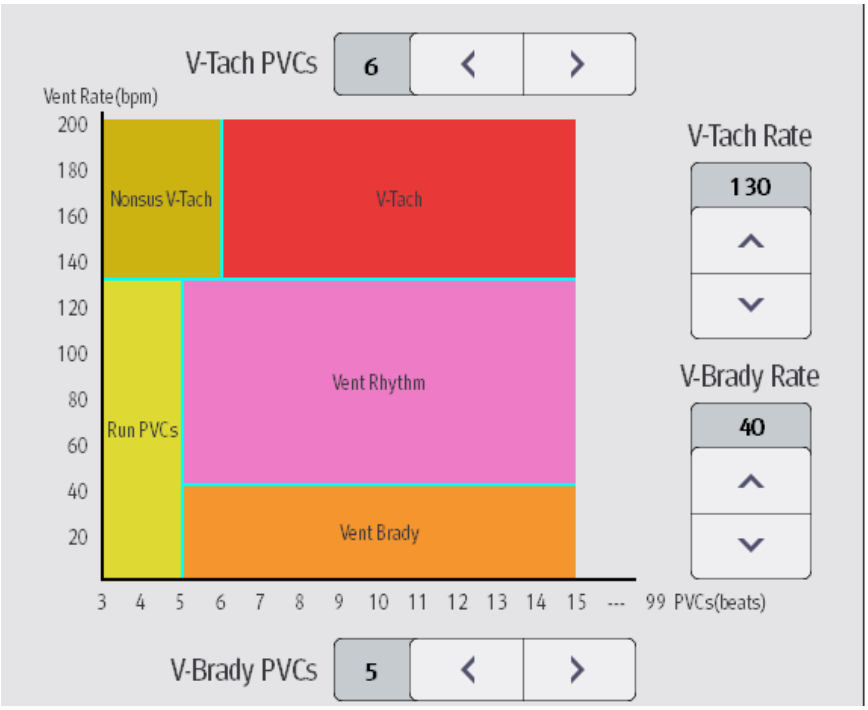
9.7.4.5 Setting Thresholds for PVC-Related Alarms

PVC-related alarms are detected on the basis of the current PVC rate and the number of consecutive PVCs.

To set the required thresholds for PVC-related alarms, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Arrhythmia** tab → select the **More Threshold** tab.
3. Enter the password if required. For more information, refer to *7.8.3 Selecting Password for User Authentication*.
4. Adjust **V-Tach PVCs**, **V-Tach Rate**, **V-Brady PVCs**, and **V-Brady Rate** to set the threshold of desired PVC-related alarms.

The following figure illustrates the conditions under which PVC alarms will be generated if **V-Tach PVCs** is set to 6, **V-Tach Rate** is set to 130, **V-Brady PVCs** is set to 5, and **V-Brady Rate** is set to 40.



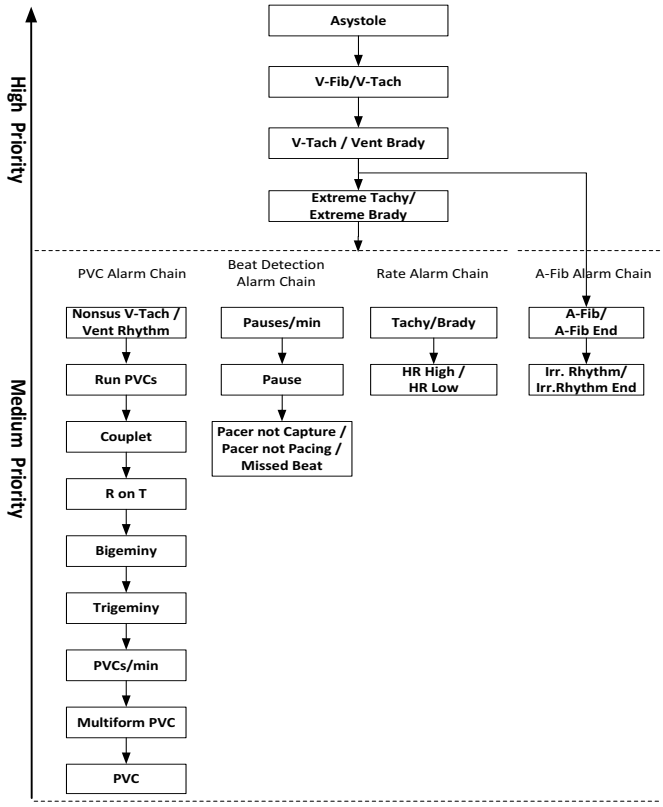
- If both V-Tach PVCs and V-Tach Rate are greater than or equal to the limits, a V-Tach alarm is generated.
- If the number of consecutive PVCs is lower than the V-Tach PVCs limit (6) but greater than 2, and PVC rate is greater or equal to the V-Tach Rate limit (130), a Nonsus V-Tach alarm is generated.
- If the number of consecutive PVCs is greater than or equal to the V-Brady PVCs limit (5), and PVC rate is lower than the V Brady limit (40), a Vent Brady alarm is generated.
- If both the V-Brady PVCs and V-Brady Rate are lower than the limits, but V-Brady PVCs is greater than 2, a Run PVCs alarm is generated.
- If the V-Brady PVCs and V-Brady Rate are greater than or equal to limits, but the Vent rate is is lower than V-Tach Rate (130), a Vent Rhythm alarm is generated.

9.7.5 Arrhythmia Alarms Timeout

Normally, an arrhythmia alarm is presented when an alarm condition is detected. However, there are certain situations that can inhibit audible and visible alarm indications even though an alarm condition was detected. For more information, see *9.7.5.1 Arrhythmia Alarm Chains* and *9.7.5.2 Setting Arrhythmia Alarm Timeout Period*.

9.7.5.1 Arrhythmia Alarm Chains

If multiple alarms overlap, announcing all of the detected alarm conditions would be confusing, and a more serious condition might be overlooked. So arrhythmia alarms are prioritized by alarm "chains".



9.7.5.2 Setting Arrhythmia Alarm Timeout Period

The arrhythmia algorithm can disable alarm light and alarm tone for designated period of time when certain arrhythmia alarms are detected.

This function is password protected. For more information, see *22.4.5 The Other Tab*.

NOTE

- **For the following alarms, alarm light and alarm tone cannot be disabled: HR high, HR low, Tachycardia, Bradycardia, Afib End, Irr. Rhythm End.**
- **The timeout period is only applicable to the alarms in the medium priority chains and atrial fibrillation chain. For the alarms in the high priority chain, alarm tone and alarm light are presented as soon as the alarm condition is detected.**
- **Alarm indication rules for alarms in the atrial fibrillation chain are the same with those for the medium priority chains.**

9.7.5.3 Arrhythmia Alarm Timeout Rules

The following table explains how auidble and visual alarm indicate during arrhythmia alarm timeout.

Previous alarm	Current alarm	Alarm indication
Alarm in high priority chain	Alarm in high priority chain	Alarm light and alarm tone
	Alarm in medium priority chain	During timeout period, alarm light and alarm tone are disabled. When the timeout period is reached, alarm light and alarm tone are reactivated.

Previous alarm	Current alarm	Alarm indication
Alarm in medium priority chain	Alarm in high priority chain	Alarm light and alarm tone
	Alarm in the same medium priority chain, but with higher priority	Alarm light and alarm tone
	The same alarm reoccurs	During timeout period, alarm light and alarm tone are disabled. When the timeout period is reached, alarm light and alarm tone are reactivated.
	Alarm in the same medium priority chain, but with lower priority	During timeout period, alarm light and alarm tone are disabled. When the timeout period is reached, alarm light and alarm tone are reactivated.
	Alarm in other medium priority chain	Alarm light and alarm tone

9.8 ST Segment Monitoring

ST monitoring is intended for adult, pediatric and neonatal patient.

9.8.1 ST Safety Information

WARNING

- **ST values may be affected by such factors as some drugs or metabolic and conduction disturbances.**
- **ST deviation is often calculated at a fixed offset from the J point. Changes in heart rate may affect ST.**
- **The ST deviation measurement algorithm has been tested for accuracy. The significance of ST segment changes needs to be determined by a physician.**
- **This monitor provides ST deviation level change information. The clinical significance of the ST level change information should be determined by a physician.**

9.8.2 Enabling ST Monitoring

The ST monitoring function is disabled by default. Before you start ST monitoring, enable the ST function. To do so, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **ST** tab→ select the **Setup** tab.
3. Switch on **ST Analysis**.

Reliable ST monitoring cannot be ensured under the following situations:

- You are unable to get a lead that is not noisy.
- Arrhythmias, such as atrial fib or flutter, cause irregular baseline.
- The patient is continuously ventricularly paced.
- The patient has left bundle branch block.

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

9.8.3 Displaying ST Numerics

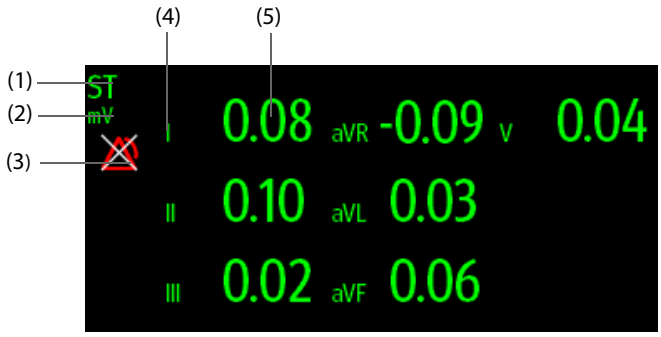
To display ST numerics and Segments, follow this procedure:

1. Access **Tile Layout** by either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select **Main Menu** quick key → from the **Display** column select **Tile Layout**.
2. Click the numeric area where you want to display the ST numerics, and then select **ECG** → **ST**.

The display of ST parameters area is different according to the lead type:

- When you are using the 3-lead ECG leadwires, the ST numeric area does not display. A ST value displays in the ECG numeric area.
- When you are using the 5-lead ECG leadwires, the ST numeric area displays 7 ST values: ST-I, ST-II, ST-III, ST-aVR, ST-aVL, ST-aVF, ST-V.
- When you are using the 6-lead ECG leadwires, the ST numeric area displays 8 ST values: ST-I, ST-II, ST-III, ST-aVR, ST-aVL, ST-aVF, ST-Va, ST-Vb.
- When you are using the 12-lead ECG leadwires, the ST numeric area displays12 ST values: ST-I, ST-II, ST-III, ST-aVR, ST-aVL, ST-aVF, ST-V1, ST-V2, ST-V3, ST-V4, ST-V5, ST-V6.

This example shows the ST numeric area when 5-lead ECG cable is used. Your monitor screen may look slightly different:



(1) Parameter label

(2) ST unit

(3) ST alarm off symbol

(4) Lead labels

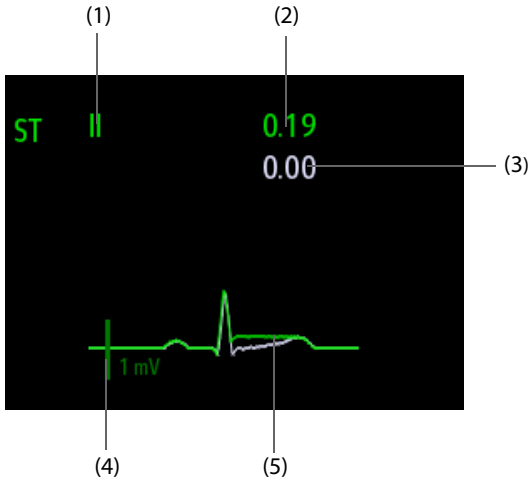
(5) ST numerics: a positive value indicates ST segment elevation, and a negative value indicates ST segment depression.

9.8.4 Displaying ST Segments in the Waveform Area

You can display ST segments in the waveform area. To do so, follow this procedure:

1. Access **Tile Layout** by either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select **Main Menu** quick key → from the **Display** column select **Tile Layout**.
2. Select the waveform area where you want to display the ST segments, and then select **ST**→ **ST Segment**.

The waveform area displays the current and baseline ST segments. It also displays the current and baseline ST values. In the following picture, the current ST segment and value are in green, while the baseline ST segment and value are in white.



(1) ST lead

(2) Current ST value

(3) Baseline ST value (4) 1 mV scale

(5) Current ST segment (green) and baseline ST segment (white)

9.8.5 Entering the ST View

The ST View shows a complete QRS segment for each ST lead. The color of current ST segments and ST values is consistent with the color of ECG waveforms, normally green. The color of baseline ST segments and ST values is white.

You can enter the ST view either by selecting the ST segment in the waveform area, or by the following ways:

1. Select the ST numeric area, ECG numeric area or ECG waveform area to enter the **ECG** menu.
2. Select the **ST** tab.
3. From the bottom of the menu, select **ST View**.

9.8.6 Saving the Current ST as Baseline

ST deviation is typically monitored as a relative change from a baseline value. Set an ST baseline when ST values become stable. If you did not set the ST baseline, the monitor automatically saves the baseline when valid ST values appear for 5 minutes. To manually set the ST baseline, select **Set Baseline** in the **ST View** window.From the **ST View** window, you can also perform the following operations:

- Display or hide ST baseline by selecting **Display Baseline** or **Hide Baseline**.
- Display or hide the position of ISO point, J point and ST point by selecting **Display Marker** or **Hide Marker**.

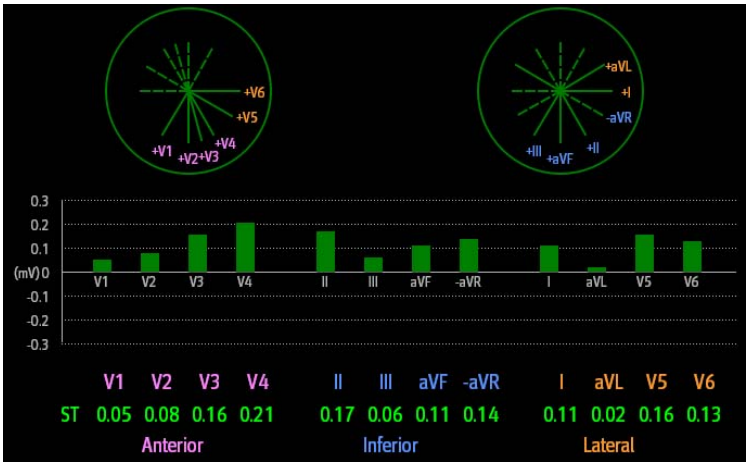
CAUTION

- **Updating ST baseline affects ST alarms.**

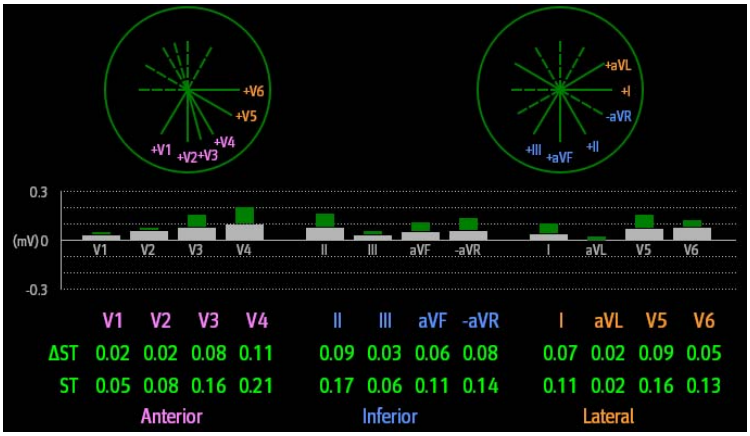
9.8.7 Entering the ST Graphic Window (only available for the independent external display)

To display **ST Graphic** window, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **ST** tab.
3. From the bottom of the menu, select **ST Graphic**.The following figure shows the ST Graphic when **ST Alarm Mode** is set to **Absolute**. The height of the bar indicates the ST value of corresponding ST lead. The color of the bar indicates ST alarm status: green indicates that corresponding ST value is within alarm limits; cyan, yellow and red indicate that the ST value exceeds the alarm limits. The color matches ST alarm priority.



The following figure shows the ST Graphic when **ST Alarm Mode** is set to **Relative**. The height of grey bar indicates the baseline ST value and the green bar (cyan, yellow or red if an alarm occurs) indicates ΔST.



9.9 Changing ST Settings

9.9.1 Setting ST Alarm Properties

To set ST alarm properties, follow this procedure:

1. Select the ST numeric area, ECG numeric area or ECG waveform area to enter the **ECG** menu.
2. Select the **ST** tab→ **Alarm** tab.
3. Set **ST Alarm Mode** to **Absolute** or **Relative**.
   - **Absolute**: you can separately set the alarm properties for each ST alarm.
   - **Relative**: you can set the alarm properties for **ST Single** and **ST Dual** alarms.
4. Set ST alarm properties.

9.9.1.1 Changing Leads for ST Display

The monitor automatically selects the three most deviated leads for ST display. You can also manually select the leads. To do so, follow this procedure:

1. Select the ST numeric area, ECG numeric area or ECG waveform area to enter the **ECG** menu.
2. Select the **ST** tab → select the **Setup** tab.
3. Set **ST Segment**. You can select up to 3 leads.

9.9.1.2 Showing ISO Point, J Point, and ST Point Marks

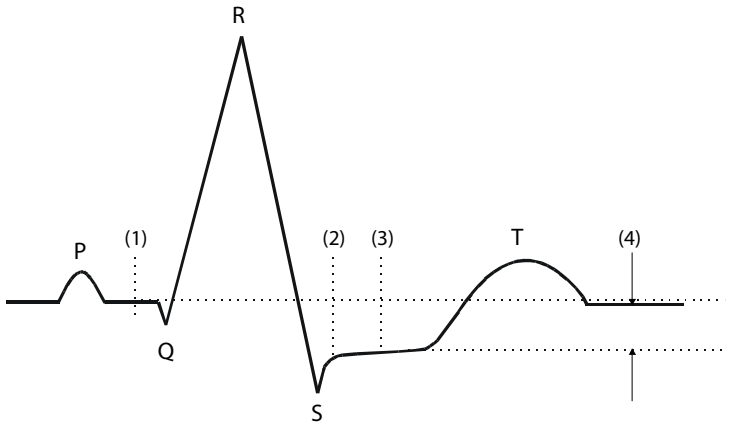
In the waveform area, the ISO point, J point, and ST point mark do not display on the ST segments by default. To show these marks, follow this procedure:

1. Select the ST numeric area, ECG numeric area or ECG waveform area to enter the **ECG** menu.
2. Select the **ST** tab→ select the **Setup** tab.
3. Switch on **Show Markers**.

9.9.2 Adjusting ST Measurement Points

9.9.2.1 About ST Point, ISO Point, and J Point

The ST deviation value for each beat is the potential difference between the isoelectric (ISO) point and the ST point. The ISO point provides the baseline. The ST point is at the midpoint of the ST segment. The J point is the end of the QRS complex. As the J point is a fixed distance away from the ST point, it can be useful to help you correctly position the ST point.



(1) ISO point (2) J point (3) ST point (4) ST deviation

9.9.2.2 Setting ST Point, ISO Point, and J Point

CAUTION

- **You need to adjust the ST points before starting monitoring, or if the patient's heart rate or ECG morphology changes significantly, as this may affect the size of the QT interval and thus the placement of the ST point. Artifactual ST segment depression or elevation may occur if the isoelectric point or the ST point is incorrectly set.**
- **Always make sure that the positions of ST points are appropriate for your patient.**

To set ST point, ISO point, and J point, follow this procedure:

1. Select the ST numeric area, ECG numeric area or ECG waveform area to enter the **ECG** menu.
2. Select the **ST** tab→ select the **Adjust** tab.
3. Set **ST Point**.

The setting of **Auto Adjust** defines the method of adjusting the ISO point and J point. **Auto Adjust** is enabled by default. In this case, positions of ISO point and J point are automatically adjusted accordingly. If you disable when **Auto Adjust**, you need to manually adjust the position of ISO point and J point by selecting the arrows at the right sides of **ISO** and **J**.

- The ISO point (isoelectric) position is given relative to the R-wave peak. Position the ISO point in the middle of the flattest part of the baseline (between the P and Q waves).
- The J point position is given relative to the R-wave peak and helps locating the ST point. Position the J point at the end of the QRS complex and the beginning of the ST segment.
- The ST point is positioned a fixed distance from the J point. Move the J point to position the ST point at the midpoint of the ST segment. Position the ST point relative to the J point at **J+60/80ms**, **J+40ms**, **J+60ms** or **J+80ms**. When **J+60/80ms** is selected, the ST point will be positioned 80 ms (heart rate 120 bpm or less) or 60 ms (heart rate more than 120 bpm) from the J point.

9.10 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 ventricular depolarization (QRS duration) and repolarization (ST-T). QT interval monitoring can assist in the detection of long QT syndrome.

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

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

9.10.1 QT/QTc Monitoring Limitations

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

- R-wave amplitudes are too low
- 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
- The T-wave is very flat or T-wave are 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, atrial fibrillation, and ECG lead off

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

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

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

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

9.10.2 Enabling QT/QTc Monitoring

The QT monitoring function is disabled by default. Before you start QT monitoring, enable the QT function. To do so, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **QT** tab→ select the **Setup** tab.
3. Switch on **QT Analysis**.

9.10.3 Displaying QT/QTc Numerics and Segments

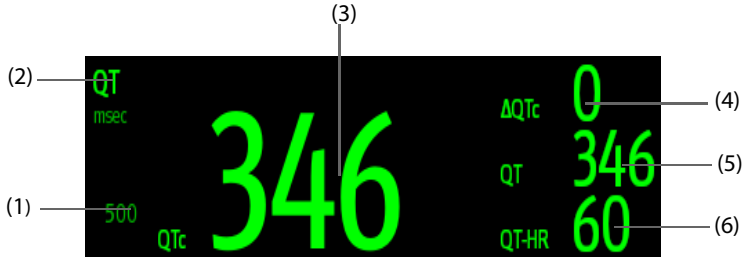
To display QT/QTc numerics and Segments, follow this procedure:

1. Access **Tile Layout** by either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select **Main Menu** quick key → from the **Display** column select **Tile Layout**.
2. Click the parameter numeric area where you want to display the QT numerics, and then select **ECG** → **QT/QTc**.

NOTE

- **QTc values are calculated based on the QT-HR, not the ECG HR. For more information, see *9.10.4 Entering the QT View*.**

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



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

(2) Parameter label

(3) QTc value

(4) ΔQTc value (the difference between the current and baseline QTc values)

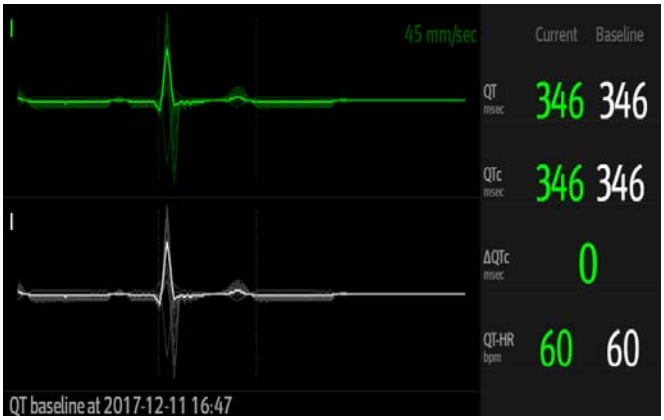
(5) QT value (6) QT-HR value

9.10.4 Entering the QT View

QT View shows the current and baseline QT parameter values and waveforms. To enter the QT View, follow this procedure:

1. Select the QT numeric area, ECG numeric area or ECG waveform area to enter the **ECG** menu.
2. Select the **QT** tab.
3. From the bottom of the menu, select **QT View**.

The following picture shows the QT view.



- The current waveform is shown in the upper half in green.
- The baseline waveform is shown below in white.
- The start of QRS complex and the end of the T wave are marked with a vertical line.
- In some conditions, no QT measurement can be calculated. Then the cause of failed QT measurement is shown at the bottom of the QT numerics area and the message "Cannot Analyze QT" is shown in the technical alarm area.

Select the left or right arrow to switch leads. Corresponding waveform will be highlighted.

9.10.5 Changing the Current QTc as Baseline

In order to quantify changes in the QTc value, you can set a QTc baseline. If no baseline has been set for this patient within the first five minutes after getting valid QT values, the monitor will automatically set a baseline. To set the current values as baseline, follow this procedure:

1. From the **QT View** window, select **Set Baseline**.
2. From the pop-up dialog box, select **OK**. This baseline will then be used to calculate ΔQTc.

If you set a new baseline the previous baseline is discarded.

From the **QT View** window, you can also perform the following operations:

- Select the left or right arrow to select a lead label to highlight corresponding waveform.
- Select **Display Baseline** or **Hide Baseline** to display or hide baseline waveform.

CAUTION

- **Updating QTc baseline affects ΔQTc value and ΔQTc alarm.**

9.10.6 Changing QT Settings

9.10.6.1 Setting QT Alarm Properties

To set QT alarm properties, follow this procedure:

1. Select the QT numeric area, ECG numeric area or ECG waveform area to enter the **ECG** menu.
2. Select the **QT** tab→ select the **Alarm** tab.
3. Set QTc and ΔQTc alarm properties.

9.10.6.2 Selecting Leads for QT Calculation

You can select one lead or all leads for QT calculation. To do so, follow this procedure:

1. Select the QT numeric area, ECG numeric area or ECG waveform area to enter the **ECG** menu.
2. Select the **QT** tab→ select the **Setup** tab.
3. Set **QT Leads**. **All** is selected by default. This means all leads are used for QT calculation.

9.11 ECG Relearning

Changes in ECG template could result in incorrect arrhythmia alarms and/or inaccurate heart rate. ECG relearning allows the monitor to learn new ECG template so as to correct arrhythmia alarms and HR value. Once learning is complete, the dominant QRS complex is stored as a reference template. The reference template is used as a normal morphology of that patient and it is compared with incoming beats to identify possible arrhythmias.

9.11.1 Auto ECG Relearning

Auto arrhythmia relearning happens in the following situation:

- The ECG lead type or lead label is changed.
- ECG leads are off and are not reconnected within 60 seconds.
- The patient's paced status is changed.

9.11.2 Initiating an ECG Relearning Manually

If you suspect that abnormal arrhythmia alarms are presented, you may need to manually initiate an ECG relearning. To do so , follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select **Relearn** at the bottom left corner of the menu.

CAUTION

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

9.12 Calibrating ECG

The ECG signal may be inaccurate due to hardware or software problems. As a result, the ECG waveform amplitude becomes greater or smaller. In that case, you need to calibrate the ECG module. For more information, see *22.6.1 The ECG Tab*.

9.13 Defibrillation Synchronization Pulse Output

The monitor provides an multifunctional connector to output defibrillation synchronization pulse. If a defibrillator is connected, it receives a synchronization pulse (100 ms, +5 V) through the analog out connector each time an R-wave is detected.

WARNING

- **Improper use of a defibrillator may cause injury to the patient. The operator should determine whether to perform defibrillation or not according to the patient's condition.**
- **According to AAMI specifications the peak of the synchronized defibrillator discharge should be delivered within 60 ms of the peak of the R wave. The signal at the ECG output (sync pulse) on the monitor is delayed by maximum of 30 ms. Your biomedical engineer should verify that your ECG/ Defibrillator combination does not exceed recommended maximum delay of 60 ms.**
- **Before defibrillation, the user must ensure both defibrillator and monitor has passed the system test and can be safely used together.**

9.14 ECG Troubleshooting

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

Problem	Corrective Actions
Do not see ECG numeric area or waveform area on the main screen	1. Check that ECG is set to display in the **Screen Setup** menu. For more information, see *3.11.2 Displaying Parameter Numerics and Waveforms*. 2. Check that if the ECG parameter switch is enabled. If not, enable the ECG measurement. For more information, see *3.11.1 Switching On or Off a Parameter*. 3. Check that the cable connections of ECG electrode and the lead set are tight. Replace the ECG electrode or the lead set if needed.
Noisy ECG traces	1. Check that electrodes are not detached or dry. Replace with fresh and moist electrodes if necessary. 2. Check that leadwires are not defective. Replace leadwires if necessary. 3. Check that patient cable or leadwires are routed too close to other electrical devices. Move the patient cable or leadwires away from electrical devices.
Excessive electrosurgical Interference	Use ESU-proof ECG cables. For more information, see *26.1 ECG Accessories*.
Muscle Noise	Inadequate skin preparation, tremors, tense subject, and/or poor electrode placement. 1. Perform skin preparation again and re-place the electrodes. For more information, see *9.4.1 Preparing the Patient Skin* and *9.4.2 Applying Electrodes*. 2. Apply fresh, moist electrodes. Avoid muscular areas.
Intermittent Signal	1. Check that cables are properly connected. 2. Check that electrodes are not detached or dry. Perform skin preparation again as described in *9.4.1 Preparing the Patient Skin* and apply fresh and moist electrodes. 3. Check that the patient cable or leadwires are not damaged. Change them if necessary.
Excessive alarms: heart rate, lead fault	1. Check that electrodes are not dry. Perform skin preparation again and re-place the electrodes. For more information, see *9.4.1 Preparing the Patient Skin* and *9.4.2 Applying Electrodes*. 2. Check for excessive patient movement or muscle tremor. Reposition the electrodes. Replace with fresh and moist electrodes if necessary.
Low Amplitude ECG Signal	1. Check that the ECG gain is not set too low. Adjust the gain as required. For more information, see *9.5 Using 6-lead Placement to Derive 12-lead ECG (D12L)*. 2. Perform skin preparation again and re-place the electrodes. For more information, see *9.4.1 Preparing the Patient Skin* and *9.4.2 Applying Electrodes*. 3. Check electrode application sites. Avoid bone or muscular area. 4. Check that electrodes are not dry or used for a prolonged time. Replace with fresh and moist electrodes if necessary.

Problem	Corrective Actions
No ECG Waveform	1. Check that the ECG gain is not set too low. Adjust the gain as required. For more information, see • . 2. Check that the leadwires and patient cables are properly connected. 3. Change cable and lead wires. 4. Check that the patient cable or leadwires are not damaged. Change them if necessary.
Base Line Wander	1. Check for excessive patient movement or muscle tremor. Secure leadwires and cable. 2. Check that electrodes are not detached or dry and replace with fresh and moist electrodes if necessary. For more information, see *9.4.1 Preparing the Patient Skin* and *9.4.2 Applying Electrodes*. 3. Check for ECG filter setting. Set ECG Filter mode to **Monitor** to reduce baseline wander on the display.

10 Resting 12-Lead ECG Analysis

10.1 Resting 12-Lead ECG Analysis Introduction

The monitor can be configured with either Glasgow 12-lead ECG analysis algorithm or Mindray 12-lead ECG analysis algorithm.

The Glasgow algorithm is intended for adult, pediatric, and neonatal patients. The Mindray algorithm is intended for adult patients only.

The monitor providing the 12-lead ECG analysis function has a 12-lead label. The monitor incorporating the Glasgow algorithm is labelled with the logo of Glasgow.

For more information on the Glasgow algorithm, refer to *12-Lead ECG Interpretive Program Physician's Guide (PN: 046-004817-00)* for detail.

10.2 Entering the 12-Lead Screen

To enter the 12-Lead screen, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab.
3. Set the **Lead Set** to **12-Lead**.
4. From the bottom of the **ECG** menu, select **12-Lead**.

You can also enter the 12-Lead screen by following this procedure:

- Select the **Screen Setup** quick key → select **Choose Screen** → select **ECG 12-Lead**.
- Select **Main Menu** quick key → from the **Display** column select **Choose Screen** → select **ECG 12-Lead**.

10.3 Initiating Resting 12-Lead ECG Analysis

Before 12-lead ECG interpretation, check that all electrodes are correctly connected to the lead wires and the ECG trunk cable is properly connected. Check that patient information is correct. Keep the patient still.

To initiate 12-Lead ECG analysis, select **Analyze** from the left bottom of the 12-Lead screen.

10.4 Changing 12-Lead ECG Analysis Settings

On the ECG 12-Lead screen, you can set the high frequency filter, baseline drift removal (BDR) switch, and the waveform layout.

10.4.1 Setting the High Frequency Filter

The high frequency filter attenuates muscle artifact by restricting the included frequencies. The setting of the high frequency filter is 35 Hz by default. To change the setting, follow this procedure:

1. On the ECG 12-Lead screen, select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab.
3. Set **HighFreq Cut-off**.

The high frequency filter is a low-pass filter. That is to say signal that exceeds the set frequency is filtered out. For example, if you set **High Freq Cut-off** to **35 Hz**, only signal at 35 Hz or less displays. Signal exceeding 35 Hz is attenuated.

10.4.2 Setting the Baseline Drift Removal

The baseline drift removal (BDR) suppresses most baseline drift interference and also is able to preserve the fidelity of the ST-segment level. BDR is switched on by default. To set the BDR, follow this procedure:

1. On the ECG 12-Lead screen, select the ECG numeric area or waveform area to enter the **ECG** menu.
2. Select the **Setup** tab.
3. Switch on or off **Baseline Drift Removal**. If BDR is switched off, the 0.05 Hz high pass filter is used.

NOTE

- **BDR introduces around 1-second delay. We recommend using BDR except when the delay is unacceptable.**

10.5 Glasgow Resting 12-lead ECG Analysis Algorithm Settings

For the Glasgow algorithm, besides filter mode, BDR, and waveform layout, you can also perform the following operation:

- Editing patient information
- Changing tachycardia and bradycardia thresholds.
- Setting the 12-lead ECG report

10.5.1 Editing Patient Information (For Glasgow Algorithms)

Some patient information may directly affect ECG analysis. Complete and correct patient information is helpful for accurate diagnosis and treatment of the patient. Enter patient information before taking an ECG measurement.

To enter patient information, follow this procedure:

1. On the ECG 12-Lead screen, select **Setup** to enter the **12-Lead Setup** menu.
2. On the **Patient Demographics** page, input or edit patient information.

NOTE

- **Check that patient information is correct before resting 12-lead analysis.**
- **We recommend using pediatric lead placement V4R, V1, V2, V4 - V6 if the patient is under 16 years of age. Please record V4R using the V3 electrode. Also set V3 Electrode to V4R. This is a normal practice for a patient of this age.**

10.5.2 Setting Tachycardia and Bradycardia Thresholds (For Glasgow Algorithms)

To set tachycardia and bradycardia thresholds, follow this procedure:

1. On the ECG 12-Lead screen, select **Setup** to enter the **12-Lead Setup** menu.
2. Select the **Setup** tab.
3. Set **Tachy** and **Brady**.

NOTE

- **The tachycardia threshold only applies to patients whose age exceeds 180 days.**
- **The bradycardia threshold only applies to patients whose age exceeds 2191 days.**

10.5.3 Setting the 12-Lead Interpretation Report (For Glasgow Algorithms)

To set the 12-lead interpretation report, follow this procedure:

1. On the ECG 12-Lead screen, select **Setup** to enter the **12-Lead Setup** menu.
2. Select the **Report** tab.
3. Set the format and items included in the 12-lead interpretation report.

10.6 Saving the 12-Lead Interpretation Report

At the completion of 12-lead ECG interpretation, select **Save** to save the report. You can review the saved 12-lead interpretation reports. For more information, see *18.2.10 12-Lead ECG Review Page*.

10.7 Printing the 12-Lead Interpretation Report

At the completion of 12-lead ECG interpretation, select **Print** to output the report via the printer.

10.8 Exiting the ECG 12-Lead Screen

To exit the ECG 12-Lead screen, select **Exit** on the ECG 12-Lead screen.

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11 Monitoring Respiration (Resp)

11.1 Resp Introduction

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

Respiration monitoring is intended for adult, pediatric and neonatal patients.

11.2 Resp Safety Information

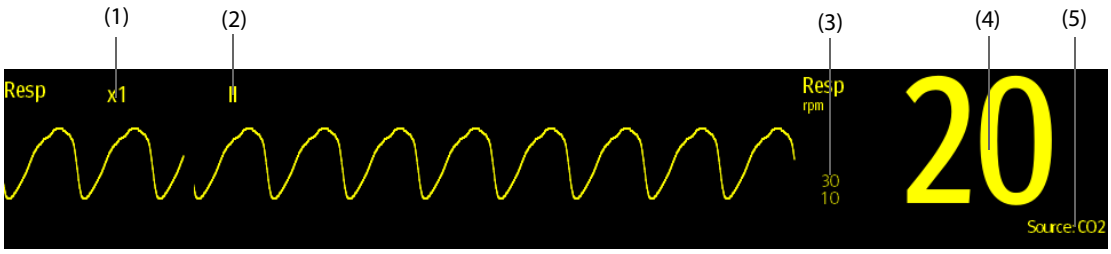
WARNING

- **When monitoring the patient's respiration, do not use ESU-proof ECG cables.**
- **If you do not set the detection level for the respiration correctly in manual detection mode, it may not be possible for the monitor to detect apnea. If you set the detection level too low, the monitor is more likely to detect cardiac activity, and to falsely interpret cardiac activity as respiratory activity in the case of apnea.**
- **The respiration measurement does not recognize the cause of apneas. It only indicates an alarm if no breath is detected when a pre-adjusted time has elapsed since the last detected breath. Therefore, it cannot be used for diagnostic purpose.**
- **If operating under conditions according to the EMC Standard IEC 60601-1-2 (Radiated Immunity 3V/m), field strengths above 3V/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.**
- **The impedance respiration measurement may cause rate changes in Minute Ventilation Rate Responsive Pacemakers. Set the pacemaker rate responsive mode off or disable the impedance respiration measurement on the monitor.**
- **When using the electrosurgery unit, ensure proper contact of the ESU return electrode to the patient to avoid burns at monitor measurement sites. Also ensure that the ESU return electrode is near the operating area.**

CAUTION

- **Only use parts and accessories specified in this manual.**
- **Respiration monitoring is not for use on the patients who are very active, as this will cause false alarms.**

11.3 Resp Display



(1) Resp waveform gain (2) Resp lead label (3) Alarm limits

(4) Respiration rate (RR) (5) RR source

NOTE

- **If ESU-proof ECG cables are used, the Resp waveform area will display the message "Check Leads". Replace the ECG cable if necessary.**

11.4 Preparing for Resp Monitoring

11.4.1 Preparing the Patient

Follow this procedure to prepare the patient:

1. Shave hair from skin at chosen sites.
2. Gently rub skin surface at sites to remove dead skin cells.
3. Thoroughly cleanse the site with a mild soap and water solution.
4. Dry the skin completely before applying the electrodes.

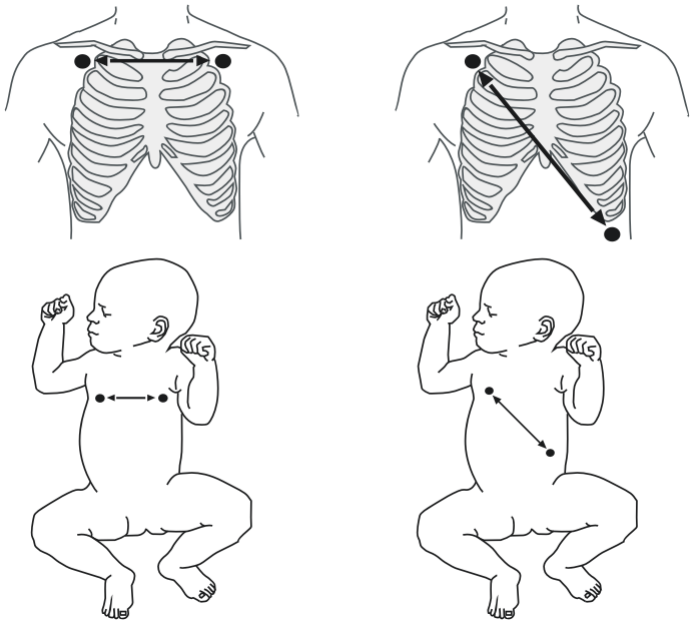
CAUTION

- **Proper skin preparation is necessary for good signal quality at the electrode site, as the skin is a poor conductor of electricity.**

11.4.2 Placing the Electrodes

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

For more information, see *9.4.4 ECG Electrode Placements*.



(1) (2)

(1) Lead I (2) Lead II

CAUTION

- **Correct electrodes placement can help to reduce cardiac overlay: avoid the liver area and the ventricles of the heart in the line between the respiratory electrodes. This is particularly important for neonates.**
- **Some patients with restricted movements breathe mainly abdominally. In these cases, you may need to place the left leg electrode on the left abdomen at the point of maximum abdominal expansion to optimize the respiratory wave.**
- **In clinical applications, some patients (especially neonates) expand their chests laterally, causing a negative intrathoracic pressure. In these cases, it is better to place the two respiration electrodes in the right midaxillary and the left lateral chest areas at the patient's maximum point of the breathing movement to optimize the respiratory waveform.**
- **To optimize the respiration waveform, place the RA and LA electrodes horizontally when monitoring respiration with ECG Lead I; place the RA and LL electrodes diagonally when monitoring respiration with ECG Lead II.**
- **Periodically inspect the electrode application site to ensure skin quality. If the skin quality changes, replace the electrodes or change the application site.**

NOTE

- **Store the electrodes at room temperature. Open the electrode package immediately prior to use.**
- **Check that the electrode packages are intact and not expired. Make sure the electrode gel is moist.**

11.5 Changing Resp Settings

11.5.1 Setting the Resp Alarm Properties

To set the Resp alarm properties, follow this procedure:

1. Select the Resp numeric area or waveform area to enter the **Resp** menu.
2. Select the **Alarm** tab.
3. Enter the password if required.
4. Set alarm properties as desired.

NOTE

- **You can switch off the apnea alarm only when Apnea Alarm Off is enabled. For more information, see section *8.6.10 Setting the Switch of the Apnea Alarm Off*.**

11.5.2 Setting the RR Source

To set RR source, follow this procedure:

1. Select the Resp numeric area or waveform area to enter the **Resp** menu.
2. Select the **Setup** tab.
3. Choose **RR Source** from the dropdown list.

When you select **Auto**, the system automatically selects the RR source according to the priority. The priority of RR source is first CO_2, and then RM, and finally ECG. When the current RR source does not have valid measurement, the system automatically switches the **RR Source** to **Auto.**

11.5.3 Choosing the Respiration Lead

To set the respiration lead, follow this procedure:

1. Select the Resp numeric area or waveform area to enter the **Resp** menu.
2. Select the **Setup** tab.
3. Set **Resp Lead**.

If you cannot get optimal Resp waveform or you suspect the Resp value after choosing the Resp lead, you may need to optimize the electrode placement.

11.5.4 Setting the Resp Waveform Size

To set the Resp waveform size, follow this procedure:

1. Select the Resp numeric area or waveform area to enter the **Resp** menu.
2. Select the **Setup** tab.
3. Set **Gain**.

11.5.5 Setting the Resp Waveform Speed

To set the Resp waveform speed, follow this procedure:

1. Select the Resp numeric area or waveform area to enter the **Resp** menu.
2. Select the **Setup** tab.
3. Set **Speed**.

11.5.6 Setting the Auto Detection Switch

To set the auto detection switch, follow this procedure:

1. Select the Resp numeric area or waveform area to enter the **Resp** menu.
2. Select the **Setup** tab.
3. Switch on or off **Auto Threshold Detection**.
   - If **Auto Threshold Detection** is switched on, the monitor automatically adjusts the Resp waveform detection level, or threshold.
   - If **Auto Threshold Detection** is switched off, you have to manually adjusts the Resp waveform threshold. For more information, see *11.5.7 Adjusting the Resp Waveform Detection Threshold*.

In the 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 the 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.

11.5.7 Adjusting the Resp Waveform Detection Threshold

Use the manual detection mode in the following situations:

- The respiration rate and the heart rate are close.
- Patients have intermittent mandatory ventilation.
- Respiration is weak. Try repositioning the electrodes to improve the signal.

To set the Resp waveform threshold to the desired level, follow this procedure:

1. Select the Resp numeric area or waveform area to enter the **Resp** menu.
2. Select the **Threshold** tab.
3. Select the up and down arrows below **Upper Line** and **Lower Line** to define the Resp waveform threshold.

Once set, the detection level will not adapt automatically to different respiration depths. It is important to remember that if the depth of breathing changes, you may need to change the detection level.

11.6 Resp Troubleshooting

For more information, see *D Alarm Messages*.

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12 Monitoring Pulse Oxygen Saturation (SpO_2)

12.1 SpO_2 Introduction

Pulse Oxygen Saturation (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 emitter side of the probe is partly absorbed when it passes through the monitored tissue. The amount of transmitted light is detected in the detector side of the probe. When the pulsative part of the light signal is examined, the amount of light absorbed by the haemoglobin is measured and the pulse oxygen saturation can be calculated. This device is calibrated to display functional oxygen saturation.

SpO_2 monitoring is intended for adult, pediatric and neonatal patients.

The following types of SpO_2 can be configured for the N1 monitor:

- Mindray SpO_2: the connector is blue and no logo is on the monitor.
- Nellcor SpO_2: the connector is grey and the logo of Nellcor is on the monitor.
- Masimo SpO_2: the connector is purple and the logo of Masimo SET is on the monitor.

NOTE

- **The SpO_2 extension cable should be compatible with the SpO_2 connectors. For example, you can only connect the Mindray SpO_2 extension cable to the Mindray SpO_2 connectors.**
- **A functional tester or SpO_2 simulator can be used to determine the pulse rate accuracy.**
- **A functional tester or SpO_2 simulator cannot be used to assess the SpO_2 accuracy.**

12.2 SpO_2 Safety Information

WARNING

- **When a trend toward patient deoxygenation is indicated, analyze the blood samples with a laboratory co-oximeter to completely understand the patient's condition.**
- **Do not use SpO_2 sensors during magnetic resonance imaging (MRI). Induced current could potentially causes burns. The sensor may affect the MRI image, and the MRI unit may affect the accuracy of the oximetry measurements.**
- **Prolonged continuous monitoring may increase the risk of undesirable changes in skin characteristics, such as irritation, reddening, blistering or burns. Inspect the sensor site every two hours and move the sensor if the skin quality changes. Change the application site every four hours. For neonates, or patients with poor peripheral blood circulation or sensitive skin, inspect the sensor site more frequently.**
- **If the sensor is too tight because the application site is too large or becomes too large due to edema, excessive pressure for prolonged periods may result in venous congestion distal from the application site, leading to interstitial edema and tissue ischemia.**
- **When patients are undergoing photodynamic therapy they may be sensitive to light sources. Pulse oximetry may be used only under careful clinical supervision for short time periods to minimize interference with photodynamic therapy.**
- **SpO_2 is empirically calibrated in healthy adult volunteers with normal levels of carboxyhemoglobin (COHb) and methemoglobin (MetHb).**

CAUTION

- **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 off the alarm.**

- **Change the application site or replace the sensor and/or patient cable when a persistent SpO2 Low Signal Quality message is displayed on the equipment. These messages may indicate that patient monitoring time is exhausted on the patient cable or sensor.**
- **Replace the cable or sensor when a "SpO2 Sensor Off", "SpO2 No Sensor", or "SpO2 Low Signal Quality" message is consistently displayed while monitoring consecutive patients after completing troubleshooting steps listed in this manual.**
- **Variation in measurements may be profound and may be affected by sampling technique as well as the patient's physiological conditions. Any results exhibiting inconsistency with the patient's clinical status should be repeated and/or supplemented with additional test data. Blood samples should be analyzed by laboratory instruments prior to clinical decision making to completely understand the patient's condition.**
- **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.**

NOTE

- **Additional information specific to the Masimo sensors compatible with the equipment, including information about parameter/measurement performance during motion and low perfusion, may be found in the sensor's directions for use (DFU).**
- **Masimo cables and sensors are provided with X-Cal™ technology to minimize the risk of inaccurate readings and unanticipated loss of patient monitoring. Refer to the Cable or Sensor DFU for the specified duration of the patient monitoring time.**

12.3 SpO_2 Measurement Limitations

The following factors may influence the accuracy of SpO_2 measurement:

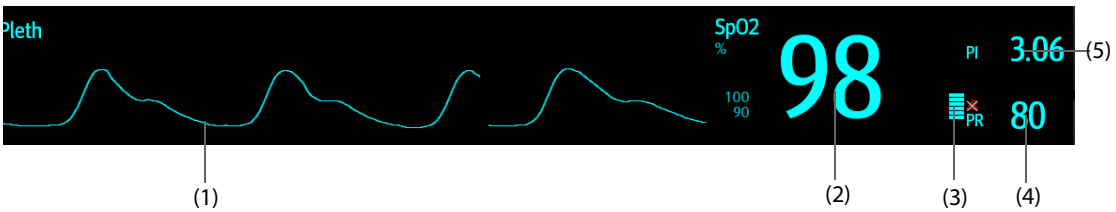
- Patient physiological characteristics:
  - Cardiac arrest
  - Hypotension
  - Darkly pigmented skin
  - Shock
  - Severe vasoconstriction
  - Hypothermia
  - Severe anemia
  - Ventricular septal defects (VSDs)
  - Venous pulsations
  - Poor perfusion
  - Dysfunctional hemoglobin, such as carboxyhemoglobin (COHb) and methemoglobin (MetHb)
  - Elevated levels of bilirubin
  - Vasospastic disease, such as Raynaud's, and peripheral vascular disease
  - Hemoglobinopathies and synthesis disorders such as thalassemias, Hb s, Hb c, sickle cell, etc.
  - Hypocapnic or hypercapnic conditions
  - Birthmark(s), tattoos, skin discolorations, moisture on skin, deformed or abnormal fingers. etc.
- Interfering substances:
  - Intravascular dyes (such as indocyanine green, methylene blue, indigo carmine, etc.)
  - Dyes in the measure site, such as nail polish.
- Environmental conditions:
  - Excessive ambient light
  - Electrosurgery equipment
  - Defibrillation (may cause inaccurate reading for a short amount of time)
  - Excessive patient/sensor motion

- Electromagnetic field
- Arterial catheters and intra-aortic balloon

■ Others

- Inappropriate positioning of the SpO_2 sensor, or use of incorrect SpO_2 sensor
- Cuff or arterial blood pressure measurement device on the same limb as the SpO_2 sensor.

12.4 SpO_2 Display



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

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

(5) 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 SpO_2 signal strength.

- Above 1 is optimal.
- Between 0.3 and 1 is acceptable.
- Below 0.3 indicates low perfusion. Set **Sensitivity** to **Maximum** first. Reposition the SpO_2 sensor or find a better site. If low perfusion persists, choose another method to measure oxygen saturation if possible.

NOTE

- **PI is only available for Mindray SpO_2 and Masimo SpO_2.**

12.5 Preparing for SpO_2 Monitoring

To prepare to monitor SpO_2, follow this procedure:

1. Select an appropriate sensor according to the module type, patient category and weight.
2. Clean the contact surface of the reusable sensor.
3. Remove colored nail polish from the application site.
4. Apply the sensor to the patient according to the instruction for use of the sensor.
5. Select an appropriate extension cable according to the connector type and plug the cable into the SpO_2 connector.
6. Connect the sensor to the extension cable.

CAUTION

- **Do not apply sensor too tightly as this results in venous pulsation which may severely obstruct circulation and lead to inaccurate measurements.**
- **At elevated ambient temperatures be careful with measurement sites that are not well perfused, because this can cause burns after prolonged application.**
- **Avoid placing the sensor on extremities with an arterial catheter, an NBP cuff or an intravascular venous infusion line.**

- **For neonatal patients, make sure that all sensor connectors and adapter cable connectors are outside the incubator. The humid atmosphere inside can cause inaccurate measurements.**

12.6 Changing the SpO_2 Settings

12.6.1 Changing the SpO_2 Alarm Settings

To change the SpO_2 alarm settings, follow this procedure:

1. Select the SpO_2 numeric area or waveform area to enter the **SpO2** menu.
2. Select the **Alarm** tab.
3. Enter the password if required.
4. Set the alarm properties of SpO_2 and SpO_2 Desat.

NOTE

- **You can switch off the SpO2 Desat alarm only when SpO2 Desat Alarm Off in enabled. For more information, see section *8.6.9 Setting the Switch of the SpO_2 Desat Alarm Off*.**

12.6.2 Nellcor Sat-Seconds Alarm Management

With traditional alarm management, high and low alarm limits are set for monitoring oxygen saturation. During monitoring, once 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 to decrease the likelihood of false alarms caused by motion artifacts. With Sat-Seconds alarm management, high and low alarm limits are set in the same way as those with 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.

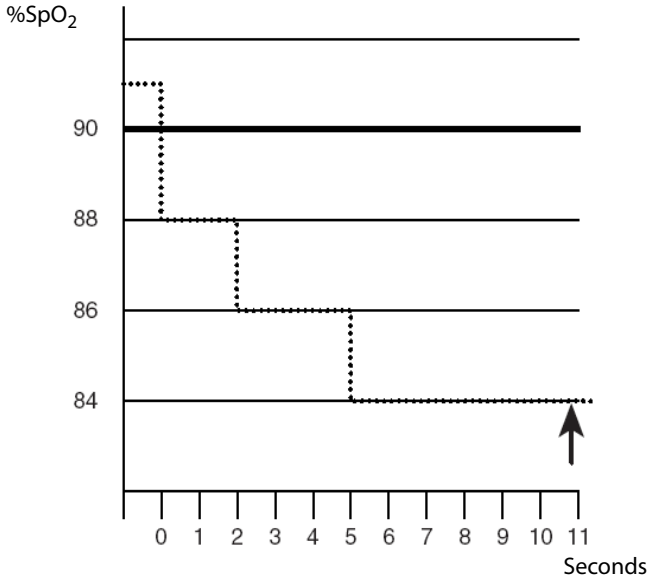
The method of calculation is as follows: the percentage points of the SpO_2 saturation falling outside the alarm limit is multiplied by the number of seconds remaining outside the limit. This can be stated as the equation:

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

- **The SpO_2 Too Low or SpO_2 Too High alarm is presented in the case that SpO_2 value violates the alarm limits for 3 times within one minute even if the setting of Sat-Seconds is not reached.**

12.6.3 Setting the Nellcor SpO_2 Sat-Seconds

To set the Sat-Seconds, follow this procedure:

1. Select the SpO_2 numeric area or waveform area to enter the **SpO2** menu.
2. Select the **Alarm** tab.
3. Set **Sat-Seconds**.

12.6.4 Setting SpO_2 Sensitivity (for Masimo SpO_2)

For Masimo SpO_2, selects the **Sensitivity** as per signal quality and patient motion.

Normal sensitivity is the recommended for patients who are experiencing some compromise in blood flow or perfusion. It is advisable for care areas where patients are observed frequently, such as the intensive care unit (ICU).

Adaptive Probe Off Detection (APOD) sensitivity is the recommended sensitivity mode where there is a high probability of the sensor becoming detached. It is also the suggested mode for care areas where patients are not visually monitored continuously. This mode delivers enhanced protection against erroneous pulse rate and arterial oxygen saturation readings when a sensor becomes inadvertently detached from a patient due to excessive movement.

Maximum sensitivity is recommended for use on patients with weak signals (e.g. high ambient noise and/or patients with very low perfusion) and for use during procedures or when clinician and patient contact is continuous such as in higher acuity settings.

To set SpO_2 sensitivity, follow this procedure:

1. Select the SpO_2 numeric area or waveform area to enter the **SpO2** dialog.
2. Select the **SpO2 Setup** tab.
3. Set **Sensitivity** to **Maximum, Normal, or APOD**.

CAUTION

- **When using the Maximum Sensitivity setting, performance of "Sensor Off" detection may be compromised. If the equipment and the sensor becomes detached from the patient, the potential for false readings may occur due to environmental noise such as light, and vibration.**

12.6.5 Changing Averaging Time (for Masimo SpO_2)

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 SpO_2 measurement is more stable. For critically ill patients, selecting a shorter averaging time will help with understanding the patient's state.

To set the averaging time, follow this procedure:

1. Select the SpO_2 numeric area or waveform area to enter the **SpO2** dialog.
2. Select the **SpO2 Setup** tab.
3. Set **Averaging**.

12.6.6 Changing the Sensitivity (for Mindray SpO_2)

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 SpO_2 measurement is more stable. For critically ill patients, selecting shorter averaging time will help understanding the patient's state.

To set the averaging time, follow this procedure:

1. Select the SpO_2 numeric area or waveform area to enter the **SpO2** menu.
2. Select the **SpO2 Setup** tab.
3. **Sensitivity** for Mindray SpO_2 module.

12.6.7 Showing/Hiding PI

You can set whether to display PI in the SpO_2 parameter area. To do so, follow this procedure:

1. Select the SpO_2 numeric area or waveform area to enter the **SpO2** menu.
1. Select the **Setup** tab.
2. Switch on or off **Display PI.**

12.6.8 Monitoring SpO_2 and NIBP Simultaneously

When monitoring SpO_2 and NIBP on the same limb simultaneously, you can switch on **NIBP Simul** to lock the SpO_2 alarm status until the NIBP measurement ends. If you switch off **NIBP Simul**, low perfusion caused by NIBP measurement may lead to inaccurate SpO_2 readings and therefore cause false physiological alarms.

To set the **NIBP Simul**, follow this procedure:

1. Select the SpO_2 numeric area or waveform area to enter the **SpO2** menu.
2. Select the **Alarm** tab.
3. Select **SpO2** tab.
4. Set **NIBP Simul**.

12.6.9 Changing the Sweep Speed of the Pleth Wave

To set the sweep speed of Pleth waveforms, follow this procedure:

1. Select the SpO_2 numeric area or waveform area to enter the **SpO2** menu.
2. Select the **SpO2 Setup** tab.
3. Set **Speed**.

12.7 Changing the PR Settings

12.7.1 Changing the PR Alarm Settings

To change the PR alarm settings, follow this procedure:

1. Select the SpO_2 numeric area or waveform area to enter the **SpO2** menu.
2. Select the **PR Alarm** tab.
3. Set the alarm properties of PR, For more information, see *22.12 The Authorization Setup Settings*.

12.7.2 Changing the QRS Volume

If the **Alarm Source** is set to **PR**, the QRS tone is derived from PR measurements. To set the QRS volume, follow this procedure:

1. Select the SpO_2 numeric area or waveform area to enter the **SpO2** menu.
2. Select the **PR Setup** tab.
3. Set **QRS Volume**.

If the SpO_2 value is effective, the monitor also adjusts the QRS tone (pitch tone) according to the SpO_2 value.

12.7.3 Setting the PR Source

Current pulse source is displayed in the PR numeric area. The PR from current pulse source has the following characteristics:

- PR is monitored as system pulse and generates alarms when you select PR as the active alarm source.
- PR 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 that of the PR source, it is unlikely to distinguish the PR source.
- PR is sent via the network to the CMS, if available.

To set which pulse rate as PR source, follow this procedure:

1. Select the SpO_2 numeric area or waveform area to enter the **SpO2** menu.
2. Select the **PR Setup** tab.
3. Set **PR Source**.

The **PR Source** 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. If 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.

12.7.4 Showing/Hiding PR

You can set whether to display the PR value in the SpO_2 parameter area. To do so, follow this procedure:

1. Select the SpO_2 numeric area or waveform area to enter the **SpO2** menu.
2. Select the **PR** tab.
3. Select the **Setup** tab.
4. Switch on or off **Display PR.**

12.8 SpO_2 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

- **For the physiological and technical alarm messages, see *D Alarm Messages*.**

Problem	Solution
Do not see SpO_2 numeric area or waveform area on the main screen	1. Check that the SpO_2 is set to display in the **Screen Setup** menu. For more information, see *3.11.2 Displaying Parameter Numerics and Waveforms*. 2. Check that if the SpO_2 parameter switch is enabled. If not, enable the SpO_2 measurement. For more information, see *3.11.1 Switching On or Off a Parameter*. 3. Check that the cable connections of SpO_2 sensor and the extension cable are tight. Replace the SpO_2 sensor or the extension cable if needed.
Dashes "- -" display in place of numerics.	1. Check that the cable connections of SpO_2 sensor and the extension cable are tight. Replace the SpO_2 sensor or the extension cable if needed. 2. Reconnect the SpO_2 sensor if the alarm **SpO2 Sensor Off** appears. 3. Check the PI value. If the PI value is too low, adjust the SpO_2 sensor, or apply the sensor to the site with better perfusion. 4. Move the sensor to the place with weaker light, or cover the sensor with shade cloth if the alarm **SpO2 Sensor Off** appears.
Low amplitude SpO_2 signal	1. The SpO_2 sensor and NIBP cuff are placed on the same limb. Change a monitoring site if necessary. 2. Check the PI value. If the PI value is too low. Adjust the SpO_2 sensor, or apply the sensor to the site with better perfusion. 3. Check the sensor and its application site.
SpO_2 value is inaccurate	1. Check the patient's vital signs. 2. Check for conditions that may cause inaccurate SpO_2 readings. For more information, see *12.3 SpO_2 Measurement Limitations*. 3. Check the monitor, the SpO_2 sensor for proper functioning.

12.9 Nellcor Information

■ Nellcor Patents

This device may be covered by one or more of the following US patents and foreign equivalents: 5,485,847, 5,676,141, 5,743,263, 6,035,223, 6,226,539, 6,411,833, 6,463,310, 6,591,123, 6,708,049, 7,016,715, 7,039,538, 7,120,479, 7,120,480, 7,142,142, 7,162,288, 7,190,985, 7,194,293, 7,209,774, 7,212,847, 7,400,919.

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13 Monitoring Temperature (Temp)

13.1 Temperature Introduction

You can continuously monitor the patient's skin temperature and core temperature by the monitor. Thermally sensitive resistors (thermistors) are used. They are based on the principle that electrical resistance of the thermistor changes as temperature changes. Thermistors measure the resistance change and use it to calculate the temperature.

You can simultaneously monitor up to two temperature sites and calculate the difference between two measured sites.

Temperature monitoring is intended for adult, pediatric and neonatal patients.

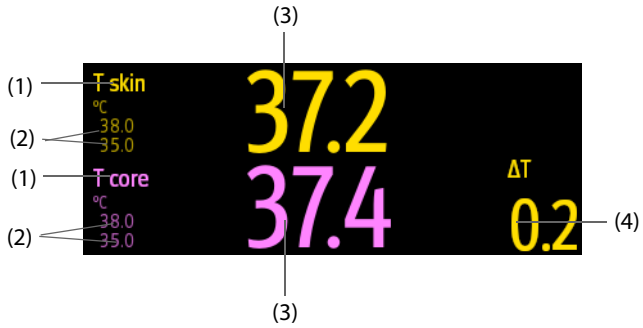
13.2 Displaying the Temp Numerics Area

To display the Temp numerics area, follow this procedure:

1. Access **Tile Layout** in either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select the **Main Menu** quick key → from the **Display** column select **Tile Layout**.
2. Select a parameter numeric area or waveform area, and then from the popup list select **Temp**.

13.3 Temperature Display

The following figure shows the Temp numeric area for temperature monitoring with the monitor. Your display may be configured to look different.



(1) Temperature site (2) Alarm limits (3) Temperature value

(4) Temperature difference (ΔT): Difference between two temperature sites. It displays only when ΔT is switched on.

13.4 Preparing for Temperature Monitoring

To prepare temperature monitoring, follow this procedure:

1. Select an appropriate probe for your patient according to patient category and measured site.
2. Plug the probe or temperature cable to the temperature connector. If you are using a disposable probe, connect the probe to the temperature cable.
3. Follow the probe manufacturer's instructions to connect the probe to the patient.

13.5 Changing Temperature Settings

13.5.1 Setting the Temperature Alarm Properties

To set the temperature alarm properties, follow this procedure:

1. Select the temperature numeric area to enter the **Temp** menu.
2. Select the **Alarm** tab.
3. Enter the password if required.
4. Set the alarm properties.

13.5.2 Selecting the Temperature Label

Select the temperature label according to the measurement site. To do so, follow this procedure:

1. Select the temperature numeric area to enter the **Temp** menu.
2. Select the **Setup** tab.
3. Set the temperature label.

13.5.3 Displaying the Temperature Difference

To display the temperature difference between two measurement sites monitored by the same temperature module, switch on corresponding ΔT. To do so, follow this procedure:

1. Select the temperature numeric area to enter the **Temp** menu.
2. Select the **Setup** tab.
3. Switch on **ΔT**.

13.6 Temperature 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

- **For the physiological and technical alarm messages, see *D Alarm Messages*.**

Problem	Solution
Do not see Temp numeric area on the main screen	1. Check that the Temp is set to display in the **Screen Setup** menu. For more information, see *3.11.2 Displaying Parameter Numerics and Waveforms*. 2. Check that if the Temp parameter switch is enabled. If not, enable the Temp measurement. For more information, see *3.11.1 Switching On or Off a Parameter*. 3. Check that the connections of the temperature probe and the temperature cable are tight.
Measurement fails/'---' is displayed in the Temp numeric area	1. If you are using a disposable probe, check the connection between the probe and the temperature cable. 2. Try using a known good probe in case the sensor is damaged.
The tympanic thermometer display is frozen.	Install or remove the probe cover to activate the thermometer.

14 Monitoring Noninvasive Blood Pressure (NIBP)

14.1 NIBP Introduction

The monitor uses the oscillometric method for measuring the non-invasive blood pressure (NIBP). NIBP measurement is based on the principle that pulsatile blood flow through an artery creates oscillations of the arterial wall. The oscillometric device uses a blood pressure cuff to sense these oscillations that appear as tiny pulsations in cuff pressure. The Oscillometric devices measure the amplitude of pressure changes in the occluding cuff as the cuff deflates from above systolic pressure. The amplitude suddenly increases as the pulse breaks through the occlusion in the artery. As the cuff pressure decreases further, the pulsations increase in amplitude, reach a maximum (which approximates to the mean pressure), and then diminish. The oscillometric method measures the mean pressure and determines the systolic and diastolic pressures.

NIBP monitoring is intended for adult, pediatric, and neonatal patients.

NOTE

- **Blood pressure measurements determined with this device are equivalent to those obtained by a trained observer using the cuff/stethoscope auscultatory method or an intra-arterial blood pressure measurement device, within the limits prescribed by the American National Standard: manual, electronic, or automated sphygmomanometers.**
- **NIBP measurement can be performed during electro-surgery and discharge of defibrillator.**

14.2 NIBP Safety Information

WARNING

- **Be sure to select the correct patient category setting for your patient before NIBP 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.**
- **Do not apply cuff on the arm on the side of a mastectomy.**
- **Continuous cuff pressure due to connection tubing kinking may cause blood flow interference, and resulting in harmful injury to the patient.**
- **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.**
- **Devices that exert pressure on tissue have been associated with purpura, ischemia, and neuropathy. Inspect the application site regularly to ensure skin quality and inspect the extremity of the cuffed limb for normal color, warmth and sensitivity. If the skin quality changes, or if the extremity circulation is being affected, move the cuff to another site or stop the blood pressure measurements immediately. Check more frequently when making automatic or STAT measurements. Auto NIBP measurements with one and two minute intervals are not recommended for extended periods of time.**
- **NIBP diagnostic significance must be decided by the physician.**

CAUTION

- **Only use parts and accessories specified in this manual. Follow the instructions for use and adhere to all warnings and cautions.**
- **Accuracy of NIBP measurement depends on using a cuff of proper size. It is essential to measure limb circumference and choose a cuff with proper size.**

14.3 NIBP Measurement Limitations

Measurements are impossible with heart rate extremes of less than 30 bpm or greater than 300 bpm, or if the patient is on a heart-lung machine. The measurement may be inaccurate or impossible in the following situations:

- Regular arterial pressure pulses are hard to detect
- With excessive and continuous patient movement such as shivering or convulsions
- With cardiac arrhythmias
- With rapid blood pressure changes
- With severe shock or hypothermia that reduces blood flow to the peripheries
- On an edematous extremity.

NOTE

- **The effectiveness of this sphygmomanometer has not been established in pregnant, including pre-eclamptic patients.**

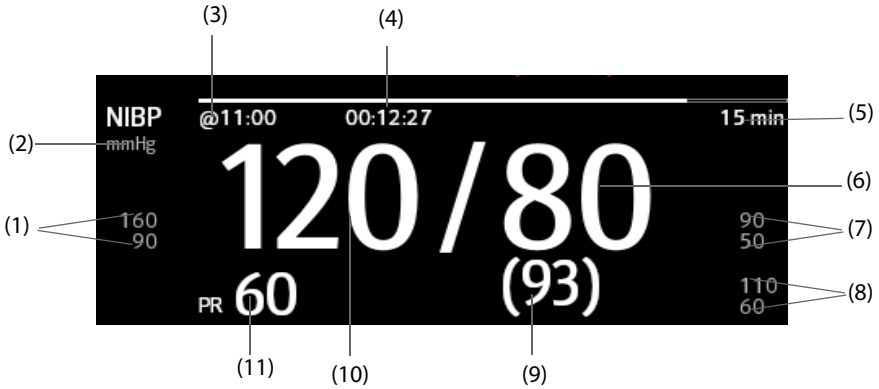
14.4 Measurement Modes

There are three NIBP measurement modes:

- Manual: measurement on demand.
- Auto: repeated measurements at set interval.
- STAT: continually rapid series of measurements over a five minute period.
- Sequence: continually automatic measurement at set durations and intervals.

14.5 NIBP Display

The NIBP display shows only numerics.



(1) Systolic pressure alarm limits

(2) NIBP unit: mmHg or kPa

(3)The last NIBP measurement time

(4) Time to the next measurement (for Auto mode and Sequence mode)

(5) Measurement mode: for Auto NIBP, interval is displayed; for Sequence mode, the current phase and interval are displayed

(6) Diastolic pressure

(7) Diastolic pressure alarm limit

(8) Mean pressure alarm limit

(9) Mean pressure (displayed after measurement completed) or cuff pressure (displayed during the measurement)

(10) Systolic pressure

(11) Pulse Rate

NOTE

- **If NIBP measurement fails, "XX" is displayed; if NIBP measurement is not taken, "--" is displayed.**
- **Outlined NIBP numerics indicate that the measurement is old and exceeds the set time. So these NIBP values are not recommended for reference.**

14.6 Preparing for NIBP Measurements

14.6.1 Preparing the Patient for NIBP Measurements

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, arm and feet supported

NOTE

- **It is recommended that the patient calms down and relaxes as much as possible before performing the measurement and that the patient do not talk during the measurement.**
- **It is recommended to have the patient sit quietly for several minutes before taking the measurement.**
- **Other factors that have been shown to result in an overestimation of blood pressure are labored breathing, full bladder, pain etc.**

14.6.2 Placing the NIBP Cuff

To place the NIBP cuff, follow this procedure:

1. Verify that the patient category setting is correct. If not, enter the Patient Management menu to change patient category. For more information, see *5.3.2 Editing Patient Information*.
2. Connect the air tubing to the NIBP connector on the monitor.
3. Select an appropriately sized cuff for the patient, and then wrap it around the limb directly over the patient's skin as follows:
   a Determine the patient's limb circumference.
   b 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 length of the upper arm or the thigh. The inflatable part of the cuff should be long enough to encircle at least 50% to 80% of the limb.
   c Apply the cuff to the patient's upper arm or leg and make sure the Φ marking on the cuff matches the artery location. The cuff should fit snugly, but with enough room for two fingers to be placed between the cuff and the patient's arm (on adults), and loosely on neonates with little or no air present within the cuff. Otherwise it may cause discoloration and ischemia of the extremities. Make sure that the cuff index line falls within the range markings on the cuff.

d Middle of the cuff should be at the level of the right atrium of the heart. If it is not, you must use the measurement correction formula to correct the measurement. For more information, see *14.8.10 Correcting the NIBP Measurements*.

4. Connect the cuff to the air tubing. Avoid compression or restriction of pressure tubes. Air must pass unrestricted through the tubing.

CAUTION

- **A wrong cuff size and a folded or twisted bladder can cause inaccurate measurements.**
- **Do not touch or apply external pressure against the cuff and air tubing during NIBP measurement. This may cause inaccurate blood pressure values.**
- **Use care when placing the cuff on an extremity used for monitoring other patient parameters.**

14.7 Starting and Stopping NIBP Measurements

Start and stop NIBP measurement by selecting the NIBP quick keys or from the NIBP menu.

Task	By Quick Key	From NIBP menu
Start a manual measurement	**NIBP Start/Stop** quick key	**Start NIBP** button
Start auto NIBP series	**NIBP Start/Stop** quick key Make sure to set the **Interval** before starting the auto NIBP.	**Setup** tab → set **Interval** → **Start NIBP** button
	NIBP Measure quick key → select interval	
Start NIBP sequence measurement	**NIBP Measure** quick key → **Sequence**	**Sequence** tab → set NIBP sequence →**Start NIBP** button
Start STAT measurement	**NIBP Measure** quick key → **STAT**	**STAT** button
Stop the current NIBP measurements	**NIBP Start/Stop** quick key	**Stop NIBP** button
End auto NIBP series or NIBP Sequence	/	**Stop All** button
Stop STAT measurement and end series	**NIBP Start/Stop** quick key	**Stop NIBP** or **Stop All** button

14.8 Changing NIBP Settings

14.8.1 Setting the NIBP Alarm Properties

To set the NIBP alarm properties, follow this procedure:

1. Select the NIBP numeric area to enter the **NIBP** menu.
2. Select the **Alarm** tab.
3. Enter the password if required.
4. Set alarm properties as desired.

14.8.2 Setting the Initial Cuff Inflation Pressure

To set initial cuff inflation pressure, follow this procedure:

1. Select the NIBP numeric area to enter the **NIBP** menu.
2. 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.**

14.8.3 Setting the NIBP Interval

For auto NIBP measurement, you need to set the interval between two NIBP measurements. To set the NIBP interval, follow this procedure:

1. Select the NIBP numeric area to enter the **NIBP** menu.
2. Set **Interval**. Selecting **Manual** switches to manual mode.

14.8.4 Selecting NIBP Start Mode

Start mode defines how NIBP auto mode works. To set the start mode, follow this procedure:

1. Select the NIBP numeric area to enter the **NIBP** menu.
2. Set **Start Mode**.
   - **Clock**: after the first measurement, 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.
   - **Interval**: after the first measurement, the monitor automatically repeats measurements at set interval. 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 14:23, and then at 14:43, 15:03, and so on.

14.8.5 Enabling the NIBP End Tone

The monitor can issue a reminder tone at the completion of NIBP measurement. The NIBP End Tone is off by default. To switch on the NIBP end tone, follow this procedure:

1. Select the NIBP numeric area to enter the **NIBP** menu.
2. Switch on **NIBP End Tone**.

14.8.6 Setting NIBP Sequence

NIBP sequence measurement can have up to five phases: A, B, C, D, and E. You can individually set the duration and interval of each phase.

To set NIBP sequence, follow this procedure:

1. Select the NIBP numeric area to enter the **NIBP** menu.
2. Select the **Sequence** tab.
3. Set **Duration** and **Interval** of each phase.

14.8.7 Setting the NIBP Display Format

To set the NIBP display format, follow this procedure:

1. Select the NIBP numeric area to enter the **NIBP** menu.
2. Select the **Setup** tab.
3. Set **Display Format**.

14.8.8 Setting the NIBP Alarm Limits Display Switch

To set whether to display the alarm limits of diastolic NIBP and mean NIBP, follow this procedure:

1. Select the NIBP numeric area to enter the **NIBP** menu.
2. Select the **Setup** tab.
3. Switch on or off **Display Alarm Limits.**

14.8.9 Showing/Hiding PR

You can set whether to display the PR value in the NIBP parameter area. To do so, follow this procedure:

1. Select the NIBP numeric area to enter the **NIBP** menu..
2. Select the **Setup** tab.
3. Switch on or off **Display PR.**

14.8.10 Correcting the NIBP Measurements

The middle of the cuff should be at the level of right atrium. If the limb is not at the heart level, you need to correct the measurement:

- Add 0.75 mmHg (0.10 kPa) to the displayed value for each centimetre higher.
- Deduct 0.75 mmHg (0.10 kPa) to the displayed value for each centimeter lower.

14.9 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. To assist venous puncture, follow this procedure:

1. Select the NIBP numeric area → **Setup** tab.
2. Set **Venipuncture pressure**.
3. Select **VeniPuncture** at the bottom of the menu.
4. Puncture vein and draw blood sample.
5. Select the **NIBP Start/Stop** quick key to deflate the cuff. If you do not deflate the cuff, the cuff automatically deflates after a period of time (170 seconds for adult and pediatric patient, 85 seconds for neonatal patient).

During venous puncture, pay attention to the cuff pressure and the remaining time displayd in the NIBP numerics area.

14.10 NIBP Maintenance

14.10.1 NIBP Leakage Test

The NIBP leakage test checks the integrity of the system and of the valve. The NIBP leakage test should be performed once every two years or when you doubt the NIBP measurements. The NIBP leakage test should be performed by Mindray-qualified service personnel only.

14.10.2 NIBP Accuracy Test

The NIBP accuracy test should be performed once every two years or when you doubt the NIBP measurements. The NIBP accuracy test should be performed by Mindray-qualified service personnel only.

14.11 NIBP Troubleshooting

For more information, see *D Alarm Messages*.

15 Monitoring Invasive Blood Pressure (IBP)

15.1 IBP Introduction

This patient monitor can monitor up to two invasive blood pressures.

IBP monitoring is intended for adult, pediatric, and neonatal patients. PAWP monitoring is available only for the external display. PAWP monitoring is only intended for adult and pediatric patients.

NOTE

- **If your monitor configures the PiCCO module, you can also measure IBP with the PiCCO module. For more information, see *17 Monitoring Continuous Cardiac Output*.**

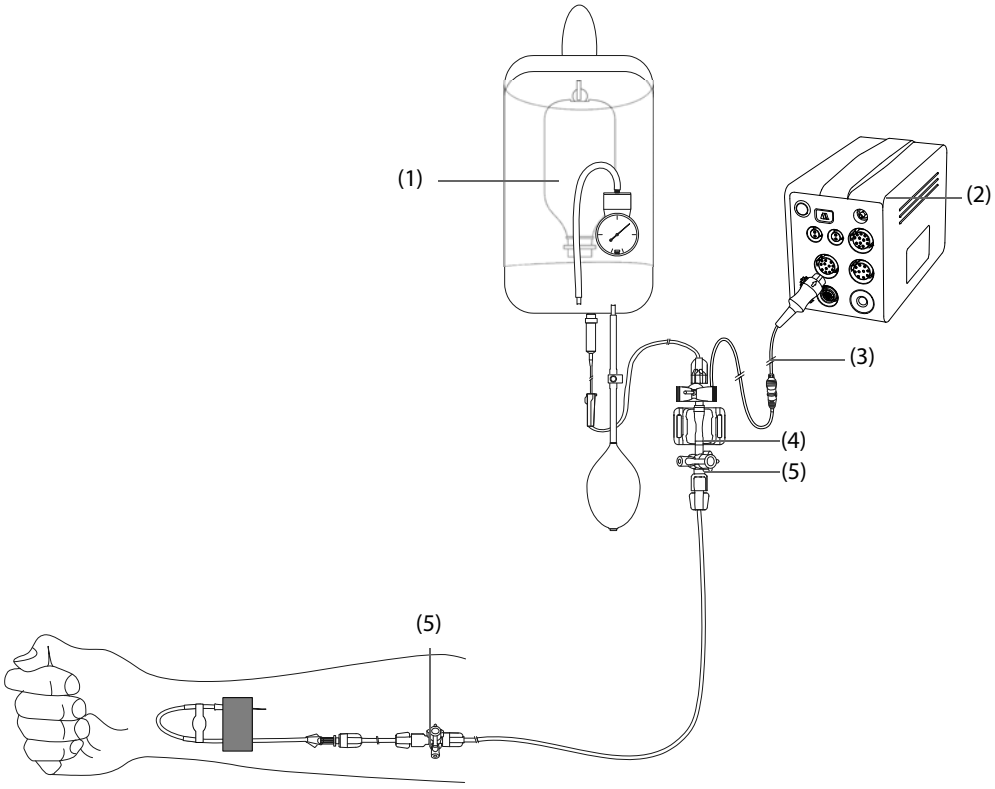
15.2 IBP Safety Information

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 more information, see instructions for use of accessories.**
- **All invasive procedures involve risks to the patient. Use aseptic technique. Follow catheter manufacturer's instructions.**
- **Mechanical shock to the invasive blood pressure transducer may cause severe shifts in zero balance and calibration, and cause erroneous readings.**

15.3 Preparing for IBP Monitoring

15.3.1 IBP Equipment to Patient Connection



(1) Pressure bag (2) N1 monitor (3) IBP cable

(4) IBP transducer (5) Three-way valve

15.3.2 Measuring an Invasive Blood Pressure

To monitor IBP, follow this procedure:

1. Connect one end of the IBP cable to the IBP cable connector on the monitor, and the other end to the IBP transducer.
2. Flush the IBP transducer system to exhaust all air from the tubing according to the manufacturer's instructions. Ensure that the system is free of air bubbles.
3. Connect the IBP transducer to the patient, making sure that the transducer is at the same horizontal level as the heart.
4. Select the proper pressure label for currently measured pressure. For more information, see *15.6.2 Changing the Pressure Label*.
5. Zero the IBP transducer. For more information, see.*15.3.3 Zeroing the IBP transducer*. After a successful zeroing, turn off the stopcock to the air and turn on the stopcock to the patient.

CAUTION

- **If you need to measure two invasive blood pressures, you can use the IBP extension cable with dual-receptacle (PN: 040-001029-00) instead of the IBP cable.**
- **Make sure that all the transducers are zeroed correctly before the IBP measure.**
- **Make sure that no air bubble exists in the IBP transducer system before the IBP measure.**
- **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(not applicable if measuring ICP with the Codman ICP transducer).**

15.3.3 Zeroing the IBP transducer

To avoid inaccurate pressure readings, the monitor requires a valid zero. Zero the transducer in accordance with your hospital policy. The IBP transducer should be zeroed in the following conditions:

- The IBP transducer or adapter cable is reconnected.
- The monitor restarts.
- You doubt the readings.
- The monitor displays the prompt message **Zero Required**.

To zero the transducer, follow this procedure:

1. Connect the IBP transducer, the IBP adapter cable and the monitor.
2. Turn off the three-way valve (the one near the transducer) to the patient, in order to vent the transducer to the atmospheric pressure.
3. Select the numeric area (such as the Art numeric area), and then select **Zero** button.
4. After the zero calibration is completed, close the stopcock to the air and open the stopcock to the patient.

Zero calibration may fail in case of pressure fluctuation or pressure exceeding the calibration range. If zero calibration fails, follow this procedure:

1. Check that the three-way valve (the one near the transducer) is open to the air.
2. Perform zero calibration again. Do not sway the IBP transducer and tubing during zero calibration.

15.4 Measuring ICP Using the Codman ICP Transducer

15.4.1 Zeroing the Codman ICP transducer

You shall zero the Codman ICP transducer (Model: 82-6653) before use. To zero the ICP transducer, follow this procedure:

1. Connect the ICP transducer, the ICP adapter cable and the monitor.
2. Follow the manufacturer's instructions to prepare the ICP transducer.
3. Zero the ICP transducer: when you see the message **Zero Reference** in the ICP numeric area, select the ICP waveform area or numeric area to enter the **ICP** menu → select the **Zero** tab → select the **Zero** button.
4. Record the zero reference value on the blank area of the ICP transducer for further reference.

If the ICP transducer zero calibration failed or you doubt the zero reference value, perform a zero calibration again.

15.4.2 Measuring ICP

To perform the ICP measurement, follow this procedure:

1. Zero the Codman ICP transducer. For more information, see section *15.4.1 Zeroing the Codman ICP transducer*.
2. Disconnect the ICP transducer and ICP adapter cable. Follow the manufacturer's instructions to apply the ICP transducer to the patient.
3. Reconnect the ICP transducer and ICP adapter cable.
4. Check that the zero reference value displayed on the monitor is consistent with that recorded on the ICP transducer.
   - Consistent: select **Accept**.
   - Inconsistent: input the zero reference value recorded on the ICP transducer, and select **Accept.**

If you have to transfer the patient who is taking ICP measurement, check that the target monitor supports the Codman ICP transducer. If the target monitor does not support the Codman ICP transducer, do not use it for ICP monitoring.

If the target monitor supports the Codman ICP transducer, follow this procedure to transfer the patient:

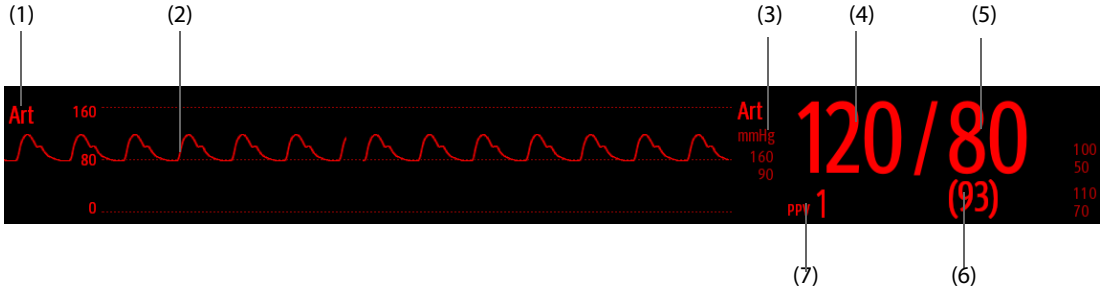
1. Disconnect the ICP adapter cable from the measurement module, or remove the module from the monitor.
2. Connect the ICP adapter cable, measurement module, and the target monitor, or insert the measurement module into the target monitor.
3. Check that the zero reference value displayed on the monitor is consistent with that recorded on the ICP transducer.
   - Consistent: select **Accept**.
   - Inconsistent: input the zero reference value recorded on the ICP transducer, and select **Accept.**

CAUTION

- **If monitors of different brands are used to zero the Codman ICP transducer, the zero reference values can be different. Use a Mindray monitor to Zero the Codman ICP transducer if you will take ICP measurement using a Mindray monitor. Otherwise the ICP measurement can be inaccurate.**

15.5 IBP Display

The IBP measurement is displayed on the monitor as a waveform and numeric pressures. For arterial pressure, the IBP numeric area displays systolic pressure, diastolic pressure and mean pressure. For venous pressure, the IBP numeric area displays only the mean pressure. The figure below shows the waveform and numerics for the Art pressure.



(1) Pressure label (2) Waveform (3) Pressure Unit

(4) Systolic pressure (5) Diastolic pressure (6) Mean pressure

(7) 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.

15.6 Changing IBP Settings

15.6.1 Changing the IBP Alarm Settings

To change the IBP alarm settings, follow this procedure:

1. Select the IBP numeric area or waveform area to enter the corresponding pressure menu.
2. Select the **Alarm** tab.
3. Enter the password if required.
4. Set the alarm properties.

15.6.2 Changing the Pressure Label

The pressure label is a unique identifier for each type of pressure. Therefore, you should select a proper pressure label for the source of the pressure you want to monitor.

To select the pressure label, follow this procedure:

1. Select the IBP numeric area or waveform area to enter the corresponding pressure menu.
2. Select the **Setup** tab.
3. Set **IBP1 Label** or **IBP2 Label**.

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
CPP	Cerebral perfusion pressure	P1 to P4	Non-specific pressure label

NOTE

- **It is not allowed to select the same label for different pressures.**

15.6.3 Setting the Pressure Type for Display

For the non-specific pressure (P1, P2, P3 or P4), the displayed pressure type is configurable. To set the displayed pressure type, follow this procedure:

1. Select the numeric area or waveform area of the non-specific pressure to enter the corresponding pressure menu.
2. Select the **Setup** tab.
3. Set **Measure**:
   - If this non-specific pressure is artery pressure, set the **Measure** to **All**. In this case, its corresponding numeric area displays systolic pressure, diastolic pressure and mean pressure.
   - If this non-specific pressure is venous pressure, set the **Measure** to **Mean Only**. In this case, its corresponding numeric area displays only the mean pressure.

15.6.4 Changing the Sensitivity

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, and the higher the sensitivity. Contrarily, the longer the averaging time is, the slower the monitor responds to changes in the patient's blood pressure, the lower the sensitivity, but the measurement accuracy will be improved. For critically ill patients, selecting higher sensitivity will help understanding the patient's state.

To set the sensitivity, follow this procedure:

1. Select the IBP numeric area or waveform area to enter the corresponding pressure menu.
2. Select the **Setup** tab.
3. Set **Sensitivity**.

15.6.5 Setting the IBP Waveform

To set the IBP waveform, follow this procedure:

1. Select the IBP numeric area or waveform area to enter the corresponding pressure menu.
2. Select the **Setup** tab.
3. Set the following properties of the IBP waveform:
   - **Speed**

- **Scale**: if **Auto** is selected, the size of the pressure's waveform will be adjusted automatically.

15.6.6 Setting the Display Format of Artery Pressure

To set the display format of the artery pressure, follow this procedure:

1. Select the numeric area or waveform area of any arterial pressure to enter the corresponding menu.
2. Select the **Setup** tab.
3. Set **Display Format**.

15.6.7 Showing/Hiding the Alarm Limits of Artery Pressure

To set whether to display the alarm limits of the arterial pressure, follow this procedure:

1. Select the numeric area or waveform area of any arterial pressure to enter the corresponding menu.
2. Select the **Setup** tab.
3. Switch on or off **Display Alarm Limits.**

15.6.8 Setting the Use PA-D as PAWP Switch (only available for the independent external display)

You can set whether PA-D value is used to replace PAWP value for hemodynamic calculation. To do so, follow this procedure:

1. Select the PA numeric area or waveform area to enter the **PA** menu.
2. Select the **Setup** tab.
3. Switch on or off **Use PA-D as PAWP**.

For more information on hemodynamic calculation, see *20.4 Hemodynamic Calculations*.

15.6.9 Enabling PPV Measurement

PPV indicates pulse pressure variation. When measuring the arterial pressure (except PA), the PPV measurement is available. To enable the PPV measurement, follow this procedure:

1. Select the IBP numeric area or waveform area to enter the corresponding pressure menu.
2. Select the **PPV Setup** tab.
3. Switch on **PPV Measure**.

You can select PPV source after 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 ("corpulmonale").
- **The PPV measurement has been validated only for adult patients.**

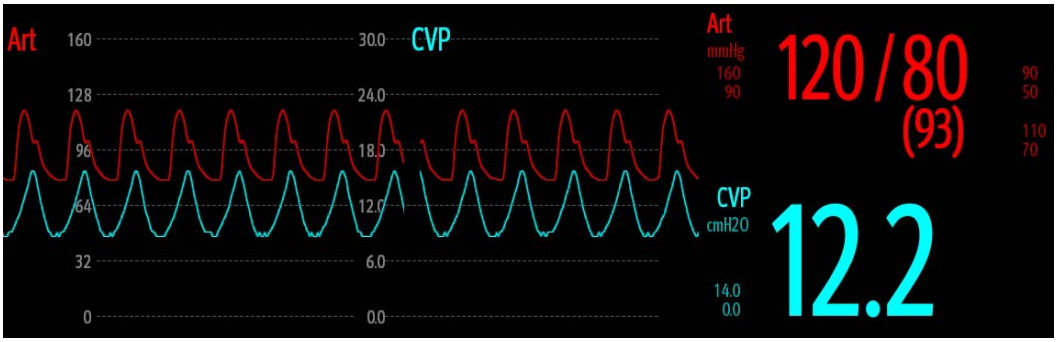
NOTE

- **The PPV measurement from IBP will automatically be switched off if PiCCO module is working. The monitor will measure PPV through PiCCO module.**

15.6.10 Overlapping IBP Waveforms

The IBP waveforms can be displayed together. To combine IBP waveforms, follow this procedure:

1. Access **Tile Layout** by either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select **Main Menu** quick key → from the **Display** column select **Tile Layout**.
2. Select the waveform area where you want to display the overlapped IBP waveforms, and then select the IBP waves to be overlapped on the left side of the same line.
3. Repeat step 2 in another waveform area if needed.
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 make the following settings:

- Scale
  - Set **Left Scale** for the arterial pressure.
  - Set **Right Scale** for the venous pressure.
  - Set **CVP Scale** individually if the CVP waveform is combined and CVP unit is different from IBP unit.
  - Set **ICP Scale** individually if the ICP waveform is combined and ICP unit is different from IBP unit.
  - Set **PA Scale** individually if the PA waveform is combined.
- Switch on or off **Gridlines** to show or hide gridlines in the overlapped waveform area.
- Set **Speed** for the overlapped waveforms.

NOTE

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

15.7 Measuring PAWP (only available for the independent external display)

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

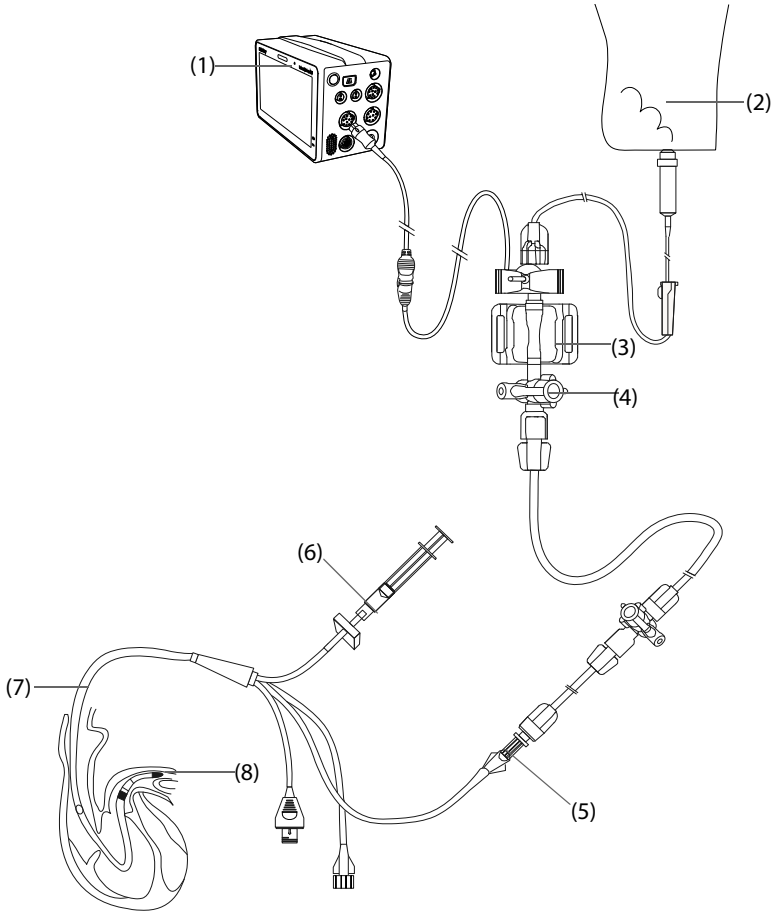
Obtain the measurement by introducing a balloon-tipped pulmonary artery flotation catheter into the pulmonary artery. When the catheter is in one of the smaller pulmonary arteries, the inflated balloon occludes the artery allowing the monitor to record changes in the intrathoracic pressures that occur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

15.7.1 PAWP Equipment to Patient Connection



(1) N1 monitor	(2) Flush bag
(3) IBP transducer	(4) Three-way valve
(5) PA distal port	(6) Balloon inflation valve
(7) Thermodilution catheter	(8) Balloon

15.7.2 Preparing to Measure PAWP

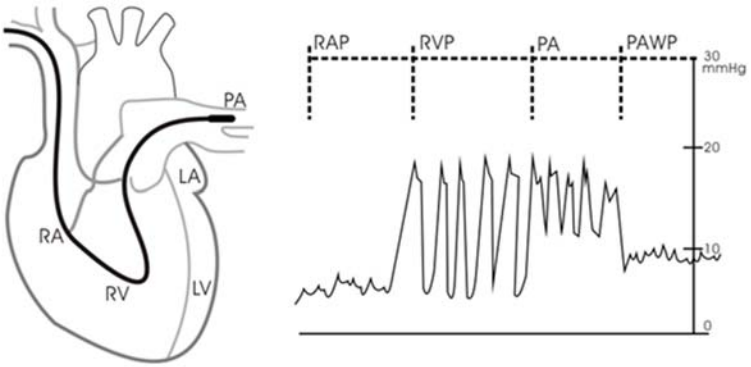
To prepare to monitor PAWP, follow this procedure:

1. Connect the IBP transducer, the IBP cable and the monitor. For more information, see *15.3.2 Measuring an Invasive Blood Pressure*.
2. Follow the manufacturer's instructions to connect the PA port of the thermodilution catheter and the patient end of the IBP transducer.
3. Zero the IBP transducer. For more information, see *15.3.3 Zeroing the IBP transducer*.
4. Set the IBP label to **PA** since the PAWP is measured on PA. For more information, see *15.6.2 Changing the Pressure Label*.

15.7.3 Measuring PAWP

To measure the PAWP, follow this procedure:

1. Select the PA numeric area or waveform area to enter the **PA** menu, and then select **PAWP**.
2. Wedge the flotation catheter into the pulmonary artery by observing the PA waveform changes on the screen, referring to the following figure.



3. Select **Start**.
4. Inflate the balloon and pay attention to PA waveform changes on the screen when the prompt message **Ready For Balloon Deflation** appears.
5. Deflate the balloon when the prompt message **Ready For Balloon Deflation** appears. If the PA waveform is stable yet the monitor still not show the prompt message **Ready For Balloon Deflation**, select the **Freeze** to freeze the waveform, and deflate the balloon.
6. Select **Accept** to save the PAWP value.
7. If you need to start a new measurement, repeat the step 3 to step 6.

If the measurement fails or you need to adjust the PAWP value, you can use the following buttons to adjust the PAWP waveform and measurement.

- Select the up or down arrow button to adjust the PAWP value.
- Select the left or right arrow button to view the frozen waveforms of 40 seconds.
- Select **Accept** to save the PAWP value.

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.**
- **If the flotation/thermodilution catheter drifts into the wedge position without inflation of the balloon, the PA waveform assumes a wedged appearance. Take appropriate action, in accord with standard procedures, to correct the situation.**

NOTE

- **The PA alarm is turned off automatically when the monitor enters the PAWP screen.**

15.7.4 Setting the Waveforms of the PAWP Screen

On the **PAWP** screen, select **Setup** to enter the **PAWP Setup** menu. In the **PAWP Setup** menu, you can make the following settings:

- Select **Reference Waveform 1** to set an ECG lead wave as the first reference wave.
- Select **Reference Waveform 2** to set a respiration wave as the second reference wave.
- Select **Speed** to set a sweep speed for the displayed waveforms on the **PAWP** screen.
- Select **Scale** to set the size of the PA waveform on the **PAWP** screen.

15.7.5 Performing Hemodynamic Calculation (only available for the independent external display)

On the **PAWP** screen, select **Hemo Calcs** to enter the **Calculations** menu. For more information, see *20.4 Hemodynamic Calculations*.

15.8 IBP 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

- **For the physiological and technical alarm messages, see *D Alarm Messages*.**

Problem	Solution
Cannot see IBP numeric area or waveform area on the main screen	1. Check that the IBP is set to display in the **Screen Setup** menu. For more information, see *.3.11.2 Displaying Parameter Numerics and Waveforms* 2. Check that if the IBP parameter switch is enabled. If not, enable the IBP measurement. For more information, see *3.11.1 Switching On or Off a Parameter*. 3. Check the connection of IBP cable, IBP transducer and module. 4. Check that the stopcock is turned to the correct position. 5. Check that the IBP transducer has been zeroed. For more information, see *15.3.3 Zeroing the IBP transducer*.
Cannot see systolic pressure and diastolic pressure for P1/P2/P3/P4	Set **Measure** to **All** in the P1/P2/P3/P4 setup menu. For more information, see *15.6.3 Setting the Pressure Type for Display*.
IBP readings seem unstable	1. Make sure there are no air bubbles in the transducer systems. 2. Check that the transducer is properly fixed. 3. Zero the transducer again. 4. Replace a transducer.
Zeroing of IBP channel(s) fails.	1. Ensure that the channels are open to air. 2. Perform zero calibration again. Do not sway the IBP transducer and tubing during zero calibration. For more information, see *15.3.3 Zeroing the IBP transducer*. 3. If zero calibration still fails, replace the transducer.

16 Monitoring Carbon Dioxide (CO_2)

16.1 CO_2 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.

CO_2 measurement are used to monitor the patient's respiratory status. The following two methods are used for measuring CO_2:

- Mainstream CO_2 measurement

  Directly insert a CO_2 sensor into the patient's breathing system.

- Sidestream/Microstream CO_2 measurement

  Take a sample of the respiratory gas with a constant sample flow from the patient's airway and analyzes it with a remote CO_2 sensor built into the Sidestream or Microstream CO_2 module.

The sidestream CO_2 module can be configured with a paramagnetic oxygen sensor. The paramagnetic oxygen sensor measures oxygen relying on its paramagnetic properties.

The mainstream CO_2 measurement can be used, with specified accessories, with intubated adult, pediatric and neonatal patients. 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.

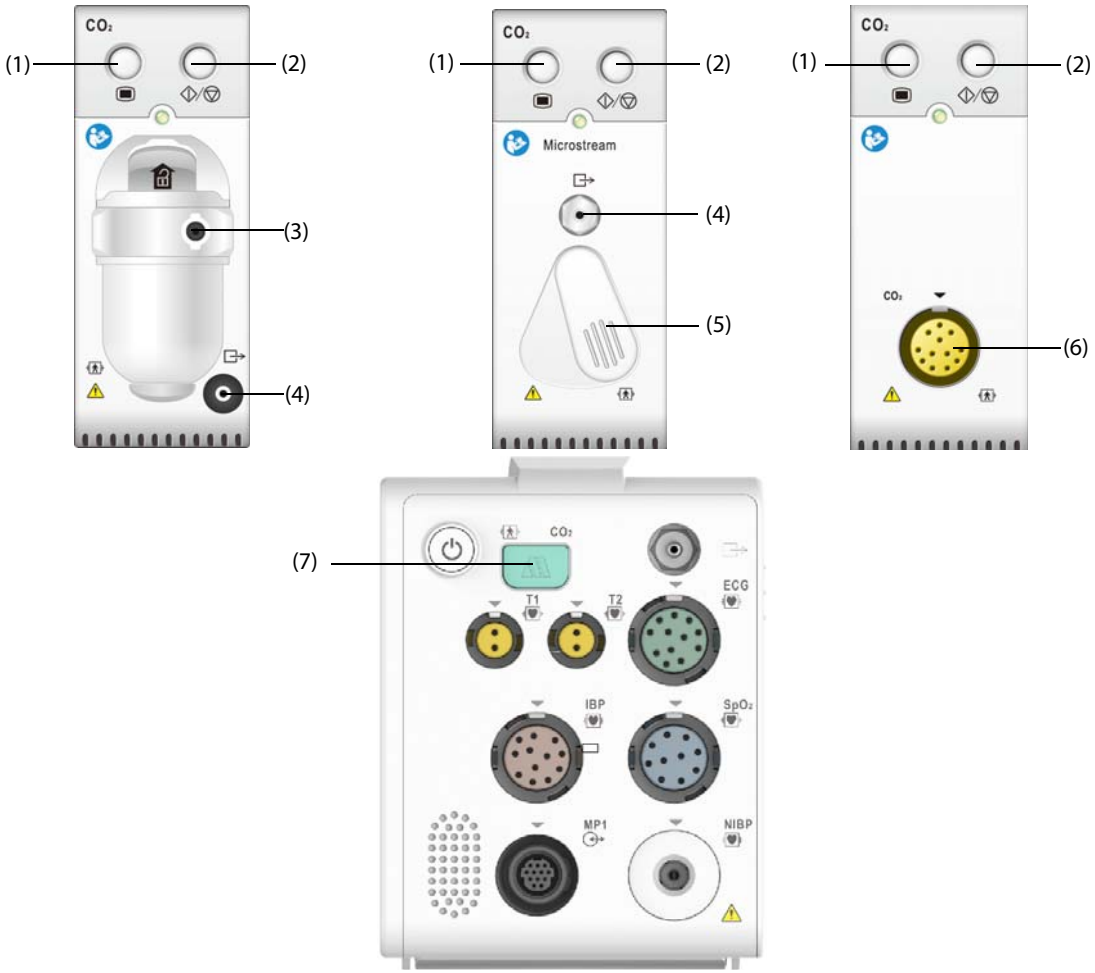
CO_2 monitoring is intended for adult, pediatric and neonatal patients.

WARNING

- **N1 monitor does not support the CO_2 measurement when it is used for transporting patient through the rotary or fixed-wing ambulance.**
- **It is recommended not to measure O_2 when you're transferring patient with the N1 monitor. Shaking the CO_2 module during O_2 measurement may lead to distorted O_2 waveform or inaccurate O_2 measurement.**

To measure CO_2, you can use either the internal CO_2 module or the external CO_2 module. The external CO_2 module is connected to the N1 through the Modular Rack. For the connection of the N1 and the external CO_2 module, see section *2.8.1Installing the N1 or External Parameter Module into the Modular Rack*.

In sequence, the follows are sidestream CO_2 module, microstream CO_2 module, mainstream CO_2 module and N1 monitor.



(1) CO_2 menu hard key

(2) CO_2 Measure/standby hard key

(3) CO_2 watertrap seat

(4) Gas outlet

(5) Sample line connector

(6) CO_2 sensor connector

(7) CO_2 adapter connector

16.2 CO_2 Safety Information

WARNING

- **Route all tubing away from the patient's throat to avoid strangulation.**

CAUTION

- **Remove the airway sample line from the patient's airway while nebulized medications are being delivered.**
- **$EtCO_2$ values measured from the CO_2 module may differ from those of from the blood gas analysis.**
- **Avoid mechanical shock to the sidestream CO_2 module**

NOTE

- **The CO_2 module automatic suppress physiological alarms until breathing waves have been detected. Make sure that a patient is properly connected when monitoring with the CO_2 module.**

16.3 CO_2 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

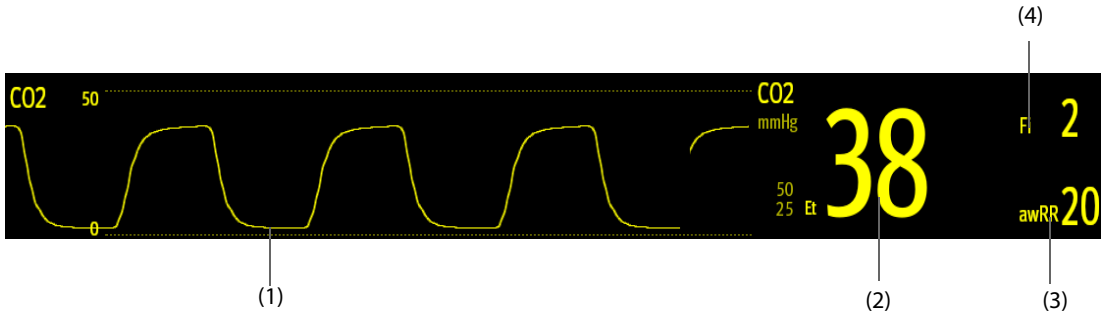
For more information, refer to *A.14.9CO_2 Specifications*.

CAUTION

- **Measurement accuracy of the sidestream CO_2 module may be affected by the breath rate and inspiration/expiration (I/E) ratio.**
- **Measurement accuracy of the microstream CO_2 module may be affected by the breath rate.**

16.4 CO_2 Display

The CO_2 numeric and waveform area provide $FiCO_2$ measurement, $EtCO_2$ measurement, awRR measurement, and a CO_2 waveform.



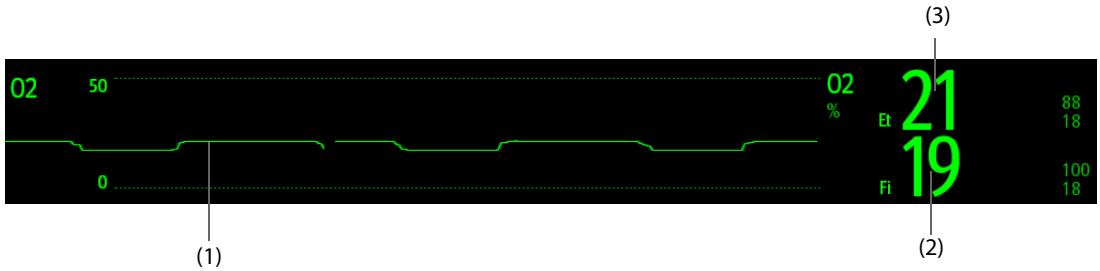
(1) CO_2 waveform

(2) End tidal CO_2 value ($EtCO_2$)

(3) Airway respiration rate (awRR)

(4) Fraction of inspired CO_2 ($FiCO_2$)

If your sidestream CO_2 module is configured with the oxygen sensor, O_2 waveform and parameters can be displayed as follows:



(1) O_2 waveform

(2) FiO_2 measurement

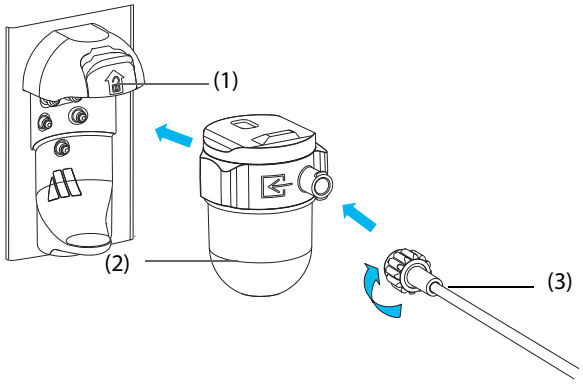
(3)EtO_2 measurement

16.5 Measuring CO_2 Using Sidestream/Microstream CO_2 Module

16.5.1 Preparing to Measure CO_2 Using Sidestream CO_2 Module

To prepare the sidestream CO_2 measurement, follow this procedure:

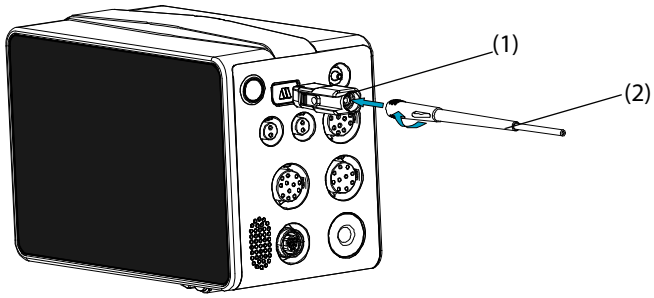
1. Select the appropriate gas sample line and watertrap according to the patient category.
2. Connect the one end of the gas sample line.
   - If you're using the sidestream CO_2 module, connect the watertrap to the CO_2 module, and connect the gas sample line to the watertrap.



(1) Watertrap receptacle (2) DRYLINE II watertrap

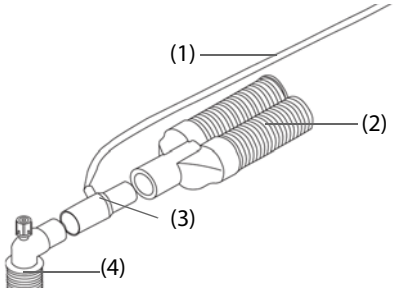
(3) Gas sample line

   - If you're using the N1 monitor for CO_2 measure, connect the one end of the gas sample line to the CO_2 adapter. Refer to the *CO2 Adapter User Manual* (PN: H-046-009994-00) for the connection of the CO_2 adapter and the gas sampling line.



(1) CO_2 adapter (2) Gas sample line

3. Connect the other end of the gas sample line to the patient.
   - For intubated patients requiring an airway adapter, install the airway adapter between the patient circuit and the ventilator Y-piece.



(1) Sample line (2) Connect to the ventilator

(3) Airway adapter (4) Connect to the patient

   - For non-intubated patients, place the nasal cannula onto the patient.

4. Connect the gas outlet to the scavenging system using an exhaust tube.

After the CO_2 module is connected, it enters measure mode by default and the monitor displays **CO2 Starting**. CO_2 can be measured after the start-up is complete.

WARNING

- **Do not apply adult or pediatric watertrap to the neonate patient. Otherwise, patient injury could result.**
- **Connect the gas outlet to the scavenging system when measuring CO_2 using the sidestream CO_2 module.**

CAUTION

- **Check the compatibility of the CO_2 adapter and the sampling line before use.The CO_2 adapter is intended for connecting an Oridion CO_2 sampling line.**
- **Leakage in the breathing or sampling system may cause the displayed $EtCO_2$ values to be significantly low. Always make sure that all components are securely connected.**
- **Inspect the airway adapter for a tight connection and proper operation before attaching it to the patient.**
- **Squeezing or bending the sample line during the sidestream or microstream CO_2 measurement may cause inaccurate CO_2 reading or no reading.**
- **To avoid blocking the airway, empty the DRYLINE II watertrap container whenever half full. Replacing the DRYLINE II watertrap once a month is recommended.**
- **The DRYLINE II watertrap has a filter preventing bacterium, water and secretions from entering the module. Extended use could destroy the filter in watertrap and fail to stop the bacterium, water and secretions entering the module, result in damaging the gas module and having infection risk.**

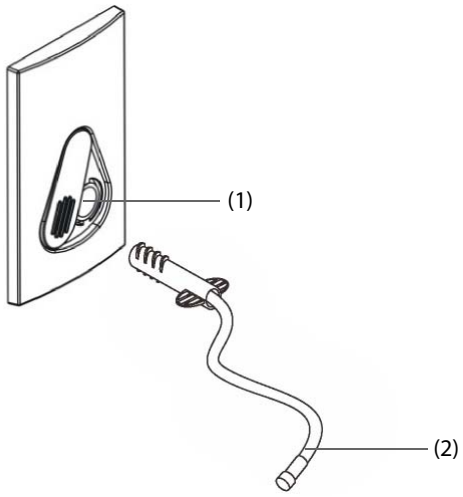
NOTE

- **It is recommended to replace the CO_2 adapter at least once a year.**
- **To extend the lifetime of the watertrap and module, disconnect the watertrap from the module and set the operating mode to Standby mode when CO_2 monitoring is not required.**
- **The sample rates are different when different types of watertraps are used.**
- **The emptying interval of the DRYLINE II adult/pediatric watertrap is 26 hours @ 120 ml/min, sample gas of 37 °C, room temperature of 23°C, and 100% RH.**
- **The emptying interval of the DRYLINE II neonatal watertrap is 35 hours @ 90 ml/min, sample gas of 37 °C, room temperature of 23°C, and 100% RH.**

16.5.2 Preparing to Measure CO_2 Using Microstream CO_2 Module

To prepare the CO_2 module for measurement, follow this procedure:

1. Connect one end of the sample line to the microstream CO_2 module.



(1) Sample line connector (2) Sample line

2. Connect the other end of the sample line to the patient.
   - For intubated patient requiring an airway adapter, install the airway adapter between the patient circuit and the ventilator Y-piece.
   - For non-intubated patient, place the nasal cannula onto the patient.
   - For patient prone to mouth breathing, place the oral-nasal cannula onto the patient.
3. Connect the gas outlet to the a scavenging system using an exhaust tube.

After the CO_2 module is connected to N1, it enters measure mode by default and the monitor displays **CO2 Sensor Warmup**. CO_2 can be measured after the start-up is complete.

CAUTION

- **Connect the gas outlet to the scavenging system when measuring CO_2 using the microstream CO_2 module.**

NOTE

- **Disconnect the sample line from the module when CO_2 monitoring is not required.**

16.5.3 Zeroing the Sidestream/Microstream CO_2 Module

The sidestream or microstream CO_2 module performs zero calibration automatically when needed.

NOTE

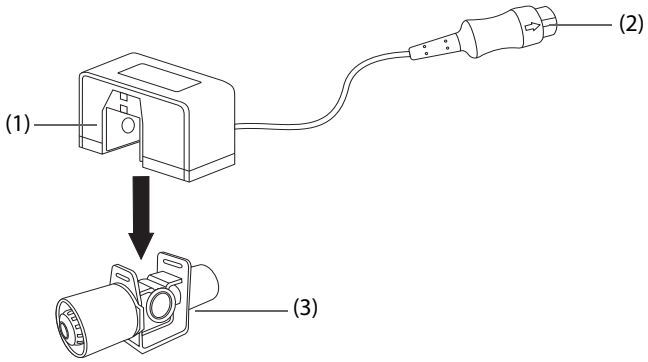
- **The CO_2 module temporally stops measuring during zeroing.**

16.6 Measuring CO_2 Using Mainstream CO_2 Module

16.6.1 Preparing to Measure CO_2 Using Mainstream CO_2 Module

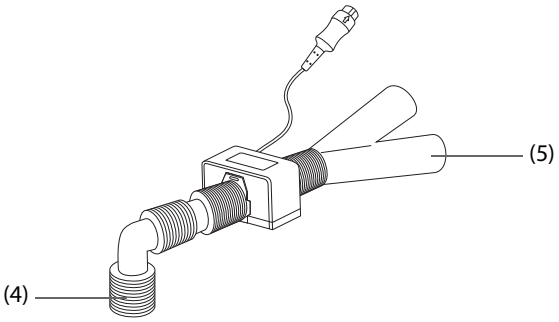
To prepare the CO_2 module for measurement, follow this procedure:

1. Connect the airway adapter to the sensor head.



(1) Sensor (2) Connect to module (3) Airway adapter

2. Attach the sensor connector to the CO_2 connector on the mainstream CO_2 module.
3. Zero the sensor after the warm-up is finished. For details, see *16.6.2Zeroing the Mainstream CO_2 sensor*.
4. After the zero calibration is finished, connect the airway as shown below.



(4) Connect to patient (5) Connect to ventilator

5. Make sure that no leakages are in the airway and then start a measurement.

NOTE

- **Be sure to set the barometric pressure properly before using the mainstream CO_2 module. Improper settings will result in erroneous CO_2 reading.**
- **Always position the sensor with the adapter in an upright position to avoid collection of fluids in the windows of the adapter. Large concentrations of fluids at this point will obstruct gas analysis.**
- **To avoid dead space, place the sensor as close to the patient as possible.**

16.6.2 Zeroing the Mainstream CO_2 sensor

For mainstream CO_2 modules, the sensor should be zeroed in the following conditions:

- Before each measurement.
- A new adapter is used.
- Reconnect the sensor to the module.
- The message **CO2 Zero Required** displays. In this case, check the airway adapter for any blockage, e.g. mucus, etc. If a blockage is detected, clear or replace the adapter.

To zero the sensor, follow this procedure:

1. Connect the sensor to the module.
2. In the **CO2** menu, select **Setup** tab.

3. Set the **Operating Mode** to **Measure**. The message **CO2 Sensor Warmup** is displayed.
4. After warm-up is finished, connect the sensor to a clean, dry airway adapter. The adapter should be vented to the air and isolated from CO_2 sources, such as ventilator, the patient's breathing, your own breathing, etc.
5. Select **Zero** in the **CO2** menu. The message **Zeroing** is displayed.

It takes about 15 to 20 seconds. The message disappears when the zero calibration is completed.

WARNING

- **When perform a zero calibration during the measurement, disconnect the sensor from the patient's airway first.**
- **Please do not rely on the readings during zeroing.**

16.7 Changing Settings for All CO_2 Modules

16.7.1 Changing CO_2 Alarm Settings

To change the CO_2 alarm settings, follow this procedure:

1. Select the CO_2 numeric area or waveform area to enter the **CO2** menu.
2. Select the **Alarm** tab.
3. Enter the password if required.
4. Set alarm properties as desired.

16.7.2 Setting the CO_2 Waveform

To set the CO_2 waveform, follow this procedure:

1. Select the CO_2 numeric area or waveform area to enter the **CO2** menu.
2. Select the **Setup** tab.
3. Set **Waveform Type**, **Speed** and **CO2 Scale** of the CO_2 waveform.

16.7.3 Setting the RR Source

To set the respiration rate (RR) source, follow this procedure:

1. Select the CO_2 numeric area or waveform area to enter the **CO2** menu.
2. Select the **Setup** tab.
3. Set **RR Source**.

When the current RR source does not have valid measurement, the system will automatically switch **RR Source** to **Auto**.

16.7.4 Entering the Standby Mode

You can set the CO_2 module to one of the following modes according to the module status:

- Select **Measure** mode when you use the CO_2 modue for monitoring.
- Select **Standby** mode when you does not use the CO_2 module to prolong the serviec life of the CO_2 module.

The default operating mode is **Measure**. If you are not using the CO_2 module, you can proceed as follows to enter the Standby mode:

1. Select the CO_2 numeric area or waveform area to enter the **CO2** menu.
2. Select the **Setup** tab.
3. Set **Operating Mode** to **Standby**.

16.7.5 Entering the Intubation Mode

When performing intubation during general anesthesia, you can enter the intubation mode in order to reduce unnecessary alarms. To enter the intubation mode, follow this procedure:

1. Select the CO_2 numeric area or waveform area to enter the **CO2** menu.
2. Select **Intubation Mode**.

For the details of the intubation mode, see *8.11Intubation Mode*.

16.8 Changing Settings for Sidestream and Microstream CO_2 Module

16.8.1 Setting the Auto Standby

The monitor enters standby mode automatically after the configured period of time if no breath is detected since the last detected breath. To set the auto standby, follow this procedure:

1. Select the CO_2 numeric area or waveform area to enter the **CO2** menu.
2. Select the **Setup** tab.
3. Set **Auto Standby**.

16.8.2 Setting Humidity Compensation

Sidestream and microstream CO_2 modules are configured to compensate CO_2 readings for either Body Temperature and Pressure, Saturated Gas (BTPS), to account for humidity in the patient's breath, or Ambient Temperature and Pressure, Dry Gas (ATPD).

- ATPD: $P_{CO2}(mmHg)=CO_2(vol\%) \times P_{amb}/100$
- BTPS (sidestream): $P_{CO2}(mmHg)=CO_2(vol\%) \times (P_{amb}- 47)/100$
- BTPS (microstream): $P_{CO2}(mmHg)=CO_2(vol\%) \times (1- 0.03) \times P_{amb}/100$

Where, $P_{CO2}(mmHg)$= partial pressure, vol%=CO_2 concentration, P_{amb}=ambient pressure, and unit is mmHg.

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, follow this procedure:

1. Select the CO_2 numeric area or waveform area to enter the **CO2** menu.
2. Select the **Setup** tab.
3. Set **BTPS Compensation**.
   - Switch on for BTPS.
   - Switch off for ATPD.

16.9 Changing O_2 Settings (For Sidestream CO_2 Module Integrating O_2)

16.9.1 Changing O_2 Alarm Settings

To change the O_2 alarm settings, follow this procedure:

1. Select the CO_2 numeric area or waveform area to enter the **CO2** menu.
2. Select the **Alarm** tab.
3. Set alarm properties as desired.

16.9.2 Setting the O_2 Waveform

To set the O_2 waveform, follow this procedure:

1. Select the CO_2 numeric area or waveform area to enter the **CO2** menu.
2. Select the **Setup** tab.

3. Set **Speed** and **O2 Scale** of the O_2 waveform.

16.10 Setting the Gas Compensation

The presence of interfering gas affects the CO_2 measurement. To get the best possible measuring result, it is needed to set the gas compensation. The configured concentration of the interfering gas should be in accordance with its actual proportion.

For the microstream CO_2 module, gas compensations are not required.

WARNING

- **Make sure to use the appropriate compensations. Inappropriate compensations may cause inaccurate measurement values and result in misdiagnosis.**

For the sidestream CO_2 module, follow this procedure to set the gas compensation:

1. Select the CO_2 numeric area or waveform area to enter the **CO2** menu.
2. Select the **Setup** tab.
3. Set the compensation according to the actual condition.

For the mainstream CO_2 module, follow this procedure to set the gas compensation:

1. Select the CO_2 numeric area or waveform area to enter the **CO2** menu.
2. Select the **Setup** tab.
3. Set the following compensation according to the actual condition.

- **Balance Gas**
  - Select **Room Air** when air predominates in the ventilation gas mixture.
  - Select **N2O** when N_2O predominates in the ventilation gas mixture.
  - Select **He** when He predominates in the ventilation gas mixture.
- **O2 Compensation**
  - Select **Off** when the amount of O_2 is less than 30%.
  - Select an appropriate setting according to the amount of O_2 in the ventilation gas mixture.
- **AG Compensation**: enters the concentration of anesthetic gas present in the ventilation gas mixture. This could compensate for the effect of AG on the readings.

16.11 Choosing a Time Interval for Peak-Picking

For microstream and mainstream CO_2 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, follow this procedure:

1. Select the CO_2 numeric area or waveform area to enter the **CO2** menu.
2. Select the **Setup** tab.
3. Set **Maximum Hold**.
4. Toggle between **Single Breath**, **10 s**, **20 s** and **30 s** if microstream CO_2 module is configured; toggle between **Single Breath**, **10 s** and **20 s** if mainstream CO_2 module is configured.
   - **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.

16.12 Changing Barometric Pressure

Both sidestream and microstream CO_2 modules have the function of automatic barometric pressure compensation (the system automatically measures the barometric pressure to which the patient monitor is exposed). However, the mainstream CO_2 module does not have such function. For the mainstream CO_2 module,

the default barometric pressure is 760 mmHg. You must modify the barometric pressure based on the actual situation.

This function is password protected. For more information, see *22.11The Other Settings*.

WARNING

- **Be sure to set the barometric pressure properly before using the mainstream CO_2 module. Improper settings will result in erroneous CO_2 reading.**

16.13 Performing the Leakage Test

When measuring CO_2 using the internal CO_2 module or the sidestream CO_2 module. The leakage test is required every time before the CO_2 measurement. To perform the CO_2 leakage test, follow this procedure:

1. Connect the measuring accessories as per section *16.5.1Preparing to Measure CO_2 Using Sidestream CO_2 Module*.
2. Wait until the startup finishes. Completely block the gas inlet on the sidestream CO2 module or on the N1. Then the alarm message "**CO2 Airway Occluded**" will appear on the screen.
3. Block the gas inlet for another one minute.
4. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select ↵.
5. Select the **Module** tab → **CO2** tab.
6. Check that the current flow rate is less than 10ml/min, and the alarm message "**CO2 Airway Occluded**" does not disappear.

   This indicates that the module does not leak. If the alarm message disappears, or the flow rate is equal to 10ml/min or greater, it indicates that the module leaks. Perform the leakage test again. If the problem remains, contact your service personnel for help.

16.14 CO_2 Calibration

For sidestream and microstream CO_2 modules, a calibration is needed every year or when the measured values have a great deviation. For maintream CO_2 module, no calibration is needed. To calibrate the CO_2 module, contact the service personnel.

CAUTION

- **Connect the gas outlet to the scavenging system when calibrating the CO_2 module.**

16.15 CO_2 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

- **For the physiological and technical alarm messages, see *DAlarm Messages*.**

16.15.1 Troubleshooting the Sidestream/Microstream CO_2 Module

Problem	Solution
$EtCO_2$measurements too low	1. Ventilate the room if the environmental CO_2 concentration is too high. 2. Check the sample line and connectors for leakage. 3. Check the patient status.

16.15.2 Troubleshooting the Mainstream CO_2 Module

Problem	Solution
Elevated baseline	1. Check the patient status. 2. Check the sensor.

16.16 Oridion Information

Microstream

This trademark is registered in Israel, Japan, German and America.

Oridion Patents

The capnography component of this product is covered by one or more of the following US patents: 6,428,483; 6,997,880; 6,437,316; 7,488,229; 7,726,954 and their foreign equivalents. Additional patent applications pending.

No Implied License

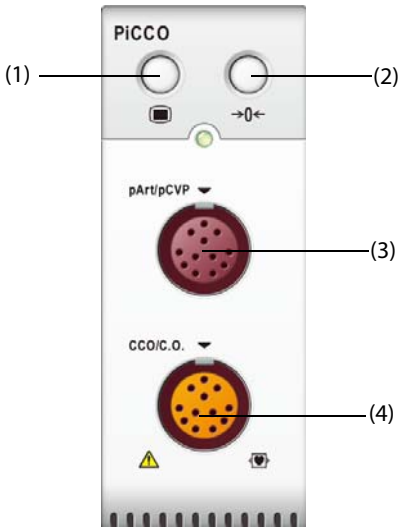
Possession or purchase of this device does not convey any express or implied license to use the device with unauthorized CO_2 sampling consumables which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device and/or CO_2 sampling consumable.

17 Monitoring Continuous Cardiac Output

17.1 CCO Introduction

The PiCCO method combines transpulmonary thermodilution and pulse contour analysis on the blood pressure waveform. A cold bolus (e.g. normal saline 0.9%) with a known volume and temperature is injected into the right atrium through a central venous catheter. The cold bolus mixes with the blood in the heart and the change in blood temperature is measured with a thermistor at the distal end of the arterial thermodilution catheter placed in one of the bigger systemic arteries, for example, the femoral artery. The monitor uses the transpulmonary thermodilution method to measure C.O., Global End Diastolic Volume (GEDV) and Extra Vascular Lung Water (EVLW). With the C.O. value with the transpulmonary thermodilution method and the result of the pulse contour analysis, a patient-specific calibration factor is calculated. The monitor uses this value to compute CCO and the other continuous hemodynamic parameters.

PiCCO monitoring is intended for adult and pediatric patients.



(1) CCO menu hard key

(2) Zero IBP hard key

(3) IBP cable connector

(4) PiCCO cable connector

17.2 CCO Safety Information

WARNING

- **PiCCO monitoring is not intended for neonatal patients.**
- **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, see instructions for use of accessories.**

17.3 Zeroing the IBP transducer

To avoid inaccurate pressure readings, the monitor requires a valid zero. Zero the transducer in accordance with your hospital policy. The IBP transducer should be zeroed in the following conditions:

- The IBP transducer or IBP cable is reconnected.
- The monitor restarts.
- You doubt the readings.
- The monitor displays the prompt message **Zero Required**.

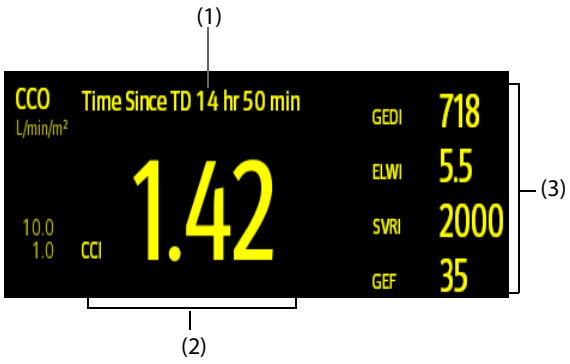
To zero the transducer, follow this procedure:

1. Connect the IBP transducer, the IBP cable and the module.
2. Turn off the three-way valve (the one close to the transducer) to the patient, in order to vent the transducer to the atmospheric pressure.
3. Zero the transducer by one of the following methods:
   - Press the **Zero** hard key on the module.
   - Select the numeric area (such as the Art numeric area), and then select **Zero**.
4. After the zero calibration is completed, close the stopcock to the air and open the stopcock to the patient.

17.4 PiCCO Display

17.4.1 CCO Display

CCO numeric area displays the CCO and other hemodynamic parameters. You can select the parameters for display on the **Parameter** page of the **CCO** menu. For more information, see *17.7.2 Setting Parameters for Display*.



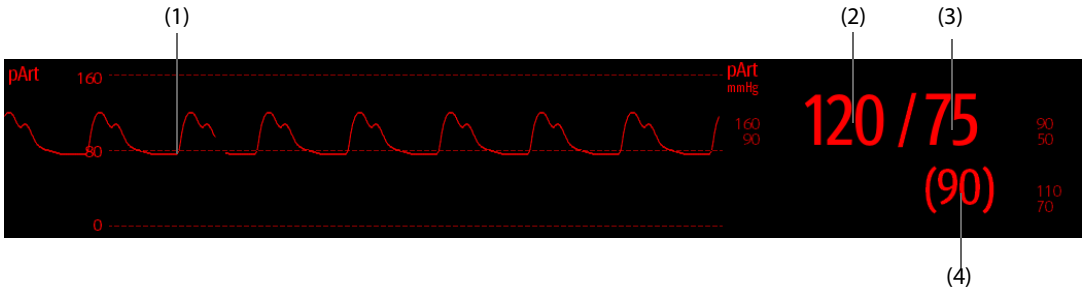
(1) Prompt message: the time since previous TD measurement

(2) Label and value for primary parameters

(3) Label and value for secondary parameters

17.4.2 pArt Display

The artery pressure from the PiCCO module (pArt) is displayed on the monitor as a waveform and numeric pressures. The figure below shows the pArt waveform and numerics.



(1) Waveform

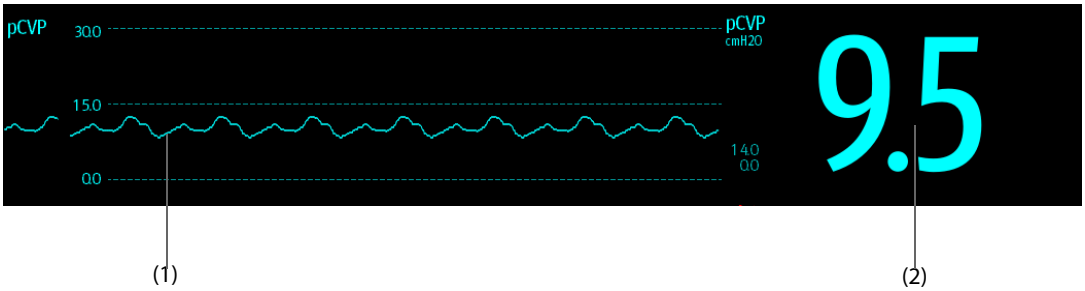
(2) Systolic pressure

(3) Diastolic pressure

(4) Mean pressure

17.4.3 pCVP Display

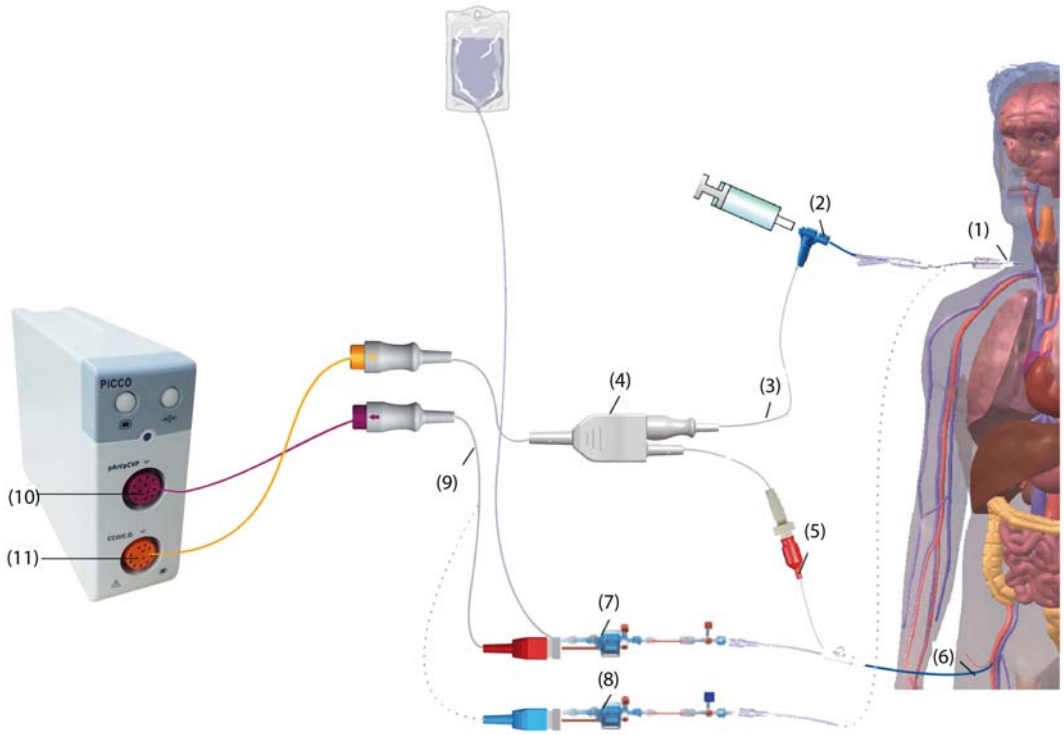
The central venous pressure from the PiCCO module (pCVP) is displayed on the monitor as a waveform and numeric pressures. The figure below shows the pCVP waveform and numerics.



(1) Waveform

(2) Central venous pressure

17.5 CCO Equipment to Patient Connection



(1) Central venous catheter

(2) Injectate temperature sensor

(3) Injectate temperature sensor cable

(4) PiCCO cable

(5) Blood temperature sensor

(6) Arterial thermodilution catheter

(7) Arterial pressure transducer

(8) CVP transducer

(9) IBP cable

(10) IBP cable connector

(11) PiCCO cable connector

17.5.1 Preparing to Monitor C.O.

To prepare to monitor C.O., follow this procedure:

1. Place the arterial thermodilution catheter.

WARNING

- **The arterial thermodilution catheter must be placed in one of the bigger systemic arteries, for example, the femoral, the brachial or the auxiliary artery.**
- **Use the specified catheters and puncture locations.**

2. Place the central venous catheter.
3. Connect the blood temperature sensor to the arterial thermodilution catheter.
4. Connect the injectate temperature sensor to the central venous catheter.
5. Plug the PiCCO cable into the CCO/C.O. connector on the PiCCO module, and connect the following devices to the PiCCO cable:
   - Injectate temperature sensor probe
   - Blood temperature sensor connector.
6. Plug the IBP cable into the pArt/pCVP connector on the PiCCO module.
7. Connect one end of the arterial pressure transducer to the arterial thermodilution catheter and the other end to the IBP cable marked with pArt.

WARNING

- **Make sure there is no air bubbles in the IBP transducer systems. If air bubbles appear in the tubing system, flush the system with the infusion solution again. Air bubble may lead to wrong pressure reading.**

8. If you need to measure CVP, connect one end of the CVP transducer to the central venous catheter and the other end to the IBP cable marked with pCVP. Then plug the IBP cable to the pArt/pCVP connector on the PiCCO module.

17.5.2 Performing the CCO Settings

To perform the CCO settings, follow this procedure:

1. Select the CCO numeric area to enter the **C.O. Measure (CCO)** menu.
2. Select the **Setup** tab to enter the CCO Setup page.
3. Set the patient information.

   Correct input of height, weight, category and gender is mandatory for the accuracy of the displayed parameters as well as for the correct indexing of some parameters. The monitor automatically calculates predicted body weight (PBW), body surface area (BSA) and predicted body surface area (PBSA) according to the inputted height and weight.
4. Check that the correct arterial catheter type is displayed at **Catheter Type**.

   The monitor can recognize the arterial catheter automatically when the arterial thermodilution catheter, PiCCO cable, and PiCCO module are connected. If the catheter constant is not recognized, enter the correct value for the catheter in the **Catheter Type** edit box. The catheter constant is usually written either on the catheter or on the catheter packaging.
5. Set **Catheter Position**.

   Set the position site of the arterial thermodilution catheter according to the catheter type.
6. Set **Injectate Volume**.

   If the injectate volume is not selected, the monitor sets the volume by default during the first measurement, which is 15ml for adult and 10 ml for pediatric. Later the monitor adjusts the injectate volume according to previous measuring result. The following table displays the recommended injectate volume depending on body weight and Extravascular Lung Water Index (ELWI):

Patient Weight (kg)	ELWI < 10	ELWI > 10	ELWI < 10
	Iced Injectate	Iced Injectate	Room Temperature Injectate
<3	2ml	2ml	3ml
<10	2ml	3ml	3ml
<25	3ml	5ml	5ml
<50	5ml	10ml	10ml
<100	10ml	15ml	15ml
≥100	15ml	20ml	20ml

CAUTION

- **The selected volume should be strictly the same as actual injected volume. Otherwise, the measurement accuracy may be compromised or measurement may be failed.**

7. Set **Auto Start**.
   - ◆ If **Auto Start** is disabled, you should start each measurement manually by selecting **Start** in **C.O. Measure (CCO)** window.

- If **Auto Start** is enabled, C.O. measurements can be performed consecutively after you start the first measurement, without the need for pressing **Start** between measurements.

8. Set the **Auto pCVP**.
   - Enable **Auto pCVP** if the monitor is performing pCVP measurement. In this case, the monitor obtains the pCVP value automatically.
   - Disable **Auto pCVP** if the monitor fails to obtain the pCVP value. In this case, the pCVP value should be input manually at **pCVP**.

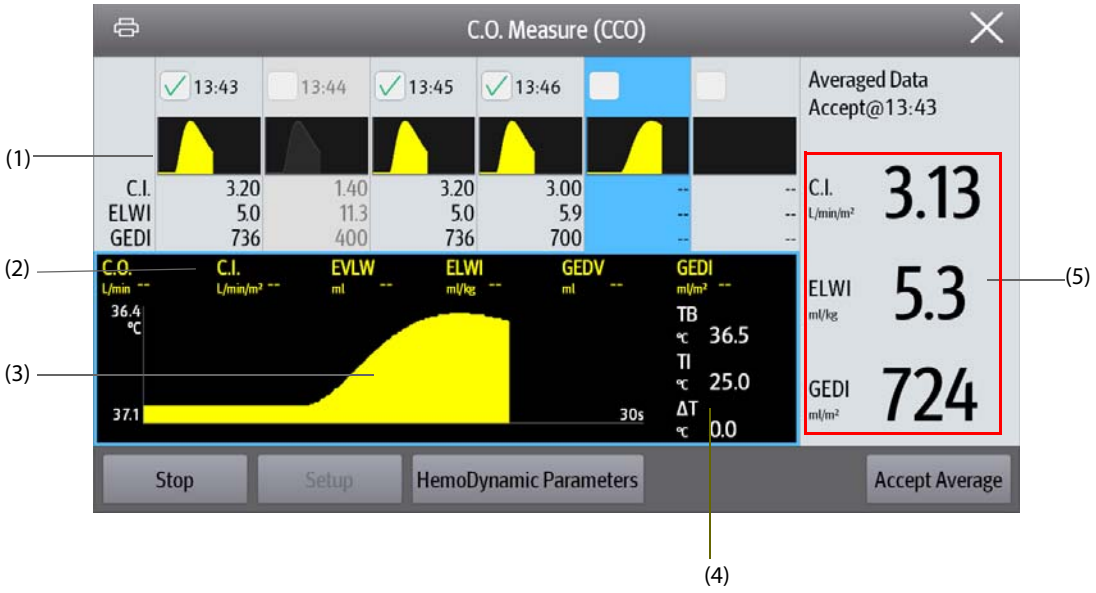
NOTE

- **Input a proper pCVP value if Auto pCVP is disabled. The system adopts 5mmHg by default if the pCVP value is not input manually.**

17.5.3 Performing C.O. Measurement

To perform the C.O. measurement, follow this procedure:

1. Select the CCO numeric area to enter the **C.O. Measure (CCO)** menu.



(1) History window

(2) Current measurements

(3) Thermodilution curve

(4) Variation of blood temperature (ΔT)

(5) Average values

2. Select **Start** and inject the bolus rapidly (<7sec) and smoothly as soon as the message **Inject xx ml!** displays and prompt tone sounds. As shown in the figure above, during the measurement, the currently measured thermodilution curve is displayed. At the end of the measurement, the measured values are displayed in the history window and the monitor prompts you to wait for a certain period of time before starting a new measurement. The ΔT value should be greater than 0.15°C to ensure high accuracy. A low ΔT can be caused by a very high ELWI or an extreme low CI. If ΔT is too low, you can try to increase it by the following method:
   - Inject more volume (remember to reenter the injectate volume in the **Setup** page of the **CCO** menu before injecting).
   - Inject colder bolus.
   - Inject the bolus in a shorter time.
3. Perform three to five single measurements directly after each other within a maximum of 10 minutes as described in Step 2. A new measurement is available when you see the blood temperature is steady in the **C.O. Measure (CCO)** window.
   - If **Auto Start** is disabled in the **Setup** page of the **CCO** menu, you should repeat step 2 manually.

- If **Auto Start** is enabled in the **Setup** page of the **CCO** menu, the C.O. measurements can be performed consecutively, without the need for pressing **Start** between measurements. A new thermodilution measurement is possible as soon as **Inject xx ml** is displayed on the screen. The patient monitor automatically detects further thermodilution measurements.

4. Select the thermodilution curves you desired in the history window, and select **Accept Average** to obtain the averaged value of parameters.

   A maximum of six C.O. measurements can be stored. The monitor automatically performs calibration and calculates the CCO and CCI values according to the C.O. measurements you select.

CAUTION

- **If the monitor can not get a reliable pArt value during a C.O. measurement, the corresponding C.O. value is invalid for CCO calibration.**
- **If the option of the auto pCVP measurement is not enabled, pCVP value should be manually updated as soon as a new value is obtained to accurately calculate SVR and CCO.**
- **If the displayed continuous parameters are not plausible, they should be checked by a thermodilution measurement. The PiCCO measurement will be recalibrated automatically.**
- **Faulty measurements can be caused by incorrectly placed catheters, interfering signal transmission e.g. of arterial pressure, defective connections or sensors, or by electromagnetic interference.**
- **Aortic aneurysms may cause the displayed blood volume (GEDV/ITBV) derived by thermodiution measurement to be erroneously high if the arterial thermodilution catheter is placed in the femoral artery.**
- **The use of injectate solution with a temperature that is not at least 10°C lower than the blood temperature may cause incorrect values for the thermodilution and CCO calibration.**

NOTE

- **Three to five single thermodilution measurements within 10 minutes are recommended. For a stable patient it is recommended to perform a thermodilution measurement every eight hours. For an unstable patient it may be necessary to perform thermodilution measurements more frequently in order to determine the patient's volume status and to recalibrate the continuous determination of C.O..**
- **As the pulse contour cardiac output of children has not been sufficiently validated thus far, the C.O. should be checked by thermodilution before therapeutic interventions.**
- **A new measurement is recommended with significant changes in hemodynamic conditions, such as volume shifts or changes to medication.**

17.6 Viewing the Hemodynamic Parameters

To view the hemodynamic parameters, follow this procedure:

1. Select the CCO numeric area to enter the **C.O. Measure (CCO)** menu.
2. Select the **HemoDynamic Parameters**.

In the **HemoDynamic Parameters** menu, you can view both the measurement and referential normal range of each parameter. If a parameter value exceeds its normal range, the system will add a "↑" or "↓" to the right of the parameter.

	Abbreviation	Full Spelling	Unit	Default Normal Range
Output	CCO	Continuous Cardiac Output	L/min	/
	CCI	Continuous Cardiac Index	L/min/m^2	3.0-5.0
	SV	Stroke Volume	ml	/
	SVI	Stroke Volume Index	ml/m^2	40-60
	HR	Heart Rate	bpm	60-80

	Abbreviation	Full Spelling	Unit	Default Normal Range
Contractility	GEF	Global Ejection Fraction	%	25-35
	CFI	Cardiac Function Index	1/min	4.5-6.5
	dPmx	Left Ventricular Contractility	mmHg/s	/
Preload Volume	GEDV	Global End Diastolic Volume	ml	/
	GEDI	Global End Diastolic Volume Index	ml/m^2	680-800
	ITBV	Intrathoracic Blood Volume	ml	/
	ITBI	Intrathoracic Blood Volume Index	ml/m^2	850-1000
	SVV	Stroke Volume Variation	%	0-10
	PPV	Pulse Pressure Variation	%	0-10
Afterload Volume	SVR	Systemic Vascular Resistance	DS/cm^5 or kPa-s/l	/
	SVRI	Systemic Vascular Resistance Index	$DS•m^2/cm^5$ or kPa-s-m^2/l	1700-2400
	pArt-M	Mean Artery Pressure	mmHg, kPa or cmH_2O	70-90
	pArt-D	Diastolic Artery Pressure	mmHg, kPa or cmH_2O	60-80
	pArt-S	Systolic Artery Pressure	mmHg, kPa or cmH_2O	100-140
Organ Function	EVLW	Extravascular Lung Water	ml	/
	ELWI	Extravascular Lung Water Index	ml/kg	3.0-7.0
	CPO	Cardiac Power Output	W	/
	CPI	Cardiac Power Index	W/m^2	0.5-0.7
	PVPI	Pulmonary Vascular Permeability Index	no unit	1.0-3.0
	TB	Blood Temperature	ºC	/

17.7 Changing CCO Settings

17.7.1 Changing CCO and CCI Alarm Settings

To change the CCO and CCI alarm settings, follow this procedure:

1. Select the CCO numeric area to enter the **C.O. Measure (CCO)** menu.
2. Select the **Setup** button.
3. Select the **Alarm** tab.
4. Enter the password if required..
5. Set alarm properties as desired.

17.7.2 Setting Parameters for Display

To set the parameters for display, follow this procedure:

1. Select the CCO numeric area to enter the **C.O. Measure (CCO)** menu.
2. Select the **Setup** button.
3. Select the **Select Parameter** tab.
4. Select the primary and secondary parameters for display.

17.7.3 Normal Range Setup

You can set the normal range for the hemodynamic parameters according to patient condition. The system adopts the default normal ranges for the parameters if the ranges are not set up manually. Please refer to section *17.6 Viewing the Hemodynamic Parameters* for the hemodynamic parameters to see the default normal ranges of the hemodynamic parameters. To set the normal range of the hemodynamic parameters, follow this procedure:

1. Select the CCO numeric area to enter the **C.O. Measure (CCO)** menu.
2. Select **HemoDynamic Parameters**.
3. Select **Setup** button.
4. Set the normal range of parameters.
5. Select **Defaults** to restore the normal ranges of all parameters to the defaults.

NOTE

- **The normal ranges are based upon clinical experience and can vary from patient to patient. The stated values are therefore offered without guarantee. Indexed parameters are related to body surface area, predicted body weight or predicted body surface area and can also be displayed as absolute values.**
- **The values listed are not recommended for use on a specific patient. The treating physician is in any case responsible for determining and utilizing the appropriate diagnostic and therapeutic measures for each individual patient**

17.8 PiCCO 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

- **For the physiological and technical alarm messages, see *D Alarm Messages*.**

Problem	Solution
Do not see CCO numeric area on the main screen	1. Check that the CCO is set to display in the **Screen Setup** menu. For more information, see *3.11.2 Displaying Parameter Numerics and Waveforms*. 2. Check that if the CCO parameter switch is enabled. If not, enable the CCO measurement. For more information, see *3.11.1 Switching On or Off a Parameter*. 3.Check that the patient type is adult. 4. Check the connection of PiCCO cable, arterial thermodilution catheter and injectate temperature sensor.
CCO value is inaccurate	1. Check that the arterial thermodilution catheter is positioned properly. 2. Check that the catheter type is proper. 3. Inject solution rapidly and smoothly. 4. Finish injection within four to five seconds. 5. Inject more volume, or inject colder solution. 6. Check that the height and weight of patient is properly configured. 7. Check that the entered **Injectate Volume** is correct.
CCO measurement fails	1. Inject more volume, or inject colder solution. Make sure that the injectate temperature is at least 10°C colder than the patient blood temperature. 2. Finish injection within four to five seconds. 3. Check the connection of PiCCO cable, arterial thermodilution catheter and injectate temperature sensor.

Problem	Solution
Message "Unstable baseline. Please wait." constantly appears.	1. Check if the patient's temperature changes rapidly. Wait till the patient's temperature is stable. 2. Check if the patient is being transfused with large volume of fluid. Wait till transfusion stops. 3. IBP cable fails or incorrectly connected. Check the cable and its connection. Replace the cable if necessary. 3. The temperature sensor of the thermodilution catheter may fail. Flush the catheter and check if TB changes. If TB does not change, replace the catheter.

18 Review

18.1 Review Overview

Trends are patient data collected over time and displayed in graphic, tabular, or other forms to give you a picture of how your patient's condition is developing. You can also review the events, 12-lead ECG analysis results and waveforms, full disclosure waveforms, and so on.

18.2 Review Page

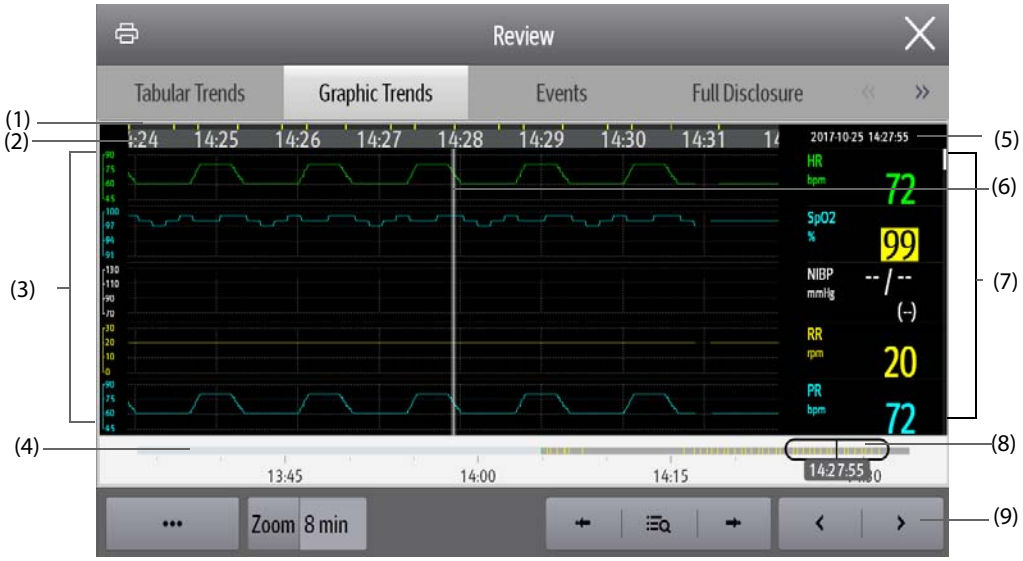
The **Review** page contains tabs to display trend data in tabular, graphic, or other forms.

18.2.1 Accessing the Review Page

To enter the review page, select the **Main Menu** quick key → from the **Review** column select the desired option.

18.2.2 Example Review Page

The review pages have similar structure. We take the graphic trends review page as an example.



(1) Event type indicator: different color blocks match different types of events:

- Red: high priority alarm event
- Yellow: medium priority alarm event
- Cyan: low priority alarm event
- Green: manual event
- White: operation-related event

(2) Current window time line: indicates the time length of the current window.

(3) Waveform area: displays trend curves. The color of trend curves is consistent with the color of parameter labels.

(4) Time line: indicates the entire time length.

- : indicates the time length of reviewable trend data. can be moved within this time length.
- : indicates the time length of no trend data. cannot be moved within this time length.

Different color blocks at the time line indicate events of different types. See the color definition for the event type indicator.

(5) Event area: displays the event of the cursor time. Selecting the event access the event list. If there is no event at the cursor time, the cursor time is displayed.

(6) Cursor

(7) Numeric area: displays numeric values at the cursor indicated time. The background color of numeric values matches the alarm priority.

(8) Slider: indicates the position of current window time in the entire time length. Dragging this button left or right enables you to locate the trend data at a specific time and also refreshes trend data in current window accordingly.

(9) Button area.

18.2.3 Symbols on Review Pages

The following table lists the symbols on review pages.

Symbol	Description
	Slider: indicates the position of current window time in the entire time length. Dragging the slider left or right enables you to locate the trend data at a specific time and also refreshes data in current window accordingly.
or	Goes to the previous or next event.
	Event list: displays events in a chronological order. The most recent event is displayed at the top.The number of asterisk symbols before an event matches alarm priority.
	Print button: select it to output patient information and data through the printer.

18.2.4 Common Operations

This section describes common operations for all review pages.

18.2.4.1 Browsing Trend Data

Browse trend data in one of the following ways:

- Move the cursor.
- Move the slider .
- Slide your finger on the screen.

18.2.4.2 Viewing Events

You can view the following types of events:

- Manually triggered events
- Parameter-related operation events and alarm-related events, such as starting C.O. measurement
- Operation events not related to parameters, such as system time change

View events in either of the following ways:

- Select and select the desired event.
- Select or to view the previous or next event.

Events are displayed in a chronological order. The most recent event is displayed at the top. The number of asterisk symbols before and event matches alarm priorities as follows:

- ***: high priority alarm
- **: medium priority alarm
- *: low priority alarm

18.2.5 Reviewing the Tabular Trends

The tabular trends review page displays trend data in a tabular form. To enter the tabular trends review page, select the **Main Menu** quick key → from the **Review** column select **Tabular Trends**.

18.2.5.1 Changing the Trend Group

To change the trend group, follow this procedure:

1. Enter the tabular trends review page.
2. Set **Trend Group**.

18.2.5.2 Editing the Trend Group

The setting of the **Trend Group** defines the contents of displayed and printed trends. You can edit the trend group. To do so, follow this procedure:

1. Enter the tabular trends review page.
2. Select **Group Setup**.

NOTE

- **You cannot edit the trend groups labeled All or Standard.**
- **ECG parameter and waveform are always displayed in the first row on the trend page. It cannot be deleted or moved.**

18.2.5.3 Changing the Resolution of Trend Data

The interval of tabular trends defines the interval of displaying trend data. Short interval is especially suited for neonatal applications, where the clinical situation may change very quickly. In adult monitoring, where the patient's status typically changes more gradually, a longer interval may be more informative.

To change the interval of trend data, follow this procedure:

1. Enter the tabular trends review page.
2. Select **Interval**.
   - **5 sec or 30 sec**: select to view up to 4 hours of tabular trends at an interval of 5 seconds or 30 seconds.
   - **1 min, 5 min, 10 min, 15 min, 30 min, 1 hr, 2 hrs, or 3 hrs**: select to view up to 120 hours of tabular trends at selected interval.
   - Select parameters, such as NIBP, C.O. to view the tabular trends when parameter measurements are acquired.

18.2.5.4 Printing a Tabular Trends Report

To print a tabular trends report, follow this procedure:

1. Enter the tabular trends review page.
2. Select  at the upper left corner of the review page
3. Set the tabular trends report as described in *21.6.3 Setting Tabular Trends Reports*.
4. Select **Print**.

18.2.6 Reviewing the Graphics Trends

The graphic trends review page displays trend data in a graphic form. To enter the graphic trends review page, select the **Main Menu** quick key → from the **Review** column select **Graphic Trends**.

18.2.6.1 Changing the Trend Group

To change the trend group, follow this procedure:

1. Enter the Graphic trends review page.
2. Select ••• and set **Trend Group**.

18.2.6.2 Editing the Trend Group

The setting of the **Trend Group** defines the contents of displayed and printed trends. You can edit the trend group. To do so, follow this procedure:

1. Enter the Graphic trends review page.
2. Select ••• and select **Group Setup**.

NOTE

- **You cannot edit the trend groups labeled All or Standard.**
- **ECG parameter and waveform are always displayed in the first row on the trend page. It cannot be deleted or moved.**

18.2.6.3 Changing the Resolution of Trend Data

To change the length of trend data displayed on the current screen, follow this procedure:

1. Enter the graphic trends review page.
2. Select **Zoom**.
   - **8 min:** the screen displays eight minutes of trend data. You can view the recent one hour data.
   - **30 min, 1 hr, 2 hrs, 4 hrs**: the screen displays 30 minutes, one hour, two hours, or four hours of trend data. You can view the recent four hour data.
   - **8 hrs, 12 hrs, 24 hrs, 48 hrs**: the screen displays eight hours, 12 hours, 24 hours, or 48 hours of trend data. You can view the recent 120 hours of data.

18.2.6.4 Changing the Number of Waveforms

To change the number of waveforms displayed on the trend review page, follow this procedure:

1. Enter the graphic trends review page.
2. Select ••• and set **Trends**.

18.2.6.5 Printing a Graphic Trends Report

To print a graphic trends report, follow this procedure:

1. Enter the graphic trends review page.
2. Select  at the upper left corner of the review page.
3. Set the graphic trends report as described in *21.6.4 Setting Graphic Trends Reports*.
4. Select **Print**.

18.2.7 Events Review Page

The monitor stores events in real time, including technical alarm events, physiological alarm events, manual events, and operational events. When an event occurs, all the measurement numerics and three event-related waveforms 16 seconds before and after the event are stored.

NOTE

- **A total loss of power has no impact on the events stored.**
- **Alarms are saved as events and will be maintained if the equipment is powered down. The time of equipment power down is not recorded as an event and cannot be reviewed.**

- **Earlier events will be overwritten by later ones if the capacity is reached.**

18.2.7.1 Entering the Events Review Page

To enter the events review page, select the **Main Menu** quick key → from the **Review** column select **Events**.

The **Event** page displays event list. Events are displayed in descending chronological order. The most recent event is displayed at the top.The number of asterisk symbols before an event indicate alarm priorities. Different color blocks are displayed on the left of each event to indicate different event types.

- Red: high priority alarm event
- Yellow: medium priority alarm event
- Cyan: low priority alarm event
- Green: manual event
- White: operation-related event

18.2.7.2 Configuring the Filter

You can filter events by time, alarm priority, alarm category, or parameter group. To configure the filter, follow this procedure:

1. Enter the **Events** page.
2. Select **Event List**.
3. Select **Filter Setup** and set the desired filter criterion.

18.2.7.3 Editing Events

To edit events, follow this procedure:

1. Enter the **Events** page and tick off the desired events.
2. Select  to edit the selected events.
   - **Lock**: manually lock the event. Locked events cannot be deleted.
   - **Note**: enter comments for the event.

18.2.7.4 Viewing Event Details

To view waveforms and parameter values at the event time, follow this procedure:

1. Enter the **Events** page.
2. Select **Detail**.

To display beat labels on the first ECG waveform, switch on **Beat Anno**. The white beat labels indicate heart beats classification and may explain suspected, missed, or false arrhythmia calls. Heart beats are classified as follows:

- N = Normal
- V = Ventricular ectopic
- S = Supraventricular premature
- P = Paced
- L = Learning
- ? = Insufficient information to classify beats
- I = Inoperative (for example, Lead Off)
- M = Missed beat

18.2.7.5 Printing Event Reports

To print event reports, follow this procedure:

1. Enter the events review page.

2. Select  at the upper left corner of the review page.
3. Select the desired options.
   - **Print All Event List**: print the entire event list.
   - **Print List of Selected Events**: print the list of selected events.
   - **Print Detail of Selected Events**: print the details of selected events.
   - **Print Displayed Event Detail**: print the waveforms and parameters of the currently displayed event.
4. Select **Print**.

18.2.8 Viewing the Full Disclosure

You can review up to 48-hours' waveform data on the full disclosure review page. You can view both the compressed waveforms, full waveforms and numeric values. To enter the full disclosure review page, select the **Main Menu** quick key → from the **Review** column select **Full Disclosure**.

18.2.8.1 Selecting Waveforms

Before reviewing compressed waveforms, you must select waveforms you want to store and display. To store and display the desired waveforms, follow this procedure:

1. Enter the full disclosure review page.
2. Select  and select **Setup**.
3. Select the **Storage** tab and set the desired waveforms to be stored in the monitor.
4. Select the **Display (Maximum: 3)** tab and set the desired waveforms to be displayed on the **Full Disclosure** page.

NOTE

- **The more waveforms selected in the Storage column, the shorter the waveform storage time. The waveforms may not be stored for 48 hours. Please exert caution when selecting waveforms.**

18.2.8.2 Setting Scale and Duration

To set the length and size of displayed compressed waveforms, follow this procedure:

1. Enter the full disclosure review page.
2. Select  .
3. Select **Scale** to set ECG waveform gain.
4. Select **Duration** to set the length of displayed waveforms.

18.2.8.3 Viewing Details of Compressed Waveforms

To view the full waveforms and numeric values, follow this procedure:

1. Enter the full disclosure review page.
2. Select **Details**.

You can perform the following operations on the this page:

- Switch on **Beat Anno**. For more information, see *18.2.7.4 Viewing Event Details*.
- Select  and make the following settings:
  - Set **Speed** and **ECG Gain**
  - Select **Save As Event**, and edit according to prompt to save current waveform as an event.
- Select **Overview** to switch to the compressed waveform page.

18.2.8.4 Printing the Full Disclosure Waveform Report

To print a compressed waveform report, follow this procedure:

1. Enter the full disclosure review page.

2. Select and set the time range for printing.
3. Select **Print**.

18.2.9 OxyCRG Review Page (available for the independent external display)

You can review up to 48 hours' trend curves on the OxyCRG review page. The OxyCRG review functionality is applicable for neonatal monitoring only.

18.2.9.1 Entering the OxyCRG Review Page

Choose one of the following methods to enter the OxyCRG review page:

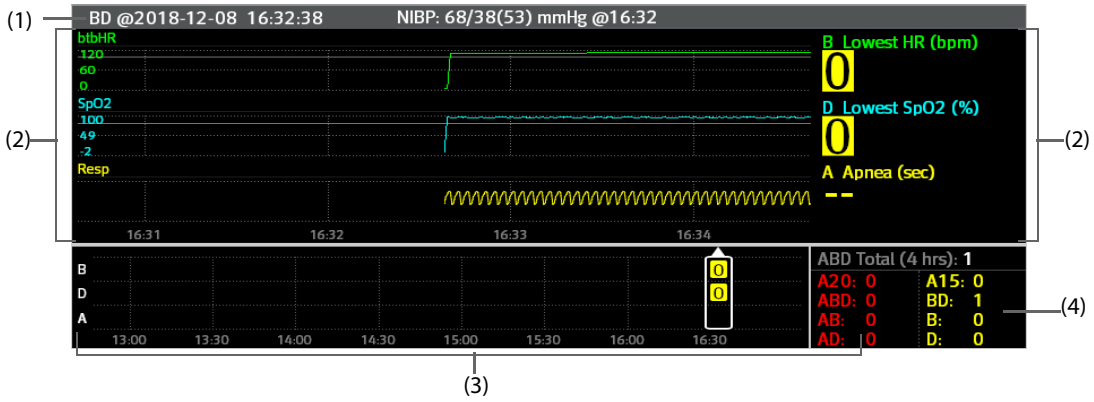
- From the OxyCRG screen, select the ABD events list area.
- Select the **Review** quick key → select the **OxyCRG** tab.
- Select the **Main Menu** quick key → from the **Review** column select **OxyCRG**.

NOTE

- **OxyCRG Review Page is available only when Patient Category is set to Neo.**

18.2.9.2 The Display of the OxyCRG Review Page

The following figure shows the OxyCRG screen:



(1) Event title area: displays information of the selected event, such as the event type and time.

(2) Event detail area: displays parameter trends, compressed waveform, and parameter values of selected event.

(3) Event summary area: displays ABD events within the **Zoom** period. The selected event is enclosed in a white frame.

(4) Event statistics area: displays the total number of ABD events and the numbers of each event within the **Zoom** period.

18.2.9.3 Changing the Resolution of Trend Curves

To set the resolution of trend curves, follow this procedure:

1. Enter the OxyCRG review page.
2. Set **Zoom**.

18.2.9.4 Printing an OxyCRG Review Report

To print an OxyCRG review report, follow this procedure:

1. Enter the OxyCRG review page.

2. Set the desired compressed waveform and duration.
3. Select  .

18.2.10 12-Lead ECG Review Page

When 12-lead ECG analysis is performed, you can review the most recent 20 events of 12-lead analysis. For more information, see *10 Resting 12-Lead ECG Analysis*.

18.2.10.1 Entering the 12-Lead Review Page

Choose one of the following methods to enter the 12-lead ECG review page:

- Upon completion of 12-lead ECG analysis, select **Review** from the **12-Lead Interpretation** screen. For more information, see *10 Resting 12-Lead ECG Analysis*.
- Select the **Main Menu** quick key → from the **Review** column select **12-Lead ECG**.

18.2.10.2 Switching to Median Complex (for Glasgow Algorithm Only)

The median complex template displays 12-lead ECG waveforms on one page in 4 columns, with 3 lines in each column, and one rhythm lead waveform at the bottom. Besides, a short vertical bar appears above each waveform, marking the start and end position of P-wave and QRS-wave and the end position of T-wave.

To view Median Complex, follow this procedure:

1. Enter the 12-lead review page.
2. Select **Median Complex**.

Selecting **Waveform** can return to the 12-lead ECG waveform page.

18.2.10.3 Setting 12-Lead ECG Waveforms

To set the 12-lead ECG waveforms on the review page, follow this procedure:

1. Enter the 12-lead review page.
2. Set **Speed**, **Gain**, and **Layout**.

18.2.10.4 Printing the 12-Lead ECG Report

To print the 12-Lead ECG report, follow this procedure:

1. Enter the 12-lead review page.
2. Select  .

18.3 Reviewing Discharged Patients

For discharged patients, you can review the trend data in the review page. You can also review the events and 12-lead ECG analysis results.

18.3.1 Checking the Data of a Discharged Patient

1. Access the **Discharged Patients** dialog box by selecting the **Main Menu** quick key → from the **Patient Management** column select **Discharged Patients**.
2. From the patient list select the desired patient.
3. Select **Detail**.

18.3.2 Checking the Information of a Discharged Patient

1. Access the **Discharged Patients** dialog box by selecting the **Main Menu** quick key → from the **Patient Management** column select **Discharged Patients**.
2. From the patient list select the desired patient.

3. Select **Detail**.
4. Select the  icon to enter the **Patient Management** dialog box.
5. Select **OK** to exit the **Patient Management** dialog box.

This page intentionally left blank.

19 Clinical Assistive Applications (only available for the independent external display)

The Clinical Assistive Applications (CAA) function integrates some commonly used clinical guidelines and tools into the monitor. It puts the currently monitoring parameter measurements together and provides comprehensive analysis results.

CAA can improve the clinician's working efficiency. However, it is not directly used for diagnosis and cannot not replace the clinician's judgement.

19.1 Checking Software Licenses

To run the following functions in your monitor, software licenses are required:

- BoA Dashboard
- Early Warning Score (EWS)
- CQI
- CPR Dashboard

To check the licenses, select the **Main Menu** quick key → select **License** → **Local**.

To install the licenses, follow this procedure:

1. Connect the USB drive with the licenses in to the monitor's USB connector.
2. Select the **Main Menu** quick key → select **License**→ select **External**.
3. Select **Install**.

19.2 BoA Dashboard

The Balance of Anesthesia (BoA) Dashboard helps the clinicians to monitor the patient's status during anesthetic induction, maintenance, and postoperative recovery.

NOTE

- **BOA Dashboard is only available in OR department.**

19.2.1 Accessing BoA Dashboard

Access BoA Dashboard in any of the following ways:

- Select the **BoA** quick key.
- Select the **Screen Setup** quick key → Select the **Choose Screen** tab → select **BoA Dashboard**.
- Select the **Main Menu** quick key → from the **CAA** column select **BoA Dashboard**.

BoA Dashboard has three pages:

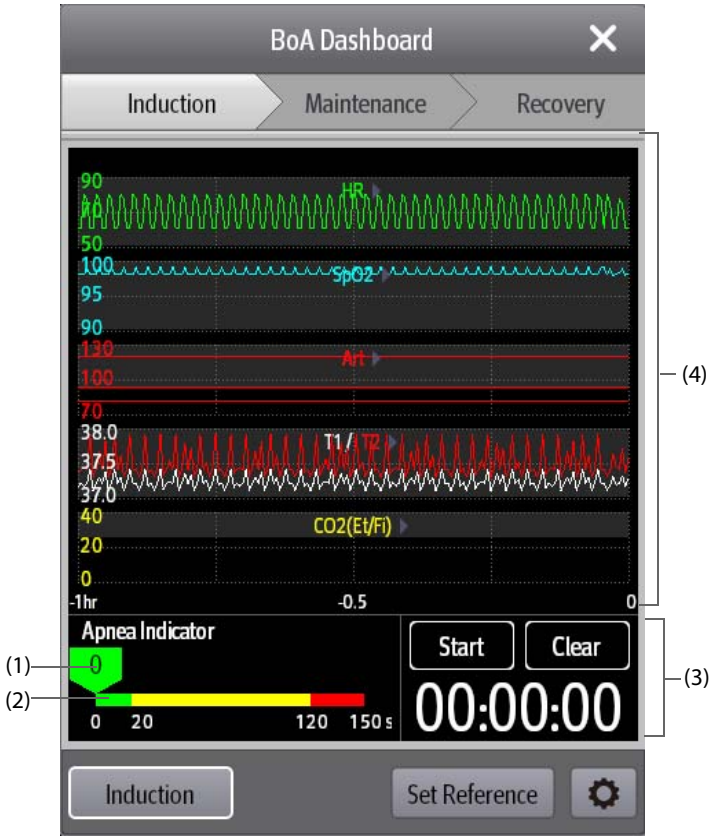
- Induction
- Maintenance
- Recovery

19.2.2 Induction

Select the **Induction** tab to enter the **Induction** page. You can check parameter minitrends and apnea time from the **Induction** page.

Select **Induction** to start apnea detection, mark the induction event, and start an NIBP STAT measurement. The systolic pressure value will be saved as the reference.

The following figure shows the **Induction** page. Your display may be configured to look slightly different.



(1) Cursor: indicates the current apnea time.

(2) Apnea indicator: provides apnea time scale.

(3) Timer: displays the time elapsed since the timer was started.

(4) Minitrends area: provides parameter minitrends. You can select the parameters you want to view. For more information, see *19.2.5.1 Selecting Parameters for Viewing Trends*.

19.2.3 Maintenance

Select the **Maintenance** tab to enter the **Maintenance** page. You can check the patient's parameter trends..

19.2.4 Recovery

You can view parameter trends from the **Recovery** page.

Select **Aldrete Score** to show the latest score and scoring time. To understand the current patient status, select a score for each item and then select **OK** to get a new score.

WARNING

- **The Aldrete score and recommendation is for reference only. Clinicians must make the decision of discharging the patient from recovery according to the patient's actual condition.**

19.2.5 Setting the BoA Dashboard

From the BoA Dashboard, you can set the parameters, anesthesia status indicator, and triple low indicator.

19.2.5.1 Selecting Parameters for Viewing Trends

You can view the trends of parameters from the **Induction** page, **Maintenance** page and **Recovery** page.

To select the parameters you want to view, use either of the following ways:

- Select  .
  - Select the **Induction** tab, **Maintenance** tab or **Recovery** tab to set the parameters you want to view.
  - Selecting **Defaults** resumes the default setting.
- Select a parameter on the trend view, and set which parameter you want to display in this position.

19.2.5.2 Setting References for Heart Rate and Systolic Blood Pressure

The current heart rate and systolic blood pressure references are displayed as white lines in minitrends area. To set the references, follow this procedure:

1. Select **Set Reference**.
2. Set the current HR and BP-S measurements as the reference. You can also input HR and BP-S values and then select **OK**.

19.3 Early Warning Score (EWS)

The Early Warning Scores (EWS) can help you recognize the early sign of deterioration in patients based on vital signs and clinical observations. Depending on the score calculated, appropriate recommendations are displayed.

The monitor supports the following scores:

- MEWS (Modified Early Warning Score)
- NEWS (National Early Warning Score)
- NEWS2 (National Early Warning Score 2)
- Custom Score

There are two types of scoring tools:

- Total score: A subscore is given for each parameter based on the measured or entered value. When all the required parameters are entered or measured, the subscores are added together to calculate the total early warning score. Each subscore has a color coding to indicate associated level of risk, When the total score is outside of the thresholds, actions are recommended. MEWS, NEWS and NEWS2 can give total scores.
- IPS (individual parameter score): A color-coded score is given for each parameter based on the measured or entered value. Each parameter has upper and lower thresholds. When an individual parameter measured or entered is outside of the thresholds, actions are recommended.

Custom Score is based on user-defined parameters. It can be a total score or an IPS, depending on the configuation.

MEWS, NEWS and NEWS2 are intended for adult patients only. The patient category applied to the Custom Score is defined by Mindray Clinical Score Configuration Tool. For more information, see *Mindray Clinical Scoring Config Tool Instruction for Use (P/N: 046-007126-00)*.

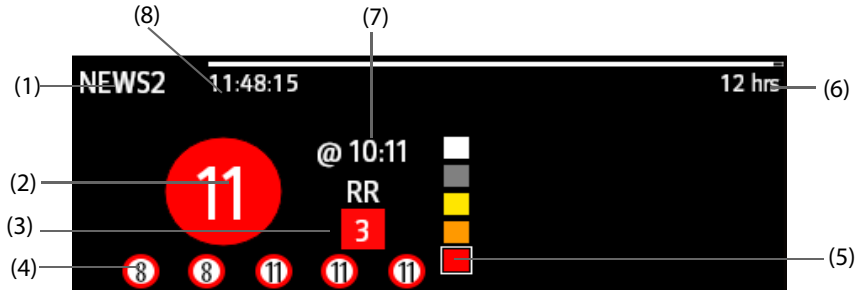
WARNING

- **The EWS scores and recommended actions are for reference only and cannot be directly used for diagnostic interpretation.**
- **EWS cannot be used as an prognosis index. It is not a clinical judgement tool. Clinicians must use their clinical judgement in conjunction with the EWS tool at all times.**
- **MEWS and NEWS are not applicable to pregnant woman, COPD (Chronic Obstructive Pulmonary Disease) patients and patients under 16 years old. NEWS2 is not applicable to pregnant woman and patients under 16 years old.**

19.3.1 Displaying the EWS Numerics Area

To display the EWS numerics area, follow this procedure:

1. Access **Tile Layout** in either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select the **Main Menu** quick key → from the **Display** column select **Tile Layout**.
2. Select the parameter area where you want to display the EWS score, and then from the popup list select **EWS**.



(1) EWS protocol label

(2) Total score. The color of the circle indicates the level of risk. For IPS, no score is displayed. Only level of risk is shown: white means normal and red indicates alert.

(3) Single parameter whose score reaches 3

(4) Latest history total score

(5) Risk level indicator. The level of risk increases from top down. The current level is enclosed by a white square frame. For IPS, this indicator does not display.

(6) Scoring interval

(7) The current scoring time

(8) Scoring countdown: time to the next scoring.

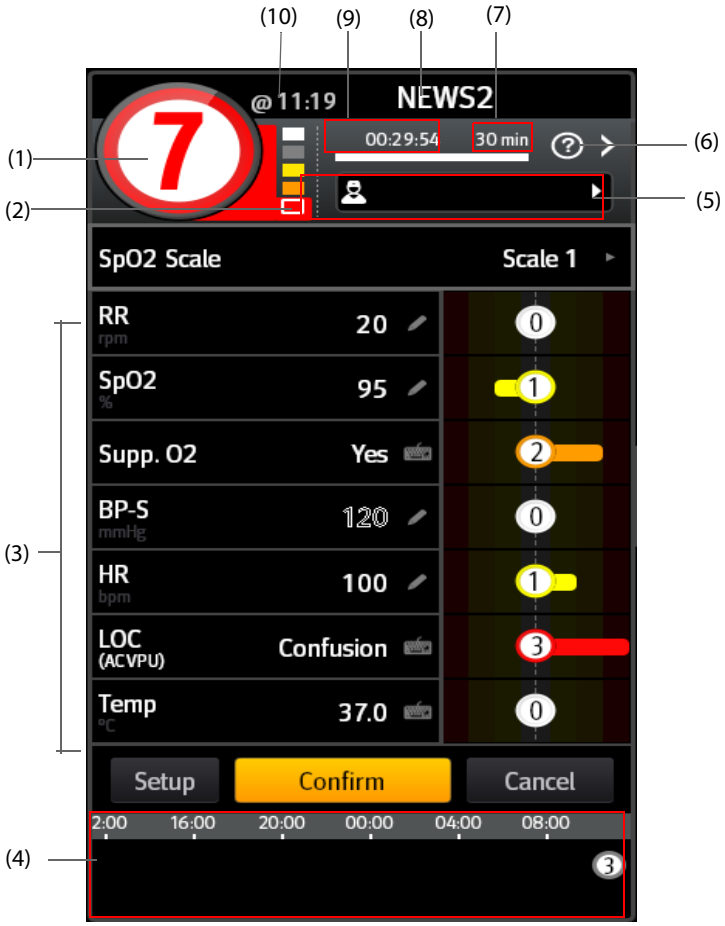
19.3.2 Accessing the EWS Screen

Access the EWS window in any of the following ways:

- Select the EWS parameter area
- Select the **EWS** quick key.
- Select the **Screen Setup** quick key → select the **Choose Screen** tab → select **EWS**.

■ Select the **Main Menu** quick key → from the **CAA** column select **EWS**.

Take NEWS2 as an example, the EWS screen is shown as follows. Your screen may be slightly different due to the configuration.



(1) Total score. The color of the circle indicates the level of risk. For IPS, no numeric score is displayed. Only level of risk is shown: white means normal and red indicates alert by default.

(2) Risk level indicator. The level of risk increases from top down. The current level is enclosed by a white frame. For IPS, this indicator does not display.

(3) Parameter area: display the subscore and parameter value of each parameter. The keyboard symbol indicates that the parameter value is manually entered.

(4) History total scores

(5) Operator ID (displays only when the operator ID is selected)

(6) Selecting this button to see the clinical response to the current score

(7) Scoring interval

(8) EWS protocol label

(9) Scoring countdown: time to the next scoring.

(10) The scoring time

19.3.3 Performing EWS Scoring

To perform scoring, follow this procedure:

1. Select **Reset** to clear the previous score and update values of currently monitored parameters and relevant subscores.

2. For NEWS2, set the **SpO2 Scale**.
   - **Scale 1**: for patient without hypercapnic respiratory failure.
   - **Scale 2**: for patients with a prescribed oxygen saturation requirement of 88–92% (for example, in patients with hypercapnic respiratory failure).
3. Measure or manually enter other required parameters and observations.
4. If enabled, select the operator ID  .
5. Select **Calculate** to get the total score.
6. If **Score Confirmation** is enabled, select **Confirm** to save current scoring, or select **Cancel** to give up current scoring. Refer to section *19.3.6.2 Setting the Scoring Confirmation Switch* for more information.

NOTE

- **The decision to use Scale 2 of the SpO2 Scale should be made by a competent clinical decision maker and should be recorded in the patient's clinical notes.**
- **Before calculating the score, select Reset to clear the previous score.**
- **The keyboard symbol at the right of the parameter value indicates that the value is manually entered.**
- **You can get the score only when all required parameters have been measured or entered.**

19.3.4 Auto Scoring

The monitor automatically starts scoring at the preset interval. To enable auto scoring, follow this procedure:

1. From the EWS page select **Setup**.
2. Set **Auto Scoring**:
   - **Interval**: the monitor automatically starts scoring at the preset interval.
   - **NIBP**: the monitor automatically starts scoring at the completion of each NIBP measurement.
   - **Alarm**: the monitor automatically starts scoring when an alarm occurs to the parameter for scoring.
   - If no option is selected, the monitor does not initiate auto scoring.

19.3.4.1 Setting Auto Scoring Interval

1. From the EWS page select **Setup**.
2. Set **Interval**:
   - **By Score**: the monitor automatically starts scoring as per the interval selected for corresponding total score.
   - **5 min** - **24 h**: If **Auto Scoring** is set to **Interval**, the monitor automatically starts scoring as per the selected interval. If **Auto Scoring** is not set to **Interval**, the countdown timer of manual scoring is selected.

19.3.5 EWS Alarm

If enabled, the monitor can automatically give alarms and refreshes the score.

19.3.5.1 Setting the EWS Alarm

If enabled, the monitor can automatically give alarms in the following cases:

- The total score exceeds the configured threshold
- The score of auto obtained parameter is 3.

To configure the EWS alarm, follow this procedure:

1. From the EWS page select **Setup**.
2. Select the **Alarm** tab.
3. Turn on the **Alarm** switch.
4. Set the alarm switches for the single parameters listed in the **3 in single parameter** area.

5. Set the alarm switch and threshold of the total score in the **EWS Score** area.

19.3.5.2 Auto Refreshing Scores

If enabled, the monitor can automatically refresh the total score in the following cases:

- The total score reaches the configured threshold, or falls from the configured threshold to a lower score.
- The score of auto obtained parameter reaches 3, or falls from 3 to a lower score.

To enable the auto refreshing score function, follow this procedure:

1. From the EWS page select **Setup**.
2. Select the **Alarm** tab.
3. Turn on the **Auto Refresh Score** switch.

19.3.6 Changing EWS Settings

19.3.6.1 Changing the Scoring Protocol

The monitor is configured with a default scoring protocol. To change the scoring protocol, follow this procedure:

1. From the EWS page select **Setup**.
2. Set **Score**.

19.3.6.2 Setting the Scoring Confirmation Switch

To select if confirmation is required before saving score, follow this procedure:

1. From the EWS screen select **Setup**.
2. Set **Scoring Confirmation** switch.
   - **Off**: the monitor automatically saves the scoring result after the scoring is completed.
   - **On**: you need to confirm that whether the scoring result is saved or not after the scoring is completed.

19.3.6.3 Setting the Manual Data Timeout

The manually input parameter data become invalid after a preset time. To set the timeout period for the input data, follow this procedure:

1. From the EWS screen select **Setup**.
2. From the **Manual Data Timeout** area, select a desired parameter and set its timeout period.

NOTE

- **If the data is expired and not updated, the monitor displays the corresponding parameter score in outline font, and gives a timeout alarm.**

19.3.6.4 Managing Operator ID

To manage the Operator ID, follow this procedure:

1. From the EWS screen select **Setup**.
2. Select the **Manage Operator ID** button at the bottom left corner to add or delete the operator IDs.

NOTE

- **Manage Operator ID button is available when it is enabled in the Maintenance menu. For more information, see section *22.5 The CAA Settings*.**

19.4 Glasgow Coma Scale (GCS)

The Glasgow Coma Scale (GCS) function is based on 1974_Lancet_ Teasdale Assessment of Coma and Impaired Consciousness-A Practical Scale. Three aspects of behavior are independently measured: eye opening, verbal response, and motor response. The scores are added together to indicate that patient's level of consciousness.

GCS is intended for adults and pediatric patients.

CAUTION

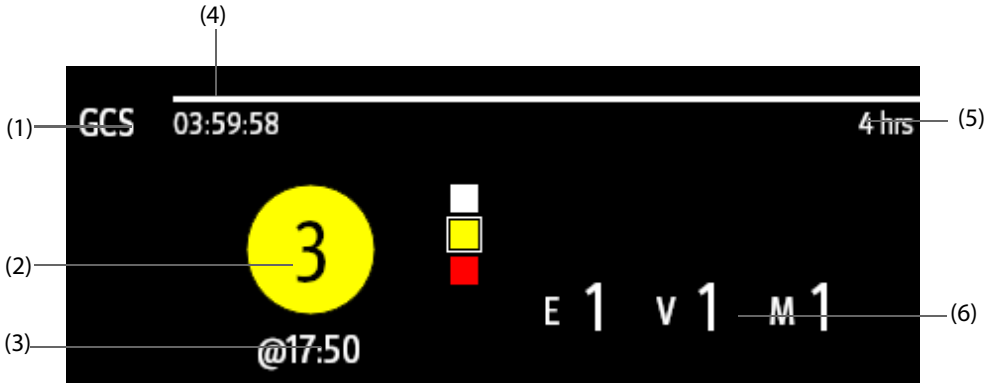
- **GCS is for reference only. Consult other clinical observations for diagnosis.**
- **GCS is not applied to patients that are sedated, muscularly relaxed, with artificial airway, drunk, or in status epilepsies.**
- **GCS is not applied to deaf people and patients having language barrier or with mental disorder.**
- **When applied to children younger than five years old or elder people who are slow, the GCS score might be low.**

19.4.1 Displaying the GCS Parameter Area

To Display the GCS parameter area, follow this procedure:

1. Access **Tile Layout** in either of the following ways:
   - Select the **Screen Setup** quick key → select the **Tile Layout** tab.
   - Select the **Main Menu** quick key → from the **Display** column select **Tile Layout**.
2. Select the parameter area where you want to display the GCS score, and then from the popup list select **GCS**.

The following figure shows the GCS parameter area. Your display may be configured to look slightly different.



(1) GCS label

(2) Total score and level of consciousness. The color of the circle indicates the level of risk.

(3) Scoring time

(4) Scoring countdown: time to the next scoring.

(5) Scoring interval

(6) Subscores

- E: eye opening
- V: verbal response
- M: motor response

19.4.2 Accessing the GCS Menu

Enter the GCS menu in any of the following ways:

- Select the GCS parameter area

- Select the **GCS** quick key.
- Select the **Main Menu** quick key → from the **CAA** column select **GCS**.

(1) Subscore (2) Total score

19.4.3 Performing GCS Scoring

To perform scoring, follow this procedure:

1. From the **Eye Opening** area, **Verbal Response** area, and **Motor Response** area, respectively select an item that represents the patient's status.
2. Select **OK** to accept the total score.

The following table lists the default score range and color of relevant consciousness level.

Level	Range	Color	Description
Mild	13 to15	White	The brain function is normal or mildly damaged.
Moderate	9 to 12	Yellow	The brain function is suffered from moderate to severe damage.
Severe	3 to 8	Red	Can be brain death or remain vegetative.

19.4.4 Setting GCS Scoring Interval

From the **GCS** menu, select **Interval** to set GCS scoring interval. When the scoring interval is reached and you do not perform another scoring, the score will be invalid and displayed as outline fonts.

19.4.5 Reviewing GCS Trend Data

From the **GCS** menu, select **Review** to enter the **Review** menu and view the GCS trend data from the **Tabular Trends**.

19.5 Rescue Mode

You can put the monitor into the rescue mode when rescuing a patient. In the rescue mode, the monitor displays the following information:

- Values and waveforms of physiological parameters
- CPR parameters and CQI (CPR quality index) trend
- CPR Dashboard

You can output the rescue report.

The rescue mode is intended for adult and pediatric patients.

WARNING

- **The rescue mode is not intended for neonatal patients.**
- **In the rescue mode, all physiological alarms and part of technical alarms are disabled.**

NOTE

- **Licenses are required for the CQI and CPR Dashboard function.**
- **A responsible nurse is required to record the rescue process. Recording shall not affect patient rescue.**

19.5.1 Entering the Rescue Mode

To enter the rescue mode, choose either of the following ways:

- Select the **Rescue Mode** quick key.
- Select the **Main Menu** quick key → from the **Alarm** column select **Rescue Mode**.

19.5.2 Monitoring CPR

If your monitor is configured with the Mindray SpO_2, by monitoring CPR parameters you can know compression quality and the patient's peripheral circulation status when administrating CPR.

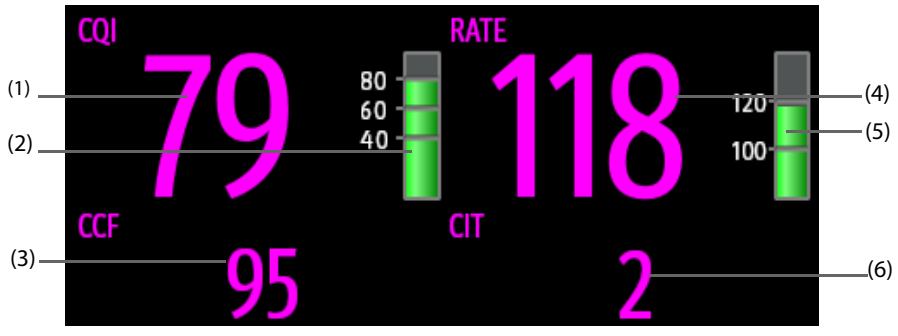
CAUTION

- **Apply the SpO_2 sensor properly. If the sensor is improperly applied or wrong SpO2 sensor is used, erroneous CQI and CPR parameters could result. For more information, refer to *12.3 SpO_2 Measurement Limitations***

19.5.2.1 CPR Parameters

You can monitor the following parameters when administrating CPR:

- CQI: CPR quality index. It indicates the compression quality. The greater the CQI, the better the compression quality.
- RATE: times of chest compression per minute.
- CCF: CPR compression fraction. It indicates the percentage of compression time within the CPR duration.
- CIT: compression interruption time in second.



(1) CQI value

(2) CQI indicator: dark green indicates good compression quality.

(3) CCF: CCF value with no background indicates proper compression time. CCF value with a red background indicates short compression time.

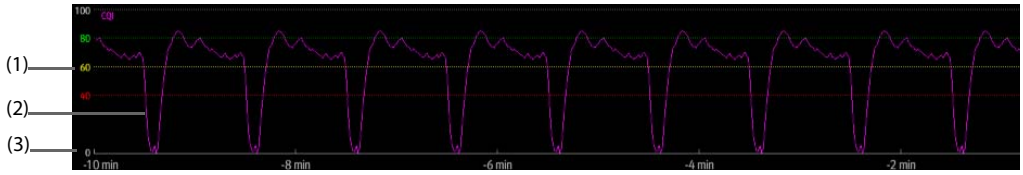
(4) RATE value

(5) RATE indicator: green indicates proper compression rate.

(6) CIT value: CIT value with no background indicates proper interrupt time. CIT value with a red background indicates long interruption.

19.5.2.2 CQI Trend

The following figure shows the CQI trend.



(1) CQI scale

(2) CQI trend: indicates the change of CQI values.

(3) CQI trend length: time span till the current time

19.5.2.3 Setting the CQI Trend Length

To set the CQI trend length, follow this procedure:

1. Select the CPR parameter area to enter the **CPR** menu.
2. Set **Trend Length**.

19.5.3 CPR Dashboard

The CPR Dashboard helps you record the medications and treatments administrated during patient rescue. You can record the following information on the monitor:

- Rescue start time and end time
- The use of drugs, for example adenaline, amiodarone and other drugs
- The administrated treatments, for example, CPR, defibrillation, and other treatments

19.5.3.1 Accessing the CPR Dashboard

If you are entering the rescue mode for the first time, the CPR Dashboard opens automatically. If you have closed the CPR Dashboard, to open it, select the **Main Menu** quick key → from the **CAA** column select **CPR Dashboard**.choose either of the following ways:

- Select the **Main Menu** quick key → from the **CAA** column select **CPR Dashboard**.
- Select the CPR parameter area, from the **CPR** menu, select **CPR Dashboard**.

19.5.3.2 Recording the Rescue Process

To record the rescue process using the CPR Dashboard, do as follows:

- To record the rescue start time: select **Start Rescue**. When entering the rescue mode, the monitor automatically records the rescue start time.
- To record the medications and the doses, select **Adrenaline**, **Amiodarone**, or **Other Drugs** accordingly.
- To record the treatments, select **Start Compression/Pause Compression**, **Defibrillation**, or **Other Treatment** accordingly.
- To record the rescue end time, select **End Rescue**.

19.5.3.3 Saving the Rescue Record

On the CPR Dashboard, select **Save** to save the rescue record.

19.5.3.4 Exporting the Rescue Record

You can export the rescue record using a USB drive. To do so, follow this procedure:

1. Connect the N1 and Dock.
2. Connect the USB drive to the Dock's USB connector.
3. Select **Export**.

19.5.3.5 Closing the CPR Dashboard

CPR Dashboard automatically closes when you exit the rescue mode. In the rescue mode, if you want to close the CPR Dashboard, choose any of the following ways:

- Select the exit key at the top right corner of the CPR Dashboard.
- Select the **Main Menu** quick key → from the **CAA** column select **Exit CPR Dashboard**.
- Select the CPR parameter area, from the **CPR** menu, select **Exit CPR Dashboard.**

19.5.4 Exit the Rescue Mode

To exit the rescue mode, choose either of the following ways:

- Select the **Exit Rescue Mode** quick key.
- Select the **Main Menu** quick key → from the **Alarm** column select **Exit Rescue Mode**.

20 Calculation (only available for the independent external display)

20.1 Calculation Overview

The monitor provides calculation functions. The calculated values, which are not directly measured, are computed based on the values you provide. The calculation feature is independent of other monitoring functions and can be therefore used for patients being monitored by other monitors. Any operation in a calculation window does not affect the patient monitored by the current monitor.

You can perform the following calculations:

- Drug calculations
- Hemodynamic calculations
- Oxygenation calculations
- Ventilation calculations
- Renal calculations

20.2 Calculation Safety Information

WARNING

- **Decisions on the choice and dosage of drugs administered to patients must always be made by the physician in charge. The drug calculations are based on the values input, it does not check the plausibility of the calculation performed.**
- **Check that 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.**

20.3 Drug Calculations

The monitor provides the drug calculation function.

20.3.1 Performing Drug Calculations

To perform drug calculations, follow this procedure:

1. Access drug calculator by either of the following ways:
   - Select the **Calculations** quick key.
   - Select the **Main Menu** quick key → from the **Calculations** column select **Drug**.
2. Set **Drug Name** and **Patient Category.** If the dose of drug is weight dependent, you must input the patient's weight. The dose calculation program has a library of commonly used drugs, of which Drug A through Drug E are user defined.
3. Enter the known values, for example **Drug Amount** and **Solution Volume.**
4. Select **Calculate**. The calculated values are indicated by red arrows.

NOTE

- **If available, the patient category and weight from the Patient Demographics menu are automatically entered when you first access drug calculation. You can change the patient category and weight. This will not change the patient category and weight stored in the patient demographic information.**

20.3.2 Checking the Titration Table

The titration table shows information on the currently used drugs. Use the titration table to see what dose of a drug your patient will receive at different infusion rates. To access the titration table, follow this procedure:

1. Access drug calculator by either of the following ways:
   - Select the **Calculations** quick key.
   - Select the **Main Menu** quick key → from the **Calculations** column select **Drug**.
2. Select the **Titration Table** tab.
3. Select **Dose Type** to set the type of dose unit in the titration table.
4. Select **Interval** to set the interval between two adjacent titration table items.

You can select how to display the titration table:

- **Dose**: the titration table is listed in the sequence of increased drug dose.
- **Infusion Rate**: the titration table is listed in the sequence of increased infusion rate. Normally the resolution of the infusion rate is one (1). By selecting **Exact Rate** the resolution of the infusion rate can reach 0.01 so that you can display the infusion rate more accurately.

20.3.3 Drug Calculation Formula

Description	Unit	Formula
Dose	Dose/hr Dose/min	Dose = Infusion Rate × Concentration
Dose (weight based)	Dose/kg/hr Dose/kg/min	Dose (weight based) = Infusion Rate × Concentration/Weight
Drug Amount	g series: mcg, mg, g unit series: Unit, KU, MU mEq series: mEq	Drug Amount =Dose × Duration
Drug Amount (weight based)	g series: mcg, mg, g unit series: Unit, KU, MU mEq series: mEq	Drug Amount (weight based) = Dose × Duration × Weight
Duration	hr	Duration = Amount/Dose
Duration (weight based)	hr	Duration (weight based) = Amount/(Dose × Weight)
Concentration	mcg/ml, mg/ml, g/ml, Unit/ml, KU/ml, MU/ml, mEq/ml	Concentration = Drug Amount/Solution Volume
Solution volume	ml	Volume = Infusion Rate × Duration
Infusion rate	ml/hr	Infusion Rate = Dose/Concentration
Infusion rate (weight based)	g•ml/hr	Infusion Rate = Dose × Weigh/Concentration

20.3.4 Titration Table Calculation Formula

Description	Unit	Formula
Infusion Rate	ml/hr	Infusion Rate = Dose/Concentration
Infusion Rate (weight based)	ml/hr	Infusion Rate = Weight × Dose/Concentration
Dose	Dose/hr Dose/min	Dose = Infusion Rate × Concentration
Dose (weight based)	Dose/kg/hr Dose/kg/min	Dose (weight based) = INF Rate × Concentration/ Weight

20.4 Hemodynamic Calculations

The monitor provides the hemodynamic calculation function. The monitor can save the results of up to 10 calculations, which are displayed in groups.

20.4.1 Performing Hemodynamic Calculations

To perform hemodynamic calculation, follow this procedure:

1. Access hemodynamic calculation by either of the following ways:
   - Select the **Calculations** quick key → **Hemodynamics** tab.
   - Select the **Main Menu** quick key → from the **Calculations** column select **Hemodynamics**.
2. Enter the known values. For a patient who is being monitored, the currently measured values are automatically taken.
3. Select **Calculate**.

The calculated value greater than the normal upper limit is indicated by an up arrow "↑". The calculated value lower than the normal lower limit is indicated by a down arrow "↓".

You can select **Range** to show the normal range of each parameter.

20.4.2 Input Parameters for Hemodynamic Calculations

Input Parameter	Label	Unit
cardiac output	C.O.	L/min
heart rate	HR	bpm
pulmonary artery wedge pressure	PAWP	mmHg
artery mean pressure	PMAP	mmHg
pulmonary artery mean pressure	PA Mean	mmHg
central venous pressure	CVP	mmHg
end-diastolic volume	EDV	ml
height	Height	cm
weight	Weight	kg

NOTE

- **If you enable Use PA-D as PAWP, PA-D value will be used to replace PAWP value for hemodynamic calculation. For more information, refer to *15.6.8 Setting the Use PA-D as PAWP Switch (only available for the independent external display)*.**

20.4.3 Calculated Parameters and Formulas for Hemodynamic Calculations

Calculated Parameters	Label	Unit	Formula
cardiac index	C.I.	$L/min/m^2$	C.I. ($L/min/m^2$) = C.O. (L/min)/BSA (m^2)
body surface area	BSA	m^2	BSA (m^2) = $Wt^{0.425}$ (kg) × $Ht^{0.725}$ (cm) × 0.007184
stroke volume	SV	ml	SV (ml) = 1000× C.O. (L/min)/HR (bpm)
stroke index	SVI	ml/m^2	SVI (ml/m^2) = SV (ml)/BSA (m^2)
systemic vascular resistance	SVR	DS/cm^5	SVR (DS/cm^5) = 79.96 × [APMAP (mmHg) - CVP (mmHg)]/C.O. (L/min)

Calculated Parameters	Label	Unit	Formula
systemic vascular resistance index	SVRI	$DS•m^2/cm^5$	SVRI ($DS•m^2/cm^5$) = SVR (DS/cm^5) × BSA (m^2)
pulmonary vascular resistance	PVR	DS/cm^5	P VR (DS/cm^5) = 79.96 × [PAMAP (mmHg) - PAWP (mmHg)]/C.O. (L/min)
pulmonary vascular resistance index	PVRI	$DS•m^2/cm^5$	PVRI ($DS•m^2/cm^5$) = PVR (DS/cm^5)× BSA (m^2)
left cardiac work	LCW	kg•m	LCW (kg•m) = 0.0136 × APMAP (mmHg) × C.O. (L/min)
left cardiac work index	LCWI	$kg•m/m^2$	LCWI ($kg•m/m^2$) = LCW (kg•m)/BSA (m^2)
left ventricular stroke work	LVSW	g•m	LVSW (g•m) = 0.0136 × APMAP (mmHg) × SV (ml)
left ventricular stroke work index	LVSWI	$g•m/m^2$	LVSWI ($g•m/m^2$) = LVSW (g.m)/BSA (m^2)
right cardiac work	RCW	kg•m	R CW (kg•m) = 0.0136 × PAMAP (mmHg) × C.O. (L/min)
right cardiac work index	RCWI	$kg•m/m^2$	R CWI ($kg•m/m^2$) = RCW (kg.m)/BSA (m^2)
right ventricular stroke work	RVSW	g•m	R VSW (g•m) = 0.0136 × PAMAP (mmHg) × SV (ml)
right ventricular stroke work index	RVSWI	$g•m/m^2$	R VSWI ($g•m/m^2$) = RVSW (g•m)/BSA (m^2)
ejection fraction	EF	%	EF (%) = 100 × SV (ml)/EDV (ml)
End-diastolic volume index	EDVI	ml/m2	EDVI (ml/m^2) = EDV (ml)/BSA (m^2)
End-systolic Volume	ESV	ml	ESV (ml) = EDV (ml) –SV (ml)
End-systolic Volume index	ESVI	ml/m^2	ESVI (ml/m^2) = ESV (ml)/BSA (m^2)

20.5 Oxygenation Calculations

The monitor provides the oxygenation calculation function. The monitor can save the results of up to 10 calculations, which are displayed in groups.

20.5.1 Performing Oxygenation Calculations

To perform oxygenation calculations, follow this procedure:

1. Access oxygenation calculation by either of the following ways:
   - Select the **Calculations** quick key → **Oxygenation** tab.
   - Select the **Main Menu** quick key → from the **Calculations** column select **Oxygenation**.
2. Enter the known values. For a patient who is being monitored, the currently measured values are automatically taken.
3. Select **Calculate**.

   The calculated value greater than the normal upper limit is indicated by an up arrow "↑". The calculated value lower than the normal lower limit is indicated by a down arrow "↓".

In the **Oxygenation** page, you can also perform the following operations:

- Select **Oxycont Unit**, **Hb Unit**, and **Pressure Unit**. Then corresponding parameter values will be automatically converted and updated accordingly.
- Select **Range** to show the normal range of each parameter.

20.5.2 Input Parameters for Oxygenation Calculations

Input Parameter	Label	Unit
cardiac output	C.O.	L/min
percentage fraction of inspired oxygen	FiO_2	%
partial pressure of oxygen in the arteries	PaO_2	mmHg, kPa
partial pressure of carbon dioxide in the arteries	$PaCO_2$	mmHg, kPa
arterial oxygen saturation	SaO_2	%
partial pressure of oxygen in venous blood	PvO_2	mmHg, kPa
venous oxygen saturation	SvO_2	%
hemoglobin	Hb	g/L, g/dl, mmol/L
respiratory quotient	RQ	None
atmospheric pressure	ATMP	mmHg, kPa
height	Height	cm, inch
weight	Weight	kg, lb

20.5.3 Calculated Parameters and Formulas for Oxygenation Calculations

Calculated Parameters	Label	Unit	Formula
body surface area	BSA	m^2	BSA (m^2) = $Wt^{0.425}$ (kg) × $Ht^{0.725}$ (cm) × 0.007184
oxygen consumption	VO_2	ml/min	VO_2 (ml/min) = C(a-v)O_2 (ml/L)× C.O. (L/min))
arterial oxygen content	CaO_2	ml/L, ml/dL	CaO_2 (ml/L) = 10× (0.0134 × Hb (g/dl) × SaO_2 (%)) +0.031× PaO_2 (mmHg)
venous oxygen content	CvO_2	ml/L, ml/dL	CvO_2 (ml/L) = 10× (0.0134 × Hb (g/dl) × SvO_2 (%)) +0.031 × PvO_2 (mmHg)
arteriovenous oxygen content difference	C(a-v)O_2	ml/L, ml/dl	C(a-v)O_2 (ml/L) = CaO_2 (ml/L) - CvO_2 (ml/L)
oxygen extraction ratio	O_2ER	%	O_2ER (%) = 100×C(a-v)O_2 (ml/L)/CaO_2 (ml/L)
oxygen transport	DO_2	ml/min	DO_2(ml/min) = C.O. (L/min) × CaO_2(ml/L)
partial pressure of oxygen in the alveoli	PAO_2	mmHg, kPa	PAO_2 (mmHg) = [ATMP (mmHg) - 47 mmHg] × FiO_2 (%)/100 - $PaCO_2$ (mmHg) × [FiO_2 (%)/100 + (1 - FiO_2 (%)/100)/RQ]
alveolar-arterial oxygen difference	$AaDO_2$	mmHg, kPa	$AaDO_2$ (mmHg) = PAO_2 (mmHg) - PaO_2 (mmHg)
capillary oxygen content	CcO_2	ml/L, ml/dl	CcO_2 (ml/L) = Hb (g/L) × 1.34 + 0.031 × PAO_2 (mmHg)
venous admixture	QS/QT	%	QS/QT (%) = 100× [1.34 × Hb (g/L) × (1 - SaO2 (%)/100) + 0.031 × (PAO2 (mmHg) - PaO2 (mmHg))]/[1.34 × Hb (g/L) × (1 - SvO2 (%)/100) + 0.031× (PAO2 (mmHg) - PvO2 (mmHg))]
oxygen transport index	DO_2I	ml/min/m^2	DO2I (ml/min/m^2) = CaO2 (ml/L) × (C.O. (L/min)/BSA (m^2))
oxygen consumption	VO_2I	ml/min/m^2	VO2I (ml/min/m^2) = C (a-v) O2 (ml/L) ×(C.O. (L/min)/BSA (m^2))

20.6 Ventilation Calculations

The monitor provides the ventilation calculation function. The monitor can save the results of up to 10 calculations, which are displayed in groups.

20.6.1 Performing Ventilation Calculations

To perform ventilation calculations, follow this procedure:

1. Access ventilation calculation by either of the following ways:
   - Select the **Calculations** quick key → **Ventilation** tab.
   - Select the **Main Menu** quick key → from the **Calculations** column select **Ventilation**.
2. Enter the known values. For a patient who is being monitored, the currently measured values are automatically taken. If the anesthesia machine or ventilator is connected, measured values for ventilation calculation are also automatically taken.
3. Select **Calculate**.

   The calculated value greater than the normal upper limit is indicated by an up arrow "↑". The calculated value lower than the normal lower limit is indicated by a down arrow "↓".

On the **Ventilation** page, you can also perform the following operations:

- Select **Pressure Unit**. Then corresponding parameter values will be automatically converted and updated accordingly.
- Select **Range** to show the normal range of each parameter.

20.6.2 Input Parameters for Ventilation Calculations

Input Parameter	Label	Unit
percentage fraction of inspired oxygen	FiO_2	%
respiration rate	RR	rpm
partial pressure of mixed expiratory CO2	$PeCO_2$	mmHg, kPa
partial pressure of carbon dioxide in the arteries	$PaCO_2$	mmHg, kPa
partial pressure of oxygen in the arteries	PaO_2	mmHg, kPa
tidal volume	TV	ml
respiratory quotient	RQ	None
atmospheric pressure	ATMP	mmHg, kPa

20.6.3 Calculated Parameters and Formulas for Ventilation Calculations

Calculated Parameters	Label	Unit	Formula
partial pressure of oxygen in the alveoli	PAO_2	mmHg, kPa	PAO_2 (mmHg) = [ATMP (mmHg) - 47 mmHg] × FiO_2 (%)/100 - $PaCO_2$ (mmHg) × [FiO_2(%)/100 + (1 - FiO_2 (%)/100)/RQ]
alveolar-arterial oxygen difference	$AaDO_2$	mmHg, kPa	$AaDO_2$ (mmHg) = PAO_2 (mmHg) - PaO_2 (mmHg)
oxygenation ratio	Pa/FiO_2	mmHg, kPa	Pa/FiO_2(mmHg) = 100 × PaO_2 (mmHg)/FiO_2 (%)
arterial to alveolar oxygen ratio	a/AO_2	%	a/AO_2 (%) = 100 × PaO_2 (mmHg)/PAO_2 (mmHg)
minute volume	MV	L/min	MV (L/min) = [TV (ml) × RR (rpm)]/1000

Calculated Parameters	Label	Unit	Formula
volume of physiological dead space	Vd	ml	Vd (ml) = TV (ml) × [1 - $PeCO_2$ (mmHg)/$PaCO_2$ (mmHg)]
physiologic dead space in percent of tidal volume	Vd/Vt	%	Vd/Vt (%) = 100 × Vd (ml)/TV (ml)
alveolar volume	VA	L/min	VA (L/min) =[TV (ml) - Vd (ml)] × RR (rpm)/ 1000

20.7 Renal Calculations

The monitor provides the renal calculation function. The monitor can save the results of up to 10 calculations, which are displayed in groups.

20.7.1 Performing Renal Calculations

To perform renal calculations, follow this procedure:

1. Access renal calculation by either of the following ways:
   - Select the **Calculations** quick key → select the **Renal** tab.
   - Select the **Main Menu** quick key → from the **Calculations** column select **Renal**.
2. Enter the known values. .
3. Select **Calculate**.

   The calculated value greater than the normal upper limit is indicated by an up arrow "↑". The calculated value lower than the normal lower limit is indicated by a down arrow "↓". You can select **Range** to show the normal range of each parameter.

20.7.2 Calculated Parameters and Formulas for Renal Calculations

Input Parameter	Label	Unit
urine pstassium	URK	mmol/L
urinary sodium	URNa	mmol/L
urine	Urine	ml/24 hrs
plasm osmolality	Posm	mOsm/kgH_2O
urine osmolality	Uosm	mOsm/kgH_2O
serum sodium	SerNa	mmol/L
creatinine	Cr	μmol/L
urine creatinine	UCr	μmol/L
blood urea nitrogen	BUN	mmol/L
height	Height	cm
weight	Weight	kg

20.7.3 Calculated Parameters and Formulas for Renal Calculations

Calculated Parameters	Label	Unit	Formula
urine sodium excretion	URNaEx	mmol/24 hrs	URNaEx (mmol/24 hrs) = Urine (ml/24 hrs) × URNa (mmol/L)/1000

Calculated Parameters	Label	Unit	Formula
urine potassium excretion	URKEx	mmol/24 hrs	URKEx (mmol/24 hrs) = Urine (ml/24 hrs) × URK (mmol/L)/1000
sodium potassium ratio	Na/K	%	Na/K (%) = 100 × URNa (mmol/L)/URK (mmol/L)
clearance of sodium	CNa	ml/24 hrs	CNa (ml/24 hrs) = URNa (mmol/L) × Urine (ml/24 hrs)/SerNa (mmol/L)
creatinine clearance rate	Clcr	ml/min	Clcr (ml/min) = Ucr (μmol/L) × Urine (ml/24 hrs)/[Cr (μmol/L) × (BSA (m^2)/1.73) × 1440]
fractional excretion of sodium	FENa	%	FENa (%) = 100 × URNa (mmol/L) × Cr (μmol/L)/[SerNa (mmol/L) × Ucr (μmol/L)]
osmolar clearance	Cosm	ml/min	Cosm (ml/min) = Uosm (mOsm/kgH_2O) × Urine (ml/24 hrs)/(Posm (mOsm/kgH_2O) × 1440)
free water clearance	CH2O	ml/hr	CH2O (ml/hr) = Urine (ml/24 hrs) × [1 - Uosm (mOsm/kgH_2O)/Posm (mOsm/kgH_2O)]/24
urine to plasma osmolality ratio	U/P osm	None	U/P osm = Uosm (mOsm/kgH_2O)/Posm (mOsm/kgH_2O)
blood urea nitrogen creatinine ratio	BUN/Cr*	Mmol/L	BUN/Cr = 1000 × BUN (mmol/L)/Cr (μmol/L)
urine-serum creatinine ratio	U/Cr	None	U/Cr (mmol/L) = Ucr (μmol/L)/Cr (μmol/L)

*: BUN/Cr is a ratio at mol unit system.

21 Printing

21.1 Supported Printer

The monitor supports the following printer:

- HP LaserJet Pro M202dw
- HP LaserJet Enterprise M605
- HP LaserJet P4015n
- HP LaserJet Pro 400 M401n
- HP LaserJet 600 M602

NOTE

- **For more details about the printer, see the document accompanying the printer. With product upgrades, the monitor may support more printers and no prior notice will be given. If you have any doubt about the printer you have purchased, contact Mindray.**

21.2 End Case Reports

21.2.1 Printing the End Case Report

To print the end case report, choose one of the following ways:

- Select **Print** from the **End Case Report** menu.
- Select **Print End Case Report** when you discharge a patient
- Select the **End Case Report** quick key (only available for the independent external display)

21.2.2 Setting a Report as An End Case Report

The following reports can be set as end case reports:

- Tabular Trends Report
- Graphic Trend Report
- Event Report
- 12-lead Interpretation
- Alarm Limits Report
- Realtime Report
- ECG Report

To set a report as an end case report, follow this procedure:

1. Select the **Main Menu** quick key → from the **Report** column select **End Case Report**.
2. From the **Select Reports** page, select the checkbox before the desired report, for example **ECG Report**.

21.2.3 Setting the End Case Report

To set the end case report, follow this procedure:

1. Select the **Main Menu** quick key → from the **Report** column select **End Case Report**.
2. From the **Report Setup** page, set the following end case reports:
   - Select the **Tabular Trends Report**, **Graphic Trends Report**, **Realtime Report**, and **ECG Report** tab, and set these end case report by referring to section *21.6 Setting Reports*.

- Select the **Event Report** tab, and select the event that needs to be printed.
- Select the 12-Lead Interpretation tab, and set the switch of **Median Complex**, **Measurements**, **Interpretation**, or **Interpretation Summary**. For other settings, refer to section *21.6.1 Setting ECG Reports*.

21.2.4 Setting the End Case Report Period

To set the end case report print period, follow this procedure:

1. Select the **Main Menu** quick key → from the **Report** column select **End Case Report**.
2. From the **Select Reports** page, set the **Period**.

NOTE

- **End case report print period is calculated from the patient discharged time to the configured period.**
- **Period setting is applicable to all the end case report.**

21.3 Manually Starting a Printing Task

You can start a printing task manually.

21.3.1 Starting Printing from the Current Page

From the current page, select the button, if available, to start printing.

21.3.2 Printing Realtime Reports

Select the quick key to print a realtime report. You can also print a realtime report from the **Normal Report** page. For more information, see *21.3.3 Printing Most Common Reports*.

21.3.3 Printing Most Common Reports

The following most common reports can be printed:

- ECG Report
- Realtime Report
- Tabular Trends Report

Graphic Trend ReportTo print normal reports, follow this procedure:

1. Select the **Main Menu** quick key →from the **Report** column select **Report Setup**.
2. Select the desired report tab.
3. Check the settings.
4. Select **Print**.

21.4 Automatically Printing Reports

When a parameter alarm switch is set to on and an alarm is triggered for this parameter, you can set a printer to start alarm printing automatically.

To do so, follow this procedure:

1. Access alarm related tabs such as the **Alarm** tab for a parameter in one of the following ways:
   - Select the parameter or waveform area of the desired parameter → select the **Alarm** tab.
   - Select the **Main Menu** quick key → from the **Parameters** column select **Setup**→ select **the desired parameter** → select the **Alarm** tab.
2. Switch on **On/Off** and **Alarm outputs** for desired parameters.

21.5 Stopping a Printing Task

To stop a printing task, follow this procedure:

1. Select the **Main Menu** quick key → from the **Report** column select **Print Queue**.
2. Select desired printing tasks and then select **Delete**. Selecting **Delete All** to stop all the printing tasks.

21.6 Setting Reports

This section focuses on how to set ECG reports, realtime reports, tabular trends reports, and graphic trends reports.

21.6.1 Setting ECG Reports

To set ECG reports, follow this procedure:

1. Select the **Main Menu** quick key → from the **Report** column select **Report Setup**.
2. Select **ECG Report**.
3. Set the desired options. The following table only lists some of the options.

Menu item	Function	Description
Speed	Set the print speed of ECG waveforms	**25 mm/sec**: prints 25 mm of ECG waveform per second. **50 mm/sec**: prints 50 mm of ECG waveform per second.
Auto Interval	Defines the spacing between the ECG waveforms on a printout	**On:** automatically adjusts the space between waveforms to avoid overlapping. **Off**: each waveform area has the same sizeon a printout.
	Note: This setting is only relevant when **12×1** is selected for **12-Lead Format**.	
12-Lead Format	Select the format of 12-lead ECG waveforms on a printout.	**12×1:** displays 12-lead ECG waveforms on one page in one column. **6×2**: displays 12-lead ECG waveforms on one page in two columns, with 6 lines in each column. **6×2+1**: displays 12-lead ECG waveforms on one page in two columns, with 6 lines in each column, and one rhythm lead waveform at the bottom. **3×4+1**: displays 12-lead ECG waveforms on one page in 4 columns, with 3 lines in each column, and one rhythm lead waveform at the bottom. **3×4+3**: displays 12-lead ECG waveforms on one page in 4 columns, with 3 lines in each column, and three rhythm lead waveforms at the bottom.
Rhythm Lead 1 **Rhythm Lead 2** **Rhythm Lead 3**	Select the lead that will be used as Rhythm Lead 1, 2, or 3.	I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6
	Note: This setting is only relevant when **6×2+1**,**3×4+1**, or **3×4+3** is selected for **12-Lead Format**.	
Format sequence	Select the recording method of ECG report generated by auto measurement	**Sequential**: 12-lead ECG data are recorded sequentially and displayed in 3 lines and 4 columns with 2.5 seconds of ECG data for each column. **Simultaneous**: Record simultaneous 12-lead ECG data.

NOTE

- **When ECG Lead Set is set to 3-Lead, ECG report cannot be printed.**

21.6.2 Setting Realtime Reports

To set tabular realtime reports, follow this procedure:

1. Select the **Main Menu** quick key → from the **Report** column select **Report Setup**.
1. Select **Realtime Report**.
2. Set the desired options. The following table only list some of the options.

Menu item	Function	Description
Select Waveform	Select the desired waveform to print	**Current Waveforms**: prints the realtime report for current waveforms. **Selected Waveforms**: prints the realtime report for the selected waveforms.

21.6.3 Setting Tabular Trends Reports

To set tabular trends reports, follow this procedure:

1. Select the **Main Menu** quick key → from the **Report** column select **Report Setup**.
2. Select **Tabular Trends Report**.
3. Set the desired options. The following table only list some of the options.

Menu Item	Function	Description
Period	Select the period during which a tabular trends report will be printed.	**Auto**: one page of a tabular trends according to the selected interval.
Interval	Select the resolution of the tabular trends printed on a report.	**NIBP, EWS**, **GCS**, **C.O**.: at an interval of acquiring the values of selected parameter. (EWS, and GCS are only available for the independent external display) **Auto**: using the **Interval** setting of the **Tabular Trends** review page.
Report Format	Select the printing principle.	**Parameter Oriented**: print one page of report by parameters when **Interval** is set to **Auto**. **Time Oriented**: print one page of report by time when **Interval** is set to **Auto**.

21.6.4 Setting Graphic Trends Reports

To set graphic trends reports, follow this procedure:

1. Select the **Main Menu** quick key → from the **Report** column select **Report Setup**.
2. Select **Graphic Trends Report**.
3. Set **the desired options**.

21.7 Viewing Printer Status

You can view the status of the recent ten printing tasks in the **Print Queue** window. To view the status of printing tasks, select the **Main Menu** quick key → from the **Report** column select **Print Queue**.

Each printing task includes the following information:

- Print time
- Report title
- Printer name (when using the printer server) or IP address (when using the network printer)
- Printing status, for example, printing, failed, retrying, and waiting.

21.8 Printer Out of Paper

When the printer runs out of paper, the print request will not be responded. If there are too many print jobs that are not responded, a printer error may occur. In these cases, you need to install paper and then re-send the print request. Restart the printer if necessary.

Therefore, you'd better ensure that there is enough paper in the printer before sending a print request.

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22 User Maintenance Settings

User maintenance enables you to customize your equipment to best meet your needs. Accessing the **Maintenance** menu is password protected.

This chapter describes the settings and functions in the **Maintenance** menu.

CAUTION

- **The maintenance settings can only be changed by authorized personnel. Contact your department manager or biomedical engineering department for the passwords used at your facility.**

22.1 Accessing the Maintenance Menu

To perform user maintenance, follow this procedure:

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select ↵.
2. Select desired tab.

22.2 The Device Location Settings

Menu Item	Default Setting	Function
Monitor Name	/	/
Facility		
Department		
Room No.		
Bed No.		
Location	Fixed	• **Fixed**: the **Patient Management** dialog displays Bed No. and Room No., but you cannot change them. • **Unfixed**: you can change Bed No. and Room No. from the **Patient Management** dialog.

NOTE

- **If Location is set to Unfixed, Bed No. and Room No. are cleared each time you discharge a patient.**

22.3 The Patient Management Settings

22.3.1 The Field Tab

Menu Item	Default Setting	Function
Room No	Unselected	Selects which items can be displayed and edited from the **Patient Management** menu.
Visit Number	Unselected	
Patient ID	Selected	
Middle Name	Unselected	
Race	Unselected	
Age	Selected	
Custom Filed 1 -Custom Filed4	Unselected	

NOTE

- **If the monitor is connected with the CMS, the patient information items and customized fields are loaded from the CMS.**

22.3.2 The ADT Query Tab

Menu Item	Default Setting	Function
Facility	Unselected	Selects which criteria can be used to search patients in the ADT server
Department		
Room No		
Bed No		
Visit Number		
Patient ID	Selected	
Patient Name		

22.3.3 The Discharge Tab

Menu Item	Default Setting	Function
Auto Discharge When Power Off	Never	Automatically discharges the patient when the monitor is turned off for the designated period of time. **Never**: not discharge a patient no matter for how long the monitor has been switched off.
Auto delete discharged patients on storage space is full	On	/
Prompt on patient auto deleted	On	**On:** an alarm is issued when the monitor automatically deletes earlier discharged patients.
Alarm on storage is nearly full	Med	Selects whether an alarm is issued when the monitor memory is very low and the priority of this alarm.
Clear All Patient Data	/	Deletes all patient information and data. Clearing patient data will discharge the current patient.

22.3.4 The Location Tab

Menu Item	Default Setting	Function
Location 1 - Location 10	/	Selects where the patient goes after patient monitoring stops.

22.3.5 The Display Tab

Menu Item	Default Setting	Function
Primary Screen Display Full Name	On	Selects whether patient name is displayed in the patient information area on the primary display.
Secondary Screen Display Full Name	On	Selects whether patient name is displayed in the patient information area on the secondary display, if configured.
Remote View Display Full Name	On	Selects whether patient name is displayed in the patient information area on the remote monitors when this monitor is viewed by other monitors.
Remote View Bedlist Display Full Name	On	Defines whether patient name is displayed in beds list on the remote monitors when this monitor is viewed by other monitors.

22.4 The Alarm Settings

22.4.1 The Audio Tab

Menu Item	Default Setting	Function
Minimum Alarm Volume	2	/
Alarm Sound	ISO	Defines the alarm tone pattern to distinguish the heart beat tone, pulse tone, and keystroke tone by frequency.
High Alarm Interval	10 sec	Defines the interval between alarm tones for the ISO mode.
Med Alarm Interval	20 sec	
Low Alarm Interval	20 sec	
Auto Increase Volume	2 Steps	• **2 Steps**: if an alarm is not reset within the designated delay time after the alarm occurs, the alarm volume automatically increases by two levels. • **1 Step**: if an alarm is not reset within the designated delay time after the alarm occurs, the alarm volume automatically increases by one level. • **Off**: if an alarm is not reset within the designated delay time after the alarm occurs, the volume of the alarm tone does not change.
Increase Volume Delay	20 sec	Defines the delay time of alarm volume escalation

NOTE

- **The alarm volume escalation function is not applied to the latched alarms.**
- **The monitor provides the same alarm tone pattern for the remote device alarms as those for your monitor alarms.**

22.4.2 The Pause/Reset Tab

Section	Menu Item	Default Setting	Function
Pause	Pause	Alarm Pause	Selects the pause function. • **Alarm Pause**: pauses alarms. • **Audio Pause**: pauses alarm tones.
	Pause Time	2 min	Selects the alarm pause time. The alarm pause time can be set to **1 min**, **2 min**, **3 min**, or **Permanent**.
	Pause Priority	All	Selects alarms of what priority can be paused. • **All**: pressing the **Alarm Pause** quick key pauses all alarms. • **Med & Low**: pressing the **Alarm Pause** quick key pauses alarms of medium and low priority. The high priority alarms will not be paused. • **Disabled**: the **Alarm Pause** quick key is disabled.
	Pause 5 min	Off	Selects how long the alarm can be paused if switched on..
	Pause 10 min	Off	
	Pause 15 min	Off	
Alarm Reset	Alarm Light	On When Reset	• **On When Reset**: when the alarm system is reset, the alarm tones of the current alarms are switched off, but the alarm lamp remains flashing. • **Off When Reset**: when the alarm system is reset, both the alarm tone and alarm lamp of the current alarms are switched off.
Reminder Tone	Alarm Reset Reminder	On	Selects the reminder tone rule when the alarm volume is set to zero, or the alarm is reset or switched off. • **On**: the monitor issues reminder tones at a designated interval. • **Re-alarm**: if the alarm condition persists the acknowledged alarms marked with "√" will be regenerated after the designated reminder tone interval. • **Off**: the monitor does not issue reminder tones at a designated interval. The acknowledged alarms marked with "√" will be silenced.
	Alarm Off Reminder	On	/
	Reminder Interval	5 min	• **10 min**: the monitor issues reminder tones every 10 minutes. • **5 min**: the monitor issues reminder tones every five minutes. • **3 min**: the monitor issues reminder tones every three minutes. • **2 min**: the monitor issues reminder tones every two minutes. • **1 min**: the monitor issues reminder tones every one minute.

22.4.3 The Latching Tab

Menu Item		Default Setting	Function
Lethal	Visible	Unselected	Selects alarm latching rules: • If **Visual** is selected, you can separately latch visual alarm signal. • Latching audible alarm signal simultaneously latches visual signal. • Selecting alarms of lower priority simultaneously latches higher priority alarms.
	Audible		
High	Visible		
	Audible		
Med	Visible		
	Audible		
Low	Visible		
	Audible		

22.4.4 The Remote View Tab (Only available for the independent external display)

Menu Item	Default Setting	Function
Reset Remote Bed Alarms	Off	Selects whether you can reset alarms occurring to the remote devices from your monitor. **On**: the **Alarm Reset** button appears on the bottom left of the **Remote View** screen.
Alarm Reset by Other Bed	On	**On**: alarms on your monitor can be reset by remote devices.
Alarm Reminder	Visible+Audible	Selects what alarm indicators are necessary for the remote devices. • **Visible + Audible**: the monitor provides visual alarm indication, and continuous audible alarm indication if the alarm persists at the remote device. • **Visible + Single Tone**: the monitor provides visual alarm indication, and a single tone when the alarm occurs at the remote device. • **Visible Only**: the monitor only provides visual alarm indication.
Alarm Priority	All	Selects what priority of remote device alarms are presented for audible notification • **All**: the monitor sounds if an alarm occurs. • **High&Med**: the monitor sounds if a high or medium priority alarm occurs. • **High Only**: the monitor sounds only if a high priority alarm occurs.
Alarm Sound	ISO	Selects the alarm tone pattern for the remote device alarms.
Remote Disconnected Alarm	On	Selects whether an alarm is issued if a remote device is disconnected.

22.4.5 The Other Tab

Section	Menu Item	Default Setting	Function
Alarm Priority	ECG Lead Off	Low	Selects the priority of the ECG lead off alarm.
	SpO2 Sensor Off	Low	Selects the alarm level for SpO_2 sensor off alarm.
	IBP No Sensor	Med	Selects the alarm level for IBP No Sensor alarm.
	CMS/eGW Disconnected	Low	Selects the priority of the CMS and eGateway disconnection alarm.
Alarm Delay	Alarm Delay	6 sec	For continuously measured parameters, the monitor does not present the alarm if the alarm condition is resolved within the delay time. The setting of **Alarm Delay** is not applied to the apnea alarms and the ST alarms.
	ST Alarm Delay	30 sec	The monitor does not present the ST alarm if the alarm condition is resolved within the delay time.
Alarm Light Brightness	Primary Screen	Med	Selects the alarm light brightness on the primary display. **Auto**: the monitor automatically adjusts the alarm light brightness according to the ambient light. The stronger the ambient light is, the brighter the alarm light is.
Other	Lethal Arrhy Alarms Off	Disable	Selects whether arrhythmia alarms can be switched off. • **Disable**: arrhythmia alarms cannot be switched off. • **Enable**: arrhythmia alarms can be switched off from the **ECG** menu.
	SpO2 Desat Alarm Off	Disable	Selects whether the SpO_2 Desat alarm can be switched off. • **Disable**: the SpO_2 Desat alarm cannot be switched off. • **Enable**: the SpO_2 Desat alarm can be switched off.
	Apnea Alarm Off	Disable	Selects whether the apnea alarm can be switched off. • **Disable**: the apnea alarm cannot be switched off. • **Enable**: the apnea alarm can be switched off.
	Arrhy Shield Time	2 min	Alarm light and alarm tone will be disabled for designated period of time when certain arrhythmia alarms are detected. **0**: disables this function.
	Intubation Mode Period	2 min	Selects the time for intubation.
	CMS/eGW Disconnected Alarm	Off	Selects whether an alarm is issued when the monitor is not connected or disconnected from the CMS/eGateway. **Off**: the "Offline" alarm is not presented when the monitor is not connected or disconnected from the CMS/eGateway.
	Battery Off Alarm	On	/

22.5 The CAA Settings

22.5.1 The EWS Tab

Menu Item		Default Setting	Function
Operator ID		Off	Selects whether to display the operator ID on the EWS screen
Operator ID Timeout		Off	Selects how long the operator ID will be invalid
Default Adult Score		NEWS	Selects the default scoring tool for different patient category.
Default Ped Score		/	
Default Neo Score		/	
Manage Score	Local	/	**Delete**: deletes the selected scoring tools. The monitor provide MEWS and NEWS by default. You cannot delete them.
	USB Drive	/	**Import**: imports the desired scoring tools to the monitor.

22.5.2 The GCS Tab

Menu Item		Default Setting	Function
Mild	High limit	15	Selects the threshold and color of each consciousness level.
	Low limit	13	
	Color	White	
Moderate	High limit	12	
	Low limit	9	
	Color	Yellow	
Severe	High limit	8	
	Low limit	3	
	Color	Red	

22.5.3 The CPR Tab

Tab	Default Setting	Function
Customized Drug	/	Customizes drugs and treatments.
Customized Treatment		

22.6 The Module Settings

22.6.1 The ECG Tab

Menu Item	Default Setting	Function
ECG Standard	AHA	Selects the ECG standard according to the leadwires you are using.

Menu Item	Default Setting	Function
QTc Formula	Hodges	Selects the QTc formula used to correct the QT interval for heart rate. • Hodges: $QTc = QT + 1.75 \times (HearRate - 60)$ • Bazett: • $QTc = QT \times \left(\frac{HearRate}{60}\right)^{\frac{1}{2}}$ • Fridericia: $QTc = QT \times \left(\frac{HeartRate}{60}\right)^{\frac{1}{3}}$ • Framingham: $QTc = QT + 154 \times \left(1 - \frac{60}{HeartRate}\right)$
12-Lead Order	No	Selects whether to send the order of 12-lead interpretation report to the hospital information system while saving the report
Calibration	/	Select this button to calibrate the ECG module.

22.6.2 The Other Tab

Menu Item	Default Setting	Function
IBP Filter	12.5 Hz	/
PAWP Timeout (only available for the independent external display)	15 min	The measurements become outline fonts after a preset time. This avoids older values being misinterpreted as current measurements.
NIBP Timeout	15 min	
C.O. Timeout	15 min	
CO2 Flow Rate for Neo (For Sidestream CO_2 Module Without O_2)	90 ml/min	Selects flow rate when using the sidestream CO_2 without the O_2 monitoring function to monitor a neonatal patient.
Outline Font for Suspected Values	On	Selects whether unreliable HR and SpO_2 measurements are displayed in outline font. This prevents unreliable measurements from being misinterpreted as normal measurements.

22.7 The Review Settings

22.7.1 The Tabs Tab

Menu Item	Default Setting	Function
Tabular Trends	Selected	Hides the trends you do not need to review if deselected.
Graphic Trends		
Events		
Full Disclosure		
OxyCRG (only available for the independent external display)		
12-Lead ECG		

22.7.2 The Event Tab

Menu Item		Default Setting	Function
Lethal	Lock	Selected	Selects what kind of events will be locked. Locked events will not be deleted.
High		Unselected	
Med			
Low			
Rename Event		On	Selects whether arrhythmia events can be renamed.

22.7.3 The Arrhy Mark Tab

From the **Arrhy Mark** page, you can define whether the compressed ECG waveform segments for arrhythmia events are marked with a specific background color.

22.8 The Print Settings

22.8.1 The Printer Tab

Menu Item		Default Setting	Description
Connection Type		Printer	Selects you want to output patient reports via the print server or a network printer.
Printer IP Address		0.0.0.0	For printer only.
Paper Size		A4	
Printer Resolution		300 dpi	
Print Server Address		/	For print server only. If the CMS is used as the printer server, set the **Port** to 6603.
Print Server IP Address		/	
Port		6603	
General Report (For print server only)	Print Action	Paper	Selects the media of the reports.
	Printer	/	Selects the default printer (for paper report only).
	Printer Resolution	/	Selects the resolution for the default printer (for paper report only).
	PDF Resolution	600 dpi	Selects the resolution for the default printer (for PDF report only).
End Case Report (For print server only)	Print Action	Paper	Selects the media of the reports.
	Printer	/	Selects the default printer (for paper report only).
	Printer Resolution	/	Selects the resolution for the default printer (for paper report only).
	PDF Resolution	600 dpi	Selects the resolution for the default printer (for PDF report only).
Print on Alarm Report (For print server only)	Print Action	Paper	Selects the media of the reports.
	Printer	/	Selects the default printer (for paper report only).
	Printer Resolution	/	Selects the resolution for the default printer (for paper report only).
	PDF Resolution	600 dpi	Selects the resolution for the default printer (for PDF report only).
Print Test Page		/	Tests whether the printer works properly.

22.8.2 The Report Layout Tab

Menu Item	Default Setting	Function
Report Layout	/	Selects the contents and location of the patient information included in non-ECG reports. **N/A**: refers to no information. Patient information configured in the Report Layout page is not applied to ECG reports.

22.8.3 The ECG Report Tab

Menu Item	Default Setting	Function
Patient Name/Age/Gender	Selected	Selects the patient information you want to display on ECG reports.
Patient ID	Selected	
Visit Number/DOB/Medication/Class/ Physician/Technician/Department/Room No/ Bed No/Race/12-Lead Order	Unselected	

22.8.4 The PDF File Name Tab

Menu Item	Default Setting	Function
PDF File Name	/	Selects the name of PDF files. **N/A**: refers to no information.

22.8.5 The Other Tab

Menu Item	Default Setting	Function
Second Mark (Printer)	On	Selects whether to show second marks on the report output by the printer.

22.9 The Unit Settings

Menu Item	Default Setting	Function
Height Unit	cm	Selects measurement unit for each parameter.
Weight Unit	kg	
ST Unit	mV	
CVP Unit	cmH2O	
ICP Unit	mmHg	
CO2 Unit	mmHg	
O2 Unit	%	
Temp Unit	°C	
Pressure Unit	mmHg	
SVR Unit	DS/cm^5	

22.10 The Time Settings

Menu Item	Default Setting	Function
Auto Daylight Saving Time	Off	**On**: auto starts the daylight saving time.

22.11 The Other Settings

Menu Item	Default Setting	Function
Barometric Pressure	760 mmHg	For the mainstream CO2 module and RM module, enter the value of barometric pressure to which the patient monitor is exposed to. Be sure to set the barometric pressure properly. Improper settings will result in erroneous measurements.
Notch Frequency	50 Hz	Selects notch filter frequency according to the power line frequency of your country.
Mouse Sensitivity	5	/
Enter Outdoor Mode	Manual	Configure the way to enter the outdoor mode: • **Manual**: Select the **Main Menu** quick key, then from the **Display** column select **Enter Outdoor Mode** to enter the outdoor mode. • **Auto**: The monitor enters the outdoor mode automatically if the strength of ambient light is greater than the threshold.
Clear CMS IP at startup	On	/
SpO_2 Tone	Mode 1	Selects the SpO_2 tone mode. The monitor adjusts the QRS tone (pitch tone) according to the SpO2 values.
Language	English	/
Parameters On/Off Config Influenced	On	Selects whether the settings of parameter switches are influenced by configuration
Parameters On/Off Protected	Off	Selects whether setting parameter switches is password protected.
Parameters On/Off	Off	Selects what parameter s can be monitored.

NOTE

- **The same SpO_2 tone mode shall be used for the same monitors in a single area.**

22.12 The Authorization Setup Settings

Section	Menu Item	Default Setting	Function
/	Retention Time	20 sec	Selects timeout period of the MLDAP password for accessing the Maintenance menu, alarm settings and arrhythmia settings. If there is no operation after the specified timeout period is reached, you need to re-enter the password.

Section	Menu Item	Default Setting	Function
Maintenance	User Maintenance	Local Password	Selects the password for accessing the monitor's **Maintenance** menu. • **Local Password**: the monitor's password for accessing the **Maintenance** menu is required. • **User Password:** the user name and password saved in the MLDAP server are required.
	Modify Local Password	/	Changes the monitor's password for accessing the **Maintenance** menu.
Others	Alarm Setup	No Password	Selects the password for changing alarm settings. • **No Password**: changing alarm settings is not password protected. • **Local Password**: changing alarm switch, alarm limit, and alarm priority is password protected. The monitor's password for changing alarm settings is required. • **User Password**: changing alarm switch, alarm limit, and alarm priority is password protected. The user name and password saved in the MLDAP server are required.
	Arrhythmia	No Password	selects the password for changing arrhythmia settings. • **No Password**: changing arrhythmia settings is not password protected. • **Local Password**: changing arrhythmia switch, alarm priority, and arrhythmia threshold is password protected. The monitor's password for changing arrhythmia settings is required. • **User Password**: changing arrhythmia switch, alarm priority, and arrhythmia threshold is password protected. The user name and password saved in the MLDAP server are required.
	Modify Local Password	/	Changes the monitor's password for accessing alarm settings and arrhythmia settings.

22.13 The Version Settings

Tab	Default Setting	Function
Version	/	Displays system software version, module hardware and software version, and firmware version.

22.14 The Battery Information Settings

Tab	Default Setting	Function
Battery 1	/	Displays battery information.
Battery 2	/	

22.15 The Scanner Settings

22.15.1 The 2D Barcode Tab (for the Mindray Custom 2D Barcode Reader)

Tab	Default Setting	Function
2D Barcode	/	Establishes the relationship between the monitor data and barcode data for selectable patient demographics. For example, the monitor has an option of **Ped** for patient category. In your hospital barcode, the text may read as **Pediatric**. You need to input **Pediatric** for the field **Ped** to establish their relationship.

22.15.2 The 1D Barcode Tab

Menu Item	Default Setting	Function
Content Fill to	Patient ID	/

22.15.3 The Scanner Info. Tab

Menu Item	Default Setting	Function
Scanner Type	2D Scanner	• **1D Scanner**: select this option when you are using a 1D scanner or a 2D scanner other than the Mindray custom 2D scanner. • **2D Scanner**: select this option when you are using the Mindray custom scanner.
Data Encoding Type	UTF8	When you set **Scanner Type** to **2D Scanner**, default settings are applied to **Data Encoding Type** and **DataParseMode**. You do not need to change these settings.
Data Parse Mode	Local	

22.15.4 The Identify Scanner Tab (for the non-Mindray Custom 2D Barcode Reader)

Tab	Default Setting	Function
Identify Scanner	/	When you are using barcode readers other than HS-1R or HS-1M, you should select the barcode reader from the USB device list, so that the monitor can identify the barcode reader. From the USB device list, select the barcode reader you are using.

22.15.5 The Field Tab (for the Mindray Custom 2D Barcode Reader)

Menu Item	Default Setting	Function
Patient ID/First Name/Last Name/Patient Category/Gender/DOB	Selected	Selects desired patient information to be output by the barcode reader.
Visit Number/Room No/Bed No/Age/ Department/Custom Field 1 - 4	Unselected	

22.16 The Network Setup Settings

22.16.1 The WLAN Tab

Menu Item		Default Setting	Function
SSID		/	/
Security		WEP OFF	Selects the security method.
Passport		/	/
WLAN Setup	WLAN Band	Auto	**Auto**: automatically identifies the WLAN band.
	Auth Server Type	ACS	Selects the type of authentication server.
	BGN Channel	All	Selects the type of B, G, and N channels.
	AN Channel	All	Selects the type of A and N channels.
Certification Management	Local	/	**Delete**: delete the selected certifications.
	USB Drive	/	Select certifications you want to import from the USB memory, and then select **Import**: import the desired certifications from the USB memory.
Network Test		/	Tests whether the wireless network is properly connected.

22.16.2 The WLAN IP Tab

Menu Item	Default Setting	Function
Obtain IP Address Automatically	On	Selects whether to enable the function of automatically getting the IP address.
Use the Following Address	Off	Select whether inputting the **IP address**, **Subnet mask**, and **Gateway** is required.
IP Address	0.0.0.0	
Subnet Mask	0.0.0.0	
Gateway	0.0.0.0	
Obtain DNS address automatically	On	Selects whether to enable the function of automatically getting the DNS address.
Using the Following DNS Address	Off	Select whether inputting the IP address of **Preferred DNS server** and **Alternate DNS server** is required.
Preferred DNS Server	0.0.0.0	
Alternate DNS Server	0.0.0.0	

22.16.3 The Central Station Setup Tab

Menu Item	Default Setting	Function
Select CMS	On	Selects whether to enable the CMS selection function for your monitor.
Add Central Station	/	Inputs the name, department, and server address of the CMS. your

22.16.4 The Device Discover Tab

Multicast helps device discovery between monitors and between monitors and CMS. Devices in the same multicast group can be mutually discovered.

Menu Item	Default Setting	Function
Multicast TTL	1	/
Multicast Address	225.0.08	
Master Server Address	/	/
Master Server IP Address	0.0.0.0	
Connected Status	Disconnected	

22.16.5 The QoS Tab

Menu Item	Default Setting	Function
QoS Level For Realime Monitoring	0	Selects the service quality of network connection for realtime monitoring, for example parameter measurements and waveforms, alarms, and so on
QoS Level For Others	0	Selects the service quality of network connection for non-realtime monitoring, for example history data, printing, and as on.

22.16.6 The ADT Tab

The ADT (admit-discharge-transfer) gateway is normally deployed in the eGateway. You can obtain patient information from the hospital ADT server through the ADT gateway.

Menu Item	Default Setting	Function
Server Address	192.168.0.100	Input the host name or IP address of the ADT gateway.
IP Address	192.168.0.100	
Port	3502	Input the port of the ADT gateway.
ADT Query	Off	Selects whether patient information can be loaded to the monitor from the ADT server.
Network Test	/	Tests whether the ADT server is properly connected.

22.16.7 The HL7 Configuration Tab

You can send the realtime data, waveforms, and alarms from the monitor to the hospital servers via HL7 protocol. This page also display the server connection status.

Section	Menu Item	Default Setting	Function
Data+Waveforms	Server Address	/	Inputs the name or IP address for the server receiving the realtime data and waveform.
	Destination IP	0.0.0.0	
	Port	0	/
	Send Data	Off	
	Data Interval	30 sec	
	Send Waveforms	Off	
	Connection Status	Disconnected	

Section	Menu Item	Default Setting	Function
Alarms	Server Address	/	Inputs the name or IP address for the server receiving the alarm data.
	Destination IP	0.0.0.0	
	Port	0	/
	Send Alarms	Off	
	Connection Status	Disconnected	

22.16.8 The Information Security Tab

Menu Item	Default Setting	Function
Encryption Connection Type	Only Private Encryption	• **Only Private Encryption**: Mindray private encryption is used to encrypt the transmitted data. You cannot connect devices supporting SSL (secure sockets layer) encryption. • **SSL Encryption Priority**: for devices supporting SSL encryption, SSL encryption is used when connecting the devices. For devices not supporting SSL encryption, private encryption is used when connecting the devices.
Broadcast Patient Demographics	On	• **On:** when viewing other patients, device location and patient information of remote devices are displayed in the remote device list. • **Off**: patient information does not display in the remote device list.

22.16.9 The MLDAP Tab

Menu Item	Default Setting	DescriptionFunction
Server Address	/	Inputs the name or IP address for the MLDAP server.
IP Address	0.0.0.0	
Port	0	/
Network Test	/	Tests whether the monitor is properly connected with the MLDAP server.

22.17 The Dock Setup Settings

After the N1 is transferred to the target location, connecting the N1 to a Dock enables N1 to use the settings of the Dock. All the settings in this section are stored in the Dock. When the N1 is disconnected from the Dock, the N1 uses its own settings and network.

22.17.1 The Setup Tab

Menu Item	Default Setting	Function
Work Mode	Dock Mode	• **Dock Mode**: the patient location settings (facility, department, room number, and bed number), printer settings, and authorization settings are from the N1. You can change these settings on **Device Location**, **Print**, or **Authorization Setup** page from the **Maintenance** menu. • **Host Mode**: the patient location settings (facility, department, room number, and bed number), printer settings, and authorization settings are from the Dock. You can change these settings on **Location**, **Print**, or **Authorization Setup** tab from the **Dock Setup** page.
Net Setting Type	Use current N1 net setting	• **Use current N1 net setting**: the IP and WLAN settings are from the N1. You can change these settings on **Network Setup** page from the **Maintenance** menu. • **Use current Dock net setting**: the IP and WLAN settings are from the Dock. You can change these settings on **IP**, or **WLAN** tab from the **Dock Setup** page.
External Display Content	Independent	• **Mirrored**: the contents of the external display is exactly the same with the monitor. • **Independent**: you can separately configure the contents and layout of the monitor and external display.

22.17.2 The Location Tab

Menu Item	Default Setting	Function
Facility	/	/
Department		
Location	Fixed	• **Fixed**: the **Patient Management** dialog displays Bed No. and Room No., but you cannot change them. • **Unfixed**: you can change Bed No. and Room No. from the **Patient Management** dialog.
Room No.	/	/
Bed No.		

22.17.3 The IP Tab

Menu Item	Default Setting	Function
Network Type	LAN 1 IP	/
Obtain IP Address Automatically	Unelected	Automatically gets the IP address.
Use the Following Address	Selected	**IP address**, **Subnet mask**, and **Gateway** are required.
IP Address	0.0.0.0	
Subnet Mask	0.0.0.0	
Gateway	0.0.0.0	
Obtain DNS address automatically	Unelected	Automatically gets the DNS address

Menu Item	Default Setting	Function
Using the Following DNS Address	Selected	IP addresses of **Preferred DNS server** and **Alternate DNS server** are required.
Preferred DNS Server	0.0.0.0	
Alternate DNS Server	0.0.0.0	

22.17.4 The WLAN Tab

Menu Item	Default Setting	Function
SSID	/	/
Security	WEP OFF	Select the security method.
Password	/	/

22.17.5 The Printer Tab

Menu Item	Default Setting	Function
Connection Type	Printer	Selects you want to output patient reports via the print server or a network printer.
Printer IP Address	0.0.0.0	For printer only.
Paper Size	A4	
Printer Resolution	300 dpi	

22.17.6 The Authorization Setup Tab

Section	Menu Item	Default Setting	Function
Maintenance	Maintenance	/	Selects the password for accessing the monitor's **Maintenance** menu. • **Local Password**: the monitor's password for accessing the **Maintenance** menu is required. • **User Password:** the user name and password saved in the MLDAP server are required.

Section	Menu Item	Default Setting	Function
Others	Alarm Setup	No Password	Selects the password for changing alarm settings. • **No Password**: changing alarm settings is not password protected. • **Local Password**: changing alarm switch, alarm limit, and alarm priority is password protected. The monitor's password for changing alarm settings is required. • **User Password**: changing alarm switch, alarm limit, and alarm priority is password protected. The user name and password saved in the MLDAP server are required.
	Arrhythmia	No Password	selects the password for changing arrhythmia settings. • **No Password**: changing arrhythmia settings is not password protected. • **Local Password**: changing arrhythmia switch, alarm priority, and arrhythmia threshold is password protected. The monitor's password for changing arrhythmia settings is required. • **User Password**: changing arrhythmia switch, alarm priority, and arrhythmia threshold is password protected. The user name and password saved in the MLDAP server are required.
	Modify Local Password	/	Changes the monitor's password for accessing alarm settings and arrhythmia settings.

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23 Battery

23.1 Battery Introduction

This monitor is designed to run on rechargeable Lithium-ion battery power when the external power is not available. The monitor can switch between battery power and the external power without interrupting patient monitoring. If both the external power and the battery power are available, the monitor uses the external power in preference to the battery power.

23.2 Battery Safety Information

WARNING

- **Keep the battery out of children's reach.**
- **Use only specified battery. Use of a different battery may present a risk of fire or explosion.**
- **Keep the battery in their original package until you are ready to use them.**
- **Do not expose the battery to liquid.**
- **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.**
- **If the battery shows signs of damage or signs of leakage, replace it immediately. Use caution in removing the battery. Avoid contacting the leakage.**
- **The battery should be charged only in this monitor.**
- **Extremely high ambient temperature may cause battery overheat protection, resulting in monitor shutdown.**
- **The lithium-ion battery has a service life. Replace your battery when it reaches the end of its service life. Failure to replace the battery may cause serious damage to your equipment from battery overheating.**
- **Do not open the battery, heat the battery above 60 °C, incinerate battery, or short battery terminals. They may ignite, explode, leak or heat up, causing personal injury.**

CAUTION

- **Remove the battery if it will not be used for an extended period of time.**

23.3 Installing the Battery

The battery must only be installed by service personnel trained and authorized by Mindray. To install the battery, contact your service personnel. The battery is installed when the monitor leaves the factory.

WARNING

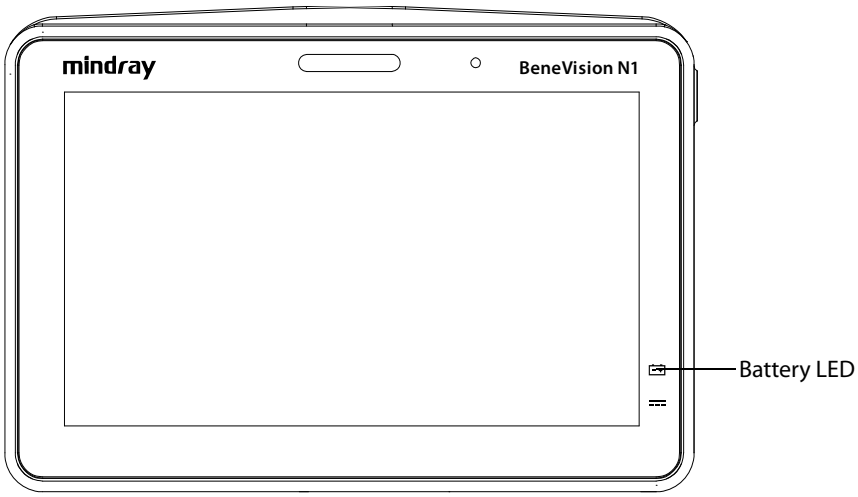
- **Lithium batteries replaced by inadequately trained personnel could result in a HAZARD (such as excessive temperatures, fire or explosion).**

23.4 Battery Indications

The battery LED, on-screen battery symbol, battery power indicator, and related alarm messages indicate the battery status.

23.4.1 Battery LED

The battery LED lies on the lower right corner of the monitor front panel.



The battery LED indications are as follows:

- Yellow: the battery is being charged.
- Green: the battery is fully charged.
- Flashing green: the monitor runs on battery power.
- Flashing yellow: the battery is malfunctioning.
- Off: no battery is installed, or the monitor is powered off and no external power is connected.

23.4.2 Battery Symbols

The on-screen power indicator indicates the battery status as follows:

-  indicates that the battery works correctly. The green portion represents the remaining charge.
-  indicates that the battery power is low and needs to be charged.
-  indicates that the battery is almost depleted and needs to be charged immediately. Otherwise, the monitor will soon automatically shut down.
-  indicates that the battery is being charged.
-  indicates that no battery is installed.
-  indicates the battery fault, battery communication fault, or battery charging fault. Contact service personnel for help.

23.4.3 Battery Power Indicator

Battery power indicator displays the remaining battery power.

23.4.4 Battery-related Alarms

The capacity of the battery is limited. When the battery is low, the monitor presents the **Low Battery** alarm, the alarm lamp flashes, and the monitor produces an alarm sound.

If the battery is almost depleted, the monitor presents the **Critically Low Battery** alarm. In this case, immediately connect the external the monitor and charge the battery. Otherwise, the monitor will automatically shut down soon.

If the battery has been used for a prolonged period of time, the battery will be aged and its runtime may be significantly less than the specification. If the battery is aged, the **Battery Service Required** alarm is presented each time the monitor is turned on, indicating that the battery reaches its lifetime.

For more information on battery-related alarms, see *D Alarm Messages*.

23.5 Charging the Battery

To optimize performance, a fully (or nearly fully) discharged battery should be charged as soon as possible. The battery can be charged in any of the following methods:

- Method 1: the monitor is connected to the AC adapter or Dock.
- Method 2: the monitor is in use with the host monitor.
- Method 3: the monitor is in use with the Transport Dock.

For method 1 and method 3, the battery is charged in regardless of whether or not the monitor is currently turned on.

23.6 Maintaining the Battery

23.6.1 Conditioning the Battery

The performance of the battery deteriorates over time. You should condition the battery every two months.

To condition a battery, follow this procedure:

1. Disconnect the monitor from the patient and stop all monitoring and measuring procedures.
2. Turn off the monitor, and connect the monitor to the external power source.
3. Allow the battery to be charged uninterruptedly till it is fully charged.
4. Disconnect the monitor from the external power source, and turn on the monitor.
5. Allow the monitor to run on the battery until the battery is completely depleted and the monitor automatically shuts down.
6. Fully charge the battery again for use or charge it to 40 – 60% for storage.

NOTE

- **If the battery is not conditioned for a prolonged time, its charge indication may not be accurate and you may wrongly evaluate the remaining battery runtime.**
- **Do not use the monitor to monitor the patient during battery conditioning.**
- **Do not interrupt battery conditioning.**

23.6.2 Checking Battery Performance

Life expectancy of a battery depends on how frequent and how long it is used. When properly used, the lithium-ion battery has a useful life of approximately two years. If improperly used, its life expectancy can be shorten. We recommend replacing lithium-ion battery every two years.

The performance of a rechargeable battery deteriorates over time. You should check the battery performance every two months or if you doubt that the battery may fail.

See steps 1 to 5 of *23.6.1 Conditioning the Battery* to check battery performance. The operating time of the battery reflects their performance directly. If the operating time of a battery is noticeably shorter than that stated in the specifications, the battery may reach its service life or malfunction.If the battery performance meets the requirement, fully charge the battery again for use or charge it to 40 – 60% for storage.

NOTE

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

23.7 Storing the Battery

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

Condition the stored battery every three months. For more information, see *23.6.1 Conditioning the Battery*.

NOTE

- **Remove the battery from the equipment if the equipment is not used for a prolonged time (for example, several weeks). Otherwise the battery may overdischarge.**
- **Storing the battery at high temperature for an extended period of time will significantly shorten their life expectancy.**
- **Storing the battery in a cool place can slow the aging process. Ideally the battery should be stored at 15 °C.**

23.8 Recycling the Battery

Discard a battery in the following situations:

- The battery has visual signs of damage.
- The battery fails.
- The battery is aged and its runtime significantly less than the specification.
- The battery has been used for more than it service time.

Properly dispose of the battery according to local regulations.

WARNING

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

24 Care and Cleaning

24.1 Care and Cleaning Introduction

In this chapter we only describe cleaning and disinfection of the monitor, parameter modules, Modular Rack, Dock, folding hook, monitor handle, bedrail hook and certain accessories. For the cleaning and disinfection of the Transport Dock and other reusable parameter accessories, refer to their instructions for use.

24.2 Care and Cleaning Safety Information

WARNING

- **Use only Mindray approved cleaners, disinfectants and methods listed in this chapter to clean or disinfect your equipment or accessories. Warranty does not cover damage caused by unapproved substances or methods.**
- **Do not mix disinfecting solutions, as hazardous gases may result.**
- **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.**
- **Be sure to turn off the system and disconnect all power cables from the outlets before cleaning the equipment.**
- **The responsible hospital or institution shall carry out all cleaning and disinfection procedures specified in this chapter.**

CAUTION

- **Never immerse any part of the equipment or accessories in liquids or allow liquid to enter the interior.**
- **Any contact of cleaners or disinfectants with connectors or metal parts may cause corrosion.**
- **Do not pour or spray any liquid directly on the equipment or accessories or permit fluid to seep into connections or openings.**
- **If you spill liquid on the equipment or accessories, disconnect the power supply, dry the equipment, and contact your service personnel.**
- **Never use abrasive materials (such as steel wool or silver polish), or erosive cleaners (such as acetone or acetone-based cleaners).**
- **Dilute and use the cleaners or disinfectants according to the manufacturer's instructions.**
- **Check the equipment after cleaning and disinfecting. If there is any sign of damage, remove it from use.**

24.3 Cleaning the Equipment and Mounting Kits

Clean the monitor, parameter modules, Modular Rack, Dock, folding hook, monitor handle, and bedrail hook on a regular basis. Before cleaning, consult your hospital's regulations.

To clean these equipment and mounting kits, follow this procedure:

1. Dampen a soft lint-free cloth with water or ethanol (70%).
2. Wring excess liquid from the cloth.
3. Wipe the display screen of the monitor.
4. Wipe the external surface of the equipment or mounting kits with the damp cloth, avoiding the connectors and metal parts.

5. Dry the surface with a clean cloth. Allow the equipment and mounting kits air dry in a ventilated and cool place.

CAUTION

- **During the cleaning procedure, disable the touch operation by switching off the monitor or locking the touchscreen.**
- **Any contact of cleaners or disinfectants with connectors or metal parts may cause corrosion.**

24.4 Disinfecting the Equipment and Mounting Kits

Disinfect the monitor, parameter modules, Modular Rack, Dock, folding hook, monitor handle, and bedrail hook as required in your hospital's servicing schedule. Cleaning the equipment and mounting kits before disinfecting is recommended. Always dilute and use disinfectants according to the manufacturer's instructions. The following table lists approved disinfectants:

Product Name	Product Type	Manufacturer
Alpet® D2 Surface Sanitizing Wipes	Wipes	BEST SANITIZERS INC™.
CIDEX® OPA	Liquid	Gilag GmbH International Advanced Sterilization products
Clorox Dispatch® Hospital Cleaner Disinfectant Towels with Bleach	Wipes	Clorox professional products company
Clorox Healthcare® Bleach Germicidal Wipes	Wipes	Clorox professional products company
Clorox Healthcare® Hydrogen Peroxide Cleaner Disinfectant Wipes	Wipes	Clorox professional products company
Diversey Oxivir® TB Wipes	Wipes	Diversey Inc
Metrex CaviCide1™	Liquid, spray	METERX® RESEARCH
Metrex CaviWipes™	Wipes	METERX® RESEARCH
PDI Sani-Cloth® AF3 Germicidal Disposable Wipe	Wipes	PDI Inc.
PDI Sani-Cloth® Bleach Germicidal Disposable Wipe	Wipes	PDI Inc.
PDI Sani-Cloth® HB Germicidal Disposable Wipe	Wipes	PDI Inc.
PDI Sani-Cloth® Plus Germicidal Disposable Cloth	Wipes	PDI Inc.
PDI Super Sani-Cloth® Germicidal Disposable Wipe	Wipes	PDI Inc.
VIRAGUARD® Hospital Surface Disinfectant Towelettle	Wipes	VERIDIEN corporation
Virex® II 256 (1:256)	Liquid	Diversey Inc
Virex® TB	Liquid, spray	Diversey Inc
JIAN ZHI SU Disinfectant Tablets	Tablet	Beijing ChangJiangMai Medical Science Technology Co. Ltd
JIAN ZHI SU Surface Disinfectant Spray	Liquid, spray	Beijing ChangJiangMai Medical Science Technology Co. Ltd

Product Name	Product Type	Manufacturer
JIAN ZHI SU Disinfectant, Double-chain Quaternary Ammonium	Liquid	Beijing ChangJiangMai Medical Science Technology Co. Ltd
DIAN'ERKANG Surface Wipes	Wipes	Shanghai Likang Disinfectant Hi-Tech Co., Ltd
DIAN'ERKANG Surface Disinfectant	Liquid	Shanghai Likang Disinfectant Hi-Tech Co., Ltd
DIAN'ERKANG Disinfectant Spray	Liquid, spray	Shanghai Likang Disinfectant Hi-Tech Co., Ltd
Clinell® Universal Wipes	Wipes	GAMA Healthcare Ltd
Clinell ® Sporicidal Wipes	Wipes	GAMA Healthcare Ltd
Tristel Duo™	Liquid, foam	Tristel solutions Limited
Tristel Jet	Liquid, spray	Tristel solutions Limited
Tristel Fuse For Surfaces, 196ppm	Liquid	Tristel solutions Limited
Surfanios Premium, 0.25%	Liquid	ANIOS LABORATORIES
Surfa 'safe	Liquid, spray	ANIOS LABORATORIES
Wip' Anios premium	Wipes	ANIOS LABORATORIES
Aniosurf ND premium, 0.25%	Liquid	ANIOS LABORATORIES
Mikrobac® Tissues	Wipes	BODE Chemie GmbH
Cleanisept® Wipes	Wipes	Dr. Schumacher GmbH
mikrozid® PAA Wipes	Wipes	Schülke & Mayr GmbH
mikrozid® Sensitive Wipes	Wipes	Schülke & Mayr GmbH
Ecolab Incidin® OxyWipe S	Wipes	Ecolab Deutschland GmbH
Glutaraldehyde, 2%	Liquid	/
*Ethanol, 70%	Liquid	/
*Isopropanol, 70%	Liquid	/
*Sodium hypochlorite bleach, 0.5%	Liquid	/
*Hydrogen peroxide, 3%	Liquid	/
*Rely+On™ Virkon® High Level surface Disinfectant, 1%	Powder	Antec International Ltd
*1-Propanol, 50%	Liquid	/
*Descosept® forte	Liquid	Dr. Schumacher GmbH
*Descosept® AF	Liquid	Dr. Schumacher GmbH
*Dismozon® plus, 0.4%	Powder	BODE Chemie GmbH
*mikrozid® AF Wipes	Wipes	Schülke & Mayr GmbH

Product Name	Product Type	Manufacturer
*Terralin® Liquid	Liquid	Schülke & Mayr GmbH
*Perform® Classic Concentrate OXY, 0.5%	Powder	Schülke & Mayr GmbH

NOTE

- **For equipment with the symbol , all the listed cleaners and disinfectants are available for use. For equipment without the symbol , only the cleaners and disinfectants marked with "*" are available for use.**

24.5 Cleaning and Disinfecting the Accessories

For the NIBP air hose, Mindray SpO_2 cable, and Nellcor SpO_2 cable, you should clean and disinfect them using the cleaners and disinfectants and methods listed in this section. For other accessories, you should consult the instructions delivered with the accessories.

CAUTION

- **Fluids entering the NIBP air hose can damage the equipment. When cleaning or disinfecting the NIBP air hose, prevent liquid from entering the hose.**
- **Periodically inspect the NIBP air hose and connector for signs of wear or deterioration after cleaning or disinfecting the NIBP air hose. Replace the NIBP air hose if you detect a leak. Dispose of damaged NIBP air hose according to local laws for disposal of hospital waster.**
- **Never immerse or soak the accessories in any liquid.**
- **Never clean or disinfect the connectors and metal parts.**
- **Use only Mindray approved cleaners and disinfectants and methods listed in this section to clean or disinfect the accessories. Warranty does not cover damage caused by unapproved substances or methods.**
- **To avoid long term damage, the accessories should be disinfected only when necessary as determined by your hospital's policy.**

24.5.1 Cleaning the Accessories

You should clean the accessories (NIBP air hose, Mindray SpO_2 cable, and Nellcor SpO_2 cable) on a regular basis. Before cleaning the accessories, consult your hospital's regulations for cleaning the accessories.

To clean the accessories (NIBP air hose, Mindray SpO_2 cable, and Nellcor SpO_2 cable), follow this procedure:

1. Clean the accessories with a soft cloth moistened with water or ethanol (70%).
2. Wipe off all the cleaner residue with a dry cloth.
3. Allow the accessories to air dry.

24.5.2 Disinfecting the Accessories

We recommend that the accessories (NIBP air hose, Mindray SpO_2 cable, and Nellcor SpO_2 cable) should be disinfected only when necessary as determined by your hospital's policy. Cleaning the accessories before disinfecting is recommended.

24.5.2.1 Disinfectants for the NIBP Air Hose

The following table lists approved disinfectants for the NIBP air hoses:

Product Name	Product Type	Manufacturer
Alpet® D2 Surface Sanitizing Wipes	Wipes	BEST SANITIZERS INC™.
CIDEX® OPA	Liquid	Gilag GmbH International Advanced Sterilization products
Clorox Dispatch® Hospital Cleaner Disinfectant Towels with Bleach	Wipes	Clorox professional products company
Metrex CaviCide1™	Liquid, spray	METERX® RESEARCH
Metrex CaviWipes™	Wipes	METERX® RESEARCH
PDI Sani-Cloth® AF3 Germicidal Disposable Wipe	Wipes	PDI Inc.
PDI Sani-Cloth® Plus Germicidal Disposable Wipe	Wipes	PDI Inc.
PDI Super Sani-Cloth® Germicidal Disposable Wipe	Wipes	PDI Inc.
VIRAGUARD® Hospital Surface Disinfectant Towelettle	Wipes	VERIDIEN corporation
Virex® TB	Liquid, spray	Diversey Inc
Clinell® Universal Wipes	Wipes	GAMA Healthcare Ltd
Surfa 'safe	Liquid, spray	ANIOS LABORATORIES
Aniosurf ND premium, 0.25%	Liquid	ANIOS LABORATORIES
mikrozid® Tissues	Wipes	Schülke & Mayr GmbH
Glutaraldehyde, 2%	Liquid	/
Ethanol, 70%	Liquid	/
Isopropanol, 70%	Liquid	/
Rely+On™ Virkon® High Level surface Disinfectant, 1%	Powder	Antec International Ltd
1-Propanol, 50%	Liquid	/

24.5.2.2 Disinfectants for the SpO_2 Cable

The following table lists approved disinfectants for the Mindray and Nellcor SpO_2 cables:

Product Name	Product Type	Manufacturer
CIDEX® OPA	Liquid	Gilag GmbH International Advanced Sterilization products
Clorox Dispatch® Hospital Cleaner Disinfectant Towels with Bleach	Wipes	Clorox professional products company
Clorox Healthcare® Bleach Germicidal Wipes	Wipes	Clorox professional products company

Product Name	Product Type	Manufacturer
Clorox Healthcare® Hydrogen Peroxide Cleaner Disinfectant Wipes	Wipes	Clorox professional products company
Diversey Oxivir® TB Wipes	Wipes	Diversey Inc
PDI Super Sani-Cloth® Germicidal Disposable Wipe	Wipes	PDI Inc.
VIRAGUARD® Hospital Surface Disinfectant Towelettle	Wipes	VERIDIEN corporation
Virex® TB	Liquid, spray	Diversey Inc
Glutaraldehyde, 2%	Liquid	/
Ethanol, 70%	Liquid	/
Isopropanol, 70%	Liquid	/
Sodium hypochlorite bleach, 0.5%	Liquid	/
Hydrogen peroxide, 3%	Liquid	/
Rely+On™ Virkon® High Level surface Disinfectant, 1%	Powder	Antec International Ltd
1-Propanol, 50%	Liquid	/

The following table lists approved Masimo SpO_2 cable cleaning and disinfecting agents:

Product Name	Product Type	Active Ingredients
Isopropanol	Liquid	Isopropanol 70%

24.6 Sterilization

Sterilization is not recommended for this monitor, related products, accessories, or supplies unless otherwise indicated in the Instructions for Use that accompany the products, accessories or supplies.

24.7 Impact of Improper Cleaning

Using cleaners other than those recommended may have the following impact:

- Product discoloration
- Metal part corrosion
- Brittle and breaking wires, connectors, and equipment housing
- Reduced cable and leadwire life
- Overall system performance degradation
- Equipment malfunction or failure

25 Maintenance

25.1 Maintenance Introduction

Regular maintenance is essential to ensure that the equipment functions properly. This chapter contains information on periodic testing and maintenance.

25.2 Maintenance Safety Information

WARNING

- **To avoid electric shock, stop using N1 if you find the housing of N1 has signs of broken. Contact the service personnel for help in that case.**
- **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.**
- **No modification of this equipment is allowed.**
- **This equipment contains no user serviceable parts.**
- **The safety checks or maintenance involving any disassembly of the equipment should be performed by professional service personnel. Otherwise, undue equipment failure and possible health hazards could result.**
- **Do not open batteries, heat batteries to above 60 °C, incinerate batteries, or short the battery terminals. Batteries may ignite, explode, leak or heat up, causing personal injury.**
- **The service personnel must be properly qualified and thoroughly familiar with the operation of the equipment.**

CAUTION

- **The equipment and accessories shall not be served or maintained while in use with a patient.**
- **If you discover a problem with any of the equipment, contact your service personnel or Mindray.**
- **Use and store the equipment within the specified temperature, humidity, and altitude ranges.**
- **When disposing of the packaging material, be sure to observe the applicable waste control regulations and keep it out of children's reach.**
- **At the end of its service life, the equipment, as well as its accessories, must be disposed of in compliance with the guidelines regulating the disposal of such products. If you have any questions concerning disposal of the equipment, please contact Mindray.**

NOTE

- **If needed, contact the manufacture for circuit diagrams, component part lists, descriptions, calibration instructions, or other information concerning the repair of the equipment.**

25.3 Maintenance and Testing Schedule

Follow the maintenance and testing schedule or local regulations to perform testing and maintenance. Make sure to clean and disinfect the equipment before taking any tests and maintenance

The following table lists the maintenance and testing schedule:

Test/Maintenance Item		Recommended Frequency
Performance Tests		
Visual inspection		Every day, before first use.
Measurement module performance test and calibration		1. If you suspect that the measurement values are incorrect. 2. Follow any repairs or replacement of relevant module. 3. Once a year for CO_2 tests. 4. Once every two years for other parameter module performance tests.
Analog output test		If you suspect that the analog output function does not work properly.
Defibrillation synchronization test		If you suspect that the defibrillation synchronization function does not work properly.
Electrical Safety Tests		
Electrical safety tests		Once every two years.
Other Tests		
Power-on test		Before use.
Network printer tests		1. When first installed. 2.Followany repair or replacement of the printer.
Battery check	Functionality test	1. When first installed. 2. When battery is replaced.
	Performance test	Every three months or if the battery runtime reduced significantly.

25.4 Checking Version Information

You may be asked for information on monitor and module version.

To view system software version information, select the **Main Menu** quick key →from the **System** column select **Version**.

You can also view more version information by following this procedure

1. Select the **Main Menu** quick key → from the **System** column select **Maintenance** → input the required password → select ↵.
2. Select the **Version** tab.

You can check system software version, module hardware and software version, and firmware version.

25.5 Testing Methods and Procedures

Except the following maintenance tasks, all other test and maintenance tasks should be performed by Mindray-qualified service personnel only.

- Regular check, including visual inspection and power-on test
- Printer tests
- Battery check

If your monitor needs a safety test and performance test, contact the service personnel.

25.5.1 Performing Visual Inspection

Visually inspect the equipment before its first used every day. If you find any signs of damage, remove your monitor from use and contact the service personnel.

Verify that the equipment meets the following requirements:

- Environment and power supply specifications are met.
- The monitor housing and display screen are free from cracks or other damages
- The power cord is not damaged and the insulation is in good condition.
- Connectors, plugs, and cables are not damaged and kinked.
- Power cord and patient cables are securely connected with the equipment and modules.

25.5.2 Performing Power-on Test

The monitor automatically performs a selftest at startup. Check the following items for the power-on test:

- The equipment powers on properly.
- The alarm system works properly.
- The monitor displays properly.

25.5.3 Testing the Network Printer

To check the printer, follow this procedure:

1. Start a printing task to print waveforms and reports.
2. Check that the printer is properly connected and functions correctly.
3. Check that the printout is clear without missing dots.

25.5.4 Checking the Battery

For information on battery check, see *23.6.2 Checking Battery Performance*.

25.6 Disposing of the Monitor

Dispose of the monitor and its accessories when its service life is reached. Follow local regulations regarding the disposal of such product.

WARNING

- **For disposal of parts and accessories, where not otherwise specified, follow local regulations regarding disposal of hospital waste.**

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26 Accessories

The accessories listed in this chapter comply with the requirements of IEC 60601-1-2 when in use with the patient monitor. The accessory material that contacts the patients has undertaken the bio-compatibility test and is verified to be in compliance with ISO 10993-1. For details about the accessories, refer to the instructions for use provided with the accessory.

WARNING

- **Use accessories specified in this chapter. Using other accessories may cause damage to the 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

- **The accessories may not meet the performance specifications if stored or used outside the specified temperature and humidity ranges. If accessory performance is degraded due to aging or environmental conditions, contact your service personnel.**
- **Check the accessories and their packages for any sign of damage. Do not use them if any damage is detected.**
- **Use the accessories before the expiry date if their expiry date is indicated.**
- **The disposable accessories shall be disposed of according to hospital's regulations.**

26.1 ECG Accessories

26.1.1 ECG Electrodes

Model	PN	Description	Applicable patient
31499224	0010-10-12304	Electrode, Kendall, 10 pcs/package	Adult
2245-50	9000-10-07469	Electrode 3M, 50 pcs/package	Pediatric
H124SG	900E-10-04880	Electrode, Kendall, 50 pcs/package	Neonate
SF06	040-002711-00	Electrode, 5 pcs/package	Adult
SF07	040-002833-00	Electrode, Intco	Pediatric, neonate
1050NPSMKittycat	0681-00-0098-01	NEO Pre-wired Electrode radio Opaque	Neonate
1051NPSMKittycat	0681-00-0098-02	NEO Pre-wired Electrode radio Transluent	Neonate

26.1.2 12-Pin Trunk Cables

Model	PN	Description	Applicable patient
EV6201	0010-30-42719	12Pin 3/5-Lead ECG Host Cable,Def-P	Adult, pediatric
EV6201	009-004728-00	12Pin 3/5-Lead ECG Host Cable,Def-P	Adult, pediatric
EV6202	0010-30-42720	ECG cable,12-pin, 3-lead, defibrillation-proof, AHA/IEC	Neonate, infant

Model	PN	Description	Applicable patient
EV6203	0010-30-42721	ECG cable, 12-lead, defibrillation-proof, AHA	Adult
EV6204	0010-30-42722	ECG cable, 12-lead, defibrillation-proof, IEC	Adult
EV6211	0010-30-42723	ECG cable, 12-pin, 3/5-lead, ESU-proof, AHA/IEC	Adult, pediatric
EV6212	0010-30-42724	ECG cable, 12-pin, 3-lead, ESU-proof, AHA/IEC	Neonate, infant
EV6222	040-000754-00	ECG cable, 12-pin, 3-lead, defibrillation-proof, DIN connector	Neonate
EV6206	009-005266-00	ECG cable, defibrillation-proof, 3.1 m, T/N series	Adult, pediatric
EV6216	009-005268-00	ECG cable, ESU-proof, 3.1 m, T/N series	Adult, pediatric
EV6205	040-001416-00	12Pin 3/5-Lead ECG Host Cable,Def-P(DS)	Adult, pediatric
EV6213	009-003652-00	12Pin 3/5-Lead ECG Host Cable,ESU-P(DS)	Adult, pediatric

26.1.3 3-lead ECG Leadwires

Model	PN	Description	Length	Applicable patient
EL6305A	0010-30-42896	ECG leadwires, 3-lead, AHA, clip, long	1 m	Neonate, infant
EL6306A	0010-30-42897	ECG leadwires, 3-lead, IEC, clip, long	1 m	Neonate, infant
EL6303A	0010-30-42731	ECG leadwires, 3-lead, AHA, clip, long	1 m	Adult, pediatric
EL6304A	0010-30-42732	ECG leadwires, 3-lead, IEC, clip, long	1 m	Adult, pediatric
EL6301B	0010-30-42734	ECG leadwires, 3-lead, AHA, snap, long	1 m	Adult, pediatric
EL6302B	0010-30-42733	ECG leadwires, 3-lead, IEC, snap, long	1 m	Adult, pediatric
EL6311B	040-000146-00	ECG leadwires, 3-lead, AHA, snap, long, disposable	1 m	Neonate, infant
EL6312B	040-000147-00	ECG leadwires, 3-lead, IEC, snap, long, disposable	1 m	Neonate, infant
EL6311A	040-000148-00	ECG leadwires, 3-lead, AHA, snap, long, disposable	1 m	Neonate, infant
EL6312A	040-000149-00	ECG leadwires, 3-lead, IEC, snap, long, disposable	1 m	Neonate, infant

26.1.4 5-lead ECG Leadwires

Model	PN	Description	Length	Applicable patient
EL6503A	0010-30-42729	ECG leadwires, 5-lead, AHA, clip, long	1m to 1.4m	Adult, pediatric
EL6504A	0010-30-42730	ECG leadwires, 5-lead, IEC, clip, long	1m to 1.4m	Adult, pediatric
EL6501B	0010-30-42735	ECG leadwires, 5-Lead, AHA, snap	1m to 1.4m	Adult, pediatric
EL6501B	009-004729-00	ECG leadwires, 5-Lead, AHA, snap	1m to 1.4m	Adult, pediatric
EL6502B	0010-30-42736	ECG leadwires, 5-Lead,IEC, snap	1m to 1.4m	Adult, pediatric
EL6502B	009-004730-00	ECG leadwires, 5-Lead, IEC, snap	1m to 1.4m	Adult, pediatric

26.1.5 6-lead ECG Leadwires

Model	PN	Description	Length	Applicable patient
EY6601B	009-004794-00	ECG leadwires, 6-lead, AHA, snap, 24 inch	24 inch	Adult, pediatric
EY6602B	009-004795-00	ECG leadwires, 6-lead, AHA, snap, 36 inch	36 inch	Adult, pediatric
EY6603B	009-004796-00	ECG leadwires, 6-lead, IEC, snap, 24 inch	24 inch	Adult, pediatric
EY6604B	009-004797-00	ECG leadwires, 6-lead, IEC, snap, 36 inch	36 inch	Adult, pediatric
EY6601A	009-004798-00	ECG leadwires, 6-lead, AHA, clip, 24 inch	24 inch	Adult, pediatric
EY6602A	009-004799-00	ECG leadwires, 6-lead, AHA, clip, 36 inch	36 inch	Adult, pediatric
EY6603A	009-004800-00	ECG leadwires, 6-lead, IEC, clip, 24 inch	24 inch	Adult, pediatric
EY6604A	009-004801-00	ECG leadwires, 6-lead, IEC, clip, 36 inch	36 inch	Adult, pediatric

26.1.6 12-lead ECG Leadwires

Model	PN	Description	Length	Applicable patient
EL6801A	0010-30-42902	ECG leadwires, 12-lead, limb lead, AHA, clip	0.8 m	Adult
EL6803A	0010-30-42904	ECG leadwires, 12-lead, chest lead, AHA, clip	0.6 m	Adult
EL6802A	0010-30-42903	ECG leadwires, 12-lead, limb lead, IEC, clip	0.8 m	Adult
EL6804A	0010-30-42905	ECG leadwires, 12-lead, chest lead, IEC, clip	0.6 m	Adult
EL6801B	0010-30-42906	ECG leadwires, 12-lead, limb lead, AHA, snap	0.8 m	Adult
EL6803B	0010-30-42908	ECG leadwires, 12-lead, chest lead, AHA, snap	0.6 m	Adult
EL6802B	0010-30-42907	ECG leadwires, 12-lead, limb lead, IEC, snap	0.8 m	Adult
EL6804B	0010-30-42909	ECG leadwires, 12-lead, chest lead, IEC, snap	0.6 m	Adult

26.2 SpO_2 Accessories

Wavelength emitted by the sensors is between 600 nm and 1000 nm. The maximum photic output consumption of the sensor is less than 18 mW.

The information about the wavelength range and maximum photic output consumption can be especially useful to clinicians, for example, when photodynamic therapy is performed.

26.2.1 Extension Cables

Model	Part No.	Description	Applicable patient
562A	0010-20-42710	7-pin, Mindray	All
562A	009-004600-00	7-pin, Mindray	All

Model	Part No.	Description	Applicable patient
572A	0010-20-42712	8-pin, Nellcor	All
582A	040-000332-00	8-pin, Masimo	All

Note: If you need to purchase Masimo sensors, please contact Masimo.

26.2.2 Mindray SpO_2 Sensors

Model	PN	Description	Applicable patient	Application site
512F	512F-30-28263	Reusable SpO_2 sensor	Adult	Finger
512H	512H-30-79061	Reusable SpO_2 sensor	Pediatric	Finger
512E	512E-30-90390	Reusable SpO_2 sensor	Adult	Finger
512G	512G-30-90607	Reusable SpO_2 sensor	Pediatric	Finger
518B	518B-30-72107	Reusable SpO_2 sensor	Neonate	Foot
520A	009-005087-00	Disposable SpO_2 sensor	Adult	Finger
520P	009-005088-00	Disposable SpO_2 sensor	Pediatric	Finger
520I	009-005089-00	Disposable SpO_2 sensor	Infant	Toe
520N	009-005090-00	Disposable SpO_2 sensor	Neonate	Foot
521A	009-005091-00	Disposable SpO_2 sensor	Adult	Finger
521P	009-005092-00	Disposable SpO_2 sensor	Pediatric	Finger
521I	009-005093-00	Disposable SpO_2 sensor	Infant	Toe
521N	009-005094-00	Disposable SpO_2 sensor	Neonate	Foot
513A	115-033848-00	Reusable SpO_2 sensor	Adult, pediatric	Ear
518C	040-000407-00	Reusable SpO_2 sensor	Neonate	Foot
518C	115-004895-00	Disposable bandage, for reusable SpO_2 sensor	Neonate	/

26.2.3 Nellcor SpO_2 Sensors

Model	PN	Description	Applicable patient	Application site
DS100A	9000-10-05161	Reusable SpO_2 sensor	Adult	Finger
OXI-P/I	9000-10-07308	Reusable SpO_2 sensor	Pediatric, infant	Finger
OXI-A/N	9000-10-07336	Reusable SpO_2 sensor	Adult, neonate	Finger, foot
MAXAI	0010-10-12202	Disposable SpO_2 sensor	Adult (>30 kg)	Finger
MAXPI	0010-10-12203	Disposable SpO_2 sensor	Pediatric (10 - 50Kg)	Finger
MAXII	0010-10-12204	Disposable SpO_2 sensor	Infant (3 - 20Kg)	Toe
MAXNI	0010-10-12205	Disposable SpO_2 sensor	Neonate (<3 kg), adult (>40 kg)	Foot Finger

26.3 Temp Accessories

26.3.1 Temp Cable

Model	Part No.	Description	Applicable patient
MR420B	040-001235-00	2-pin extension cable	All

26.3.2 Temp Probes

Model	Part No.	Description	Applicable patient
MR401B	0011-30-37392	Reusable temperature probe, esophageal	Adult
MR402B	0011-30-37394	Reusable temperature probe, esophageal	Pediatric, infant
MR403B	0011-30-37393	Reusable temperature probe, skin	Adult
MR404B	0011-30-37395	Reusable temperature probe, skin	Pediatric, infant
MR411	040-003292-00	Disposable temperature probe, esophageal/rectal, general	Adult, pediatric
MR412	040-003293-00	Disposable temperature probe, skin	Adult, pediatric, neonate

26.4 NIBP Accessories

26.4.1 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

26.4.2 Cuffs

Model	Part No.	Description	Limb Circumference (cm)	Bladder Width (cm)	Applicable patient
CM1200	115-002480-00	Reusable cuff	7 - 13	3.8	Small infant
CM1201	0010-30-12157	Reusable cuff	10 - 19	7.2	Infant
CM1202	0010-30-12158	Reusable cuff	18 - 26	9.8	Pediatric
CM1203	0010-30-12159	Reusable cuff	25 - 35	13.1	Adult
CM1204	0010-30-12160	Reusable cuff	33 - 47	16.5	Large adult
CM1205	0010-30-12161	Reusable cuff	46 - 66	20.5	Adult thigh
CM1300	040-000968-00	Reusable cuff, bladderless	7 - 13	3.8	Small infant
CM1301	040-000973-00	Reusable cuff, bladderless	10 - 19	7.2	Infant

Model	Part No.	Description	Limb Circumference (cm)	Bladder Width (cm)	Applicable patient
CM1302	040-000978-00	Reusable cuff, bladderless	18 - 26	9.8	Pediatric
CM1303	040-000983-00	Reusable cuff, bladderless	24 - 35	13.1	Adult
CM1304	040-000988-00	Reusable cuff, bladderless	33 - 47	16.5	Large adult
CM1305	040-000993-00	Reusable cuff, bladderless	46 - 66	20.5	Adult thigh
CM1306	115-015930-00	Reusable cuff, bladderless	24 - 35	13.1	Adult
CM1307	115-015931-00	Reusable cuff, bladderless	33 - 47	16.5	Large adult
CM1501	001B-30-70697	NIBP cuff, single patient use, 10 pcs/box	10 to 19	7.2	Infant
CM1502	001B-30-70698	NIBP cuff, single patient use, 10 pcs/box	18 to 26	9.8	Pediatric
CM1503	001B-30-70699	NIBP cuff, single patient use, 10 pcs/box	25 to 35	13.1	Adult
CM1504	001B-30-70700	NIBP cuff, single patient use, 10 pcs/box	33 to 47	16.5	Adult
CM1505	001B-30-70701	NIBP cuff, single patient use, 10 pcs/box	46 to 66	20.5	Adult thigh
CM1506	115-016969-00	NIBP cuff, single patient use, 10 pcs/box	25 to 35	13.1	Adult
CM1507	115-016970-00	NIBP cuff, single patient use, 10 pcs/box	33 to 47	16.5	Adult
CM1500A	001B-30-70692	NIBP cuff, single patient use, size 1, 20 pcs/box	3.1 to 5.7	2.2	Neonate
CM1500B	001B-30-70693	NIBP cuff, single patient use, size 2, 20 pcs/box	4.3 to 8.0	2.9	Neonate
CM1500C	001B-30-70694	NIBP cuff, single patient use, size 3, 20 pcs/box	5.8 to 10.9	3.8	Neonate
CM1500D	001B-30-70695	NIBP cuff, single patient use, size 4, 20 pcs/box	7.1 to 13.1	4.8	Neonate
CM1500E	001B-30-70696	NIBP cuff, single patient use, size 5, 20 pcs/box	8 to 15	5.4	Neonate

26.5 IBP Accessories

26.5.1 IBP Accessories

Model	Part No.	Description	Applicable patient
IM2202	001C-30-70757	12-pin IBP cable, Argon	All
DT-4812	6000-10-02107	IBP transducer, disposable, Argon	Adult, pediatric, neonate
682275	0010-10-12156	Transducer/Manifold Mount, Argon	All
IM2201	001C-30-70759	12 Pin IBP cable, ICU Medical	All

Model	Part No.	Description	Applicable patient
42584	0010-10-42638	IBP transducer, disposable, ICU Medical	Adult, pediatric, neonate
42602	M90-000133---	Steady Rest for IBP Transducer and Clamp, ICU Medical	All
42394	M90-000134---	Steady Rest for IBP Transducer and Clamp, ICU Medical	All
IM2211	0010-21-12179	12 Pin IBP cable, for Edwards, reusable	Adult, pediatric, neonate
IM2206	115-017849-00	12 Pin IBP cable, for Utah, reusable	Adult, pediatric, neonate
IM2207	0010-21-43082	12 Pin IBP Cable, for Memscap,SP844 82031 transducer, reusable	Adult, pediatric, neonate
IM2213	0010-30-43055	IBP adapter cable (12-pin to 6-pin), reusable	All
IM2204	040-001029-00	IBP extended cable with dual-receptacle, reusable	All

26.5.2 ICP Accessories

Model	Part No.	Description	Applicable patient
82-6653	040-002336-00	ICP sensor kit, disposable	/
CP12601	009-005460-00	12-pin ICP cable	/

26.6 PiCCO Accessories

Model	Part No.	Description	Applicable patient
CO7701	040-000816-00	12-pin PiCCO cable	/
PC80105	040-000817-00	2Pin TI sensor cable	/
PV2015L20N	040-000921-00	Arterial thermodilution catheter, disposable	Adult
PV2013L07N	040-000922-00	Arterial thermodilution catheter, disposable	Pediatric
IM2203	040-000815-00	12-pin IBP Y cable, reusable	/
IM2212	040-002827-00	12-pin AP&CVP cable, reusable	/
IM2211	0010-21-12179	Edward: IBP Truwave Reusable Cable	/
IM2201	001C-30-70759	12 Pin IBP cable (for ICU Medical)	/
IM2202	001C-30-70757	12 Pin IBP cable (for BD)	/
PMK-37	040-002903-00	PiCCO monitoring plate	/
PV8215	040-002899-00	PiCCO monitoring kits, disposable	/
PV8115	040-000918-00	PiCCO monitoring kits, disposable	/

26.7 CO_2 Accessories

26.7.1 Sidestream CO_2 Accessories

Model	Part No.	Description	Applicable patient
4000	M02A-10-25937	Nasal CO_2 sample cannula, disposable	Adult
4100	M02A-10-25938	Nasal CO_2 sample cannula, disposable	Pediatric
4200	M02B-10-64509	Nasal CO_2 sample cannula, disposable	Neonate
60-15200-00	9200-10-10533	Airway sampling line, disposable	Adult, pediatric
60-15300-00	9200-10-10555	Airway sampling line, disposable	Neonate
60-14100-00	9000-10-07486	Airway adapter, straight, disposable	/
040-001187-00	040-001187-00	Airway adapter, disposable	Neonate
60-14200-00	9000-10-07487	Airway adapter, elbow, disposable	/
100-000080-00	100-000080-00	Watertrap, DRYLINE II, reusable	Adult, pediatric
100-000081-00	100-000081-00	Watertrap, DRYLINE II, reusable	Neonate
/	045-003134-00	CO_2 adapter	/

26.7.2 Microstream CO_2 Accessories

Model	Part No.	Description	Applicable patient
XS04620	0010-10-42560	Disposable airway sampling line	Adult, pediatric
XS04624	0010-10-42561	Disposable airway sampling line, humidified	Adult, pediatric
006324	0010-10-42562	Disposable airway sampling line, humidified	Neonate
007768	0010-10-42563	Disposable airway sampling line, long	Adult, pediatric
007737	0010-10-42564	Disposable airway sampling line, long, humidified	Adult, pediatric
007738	0010-10-42565	Disposable airway sampling line, long, humidified	Neonate
009818	0010-10-42566	Disposable nasal sampling line	Adult
007266	0010-10-42567	Disposable nasal sampling line	Pediatric
009822	0010-10-42568	Disposable nasal sampling line, plus O_2	Adult
007269	0010-10-42569	Disposable nasal sampling line, plus O_2	Pediatric
009826	0010-10-42570	Disposable nasal sampling line, long, plus O_2	Adult
007743	0010-10-42571	Disposable nasal sampling line, long, plus O_2	Pediatric
008177	0010-10-42572	Disposable nasal sampling line, humidified	Adult
008178	0010-10-42573	Disposable nasal sampling line, humidified	Pediatric
008179	0010-10-42574	Disposable nasal sampling line, humidified	Neonate
008180	0010-10-42575	Disposable nasal sampling line, humidified, plus O_2	Adult
008181	0010-10-42576	Disposable nasal sampling line, humidified, plus O_2	Pediatric
008174	0010-10-42577	Disposable nasal sampling line	Adult
008175	0010-10-42578	Disposable nasal sampling line	Pediatric

26.7.3 Mainstream CO_2 Accessories

Model	Part No.	Description	Applicable patient
6063	0010-10-42662	Airway adapter, disposable	Adult, pediatric
6421	0010-10-42663	Airway adapter, disposable, with mouthpiece	Adult, pediatric
6312	0010-10-42664	Airway adapter, disposable	Pediatric, neonate
7007	0010-10-42665	Airway adapter, reusable	Adult, pediatric
7053	0010-10-42666	Airway adapter, reusable	Neonate
9960LGE	0010-10-42669	Mask, large	Large adult
9960STD	0010-10-42670	Mask, standard	Adult
9960PED	0010-10-42671	Mask	Pediatric
6934	0010-10-42667	Cable management straps	/
8751	0010-10-42668	Cable holding clips	/
1036698	6800-30-50760	CO_2 sensor	/

26.8 Mount and Mounting Accessories

Model	Part No.	Description
/	045-000924-00	Rolling stand
/	045-000934-00	Keyboard wall mount bracket
/	045-001228-00	Dock wall mount (fix screen/beneview)
/	045-002198-00	Dock install to bracket package (BD)
/	045-000931-00	Wall mount bracket
/	045-001229-00	Screen wall mount bracket
/	045-001230-00	Cross lock
/	115-050757-00	Folding hook
/	115-050756-00	Monitor handle
/	115-050759-00	Bedrail hook
Dock-T	115-049411-00	Transport Dock package (Brazilian standard power cord)
Dock-T	115-049404-00	Transport Dock (Brazilian standard power cord)
Dock-T	115-049407-00	Transport Dock package (British standard power cord)
Dock-T	115-049400-00	Transport Dock (British standard, power cord)
Dock-T	115-049408-00	Transport Dock package (European standard power cord)
Dock-T	115-048806-00	Transport Dock (European standard power cord)
Dock-T	115-049409-00	Transport Dock package (South African standard power cord)
Dock-T	115-049402-00	Transport Dock (South African standard power cord)
Dock-T	115-049410-00	Transport Dock package (Swiss standard power cord)
Dock-T	115-049403-00	Transport Dock (Swiss standard power cord)
Dock-T	115-049412-00	Transport Dock package (Chinese standard power cord)
Dock-T	115-049405-00	Transport Dock (Chinese standard power cord)

Model	Part No.	Description
Dock-T	115-049413-00	Transport Dock package (Australian standard power cord)
Dock-T	115-049406-00	Transport Dock (Australian standard, power cord)
Dock-T	115-049422-00	Transport Dock package (American standard power cord)
Dock-T	115-049423-00	Transport Dock (American standard power cord)
Dock-T	115-049503-00	Transport Dock package (Indian standard power cord)
Dock-T	115-049502-00	Transport Dock (Indian standard power cord)
/	115-048417-00	N1 Accessories Storage Box
/	042-020780-00	N1 Accessories Storage Box

26.9 Miscellaneous Accessories

Model	Part No.	Description
/	009-003648-00	Cable protecting tube
/	0010-10-42667	Cable management strap, 5 pcs/pack
/	009-003903-00	Accessory management tape
FSP030-RCAM-G	022-000327-00	AC adapter, 100 - 240 VAC, 50/60 Hz
/	009-001075-00	Power cord, 250 V, 10 A, 3m,Brazilian standard
/	509B-10-05996	Power cord,250V, 10A, 1.6m, Chinese standard
/	DA8K-10-14454	Power cord, European standard
/	DA8K-10-14453	Power cord, British standard
/	DA8K-10-14452	Power cord, American standard
/	0000-10-10903	Power cord, 1.8m, Indian standard
/	009-001791-00	Power cord, 250 V, 16 A, 3m,South African standard
/	009-002636-00	Power cord, 10 A, 1.5 m, Australian standard
/	009-007190-00	Power cord, 3m, Indian standard
/	009-007191-00	Power cord, 1.8m, Swiss standard
LI4278	115-033885-00	1D barcode scanner kit, RFID
LI4278	023-001158-00	1D barcode scanner,RFID
HS-1M	115-039575-00	2D barcode scanner kit
HS-1M	023-001286-00	2D barcode scanner
HS-1R	115-039635-00	2D barcode scanner kit, RFID
HS-1R	023-001288-00	2D barcode scanner, RFID
/	023-000248-00	USB Mouse
/	023-000247-00	USB Keyboard
/	023-000525-00	Wired keyboard and mouse
/	023-000524-00	Wireless keyboard and mouse
M202DW	023-001076-00	HP LaserJet Printer (M202dw)
LaserJet Enterprise M605	023-001139-00	HP LaserJet Printer (M605)

Model	Part No.	Description
LASERJET PRO M203DN, LASERJET PRO M203DW	023-001523-00	HP LaserJet Printer (M203dn)
M608N	023-001566-00	HP LaserJet Printer (M608n)
/	009-005391-00	Analog output cable
/	009-006593-00	Dock cable (2m, for connecting the N series monitor)
/	009-005123-00	Dock cable (4m,for connecting the N series monitor)
/	009-006594-00	Dock cable (10m, for connecting the N series monitor)
/	009-009766-00	Dock cable (20m, for connecting the N series monitor)
/	009-003591-00	Dock cable (1m, for connecting the T series monitor)
/	009-003592-00	Dock cable (4m, for connecting the T series monitor
/	009-005894-00	Dock cable (10m, for connecting the T series monitor)
/	023-001788-00	ELO LCD Display (21.5")
/	023-001129-00	ELO LCD Display (19", 5:4)
LI12I003A	115-049427-00	Lithium battery kit (2500mAh, 7.56V)
LI12I003A	022-000338-00	Lithium battery (2500mAh, 7.56V)
Rack	115-048150-00	Modular Rack package
Rack	115-048135-00	Modular Rack
Dock	115-048168-00	Dock (with packaging)
Dock	115-048136-00	Dock
Dock	115-048159-00	Dock (with VGA, with packaging)
Dock	115-048137-00	Dock (with VGA)

26.10 External Parameter Modules

Model	Part No.	Description
CO2-3	115-037385-00	Sidestream CO_2 module (with packaging)
CO2-3	115-027545-00	Sidestream CO_2 module
CO2-4	115-034095-00	Sidestream CO_2 module (with O_2 sensor, with packaging)
CO2-4	115-027544-00	Sidestream CO_2 module (with O_2 sensor)
CO2-2	115-013200-00	Mainstream CO_2 module (with packaging)
CO2-2	6800-30-50487	Mainstream CO_2 module
CO2-1	115-013201-00	Microstream CO_2 module (with packaging)
CO2-1	6800-30-50558	Microstream CO_2 module
PiCCO	115-013198-00	PiCCO module (with packaging)
PiCCO	115-007270-00	PiCCO module

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A Product Specifications

A.1 Monitor Safety Specifications

The monitor is classified, according to IEC 60601-1:

Degree of protection against electrical shock	Type CF defibrillation proof for ECG, TEMP, IBP, SpO_2, PiCCO, and NIBP Type BF defibrillation proof for CO_2
Type of protection against electrical shock	Class I
Ingress Protection	N1 monitor: IP44 (protected against ingress of foreign objects no less than 1.0 mm, and against access to hazardous parts with wire; protect against harmful effects of splashing water) Dock/Modular Rack/AC Adapter: IPX1 (protected against harmful effects of vertically falling water drops) Transport Dock: IP22 (protected against ingress of foreign objects no less than 12.5 mm and against access to hazardous parts with finger; protected against harmful effects of vertically falling water drops with the device tilted at any angle up to 15°)
Degree of safety of application in the presence of flammable anesthetic mixture with air or with oxygen or nitrous oxide	The equipment is not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide
Mode of operation	Continuous

A.2 Physical Specifications

Item	Maximum Weight (kg)	W × H × D (mm)	Comments
N1 main unit	0.95	148.5 × 103 × 81	without internal CO_2 module
N1 main unit	1.17	148.5 × 103 × 81	with internal CO_2 module
Modular Rack	1.55	165 ×130×168	with N1 not configuring the internal CO_2 module
Modular Rack	1.78	165 ×130×168	with N1 configuring the internal CO_2 module
Dock	0.97	190×125×155	/
Transport Dock	2.51	162.4×253×195.5	with cable box
Transport Dock	1.80	162.4×113×195.5	without cable box
PiCCO module	0.32	136.5 × 40 × 102	/
Mainstream CO_2 module	0.66	136.5 × 40 × 102	/
Microstream CO_2 module	0.40	136.5 × 40 × 102	/
Sidestream CO_2 module	0.64	136.5 × 40 × 102	with O_2
Sidestream CO_2 module	0.52	136.5 × 40 × 102	without O_2

A.3 Environmental Specifications

WARNING

- **The monitor may not meet the performance specifications if stored or used outside the specified temperature and humidity ranges. If the performance of the equipment is degraded due to aging or environmental conditions, contact your service personnel.**
- **When the monitor and related products have differing environmental specifications, the effective range for the combined products is that range which is common to the specifications for all products.**
- **The monitor cannot be transported in the temperature lower than -30°C.**

NOTE

- **The environmental specification of unspecified parameter modules are the same as those of the main unit.**

Components	Item	Operating Condition	Storage Condition
Main Unit/ Transport Dock/AC Adapter	Temperature (°C)	0 to 40	-30 to 70
	Relative humidity (noncondensing) (%)	5 to 95	5 to 95
	Barometric (mmHg)	427.5 to 805.5	375 to 805.5 (with CO_2) 120 to 805.5 (without CO_2)
Modular Rack/ Dock	Temperature (°C)	0 to 40	-20 to 60
	Relative humidity (noncondensing) (%)	15 to 95	10 to 95
	Barometric (mmHg)	427.5 to 805.5	120 to 805.5
Microstream CO_2 module	Temperature (°C)	0 to 40	-20 to 60
	Relative humidity (noncondensing) (%)	15 to 95	10 to 95
	Barometric (mmHg)	430 to 790	430 to 790
Sidestream CO_2 module	Temperature (°C)	5 to 40	-20 to 60
	Relative humidity (noncondensing) (%)	15 to 95	10 to 95
	Barometric (mmHg)	430 to 790	375 to 805.5
Mainstream CO_2 module	Temperature (°C)	0 to 40	-20 to 60
	Relative humidity (noncondensing) (%)	10 to 90	10 to 90
	Barometric (mmHg)	427.5 to 805.5	400 to 805.5
PiCCO module	Temperature (°C)	10 to 40	-20 to 60
	Relative humidity (noncondensing) (%)	15 to 75	10 to 90
	Barometric (mmHg)	427.5 to 805.5	120 to 805.5

Transient operating conditions

The monitor is operated in normal use for a period not less than 20 minutes when moved from room temperature (20℃ ± 2℃) to an environment of a temperature range from - 20 ℃ to 50 ℃, and relative humidity range from 15% to 95% (non-condensing).

The monitor is operated in normal use for a period not less than 20 minutes when moved from storage temperature (range from - 30 ℃ to 70 ℃) to room temperature (20℃ ± 2℃), and started up within 10 minutes after the movement.

A.4 Power Supply Specifications

A.4.1 External Power Supply Specifications

N1 main unit	
Input voltage	12VDC (±10%)
Input current	2 A
AC Adapter	
Input	100 to 240 VAC (-15%, +10%), 50/60 Hz (±3 Hz), 1.0A to 0.6A
Output	12VDC (±10%), 2.5A
Dock	
Input voltage	100 to 240VAC (±10%)
Input current	0.65A to 0.35A
Frequency	50/60Hz (±3Hz)
Transport Dock	
Input	100 to 240 VAC (-15%, +10%), 50/60 Hz (±3 Hz), 1.0A to 0.6A AC waveform: sine
Output	12VDC (±10%), 2.5A

A.4.2 Battery Specifications

Battery type	Rechargeable lithium-Ion battery
Voltage	7.56 VDC
Capacity	2500 mAh
Run time	At least 8 hours when the monitor without internal CO_2 module is powered by two new fully-charged batteries at 25°C ± 5°C with factory default screen brightness, Wi-Fi disabled, ECG and SpO_2 cable connected, and auto NIBP measurements at an interval of 15 minutes. At least 3 hours when the monitor with internal CO_2 module is powered by one new fully-charged battery at 25°C ± 5°C with factory default screen brightness, Wi-Fi enabled, CO_2 sampling line connected, Temp, IBP, ECG and SpO_2 cable connected, and auto NIBP measurements at an interval of 15 minutes. Shutdown delay: at least 15 minutes after the low battery alarm first occurs.

Charge time	For the monitor without internal CO_2 module: no more than 6 hours to 90% when the monitor is off. no more than 10 hours to 90% when the monitor is on. For the monitor with internal CO_2 module: no more than 3 hours to 90% when the monitor is off. no more than 5 hours to 90% when the monitor is on.

A.5 Display Specifications

N1 main unit	
Screen type	Color TFT LCD
Screen Size (diagonal)	5.5 inches
Resolution	1280 x 720 pixels
Pixel per inch (PPI)	269
External display	
Screen type	Medical-grade color TFT LCD
Screen Size (diagonal)	19 inches
Resolution	1280 x 720 pixels

A.6 Touchscreen Specifications

Screen type	Capacitive, multi-point touch

A.7 LEDs

A.7.1 Main Unit

Alarm lamp	1 (three color-coded: red, yellow, and cyan)
Power-on LED	1 (green)
External power LED	1 (green)
Battery LED	1 (two color-coded: yellow and green)

A.7.2 Dock

Connection status LED	1 (green)
External power supply LED	1 (green)

A.7.3 Transport Dock

Power-on LED	1 (green)

A.7.4 AC Adapter

Power-on LED	1 (green)

A.8 Audio Indicator

Speaker	Give alarm tones (45 to 85 dB), reminder tones, key tones, QRS tones; support PITCH TONE and multi-level tone modulation; alarm tones comply with IEC 60601-1-8.

A.9 Monitor Interface Specifications

A.9.1 Interface Specifications of the Main Unit

DC power input connector	1
Multifunctional connector	1
Multi-pin connector	1
Communication interface	4
Infrared filter	1
Contact	2
Power switch	1
Sample line connector of the Sidestream CO_2	1
Gas outlet	1
ECG cable connector	1
SpO_2 sensor connector	1
NIBP cuff connector	1
IBP cable connector	1
Temperature probe connector	2

A.9.2 Interface Specifications of the Modular Rack

Multi-pin connector	2
Infrared filter	1
Pogo pin	3
Contact	2

A.9.3 Interface Specifications of the Dock

Network connector	1
Equipotential grounding terminal	1
AC power input connector	1
VGA connector	1

Host monitor connector	1
USB connector	2
Multi-pin connector	1

A.10 Signal Outputs Specifications

ECG Analog Output	
Bandwidth (-3dB; reference frequency: 10Hz)	Diagnostic mode: 0.05 to 150 Hz Monitor mode: 0.5 to 40 Hz Surgical mode: 1 to 20 Hz ST mode: 0.05 to 40 Hz
Maximum QRS delay	25 ms (in diagnostic mode, and non-paced)
Gain (reference frequency 10Hz)	1V/mV (±5%)
Pace enhancement	Signal amplitude: V_{oh}≥2.5V Pulse width: 10ms±5% Signal rising and falling time: ≤100μs
IBP Analog Output	
Bandwidth (-3dB; reference frequency:1Hz)	0 to 40 Hz
Maximum transmission delay	30 ms
Gain (reference frequency 1Hz)	1 V/100 mmHg, ±5%
Defib Sync Pulse	
Output impedance	≤100 ohm
Maximum time delay	35 ms (R-wave peak to leading edge of pulse)
Amplitude	High level: 3.5 to 5 V, ±5%, 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%
maximum rising and falling time	1 ms
Video Output	
Video signals	VGA signal
Alarm output	
Alarm delay time from the monitor to remote equipment	The alarm delay time from the monitor to remote equipment is ≤2 seconds, measured at the monitor signal output connector.
Alarm signal sound pressure level range	45 db(A) to 85 db(A) within a range of one meter

A.11 Data Storage

Trends	A minimum of 120 hours' trend data with the resolution no less than 1 minute.
Events	1000 events, including parameter alarms, arrhythmia events, technical alarms, and so on
NIBP measurements	1000 sets
Interpretation of resting 12-lead ECG results	20 sets

Full-disclosure waveforms	48 hours at maximum. The specific storage time depends on the waveforms stored and the number of stored waveforms.
OxyCRG view	48 hours. Trend data is stored one dot per second and the waveform stored is a compressed waveform.

A.12 Out-Of-Hospital Transport - Standards Compliance

- **Shock Tests** according to IEC TR 60721-4-7, Class 7M3. Test procedure according to IEC/EN60068-2-27 (peak acceleration up to 100g).
- **Random Vibration** according to IEC TR 60721-4-7, Class 7M3. Test procedure according to IEC/EN 60068-2-64 (RMS acceleration 5g).
- **Sinusoidal Vibration** according to IEC TR 60721-4-7, Class 7M3. Test procedure according to IEC/EN 60068-2-6 (acceleration up to amplitude 2g).
- **Bump Test** according to IEC/EN60068-2-29 (peak acceleration 15 g, 1000 bumps).
- **Free Fall Test** according to EN 60068-2-32 (height 1.2 m).
- EN 1789:2007+A2:2014 Medical vehicles and their equipment - Road ambulances.
- EN 13718-1:2008 Medical vehicles and their equipment-Air ambulances-Part 1: Requirements for medical devices used in air ambulances.
- IEC 60601-1-12:2014 Medical electrical equipment -Part 1-12: General requirements for basic safety and essential performance -Collateral Standard: Requirements for medical electrical equipment and medical electrical systems intended for use in the emergency medical services environment.
- **RTCA DO-160G** Environmental Conditions and Test Procedures for Airborne Equipment.
  - Section 7 Operational Shocks and Crash Safety
  - Section 8 Vibration (Category S for fixed wing and Category U2 for rotary wing)
- **MIL-STD-810G** Environmental engineering considerations and laboratory tests
  - Method 514.6 Category 13 - Fixed Wing Propeller Aircraft
  - Method 514.6 Category 14 Category 14 Helicopter, General, UH-60
  - Method 514.6 Category 20 - Ground vehicles - ground mobile
  - Method 514.6 Category 24 - Helicopter minimum integrity test
- **Radiated susceptibility** 20 V/m according to IEC80601-2-30: 2013 (NIBP), ISO80601-2-55: 2011 (CO_2), ISO80601-2-56: 2009 (TEMP), ISO 80601-2-61: 2011 (SpO_2).
- **Extended radiated susceptibility tests**
  - TETRA 400: 27V/m
  - GMRS 460; FRS 460; GSM 800/900; TETRA 800; iDEN 820; CDMA 850; LTE Band 5; GSM 1800; CDMA 1900; GSM 1900; DECT; LTE Band 1, 3,4, 25; UMTS; Bluetooth; WLAN; 802.11 b/g/n; RFID 2450; LTE Band 7: 28V/m
  - LTE Band 13, 17; WLAN 802.11 a/n: 9V/m
- **Magnetic Field emission** according to MIL STD 461F, Chapter RE101: Radiated emissions, magnetic field, 30Hz to 100KHz. Limit class: Army.
- **Magnetic Field susceptibility**: Radiated susceptibility, magnetic field, 50 and 60 Hz, 30 A/m.

A.13 Wi-Fi Specifications

A.13.1 Wi-Fi Technical Specifications

Protocol	IEEE 802.11a/b/g/n	
Modulation mode	DSSS and OFDM	
Operating frequency	IEEE 802.11b/g/n (at 2.4G)	IEEE 802.11a/n (at 5G)
	ETSI: 2.4 GHz to 2.483 GHz FCC: 2.4 GHz to 2.483 GHz MIC: 2.4 GHz to 2.495GHz KC: 2.4 GHz to 2.483 GHz	ETSI: 5.15 GHz to 5.35 GHz, 5.47 GHz to 5.725 GHz FCC: 5.15 GHz to 5.35 GHz, 5.725 GHz to 5.82 GHz MIC: 5.15GHz to 5.35 GHz KC: 5.15 GHz to 5.35 GHz, 5.47 GHz to 5.725 GHz, 5.725 GHz to 5.82 GHz
Channels	ETSI 2.4G: channel 1 to 13; 5G: channel 36, 40, 44, and 48. FCC 2.4G: channel 1 to 11; 5G: channel 36, 40, 44, 48, 149, 153, 157, 161, and 165. MIC 2.4G: channel 1 to 14; 5G: channel 36, 40, 44, and 48. KC 2.4G: channel 1 to 13; 5G: channel 36, 40, 44, 48, 149, 153, 157, and 161.	
Channel spacing	IEEE 802.11b/g: 5 MHz IEEE 802.11n (at 2.4G): 5 MHz IEEE802.11a: 20 MHz IEEE802.11n (at 5G): 20 MHz	
Wireless baud rate	IEEE 802.11a: 6 Mbps to 54 Mbps IEEE 802.11b: 1 Mbps to 11 Mbps IEEE 802.11g: 6 Mbps to 54 Mbps IEEE 802.11n (both at 2.4G and 5G): 6.5 Mbps to 72.2 Mbps	
Output power	<20dBm (CE requirement, detection mode- RMS) <30dBm (FCC requirement, detection mode- peak power)	
Operating mode	Infrastructure	
Data security	Standards: WPA-PSK, WPA2-PSK, WPA-Enterprise,WPA2-Enterprise EAP method: EAP-FAST, EAP-TLS, EAP-TTLS, PEAP-GTC, PEAP- MSCHAPv2, PEAP-TLS, LEAP Encryption: TKIP, AES	

A.13.2 Wi-Fi Performance Specifications

WARNING

- **Do perform all network functions of data communication within an enclosed network.**

A.13.2.1 System capacity and resistance to wireless interference

Meets the following requirements:

- All the monitors do not encounter communication loss.
- The total delay of data transmission from the monitor to the central monitoring system: ≤ 2 seconds.
- The delay for monitor-related settings configured at the central monitoring system to be effective: ≤ 2 seconds.

- The total delay of data transmission from one monitor to the other: ≤ 2 seconds.
- The delay for the monitor to reset alarms of another to be effective: ≤ 2 seconds.
- The total delay of data transmission from the TM80 to the monitor: ≤ 2 seconds.

Testing conditions are as follows:

- Number of the monitors supported by a single AP: ≤ 16.
- Each monitor can communicate with the central monitoring system.
- Two monitors are used to view other monitors.
- Only one monitor can transmit history data.
- The weakest strength of the AP signal where the monitor is located cannot be less than -65 dBm.
- The distance between the interfering devices and the monitor is greater than 20 cm. A Wi-Fi interference (no greater than -85 dBm) in the same channel and a Wi-Fi interference (no greater than -50 dBm) in an adjacent-channel are presented synchronously. The interfering devices include, but are not limited to, 2.4 G wireless devices, cellular mobile networks, microwave ovens, interphones, cordless phones, and ESU equipment. The interfering devices do not include Wi-Fi devices.

A.13.2.2 Wi-Fi network stability

The ratio of the communication data lost on CMS from the N1 does not exceed 0.1% in 24 hours..

Testing conditions are as follows:

- Number of the monitors supported by a single AP: ≤16.
- Each monitor can communicate with the central monitoring system.
- Two monitors are used to view other monitors.
- Only one monitor can transmit history data.
- The weakest strength of the AP signal where the monitor is located cannot be less than -65 dBm.

A.13.2.3 Distinct vision distance

The distinct vision distance between the monitor and the AP is no less than to 50 meters.

A.14 Measurement Specifications

The adjustable range of alarm limits is the same with the measurement range of signals unless otherwise specified.

A.14.1 ECG Specifications

ECG	
Standards	Meet standards of IEC 60601-2-27 2011 and IEC 60601-2-25 2011
Lead set	3-lead: I, II, III 5-lead: I, II, III, aVR, aVL, aVF, V 6-lead: I, II, III, aVR, aVL, aVF, Va, Vb 12-lead: I, II, III, aVR, aVL, aVF, V1 to V6
ECG standard	AHA, IEC
Display sensitivity	1.25 mm/mV (X0.125), 2.5 mm/mV (X0.25), 5 mm/mV (X0.5), 10 mm/mV (X1), 20 mm/mV (X2), 40 mm/mV (X4), Auto, less than ±5% error
Sweep speed	6.25 mm/s, 12.5 mm/s, 25 mm/s, 50 mm/s, less than ±5% error

Bandwidth (-3dB)	Diagnostic mode: Monitor mode: Surgical mode: ST mode: High Freq Cut-off (for 12-lead ECG analysis):	0.05 to 150 Hz 0.5 to 40 Hz 1 to 20 Hz 0.05 to 40 Hz 350 Hz (0.05 to 350 Hz), 150 Hz (0.05 to 150 Hz), 35 Hz (0.05 to 35 Hz), 20 Hz (0.05 to 20 Hz) selectable.
Common mode rejection ratio	Diagnostic mode: Monitor mode: Surgical mode: ST mode:	>90 dB >105 dB (with notch filter on) >105 dB (with notch filter on) >105 dB (with notch filter on)
Notch filter	50/60 Hz Monitor, surgical, and ST mode: notch filter turns on automatically Diagnostic mode and High Freq Cut-off: notch filter is turned on/off manually	
Differential input impedance	≥5 MΩ	
Input signal range	±8 mV (peak-to-peak value)	
Accuracy of signal reproduction	Use A and D methods based on IEC 60601-2-25 2011 to determine frequency response.	
Electrode offset potential tolerance	±500 mV	
Lead-off detection current	Measuring electrode: <0.1 μA Drive electrode: <1 μA	
Input offset current	≤0.1 μA, (drive lead≤1μA)	
Defibrillation protectio	Enduring 5000V (360 J) charge without data loss or corruption Baseline recovery time: <5 s (after defibrillation) Polarization recovery time: <10 s Defibrillation energy absorption: ≤10% (100Ω load)	
Patient leakage current	<10 uA	
Calibration signal	1mV (peak-to-peak value) ±5%	
ESU protection	Cut mode: 300 W Coagulate mode: 100 W Recovery time: ≤10 s In compliance with the requirements in clause 202.6.2.101 of IEC 60601-2-27 2011	
Pace Pulse		
Pace pulse markers	Pace pulses meeting the following conditions are labeled with a PACE marker: Amplitude: Width: Rise time: No overshoot	 ±2 mV to ±700 mV 0.1 ms to 2 ms 10 μs to 100 μs (less than 10% of pulse width)
Pace pulse rejection	When tested in accordance with the IEC 60601-2-27 2011: 201.12.1.101.13, the heart rate meter rejects all pulses meeting the following conditions. Amplitude: Width: Rise time: No overshoot	 ±2mV to ±700 mV 0.1ms to 2 ms 10μs to 100 μs (less than 10% of pulse width)

HR	
Measurement range	Neonate: 15 to 350 bpm Pediatric: 15 to 350 bpm Adult: 15 to 300 bpm

Resolution	1 bpm
Accuracy	±1 bpm or ±1%, whichever is greater.
Sensitivity	200 μV (lead II)
HR averaging method	In compliance with the requirements in Clause 201.7.9.2.9.101 b) 3) of IEC 60601-2-27 2011, the following method is used: If the last 3 consecutive RR intervals are greater than 1200 ms, the 4 most recent RR intervals are averaged to compute the HR. Otherwise, heart rate is computed by subtracting the maximum and minimum ones from the most recent 12 RR intervals and then averaging them. The HR value displayed on the monitor screen is updated no more than one second.
Response to irregular rhythm	In compliance with the requirements in Clause 201.7.9.2.9.101 b) 4) of IEC 60601-2-27 2011, the heart rate after 20 seconds of stabilization is displayed as follows: Ventricular bigeminy (waveform A1): 80±1 bpm Slow alternating ventricular bigeminy (waveform A2): 60±1 bpm Rapid alternating ventricular bigeminy (waveform A3): 120±1 bpm Bidirectional systoles (waveform A4): 90±2 bpm
Response time to heart rate change	Meets the requirements of IEC 60601-2-27 2011: 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 in Clause 201.7.9.2.9.101 b) 6) of IEC 60601-2-27 2011. Waveform B1h-range: < 11 s B1-range: < 11 s B1d-range: < 11 s B2h-range: < 11 s B2-range: < 11 s B2d-range: < 11 s
Tall T-wave rejection capability	When the test is performed based on Clause 201.12.1.101.17 of IEC 60601-2-27 2011, the heart rate calculation is not affected for QRS of 1 mV amplitude and 100 ms duration, T-wave duration of 180 ms and amplitude lower than 1.2 mV, and QT interval of 350 ms.
Arrhythmia Analysis Classifications	Asystole, V-Fib/V-Tac, V-Tac, Vent Brady, Extreme Tachy, Extreme Brady, Vent Rhythm, PVCs/min, Pauses/min, Couplet, Bigeminy, Trigeminy, R on T, Run PVCs, PVC, Tachy, Brady, Missed Beat, Pacer Not Pacing, Pacer Not Capture, Multiform PVC, Nonsus V-Tach, Pause, Irr Rhythm, A-Fib
ST Segment Analysis	
Measurement range	-2.0 mV to 2.0 mV RTI
Accuracy	-0.8 mV to 0.8 mV: ±0.02 mV or ±10%, whichever is greater. Beyond this range: Not specified.
Resolution	0.01mV
QT/QTc Analysis	
Measurement range	QT: 200 to 800 ms QTc: 200 to800 ms QT-HR: 15 bpm to 150 bpm for adult, 15 bpm to 180 bpm for pediatric and neonate
Accuracy	QT: ±30 ms
Resolution	QT: 4 ms QTc: 1 ms
12-lead ECG Interpretation	

Sampling rate	1000 samples/s (waveform) 500 samples/s (algorithm)
Amplitude quantisation	24 bits

Alarm limit	**Range**	**Step**
HR High	HR≤40bpm: (low limit + 2 bpm) to 40 bpm HR > 40 bpm: (low limit + 5 bpm) to 295 bpm	HR≤40bpm: 1 bpm HR > 40 bpm: 5 bpm
HR Low	HR≤40bpm: 16 bpm to (HR high - 2 bpm) HR > 40 bpm: 40 bpm to (HR high - 5 bpm)	
ST High	(low limit + 0.2 mV) to 2.0 mV (absolute) 0 mV to 2.0 mV (relative)	0.05 mV
ST Low	-2.0 mV to (high limit - 0.2 mV) (absolute)-2.0 mV to 0 mV (relative)	
QTc High	200 to 800 ms	10 ms
ΔQTc High	30 to 200 ms	

A.14.2 Resp Specifications

Technique	Trans-thoracic impedance		
Lead	Options are lead I, II and Auto.		
Respiration excitation waveform	<300 μA RMS, 62.8 kHz (±10%)		
Minimum respiration impedance threshold	0.3Ω		
Baseline impedance range	200 to 2500Ω (using an ECG cable with 1kΩ resistance)		
Bandwidth	0.2 to 2.5 Hz (-3 dB)		
Sweep speed	3mm/s, 6.25 mm/s, 12.5 mm/s, 25 mm/s or 50 mm/s, less than 10% error		
Respiration Rate			
Measurement range	0 to 200 rpm		
Resolution	1 rpm		
Accuracy	0 to 120 rpm: ±1 rpm 121 to 200 rpm: ±2 rpm		
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: RR≤20 RR>20 Neonate: RR≤20 RR>20	 (low limit + 2) to 20 (low limit + 5) to 100 (low limit + 2) to 20 (low limit + 5) to 150	RR≤20: 1 RR>20: 5
RR Low	RR≤20 RR>20	0 to (high limit - 2) 20 to (high limit - 5)	

A.14.3 SpO_2 Specifications

Alarm limit	Range (%)	Step (%)
SpO_2 High	(low limit + 2) to 100	1
SpO_2 Low	Mindray: (Desat+1) to (high limit - 2) Nellcor: (Desat+1) or 20 (whichever is greater) to (high limit - 2)	
Desat	0 to (low limit - 1)	

Mindray SpO_2 Module

Standards	Meet standards of ISO 80601-2-61 2011
*Measurement accuracy verification: The SpO_2 accuracy has been verified in human experiments by comparing with arterial blood sample reference measured with a CO-oximeter. Pulse oximeter measurement are statistically distributed and about two-thirds of the measurements are expected to come within the specified accuracy range compared to CO-oximeter measurements.	
Measurement range	0 to 100%
Resolution	1%
Response time	< 30 s (normal perfusion, no disturbance, SpO_2 value sudden changes from 70% to 100%)
Accuracy	70 to 100%: ±2% (adult/pediatric) 70 to 100%: ±3% (neonate) 0% to 69%: Not specified.
* One percent was added to the accuracies for neonatal sensors to account for accuracy variation due to properties of fetal hemoglobin. Studies were performed to validate the accuracy of Pulse Oximeter with neonatal SpO_2 sensors by contrast with a CO-Oximeter. Some neonates aged from 1 day to 30 days with a gestation age of 22 weeks to full term were involved in this study. The statistical analysis of data of this study shows the accuracy (Arms) is within the stated accuracy specification. Please see the following table.	

Sensor type	Totally neonates	Data	Arms
518B	97 (51 male & 46 female)	200 pairs	2.38%
520N	122 (65 male & 57 female)	200 pairs	2.88%

The Pulse Oximeter with neonatal SpO_2 sensors was also validated on adult subjects.	
Refreshing rate	≤1 s
Sensitivity	High, Medium, Low
PI	
Measurement range	0.05 to 20%
Resolution	PI<10.0: 0.01 PI≥10.0: 0.1

Nellcor SpO_2 Module

Measurement range	0 to 100%
Resolution	1%
Refreshing rate	≤1 s
Response time	≤30 s (normal perfusion, no disturbance, SpO_2 value sudden change from 70% to 100%)
Accuracy	70 to 100%: ±2% (adult/pediatric) 70 to 100%: ±3% (neonate) 0% to 69%: Not specified.

When the SpO_2 sensor is applied for neonatal patients as indicated, the specified accuracy range is increased by ±1%, to compensate for the theoretical effect on oximeter measurements of fetal hemoglobin in neonatal blood.

Masimo SpO_2 Module

Standards	meets the requirements of ISO 80601-2-61: 2011
Measurement range	1 to 100%
Resolution	1%
Response time	≤20 s (normal perfusion, no disturbance, SpO2 value sudden changes from 70% to 100%)
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.
Refresh rate	≤ 1 s
SpO2 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 SpO2 accuracy[2]	±2%
PI measurement range	0.02 to 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% SpO2 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% SpO2 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.

[2] The Masimo pulse oximeter has been validated for low perfusion accuracy in bench top testing against a Biotek Index 2 simulator and Masimo's simulator with signal strengths of greater than 0.02% and a % transmission of greater than 5% for saturations ranging from 70 to 100%. This variation equals plus or minus one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.

A.14.4 PR Specifications

Alarm limit	Range (bpm)	Step (bpm)
PR High	PR≤40: (low limit +2) to 40 PR>40: (low limit +5) to 295	PR≤40: 1 PR>40: 5
PR Low	PR≤40: 16 to (high limit - 2) PR>40: 40 to (high limit - 5)	

PR from Mindray SpO_2 Module

Measurement range	20 to 300 bpm
Resolution	1 bpm
Response time	<30 s (normal perfusion, no disturbance, PR value sudden changes from 25 bpm, to 220 bpm)
Accuracy	±3 bpm
Refreshing rate	≤1 s

PR from Nellcor SpO_2 Module

Measurement range	20 to 300 bpm
Resolution	1 bpm
Response time	≤30 s (normal perfusion, no disturbance, PR value sudden change from 25 to 250 bpm)
Accuracy	20 to 250 bpm: ±3 bpm 251 to 300 bpm, not specified
Refreshing rate	≤1 s

PR from NIBP Module

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

PR from IBP Module

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

A.14.5 Temp Specifications

Standard	Meet the standard of ISO 80601-2-56 2009	
Technique	Thermal resistance	
Operating mode	Direct mode	
Measurement range	0 to 50 °C (32 to 122 °F)	
Resolution	0.1°C	
Accuracy	±0.1 °C or ±0.2 °F (excluding probe error)	
Refreshing rate	≤1 s	
Minimum time for accurate measurement	Body surface: <100 s Body cavity: <80 s	
Alarm limit	**Range**	**Step**
Txx High (xx refers to temperature site)	(low limit +1.0) to 50.0 °C (low limit +2.0) to 122.0 °F	0.1 °C 0.1 °F
Txx Low (xx refers to temperature site)	0.1 to (high limit - 1.0) °C 32.2 to (high limit - 2.0) °F	
ΔT High	0.1 to 50.0 °C 0.2 to 90.0 °F	

A.14.6 NIBP Specifications

Standard	Meet standard of IEC 80601-2-30 2013
Technique	Oscillometry
Mode of operation	Manual, Auto, STAT, Sequence

Auto mode repetition intervals	1, 2, 2.5, 3, 5, 10, 15, 20, 30, 60, 90, 120, 180, 240 or 480 min			
STAT mode cycle time	5 min			
Max measurement time	Adult, pediatric: 180 s Neonate: 90 s			
Heart rate range	30 to 300 bpm			
Measurement ranges (mmHg)		Adult	Pediatric	Neonate
	Systolic:	25 to 290	25 to 240	25 to 140
	Diastolic:	10 to 250	10 to 200	10 to 115
	Mean:	15 to 260	15 to 215	15 to 125
Accuracy	Max mean error: ±5 mmHg Max standard deviation: 8 mmHg			
Resolution	1mmHg			
Initial cuff inflation pressure range (mmHg)	Adult: 80 to 280 Pediatric: 80 to 210 Neonate: 60 to 140			
Default initial cuff inflation pressure (mmHg)	Adult: 160 Pediatric: 140 Neonate: 90			
Software overpressure protection	Adult: 297±3 mmHg Pediatric: 297±3 mmHg Neonate: 147±3 mmHg			
Static pressure measurement range	0 mmHg to 300 mmHg			
Static pressure measurement accuracy	±3 mmHg			
Alarm limit	**Range (mmHg)**		Step (mmHg)	
NIBP-S High	Adult: (low limit + 5) to 285 Pediatric: (low limit + 5) to 235 Neonate: (low limit + 5) to 135		NIBP ≤ 50: 1 NIBP > 50: 5	
NIBP-S Low	26 to (high limit - 5)			
NIBP-M High	Adult: (low limit + 5) to 255 Pediatric: (low limit + 5) to 210 Neonate: (low limit + 5) to 120			
NIBP-M Low	16 to (high limit - 5)			
NIBP-D High	Adult: (low limit + 5) to 245 Pediatric: (low limit + 5) to 195 Neonate: (low limit + 5) to 110			
NIBP-D Low	11 to (high limit - 5)			

NIBP-S Extreme High	Adult: (NIBP-S high limit + 5) to 290 Pediatric: (NIBP-S high limit +5) to 240 Neonate: (NIBP-S high limit +5) to 140	NIBP ≤ 50: 1 NIBP > 50: 5
NIBP-S Extreme Low	25 to (NIBP-S low limit - 5)	
NIBP-M Extreme High	Adult: (NIBP-M high limit + 5) to 260 Pediatric: (NIBP-M high limit + 5) to 215 Neonate: (NIBP-M high limit + 5) to 125	
NIBP-M Extreme Low	15 to (NIBP-M low limit - 5)	
NIBP-D Extreme High	Adult: (NIBP-D high limit + 5) to 250 Pediatric: (NIBP-D high limit + 5) to 200 Neonate: (NIBP-D high limit + 5) to 115	
NIBP-D Extreme Low	10 to (NIBP-D low limit - 5)	

*Measurement accuracy verification: In adult and pediatric modes, the blood pressure measurements measured with this device are in compliance with the Standard for Non-invasive sphygmomanometers (ISO 81060-2)in terms of mean error and standard deviation by comparing with intra-arterial or auscultatory measurements (depending on the configuration) in a typical patient population. For auscultatory reference, the 5th Korotkoff sound was used to determine the diastolic pressure.

In neonatal mode, the blood pressure measurements measured with this device are in compliance with the American National Standard for Non-invasive sphygmomanometers (ISO 81060-2) in terms of mean error and standard deviation by comparing with intra-arterial measurements (depending on the configuration) in a typical patient population.

A.14.7 IBP Specifications

Standard	Meet the standard of IEC 60601-2-34 2011.	
Technique	Direct invasive measurement	
IBP		
Measurement range	-50 to 360 mmHg	
Resolution	1 mmHg	
Accuracy	±2% or ±1 mmHg, whichever is greater (excluding sensor error)	
Refreshing rate	≤1s	
PPV		
Measurement range	0% ~ 50%	
Pressure transducer		
Excitement voltage	5 VDC, ±2%	
Sensitivity	5 μV/V/mmHg	
Zero adjustment range	±200 mmHg	
Impedance range	300 to 3000Ω	
Volume displacement	<0.04 mm^3 /100 mmHg	
Alarm limit	**Range (mmHg)**	**Step (mmHg)**

Sys High	IBP ≤ 50: (low limit + 2) to 50 IBP > 50: (low limit + 5) to 355	IBP ≤ 50: 1 IBP > 50: 5
Mean High		
Dia High		
Sys Low	IBP ≤ 50: - 49 to (high limit - 2) IBP > 50: 50 to (high limit - 5)	
Mean Low		
Dia Low		
Art-S Extreme High	(High limit+5) to 360	IBP ≤ 50: 1 IBP > 50: 5
Art-M Extreme High		
Art-D Extreme High		
Art-S Extreme Low	-50 to (low limit-5)	
Art-M Extreme Low		
Art-D Extreme Low		

A.14.8 CCO Specifications

Measured parameters	**Measurement range**	**Coefficient of variation**
CCO	0.25 L/min to 25.0 L/min	≤2%
C.O.	0.25 L/min to 25.0 L/min	≤2%
GEDV	40ml to 4800 ml	≤3%
SV	1ml to 250 ml	≤2%
EVLW	10ml to 5000 ml	≤6%
ITBV	50ml to 6000 ml	≤3%
TB	25°C to 45°C	±0.1°C (excluding probe error)
TI	0°C to 30°C	±0.1°C(excluding probe error)
pArt	-50 to 300 mmHg	±2% or ±1mmHg (whichever is greater)(excluding probe error)
pCvp	-50 to 300 mmHg	±2% or ±1mmHg (whichever is greater)(excluding probe error)
Alarm Limit	**Range**	**Step**
CCO High	(Low limit+0.1 L/min) to 25.0 L/min	0.1 L/min
CCO Low	0.3 L/min to (High limit - 0.1 L/min)	
CCI High	(Low limit + 0.1 L/min/m^2) to 15.0 L/min/m^2	0.1 L/min/m^2
CCI Low	0.1 L/min/m^2 to (High limit - 0.1 L/min/m^2)	
pArt-M/pArt-D/pArt-S High	pArt≤50: (Low limit + 2 mmHg) to 50 mmHg pArt>50: (Low limit + 5 mmHg) to 300 mmHg	pArt≤50: 1mmHg pArt> 50: 5mmHg
pArt-M/pArt-D/pArt-S Low	pArt≤50: -50 mmHg to (High limit - 2 mmHg) pArt> 50: 50 mmHg to (High limit - 5 mmHg)	

pCVP-M High	pCVP≤50: (Low limit + 2 mmHg) to 50 mmHg pCVP>50: (Low limit + 5 mmHg) to 300 mmHg	pCVP≤50: 1mmHg pCVP> 50: 5mmHg
pCVP-M Low	pCVP≤50: -50 mmHg to (High limit - 2 mmHg) pCVP>50: 50 mmHg to (High limit - 5 mmHg)	

* Coefficient of variation is measured using synthetic and/or database wave forms (laboratory testing). Coefficient of variation= SD/mean error.

A.14.9 CO_2 Specifications

Measurement mode	Sidestream, microstream, mainstream	
Technique	Infrared absorption	
Apnea time	10 s, 15 s, 20 s, 25 s, 30 s, 35 s, 40 s	
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	
EtO_2 High	(low limit + 2%) to 100%	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)%	

Sidestream CO_2 Module

Standard	Meet the standard of ISO 80601-2-55 2011	
CO_2 Measurement range	0 to 150mmHg	
CO_2 absolute accuracy*	Full accuracy mode: 0≤CO_2 concentration≤40 mmHg 41mmHg≤CO_2 concentration<76 mmHg: 77mmHg≤CO_2 concentration<99 mmHg: 100 mmHg≤CO_2 concentration<150 mmHg: > 150 mmHg	 ± 2mmHg ±5% of reading ±10% of reading ±(3mmHg + 8% of reading) Unspecified
Inaccuracy specifications are affected by the breath rate and I:E. The $EtCO_2$ accuracy is within specification for breath rate ≤ 60 rpm and I/E ratio ≤ 1:1, or breath rate ≤ 30 rpm and I/E ratio ≤ 2:1.		
CO_2 resolution	1 mmHg	
O_2 measurement range	0 to 100%	
O_2 absolute accuracy	0≤O_2 concentration≤25%: 25<O_2 concentration≤80%: 80<O_2 concentration≤100%:	±1% ±2% ±3%
O_2 resolution	1%	
Accuracy drift	Meet the requirement for measurement accuracy within 6 hours	

Sample flowrate	Using internal CO_2 module: Adult, pediatric, neonatal: 50 ml/min Using external CO_2 module with O_2 sensor: Adult, pediatric: 120 ml/min Neonatal: 90 ml/min Using the CO_2 module without O_2 sensor: Adult, pediatric: 120 ml/min Neonatal: 70 ml/min, 90 ml/min
Sample flowrate tolerance	±15% or ±15 ml/min, whichever is greater.
Start-up time	20s (typical), 90 s (maximum)
Response time	For CO_2 measurements (using external CO_2 module without O_2 sensor): Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line: ≤5.0 s @ 70 ml/min Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line: ≤4.5 s @ 90 ml/min Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line: ≤5.0 s @ 120 ml/min For CO_2 measurements (using external CO_2 module with O_2 sensor): Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line: ≤4.5 s @ 90 ml/min Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line: ≤5.0 s @ 120 ml/min For CO_2 measurements (using internal CO_2 module): Measured with a standard Oridion sampling line: ≤5.0 s@50 ml/min Measured with a prolonged Oridion sampling line: <6.5 s@50 ml/min For O_2 measurements: Measured with a DRYLINE II neoonatal watertrap and a 2.5-meter neonatal sampling line: ≤4.5 s @ 90 ml/min Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line: ≤5.0 s @ 120 ml/min

Rise time	For CO_2 measurements (using external CO_2 module without O_2 sensor): Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line: ≤250 ms@70 ml/min. Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line: ≤250 ms@90 ml/min. Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line: ≤300 ms@120 ml/min For CO_2 measurements (using external CO_2 module with O_2 sensor): Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line: ≤250 ms@90 ml/min. Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line: ≤300 ms@120 ml/min For CO_2 measurements (using internal CO_2 module): Measured with a standard Oridion sampling line: ≤250 ms@50 ml/min Measured with a prolonged Oridion sampling line: ≤280 ms@50 ml/min For O_2 measurements: Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line: ≤800 ms@90 ml/min. Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line: ≤750 ms@120 ml/min	
awRR measurement range	0 to 150 rpm	
awRR measurement precision	<60 rpm: ±1 rpm 60 to 150 rpm: ±2 rpm	
awRR resolution	1 rpm	
Data sample rate	50 Hz	
Effect of interference gases on CO_2 measurements		
Gas	**Concentration (%)**	**Quantitative 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 to 40mmHg.		
Effect of interference gases on O_2 measurements		
Gas	Concentration (%)	
CO_2	0.2	
N_2O	0.2	
HAL, DES, SEV, ISO, ENF	1.0	

Microstream CO_2 Module

Standard	Meet the standard of ISO 80601-2-55 2011

CO_2 Measurement range	0 to 99 mmHg	
Accuracy*	0 to 38 mmHg: 39 to 99 mmHg:	±2 mmHg ±5% of the reading (0.08% increased in error for every 1 mmHg if the reading is more than 38)
Accuracy drift	Meet the requirement for measurement accuracy within 6 hours	
* Accuracy applies for respiration rate up to 80 rpm. For respiration rate above 80 rpm and $EtCO_2$ exceeding 18 mmHg, the accuracy is 4 mmHg or ±12% of the reading, whichever is greater. For respiration rate above 60 rpm, the above accuracy can be achieved by using the CapnoLine H Set for Infant/Neonatal. In the presence of interfering gases, the above accuracy is maintained to within 4%.		
Resolution	1 mmHg	
Sample flow rate	$50^{+15}_{-7.5}$ ml/min	
Initialization time	180 s (maximum)	
Response time	≤2.9 s (The response time is the sum of the rise time and the delay time when using a FilterLine of standard length) Rise time: <190ms@50ml/min Delay time: ≤2.7 s	
awRR measurement range	0 to 150 rpm	
awRR measurement accuracy	0 to 70 rpm: 71 to 120 rpm: 121 to 150 rpm:	±1 rpm ±2 rpm ±3 rpm
awRR resolution	1 rpm	
Data sample rate	40 Hz	

Mainstream CO_2 Module

Standard	Meet the standard of ISO 80601-2-55 2011	
CO_2 Measurement range	0 to 150 mmHg	
Accuracy	0 to 40 mmHg: 41 to 70 mmHg: 71 to 100 mmHg: 101 to 150 mmHg:	±2 mmHg ±5% of the reading ±8% of the reading ±10% of the reading
Accuracy drift	Meet the requirement for measurement accuracy within 6 hours	
Resolution	1 mmHg	
Rise time	<60 ms	
Data sample rate	100 Hz	
awRR measurement range	0 to 150 rpm	
awRR measurement accuracy	±1 rpm	
awRR resolution	1 rpm	

B EMC and Radio Regulatory Compliance

B.1 EMC

The device meets the requirements of IEC 60601-1-2: 2014.

WARNING

- **Use of accessories, transducers and cables other than those specified or provided by the manufacturer of this device could result in increased electromagnetic emissions or decreased electromagnetic immunity of this device and result in improper operation.**
- **Use of this device adjacent to or stacked with other device should be avoided because it could result in improper operation. If such use is necessary, this device and the other device should be observed to verify that they are operating normally.**
- **Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of the this device, including cables specified by the manufacturer. Otherwise, degradation of the performance of this device could result.**
- **The non-ME EQUIPMENT (e.g. ITE) that is a part of an ME SYSTEM may be disrupted by the electromagnetic interference of nearby equipment. It may be necessary to take mitigation measures, such as re-orienting or relocating the non-ME EQUIPMENT or shielding the location.**
- **This device is intended for use in professional healthcare facility EMC environment and home healthcare EMC environment only. If it is used in special environment, such as magnetic resonance imaging environment, the equipment/system may be disrupted by the operation of nearby equipment.**

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**
Conducted and radiated 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 device.
Conducted and radiated RF EMISSIONS CISPR 11	Class B	The device is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Conducted and radiated RF EMISSIONS CISPR 11	Class A (Used with Dock)	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 distortion IEC 61000-3-2	Class A	The device is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Voltage fluctuations and flicker IEC 61000-3-3	Complies	

NOTE

- **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 affect this device even though they meet the requirements of CISPR.**
- **When the inputted signal is below the minimum amplitude provided in technical specifications, erroneous measurements could result.**
- **The EMISSIONS characteristics of this device make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required) this device might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the device.**
- **If the essential performance is lost or degraded, it may be necessary to take mitigation measures, such as re-orienting or relocating the ME EQUIPMENT or ME SYSTEM or shielding the location or stopping using the monitor and contact the service personnel.**

If the device is operated within the electromagnetic environment listed in Table **Guidance and Declaration — Electromagnetic Immunity**, the system will remain safe and provide the following essential performance:

- Operating mode
- Accuracy
- Function
- Accessories identification
- Data stored
- Alarm
- Detect for connection

Guidance and Declaration - Electromagnetic Immunity			
The device is intended for use in the electromagnetic environment specified below. The customer or the user of the device should assure that it is used in such an environment.			
Immunity test	**IEC60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	±8 kV contact ±15kV air	±8 kV contact ±15kV 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 (length greater than 3 m)	±2 kV for power supply lines ±1 kV for input/ output lines (length greater than 3 m)	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 and Voltage interruptions IEC 61000-4-11	0 % U_T for 0,5 cycle 0 % U_T for 1 cycle and 70 % U_T for 25/30 cycles 0 % U_T for 250/300 cycle	0 % U_T for 0,5 cycle 0 % U_T for 1 cycle and 70 % U_T for 25/30 cycles 0 % U_T for 250/300 cycle	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.
RATED power frequency magnetic fields IEC 61000-4-8	30 A/m 50 Hz / 60 Hz	30 A/m 50 Hz / 60 Hz	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
Conducted disturbances induced by RF fields IEC61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	Portable and mobile RF communications equipment should be used no closer to any part of the device, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance: 150k to 80 MHz $d = \left[\frac{3.5}{V}\right]\sqrt{P}$ 80 MHz to 80 0MHz $d = \left[\frac{3.5}{E}\right]\sqrt{P}$ 800 MHz to 2.7GHz $d = \left[\frac{7}{E}\right]\sqrt{P}$ 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). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[b], should be less than the compliance level in each frequency range[c]. Interference may occur in the vicinity of equipment marked with the following symbol: 
	6 Vrms in ISM bands and amateur radio bands[a] between 0,15 MHz and 80 MHz	6 Vrms	
Radiated RF EM fields IEC61000-4-3	10V/m 80 MHz to 2.7 GHz	10V/m	
	20V/m 80 MHz to 2.5 GHz (IEC80601-2-30: 2013, ISO80601-2-55: 2011, ISO80601-2-56: 2009, ISO80601-2-61: 2011)	20V/m	
Proximity fields from RF wireless communications equipment IEC61000-4-3	27 V/m 380–390 MHz	27 V/m	
	28 V/m 430–470 MHz, 800–960 MHz, 1700–1990 MHz, 2400–2570 MHz	28 V/m	
	9 V/m 704–787 MHz, 5100–5800 MHz	9 V/m	

Note 1: At 80 MHz and 800 MHz, 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.

Guidance and Declaration - Electromagnetic Immunity
[a] The ISM (industrial, scientific, and medical) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz. The amateur radio bands between 0,15 MHz and 80 MHz are 1,8 MHz to 2,0 MHz, 3,5 MHz to 4,0 MHz, 5,3 MHz to 5,4 MHz, 7 MHz to 7,3 MHz, 10,1 MHz to 10,15 MHz, 14 MHz to 14,2 MHz, 18,07 MHz to 18,17 MHz, 21,0 MHz to 21,4 MHz, 24,89 MHz to 24,99 MHz, 28,0 MHz to 29,7 MHz and 50,0 MHz to 54,0 MHz. [b] 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 device is used exceeds the applicable RF compliance level above, the device should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the device. [c] Over the frequency ranges 150 kHz to 80 MHz, field strengths should be less than 3V/m.

Recommended Separation Distances between Portable and Mobile RF, Communications Equipment and This Equipment			
The equipment is intended for use in an electromagnetic environment in which radiated RF disturbance 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 communication equipment.			
Rated Maximum Output power of Transmitter Watts (W)	**Separation Distance According to Frequency of Transmitter (m)**		
	150 kHz to 80 MHz $d = \left[\frac{3.5}{V}\right]\sqrt{P}$	80 MHz to 800 MHz $d = \left[\frac{3.5}{E}\right]\sqrt{P}$	800 MHz to 2.7 GHz $d = \left[\frac{7}{E}\right]\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.20	2.3
10	3.8	3.80	7.3
100	12	12.00	23
For transmitters at a maximum output power not listed above, the recommended separation distanced in meters (m) can be determined 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 higher frequency range applies. **Note 2**: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

B.2 Radio Regulatory Compliance

RF parameters

Radio devices	IEEE 802.11b/g/n (2.4G)	IEEE 802.11a/n (5G)
Operating Frequency	ETSI: 2.4 GHz to 2.483 GHz FCC: 2.4 GHz to 2.483 GHz MIC: 2.4 GHz to 2.495GHz KC: 2.4 GHz to 2.483 GHz	ETSI: 5.15 GHz to 5.35 GHz, 5.47 GHz to 5.725 GHz FCC:5.15GHz to 5.35GHz, 5.47~5.725GHz to 5.725GHz to 5.825GHz MIC: 5.15GHz to 5.35GH, 5.47 to 5.725GHz KC:5.15GHz to 5.35GHz, 5.47 to 5.725GHz, 5.725GHz to 5.825GHz
Modulation Mode	DSSS and OFDM	OFDM
Output Power	<30dBm (Peak Power) <20dBm (Average Power)	

CE

The radio device used in this product is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.

For body worn operation, this equipment has been tested and meets the CE RF exposure guidelines when used with the accessories supplied or those approved for use with this product. Use of other accessories may not ensure compliance with CE RF exposure guidelines.

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C Default Settings

C.1 Parameters Default Settings

C.1.1 ECG, Arrhythmia, ST and QT Default Settings

C.1.1.1 ECG Default Settings

Item		Default Setting
HR/PR	Alarm switch	On
	High limit	Adult: 120 bpm Pediatric: 160 bpm Neonate: 200 bpm
	Low limit	Adult: 50 bpm Pediatric: 75 bpm Neonate: 100 bpm
	Priority	Med
	Alarm Outputs	Off
	Alarm Source	Auto
Extreme Tachy	Alarm switch	On
	High limit	Adult: 160 bpm Pediatric: 180 bpm Neonate: 220 bpm
	Priority	High
	Alarm Outputs	Off
Extreme Brady	Alarm switch	On
	Low limit	Adult: 35 bpm Pediatric: 50 bpm Neonate: 60 bpm
	Priority	High
	Alarm Outputs	Off
Alarm Source		Auto
ECG1		II
ECG2 (5-lead, 6-lead, 12-lead)		V, Va, V1
Va (for 6-lead only)		Va
Vb(for 6-lead only)		Vb
ECG Gain		×1
Speed		25 mm/sec
Filter		OR: Surgery CCU: Diagnostic Other departments: Monitor

Item	Default Setting
High FreqCut-off (for 12-lead only)	35 Hz
Notch Filter	On
Lead Set	Auto
D12L(for 6-lead only)	Off
Smart Lead	On
QRS Volume	General, OR: 2 Other department : 0
Baseline Drift Removal (for 12-lead only)	On
Waveform Layout	Standard
CrozFusion	On
CrozFusion Display	Off
QRS Threshold	0.16 mV
Paced	Adult: Unspecified Pediatric/neonate: No
Pacer Reject	Off

C.1.1.2 Arrhythmia Default Settings

Arrhythmia Alarm Default Settings

Item	Alarm Switch	Priority	Alarm Outputs
Asystole	On	High, unadjustable	Off
V-Fib/V-Tach	On	High, unadjustable	Off
V-Tach	On	High, unadjustable	Off
Vent Brady	On	High, unadjustable	Off
Extreme Tachy	On	High, unadjustable	Off
Extreme Brady	On	High, unadjustable	Off
R on T	CCU: On Other departments: Off	Med	Off
Run PVCs	Off	Low	Off
Couplet	Off	Prompt	Off
Multiform PVC	Off	Med	Off
PVC	Off	Prompt	Off
Bigeminy	CCU: On Other departments: Off	Med	Off
Trigeminy	CCU: On Other departments: Off	Med	Off
Tachy	Off	Med	Off
Brady	Off	Med	Off
Pacer Not Capture	Off	Prompt	Off
Pacer Not Pacing	Off	Prompt	Off
Missed Beat	Off	Prompt	Off
Nonsus V-Tach	CCU: On Other departments: Off	Med	Off
Vent Rhythm	CCU: On Other departments: Off	Med	Off
Pause	Off	Low	Off
Irr. Rhythm	Off	Prompt	Off
A-Fib	Off	Prompt	Off
PVCs/min	CCU: On Other departments: Off	Med	Off
Pauses/min	CCU: On Other departments: Off	Med	Off

Arrhythmia Threshold Default Settings

Item	Default Setting		
	Adult	Pediatric	Neonate
Asystole Delay	5 sec	5 sec	5 sec
Tachy	120 bpm	160 bpm	200 bpm

Item	Default Setting		
	Adult	Pediatric	Neonate
Brady	50 bpm	75 bpm	100 bpm
Extreme Tachy	160 bpm	180 bpm	220 bpm
Extreme Brady	35 bpm	50 bpm	60 bpm
Multiform PVCs Window	15 beats	15 beats	15 beats
PVCs/min	10	10	10
Pauses/min	8	8	8
Pause Threshold	2.0 sec	2.0 sec	2.0 sec
AF/Irr Rhy End Time	2 min	2 min	2 min
V-Tach Rate	130 bpm	130 bpm	160 bpm
V-Brady Rate	40 bpm	40 bpm	40 bpm
V-Tach PVCs	6	6	6
V-Brady PVCs	5	5	5

C.1.1.3 ST Default Settings

Item		Default Setting
ST Alarm Mode		Absolute
ST-I, ST-II, ST-III, ST-aVR, ST-aVL, ST-aVF, ST-V1, ST-V2, ST-V3, ST-V4, ST-V5,ST-V6, ST-Va, ST-Vb (ST Alarm Mode set to **Absolute**)	Alarm switch	Off
	High limit	0.2 mV
	Low limit	-0.2 mV
	Priority	Med
	Alarm Outputs	Off
ST Single, ST Dual (ST Alarm Mode set to **Relative**)	Alarm switch	Off
	High limit	0.1 mV
	Low limit	-0.1 mV
	Priority	Med
	Alarm Outputs	Off
ST Analysis		Off
ST Segment		Auto
Show Marker		Off
ST Point		J+60 ms
Auto Adjust		On
J		48
ISO		-80

C.1.1.4 QT Default Settings

Item		Default Setting
QTc	Alarm switch	Off
	High limit	Adult: 500 Pediatric: 480 Neonate: 460
	Priority	Med
	Alarm Outputs	Off
ΔQTc	Alarm switch	Off
	High limit	60
	Priority	Med
	Alarm Outputs	Off
QT Analysis		Off
QT Lead		All

C.1.1.5 Glasgow 12-lead ECG Algorithm Default Settings

Item	Default Setting
Filter	35 Hz
Baseline Drift Removal	On
Tachy	100
Brady	50
Waveform Layout	Standard
Median Complex	Off
Measurements	On
Interpretation	On
Interpretation Summary	On
Auto Interval	10 mm/mV
Speed	25 mm/sec
Auto Interval	Off
12-Lead Format	3×4+1
Rhythm Lead 1	II
Rhythm Lead 2	V2
Rhythm Lead 3	V5

C.1.2 Respiration Default Settings

Item		Default Setting
RR	Alarm switch	On
	High limit	Adult: 30 Pediatric: 30 Neonate: 100
	Low limit	Adult: 8 Pediatric: 8 Neonate: 30
	Priority	Med
	Alarm Outputs	Off
Apnea	Alarm switch	On
	Priority	High, unadjustable
	Alarm Outputs	Off
Apnea Delay		Adult: 20 sec Pediatric: 20 sec Neonate: 15 sec
RR Source		Auto
Resp Lead		Adult: Auto Pediatric: Auto Neonate: II
Gain		×2
Speed		6.25 mm/s
Auto Threshold Detection		On

C.1.3 SpO_2 Default Settings

Item		Default Setting
SpO_2	Alarm switch	On
	High limit	Adult: 100% Pediatric: 100% Neonate: 95%
	Low limit	90%
	Priority	Med
	Alarm Outputs	Off
SpO_2 Desat	Alarm switch	On
	Low limit	80%
	Priority	High
	Alarm Outputs	Off
Satsecond (for Nellcor SpO_2)		Off
NIBP Simul		Off
Sensitivity (for Mindray SpO_2)		Medium

Item		Default Setting
Display PI (for Mindray SpO_2)		On
Speed		25 mm/s
PR	Alarm switch	On
	High limit	Adult: 120 Pediatric: 160 Neonate: 200
	Low limit	Adult: 50 Pediatric: 75 Neonate: 100
	Priority	Med
	Alarm Outputs	Off
	Alarm Source	Auto
	PR Source	Auto
	Display PR	On
	QRS Volume	General, OR: 2 Other departments: 0

C.1.4 Temperature Default Settings

Item		Default Setting
Txx (xx refers to temperature site)	Alarm switch	On
	High limit	38.0 ℃
	Low limit	35.0 ℃
	Priority	Med
	Alarm Outputs	Off
ΔT	Alarm switch	On
	High limit	2.0 ℃
	Priority	Med
	Alarm Outputs	Off

C.1.5 NIBP Default Settings

Item		Default Setting
NIBP-S	Alarm switch	On
	High limit	Adult: 160 mmHg Pediatric: 120 mmHg Neonate: 90 mmHg
	Low limit	Adult: 90 mmHg Pediatric: 70 mmHg Neonate: 40 mmHg
	Priority	Med
	Alarm Outputs	Off

Item		Default Setting
NIBP-D	Alarm switch	On
	High limit	Adult: 90 mmHg Pediatric: 70 mmHg Neonate: 60 mmHg
	Low limit	Adult: 50 mmHg Pediatric: 40 mmHg Neonate: 20 mmHg
	Priority	Med
	Alarm Outputs	Off
NIBP-M	Alarm switch	On
	High limit	Adult: 110 mmHg Pediatric: 90 mmHg Neonate: 70 mmHg
	Low limit	Adult: 60 mmHg Pediatric: 50 mmHg Neonate: 25 mmHg
	Priority	Med
	Alarm Outputs	Off
NIBP-S Extreme	Alarm switch	Off
	High limit	Adult: 175 mmHg Pediatric: 130 mmHg Neonate: 95 mmHg
	Low limit	Adult: 75 mmHg Pediatric: 60 mmHg Neonate: 35 mmHg
	Priority	High
	Alarm Outputs	Off
NIBP-D Extreme	Alarm switch	Off
	High limit	Adult: 105 mmHg Pediatric: 80 mmHg Neonate: 65 mmHg
	Low limit	Adult: 35 mmHg Pediatric: 30 mmHg Neonate: 15 mmHg
	Priority	High
	Alarm Outputs	Off
NIBP-M Extreme	Alarm switch	Off
	High limit	Adult: 125 mmHg Pediatric: 100 mmHg Neonate: 75 mmHg
	Low limit	Adult: 45 mmHg Pediatric: 40 mmHg Neonate: 20 mmHg
	Priority	High
	Alarm Outputs	Off

Item	Default Setting
Initial Pressure	Adult: 160 mmHg Pediatric: 140 mmHg Neonate: 90 mmHg
Interval	OR: 5 min Neonatology: 30 min Other departments: 15 min
Start Mode	Clock
NIBP End Tone	Off
Venipuncture Pressure	Auto
Display Format	Sys/Dia (Mean)
Display Alarm Limits	Off
Display PR	Off

C.1.6 IBP Default Settings

Item		Default Setting
IBP-S	Alarm switch	On
	High limit	• Art/pArt/Ao/UAP/BAP/FAP/LV/P1-P4 arterial pressure Adult: 160 mmHg Pediatric: 120 mmHg Neonate: 90 mmHg • PA Adult: 35 mmHg Pediatric and neonate: 60 mmHg
	Low limit	• Art/pArt/Ao/UAP/BAP/FAP/LV/P1-P4 arterial pressure Adult: 90 mmHg Pediatric: 70 mmHg Neonate: 55 mmHg • PA Adult: 10 mmHg Pediatric and neonate: 24 mmHg
	Priority	Med
	Alarm Outputs	Off

Item		Default Setting
IBP-D	Alarm switch	On
	High limit	• Art/pArt/Ao/UAP/BAP/FAP/LV/P1-P4 arterial pressure Adult: 90 mmHg Pediatric: 70 mmHg Neonate: 60 mmHg • PA Adult: 16 mmHg Pediatric and neonate: 4 mmHg
	Low limit	• Art/pArt/Ao/UAP/BAP/FAP/LV/P1-P4 arterial pressure Adult: 50 mmHg Pediatric: 40 mmHg Neonate: 20 mmHg • PA Adult: 0 mmHg Pediatric and neonate: -4 mmHg
	Priority	Med
	Alarm Outputs	Off
IBP-M	Alarm switch	On
	High limit	• Art/pArt/Ao/UAP/BAP/FAP/LV/P1-P4 arterial pressure Adult: 110 mmHg Pediatric: 90 mmHg Neonate: 70 mmHg • PA Adult: 20 mmHg Pediatric and neonate: 26 mmHg • CVP/pCVP Adult: 14 cmH_2O Pediatric and neonate: 5 cmH_2O • ICP/RAP/LAP/UVP/P1-P4 venous pressure Adult: 10 mmHg Pediatric and neonate: 4 mmHg
	Low limit	• Art/pArt/Ao/UAP/BAP/FAP/LV/P1-P4 arterial pressure Adult: 70 mmHg Pediatric: 50 mmHg Neonate: 35 mmHg • PA Adult: 0 mmHg Pediatric and neonate: 12 mmHg • CVP/pCVP Adult: 0 cmH_2O Pediatric and neonate: 0 cmH_2O • /ICP/RAP/LAP/UVP/P1-P4 venous pressure Adult: 0 mmHg Pediatric and neonate: 0 mmHg
	Priority	Med
	Alarm Outputs	Off

Item		Default Setting
Art-S Extreme	Alarm switch	Off
	High limit	Adult: 175 mmHg Pediatric: 130 mmHg Neonate: 95 mmHg
	Low limit	Adult: 75 mmHg Pediatric: 60 mmHg Neonate: 50 mmHg
	Priority	High
	Alarm Outputs	Off
Art-D Extreme	Alarm switch	Off
	High limit	Adult: 105 mmHg Pediatric: 80 mmHg Neonate: 65 mmHg
	Low limit	Adult: 35mmHg Pediatric: 30 mmHg Neonate: 15 mmHg
	Priority	High
	Alarm Outputs	Off
Art-M Extreme	Alarm switch	Off
	High limit	Adult: 125 mmHg Pediatric: 100 mmHg Neonate: 75 mmHg
	Low limit	Adult: 55 mmHg Pediatric: 40 mmHg Neonate: 30 mmHg
	Priority	High
	Alarm Outputs	Off
CPP	Alarm switch	On
	High limit	Adult: 130 mmHg Pediatric: 100 mmHg Neonate: 90 mmHg
	Low limit	Adult: 50 mmHg Pediatric: 40 mmHg Neonate: 30 mmHg
	Priority	Med
	Alarm Outputs	Off
Measure (for P1, P2)		All
Measure (for P3, P4)		Mean only
Sensitivity		Med
Speed		25 mm/sec

Item		Default Setting
Scale	ICP/RAP/LAP/UVP venous pressure	0-20 mmHg
	CVP/pCVP	0-30 cmH_2O
	Art/pArt/Ao/BAP/FAP/ LV/P1/P2 arterial pressure	0-160 mmHg
	UAP/P3/P4 venous pressure	0-80 mmHg
	PA	0-30 mmHg
Display Format		Sys/Dia (Mean)
Display Alarm Limits		Off
Use PA-D as PAWP (only available for independent external display)		Off
PPV Measure		Off
PPV Source		Auto
PAWP	Reference Waveform 1	II
	Reference Waveform 2	Resp
	Speed	12.5 mm/sec
	PA Scale	0-30 mmHg
Overlapping Waveform Setup	Left Scale	0-160 mmHg
	Right Scale	0-20 mmHg
	CVP Scale	0-20 cmH_2O
	ICP Scale	0-20 mmHg
	PA Scale	0-30 mmHg
	Speed	25 mm/sec
	Gridlines	Off

C.1.7 CCO Default Settings

Item		Default Setting
CCO	Alarm switch	On
	High limit	14.0
	Low limit	2.0
	Priority	Med
	Alarm Outputs	Off
CCI	Alarm switch	On
	High limit	10.0
	Low limit	1.0
	Priority	Med
	Alarm Outputs	Off
Auto pCVP		On

Item	Default Setting
Auto Start	On
Injectate Volume	Adult: 15 ml Pediatric: 10 ml
Select Parameter	CCI, GEDI, ELWI, SVRI, GEF

C.1.8 CO_2 Default Settings

C.1.8.1 General Settings

Item		Default Setting
$EtCO_2$	Alarm switch	On
	High limit	Adult and pediatric: 50 mmHg Neonate: 45 mmHg
	Low limit	Adult and pediatric: 25mmHg Neonate: 30mmHg
	Priority	Med
	Alarm Outputs	Off
$FiCO_2$	Alarm switch	On
	High limit	4 mmHg
	Priority	Med
	Alarm Outputs	Off
Apnea Delay		Adult and pediatric: 20 s Neonate: 15 s
RR Source		Auto
Speed		6.25 mm/s
Scale		50 mmHg
Waveform Type		Draw

C.1.8.2 Sidestream CO_2 Default Settings

Item		Default Setting
EtO_2	Alarm switch	On
	High limit	88%
	Low limit	18%
	Priority	Med
	Alarm Outputs	Off

Item		Default Setting
FiO_2	Alarm switch	On
	High limit	Adult and pediatric: 100% Neonate: 90%
	Low limit	18%
	Priority	Med
	Alarm Outputs	Off
BTPS Compensation		Off
O_2 Compensation		OR: 100% Other departments: 21%
N_2O Compensation		0%
AG Compensation		0%
Auto Standby		60 min
Operating Mode		Measure

C.1.8.3 Microstream CO_2 Default Settings

Item	Default Setting
BTPS Compen	Off
Maximum Hold	20 sec
Auto Standby	Off
Operating Mode	Measure

C.1.8.4 Mainstream CO_2 Default Settings

Item	Default Setting
Maximum Hold	10 sec
O_2 Compensation	Off
Balance Gas	Room Air
AG Compensation	0%
Operating Mode	Measure

C.2 Routine Default Settings

C.2.1 Alarm Default Settings

Item	Default Setting
Alarm Volume	2
High Alarm Volume	Alarm Volume + 2
Reminder Volume	2
Apnea Delay	Adult: 20 sec pediatric:20sec Neonate:15sec
Printing Duration on Alarm	20 sec

C.2.2 Review Default Settings

Item		Default Setting
Tabular Trends	Trend Group	Standard
	Interval	OR: 5 min Other departments: 30 min
Graphic Trends	Trend Group	Standard
	Zoom	8 hrs
	Trends	5
Events	Filter	Off
	Filter Setup	All On
	Beat Anno	Off
	Speed	25 mm/s
	Gain	×1
Full Disclosure	Display (Maximum: 3)	II
	Storage	II
	Duration	1 min
	Scale	×1
	Beat Anno	Off
	Speed	25 mm/sec
	Gain	×1
12-Lead ECG	Speed	25 mm/sec
	Gain	×1
	Layout	3×4+1

C.2.3 Minitrends Default Settings (only available for the independent external display)

Item		Default Setting
Alarm Statistics		OR: Off Other departments: On
Alarm Statistics Length		OR: 2hrs Other departments: 8 hrs
Minitrend Length		OR: 30 min Other departments: 2 hrs
Baseline (for OR department only)		On
Routine Vital		Manual
Time	(For **Routine Vital** set to **Auto**)	08:00
Interval	(For **Routine Vital** set to **Auto**)	8 hrs

C.2.4 OxyCRG Default Settings (only available for the independent external display)

Item	Default Setting
Trend1	btbHR
Trend2	SpO2
Compressed	Resp
Threshold (HR)	100 bpm
Duration (HR)	0 s
Threshold (SpO2)	80
Duration (SpO2)	0 s
Apnea	15 sec
Event Storage Format	2 min+2 min

C.2.5 Display Default Settings

Item		Default Setting
Choose Screen		Normal Screen
Screen Lock Duration		General, CCU: Permanent Other departments: 10s
Display	Brightness	5
	Key Volume	2
Night Mode	Brightness	1
	Alarm Volume	2
	QRS Volume	1
	Key Volume	0
	NIBP End Tone	Off
	Stop NIBP	Off

C.2.6 Report Default Settings

Item		Default Setting
ECG Report	Amplitude	10 mm/mV
	Speed	25 mm/sec
	Auto Interval	Off
	12-Lead Format	3×4+1
	Rhythm Lead 1	II
	Rhythm Lead 2	V2
	Rhythm Lead 3	V5
	Format Sequence	Sequential
Realtime Report	Speed	Auto
	Select Waveform	Current Waveforms
Tabular Trends Report	Period	Auto
	Interval	Auto
	Report Format	Parameter Oriented
	Trend Group	Standard
Graphic Trends	Period	Auto
	Trend Group	Standard

C.2.7 Calculations Default Settings (only available for the independent external display)

Item			Default Setting
Drug	Calculator	Weight Based	Off
		Drug Amount	mcg
		Solution Volume	ml
		Dose	mcg/min
		Concentration	mcg/ml
		Infusion Time	hr
		Infusion Rate	ml/hr
	Titration Table	Dose Type	Dose/hr
		Interval	1
Oxygenation	OxyCont Unit		ml/L
	Hb Unit		g/dl
	Pressure Unit		mmHg
Ventilation	Pressure Unit		mmHg

C.2.8 System Time Default Settings

Item	Default Setting
Date Format	yyyy-mm-dd

Item	Default Setting
24-Hour Time	On
Daylight Savings Time	Off

D Alarm Messages

D.1 Physiological Alarm Messages

This section lists physiological alarms, their default priority, and the actions that can be taken when an alarm occurs.

D.1.1 General Physiological Alarm Messages

Alarm messages	Default priority	Cause and solution
XX High	Med	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 Low	Med	

Note: XX represents a measurement or parameter label, such as HR, NIBP, PVCs, RR, SpO_2, PR, and so on.

D.1.2 Arrhythmia Alarm Messages

Alarm message	Default priority
Asystole	High
V-Fib/V-Tach	High
V-Tach	High
Vent Brady	High
Extreme Tachy	High
Extreme Brady	High
PVCs/min	Med
Pauses/min	Med
R on T	Med
Bigeminy	Med
Trigeminy	Med
Tachy	Med
Brady	Med
Multiform PVC	Med
Vent Rhythm	Med
Nonsus V-Tach	Med
Run PVCs	Low
Pause	Low
Couplet	Prompt
PVC	Prompt
Irr Rhythm	Prompt
Pacer Not Pacing	Prompt

Alarm message	Default priority
Pacer Not Capture	Prompt
Missed Beat	Prompt
A-Fib	Prompt

Note: When arrhythmia alarms occur, check the patient's condition and the ECG connections.

D.1.3 Resp Physiological Alarm Messages

Alarm message	Default priority	Cause and solution
Resp Aritifact	High	The patient's heartbeat has interfered with his respiration. Check the patient's condition and the Resp connections.
Apnea	High	The respiration signal was so weak that the monitor cannot perform respiration analysis. Check the patient's condition, module and patient connections.

D.1.4 SpO_2 Physiological Alarm Messages

Alarm message	Default priority	Cause and solution
SpO_2 Desat	High	The SpO_2 value falls below the desaturation alarm limit. Check the patient's condition and check if the alarm limit settings are correct.

D.1.5 PR Physiological Alarm Messages

Alarm message	Default priority	Cause and solution
No Pulse	High	The pulse signal was so weak that the monitor cannot perform pulse analysis. Check the patient's condition, SpO2 sensor and measurement site.

D.1.6 NIBP Physiological Alarm Messages

Alarm message	Default priority	Cause and solution
NIBP-S/NIBP-D/NIBP-M Extremely High	High	The NIBP value is higher than the NIBP Extreme alarm high limit. Check the patient's condition and check if the alarm limit settings are correct.
NIBP-S/NIBP-D/NIBP-M Extremely Low	High	The NIBP value is lower than the NIBP Extreme alarm low limit. Check the patient's condition and check if the alarm limit settings are correct.

D.1.7 IBP Physiological Alarm Messages

Alarm message	Default priority	Cause and solution
Art-S/Art-D/Art-M Extremely High	High	The Art value is higher than the Art Extreme alarm high limit. Check the patient's condition and check if the alarm limit settings are correct.
Art-S/Art-D/Art-M Extremely Low	High	The Art value is lower than the Art Extreme alarm low limit. Check the patient's condition and check if the alarm limit settings are correct.

D.1.8 CO_2 Physiological Alarm Messages

Alarm message	Default priority	Cause and solution
FiO_2 Shortage	High	FiO_2 concentration is less than18%. Check the patient's condition, the ventilated O_2 content and the airway connection.

D.1.9 EWS Physiological Alarm Messages

Alarm message	Default priority	Cause and solution
EWS Score > N	High/Mediate	The total score exceeds the configured alarm limit. Check the patient condition.
XX score = 3	Mediate	The parameter score is 3. Check the patient condition.

Note: N represents a numeric. XX represents RR, SpO_2, Temp, BP-S, BP-D, BP-M, HR, $EtCO_2$, or FiO_2.

D.2 Technical Alarm Messages

This section lists technical alarms, their default priority, indication on alarm reset, and the actions that can be taken when an alarm occurs.

Technical alarms give different alarm indicators when the alarm system is reset. In this section we classify the technical alarms into three categories for easy clarification:

- A: technical alarms are cleared. The monitor gives no alarm indications.
- B: technical alarms are changed to the prompt messages.
- C: the alarm is silenced and a √ appears before the alarm message, indicating that the alarm is acknowledged.

In the following tables we will use A, B, and C to refer to the indications on alarm reset.

D.2.1 General Technical Alarm Messages

Alarm message	Default priority	Indication on alarm reset	Cause and solution
XX Module Error	High	C	XX module does not work properly. Replug the module, if the alarm persists, contact your service personnel.

Note: XX represents a measurement or parameter label, such as ECG, SpO_2, NIBP, IBP, CO_2, and so on.

D.2.2 ECG Technical Alarm Messages

Alarm message	Default priority	Indication on alarm reset	Cause and solution
ECG Noisy	Low/Prompt	A	The ECG signal is noisy. Check for any possible sources of signal noise around the cable and electrode, and check the patient for excessive motion.
ECG Amplitude Too Small	Low	C	The ECG amplitude does not reach the detected threshold. Check for any possible source of interference around the cable and electrode.

Alarm message	Default priority	Indication on alarm reset	Cause and solution
ECG XX Lead Off	Low	B	The electrode has become detached from the patient or the lead wire has become disconnected from the adapter cable. Check the connections of the electrodes and leadwires.
ECG Signal Invalid	Low	A	Patient skin impedance is too high. Check ECG electrode application.
ECG Learning	Prompt	/	ECG learning is manually or automatically triggered.
Cannot Analyze QT	Prompt	/	/
D12L not available	Prompt	C	The current Va and Vb combination does not support D12L. Choose an available Va and Vb combination. For more information, see *9.5 Using 6-lead Placement to Derive 12-lead ECG (D12L)*.

Note: XX represents ECG lead name, for example RL, LL, V, Va, Vb, and so on.

D.2.3 Resp Technical Alarm Messages

Alarm message	Default priority	Indication on alarm reset	Cause and solution
Resp Interference	Prompt	/	The respiration circuit is disturbed. Check for any possible sources of signal noise.
Electrode Poor Contact	Prompt	/	Check the electrode application. Reposition or replace the electrodes if necessary.

D.2.4 SpO_2 Technical Alarm Messages

Alarm message	Default priority	Indication on alarm reset	Cause and solution
SpO_2 Sensor Off	Low	B	The SpO_2 sensor has become detached from the patient or the module. Check the sensor connection. If the alarm persists, replace the sensor.
SpO_2 No Sensor	Low	A	The SpO_2 extension cable is detached from the SpO_2 module, or the SpO_2 sensor is detached from the SpO_2 extension cable. Check the SpO_2 cable and the sensor connection. If the alarm persists, replace the sensor.
SpO_2 Excess Light	Low	C	Ambient light is too strong. Move the sensor to a place with lower level of ambient light or cover the sensor to minimize the ambient light.
SpO_2 No Pulse	Low	C	The SpO_2 sensor failed to obtain pulse signal. Check the patient's condition and replace the sensor application site. If the alarm persists, replace the sensor.
SpO_2 Sensor Incompatible	Low	C	Incompatible or an unspecified SpO_2 sensor is used. Use specified sensors.

Alarm message	Default priority	Indication on alarm reset	Cause and solution
SpO_2 Low Signal Quality	Low	C	1. Check the sensor and sensor position. 2. Make sure the patient is not shivering or moving. 3. The patient's pulse may be too low to be measured.
SpO_2 Interference	Low	C	The SpO_2 signal has been interfered. Check for any possible sources of signal noise and check the patient for excessive motion.
SpO_2 Sensor Error	Low	C	Replace the sensor and measure again.
SpO_2 Searching Pulse	Prompt	/	SpO_2 is searching for pulse.
SpO_2 Low Perfusion	Prompt	/	The SpO_2 sensor is not properly placed or the patient's perfusion index is too low. 1. Check the sensor and sensor position. 2. Reposition the sensor if necessary.

D.2.5 Temp Technical Alarm Messages

Alarm message	Default priority	Indication on alarm reset	Cause and solution
T1/T2 Sensor Off	Low	A	Check the sensor connection and reconnect the sensor.

D.2.6 NIBP Technical Alarm Messages

Alarm message	Default priority	Indication on alarm reset	Cause and solution
NIBP Cuff Loose	Low	A	There is a leak in the cuff or air tubing. Use a cuff of correct type based on the patient size. Apply the cuff and connect the air tubing as instructed in the manual.
NIBP Cuff or Airway Leak	Low	A	Check the NIBP cuff and pump for leakages.
NIBP Airway Error	Low	A	The air tubing may be occluded. Check the air tubing for an occlusion or kinking. If the alarm persists, contact your service personnel.
NIBP Weak Signal	Low	A	The patient's pulse is weak or the cuff is loose. Check the patient's condition and replace the cuff application site.
NIBP Overrange	Low	A	The measured NIBP value exceeds the module measurement range. Check the patient's condition.
NIBP Excessive Motion	Low	A	Check the patient's condition and reduce patient motion.
NIBP Cuff Overpressure	Low	A	The NIBP airway may be occluded. Check the airway and measure again. If the alarm persists, contact your service personnel.
NIBP Timeout	Low	A	The measurement time exceeds 120 seconds in the adult or pediatric mode, or exceeds 90 seconds in the neonatal mode, and the BP value cannot be obtained. Check the patient's condition and NIBP connections, or replace the cuff and measure again.

Alarm message	Default priority	Indication on alarm reset	Cause and solution
NIBP Cuff and Patient Mismatch	Low	A	The cuff type mismatches the patient category. Verify the patient category or replace the cuff if necessary. If patient category is correct, check that the tubing is not bent and the airway is not occluded.
NIBP Airway Leak	Low	A	Airway leakage is found during the NIBP leakage test. Check the NIBP cuff and pump for leakages.

D.2.7 IBP Technical Alarm Messages

Alarm message	Default priority	Indication on alarm reset	Cause and solution
XX Sensor Error	Med	C	The IBP sensor fails. Replace the sensor.
XX No Sensor	High, Med, or Low, configurable	A	The IBP patient cable and/or corresponding IBP sensor is not connected or detached. Check the cable and sensor connection.
XX No Pulse	Low	A	The catheter may be occluded. Please flush the catheter.
XX Disconnected	High	C	The liquid way is disconnected 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 alarm persists, contact your service personnel.

Note: XX represents an IBP label, for example PA, CVP, FAP, P1, and so on.

D.2.8 CCO Technical Alarm Messages

Alarm message	Default priority	Indication on alarm reset	Cause and solution
Invalid PiCCO Catheter	Low	C	Erroneous or invalid catheter is used. Replace the catheter with the recommended catheter.
TI /TB Sensor Off	Low	A	Check the sensor connections.
TI Sensor Error	Low	C	Replace the sensor.
Invalid CCO calibration	Low	C	The arterial pressure is invalid. Check the pArt measurement.

D.2.9 CO_2 Technical Alarm Messages

Alarm message	Default priority	Indication on alarm reset	Cause and solution
CO_2 Module High Temp	Low	C	Ambient temperature is too high or there is a module failure. 1. Lower the operating temperature. 2. Replug the module. 3. If the alarm persists, the CO_2 module may fail, contact your service personnel.

Alarm message	Default priority	Indication on alarm reset	Cause and solution
CO_2 Module Low Temp	Low	C	Ambient temperature is too low or there is a module failure. 1. Raise the operating temperature. 2. Replug the module. 3. If the alarm persists, the CO_2 module may fail, contact your service personnel.
CO_2 Zero Failed	Low	C	For mainstream CO_2 module, check the connections between the adapter and CO_2 transducer. Wait till the sensor's temperature becomes stabilized, and then perform a zero calibration again. For sidestream CO_2 module, replug the module. If the alarm persists, contact your service personnel.
CO_2 No Watertrap	Low	B	Check the watertrap connections.
CO_2 High Airway Pressure	Low	C	1. Check the airway pressure settings of the ventilator/anesthesia machine. 2. Disconnect the module from the ventilator/ anesthesia machine. 3. Replug the module. 4. If the alarm persists, contact your service personnel.
CO_2 Low Airway Pressure	Low	C	1. Check the airway pressure settings of the ventilator/anesthesia machine. 2. Disconnect the module from the ventilator/ anesthesia machine. 3. Replug the module. 4. If the alarm persists, contact your service personnel.
CO_2 High Barometric	Low	C	The ambient pressure exceeds the operating pressure range or CO_2 module fails. 1. Make sure that the ambient pressure meets the specifications, and check for sources that affect the ambient pressure. 2. Replug the module. If the alarm persists, contact your service personnel.
CO_2 Low Barometric	Low	C	The ambient pressure exceeds the operating pressure range or CO_2 module fails. 1. Make sure that the ambient pressure meets the specifications, and check for sources that affect the ambient pressure. 2. Replug the module. If the alarm persists, contact your service personnel.
CO_2 Airway Occluded	Low	C	1. Check if the sample line is kinked or occluded. 2. Replace the sample line. 3. Replug the module. 4. If the alarm persists, contact your service personnel.
CO_2 No Filterline	Low	A	Make sure that the filterline is connected.
CO_2 Calibration Required	Low	C	Perform a calibration.
CO_2 Airway Error	Low	C	1. Check if the sample line is kinked or occluded. 2. Replace the sample line. 3. Replug the module. 4. If the alarm persists, contact your service personnel.

Alarm message	Default priority	Indication on alarm reset	Cause and solution
CO_2 Adapter Error	Low	A	Check, clean or replace the airway adapter. Perform a zero calibration.
CO_2 No Sensor	Low	A	Make sure that the CO_2 transducer is connected.
CO_2: Change Watertrap	Low	C	Replace the watertrap.
CO_2 Watertrap and Patient Mismatch	Low	C	Check the patient category and use a correct watertrap.

D.2.10 EWS Technical Alarms

Alarm message	Default priority	Indication on alarm reset	Cause and solution
EWS param XX is timeout	Low	A	The manually input parameter is timeout. Input a parameter numeric again.
EWS score needs to be confirmed	Low	A	Confirm to save or give up current score.

XX represents RR, SpO2, Supp. O2, Temp, BP, HR, Consciousness, Blood Sugar, Urine Output, Catheter, Pain Score, Pain, EtCO2, FiO2, Airway, or Customer defined parameter.

D.2.11 Power Supply Technical Alarm Messages

Alarm message	Default priority	Indication on alarm reset	Cause and solution
Low Battery	Med	C	Connect the monitor to an AC power source and allow the batteries to charge.
Critically Low Battery	High	C	Connect the monitor to an AC power source and allow the batteries to charge.
Battery Service Required	Low	B	The battery reaches its lifetime. Replace the battery.
Power Board Comm Error	High	C	Restart the monitor. If the alarm persists, contact your service personnel.
Battery Error	High	C	The battery may fail. Contact your service personnel.
Battery Charging Error	High	C	The charging circuit fails or the battery fails. Contact your service personnel.
Battery Temperature Too High	High	C	Stop using the monitor after this alarm appears, and contact your service personnel.
Battery Off	High	C	Restart the monitor. If the alarm persists, contact your service personnel.
RT Clock Need Reset	High	C	Contact your service personnel.
RT Clock Not Exist	High	C	Contact your service personnel.
XX V Too High	High	C	There is a problem with the system power supply. Restart the monitor.
XX V Too Low	High	C	

XX represents 2.5 V, 3.3 V,5 V, or 12 V.

D.2.12 Printer Technical Alarm Messages

Alarm message	Default priority	Indication on alarm reset	Cause and solution
Printer Buffer Full	Prompt	/	The printer buffer is full. Wait till the printer finishes the printing task.
Fail	Prompt	/	The printer runs out of paper or cannot be connected. Check the printer.
Printing Stopped	Prompt	/	Printing is manually stopped.
Printer Unavailable	Prompt	/	The printer may fail. Check the printer.
PDF storage space is nearly full	Prompt	/	Delete the files saved under the PDF file path to release storage space. Otherwise you cannot save new PDF files.
Error storing PDF file	Prompt	/	The PDF file path settings on the printer server and the PDFCreator are not consistent or the PDF storage space is full. Check the PDF file path settings for consistency, or delete the files saved under the PDF file path to release storage space.
Change the print server language to be consistent with this monitor	Prompt	/	Verify that the language settings of the printer server and the monitor are consistent, Otherwise you cannot perform printing.
Print Server Disconnected	Prompt	/	Check that the monitor is properly connected with the printer server.

D.2.13 Technical Alarm Messages Related to Networked Monitoring

Alarm message	Default priority	Indication on alarm reset	Cause and solution
No CMS	Low	B	The monitor is disconnected from the CMS. Check the network connection.
View Bed XX YY-ZZ, Network Disconnected.	Low	A	The network is interrupted when the monitor is viewing the remote device. Check the network connection.
Viewed by Bed XX YY-ZZ, Network Disconnected.	Low	A	The network is interrupted when the monitor is viewed by another remote device. Check the network connection.
WLAN IP Address Conflict	Low	C	Wireless network IP network conflicts. Check the network settings.
LAN1 IP Address Conflict	Low	C	Wired network LAN1 IP network conflicts. Check the network settings.
Fail To Get WLAN IP Address	Low	C	Unable to automatically obtain the wireless network IP address. Check the network settings.
Fail To Get LAN1 IP Address	Low	C	Unable to automatically obtain the wired network LAN1 IP address. Check the network settings.

Note: XX refers to the department name, YY refers to the room number, and ZZ refers to the bed number.

D.2.14 Other System Technical Alarm Messages

Alarm message	Default priority	Indication on alarm reset	Cause and solution
Storage Card Error	High	C	The storage card fails or files are damaged. Restart the monitor to format the storage card. If the alarm persists, contact your service personnel.
Loading Default Config Failed	Low	A	The default configuration is not correctly loaded. The monitor will restore to the factory default configuration for the current patient category.
Read dock E2PROM error!	High	C	1. Check if you're using the specified external display. • If you're using the specified external display, remove the N1 from the Dock, and reconnect the N1 and the Dock. • If you're not using the specified external display, replace current external display with the specified external display. Then remove the N1 from the Dock, and reconnect the N1 and the Dock. 2. If the alarm persists, contact your service personnel.
XX Conflicts (XX refers to the module label)	Prompt	/	The same type of corresponding module being used exceeds the supported number. Remove the conflict module.
XX Measurement has been closed (XX refers to the module label)	Prompt	/	The parameter module is disabled. Switch on the module if you want to use it. For more information, see *3.11.1 Switching On or Off a Parameter*.
The display setup for XX is disabled. (XX refers to the parameter label)	Prompt	/	The parameter of the newly inserted module is not displayed on the screen. Select a desired area to display the parameter numerics and waveforms. For more information, see *3.11.2 Displaying Parameter Numerics and Waveforms*.
The patient data storage space is nearly full. Please delete some discharged patients.	Med	B	Delete unnecessary earlier discharged patient.

E Electrical Safety Inspection

The following electrical safety tests are recommended as part of a comprehensive preventive maintenance program. They are a proven means of detecting abnormalities that, if undetected, could prove dangerous to either the patient or the operator. Additional tests may be required according to local regulations.

All tests can be performed using commercially available safety analyzer test equipment. These procedures assume the use of a 601PROXL International Safety Analyzer or equivalent safety analyzer. Other popular testers complying with IEC 60601-1 used in Europe, such as Fluke, Metron, or Gerb, may require modifications to the procedure. Please follow the instructions of the analyzer manufacturer.

The electrical safety inspection should be periodically performed every two years.The safety analyzer also proves to be an excellent troubleshooting tool to detect abnormalities of line voltage and grounding, as well as total current loads.

E.1 Power Cord Plug

Test Item		Acceptance Criteria
The power plug	The power plug pins	No broken or bent pin. No discolored pins.
	The plug body	No physical damage to the plug body.
	The strain relief	No physical damage to the strain relief. No plug warmth for device in use.
	The power plug	No loose connections.
The power cord		No physical damage to the cord. No deterioration to the cord.
		For devices with detachable power cords, inspect the connection at the device.
		For devices with non-detachable power cords, inspect the strain relief at the device.

E.2 Device Enclosure and Accessories

E.2.1 Visual Inspection

Test Item	Acceptance Criteria
The enclosure and accessories	No physical damage to the enclosure and accessories.
	No physical damage to meters, switches, connectors, etc.
	No residue of fluid spillage (e.g., water, coffee, chemicals, etc.).
	No loose or missing parts (e.g., knobs, dials, terminals, etc.).

E.2.2 Contextual Inspection

Test Item	Acceptance Criteria
The enclosure and accessories	No unusual noises (e.g., a rattle inside the case).
	No unusual smells (e.g., burning or smoky smells, particularly from ventilation holes).
	No taped notes that may suggest device deficiencies or operator concerns.

E.3 Device Labeling

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

- Main unit label
- Integrated warning labels

E.4 Protective Earth Resistance

1. Plug the probes of the analyzer into the device's protective earth terminal and protective earth terminal of the AC power cord.
2. Test the earth resistance with a current of 25 A.
3. Verify the resistance is less than limits.

LIMITS

For all countries, R = 0.2 Ω Maximum

E.5 Earth Leakage Test

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

The following outlet conditions apply when performing the Earth Leakage test:

- normal polarity (Normal Condition),
- reverse polarity (Normal Condition),
- normal polarity with open neutral (Single Fault Condition),
- reverse polarity with open neutral (Single Fault Condition)

LIMITS

For UL60601-1,

- 300 µA in Normal Condition
- 1000 µA in Single Fault Condition

For IEC60601-1,

- 500 µA in Normal Condition
- 1000 µA in Single Fault Condition

E.6 Patient Leakage Current

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

The following outlet conditions apply when performing the Patient Leakage Current test.

- normal polarity (Normal Condition);
- reverse polarity (Normal Condition),
- normal polarity with open neutral (Single Fault Condition);
- reverse polarity with open neutral (Single Fault Condition).
- normal polarity with open earth (Single Fault Condition);
- reverse polarity with open earth (Single Fault Condition).

LIMITS

For CF  applied parts

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

For BF  applied parts

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

E.7 Mains on Applied Part Leakage

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

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

- Normal Polarity;
- Reversed Polarity

LIMITS

- For CF  applied parts: 50 µA
- For BF  applied parts: 5000 µA

E.8 Patient Auxiliary Current

Patient Auxiliary currents are measured between any selected Applied Part connector and the remaining Applied Part connector s. All measurements may have a true RMS only response.

The following outlet conditions apply when performing the Patient Auxiliary Current test.

- normal polarity (Normal Condition);
- reverse polarity (Normal Condition),
- normal polarity with open neutral (Single Fault Condition);
- reverse polarity with open neutral (Single Fault Condition).
- normal polarity with open earth (Single Fault Condition);
- reverse polarity with open earth (Single Fault Condition).

LIMITS

For CF  applied parts,

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

For BF  applied parts,

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

NOTE

- **Make sure the safety analyzer is authorized comply with requirement of IEC60601-1.**
- **Follow the instructions of the analyzer manufacturer.**

F A ECG Wave Recognition Method for Mindray Resting 12-lead ECG Analysis Algorithm

F.1 Preprocessing

Initially, a 50Hz or 60Hz notch filter should have been applied within the acquiring device. The ECG data is then filtered to minimize the effects of noise. The next step is to calculate a difference of each lead. And then choose the best 3 leads based on the amplitude of ECG. Combining the ECG data and the difference in these best 3 leads, the QRS locations are derived.

F.2 QRS typing

For each lead, the QRS complexes is compared each other, if the QRS width, RR Interval, and the morphology of QRS complex are similar, the QRS complexes are classified to the same class. Synthesizing QRS class of all the 12 leads, the beats are classified to different classes.

F.3 Selection of required QRS class

If more than one class of beat is present, then a decision has to be made as to which morphology will be used for the averaging procedure. A complex logic is used and the required QRS class is regarded as being conducted in the normal sequence through the ventricles.

F.4 Averaging

All beats in the selected class are averaged. First the alignment points are detected, and then all corresponding aligned points are straight averaged.

F.5 Wave measurement

From the 12 average beats, first the peak of QRS is determined, and then considering the amplitude and the slope, the QRS onset and termination are determined.

In each individual lead, the QRS onset is taken as the baseline and hence Q, R, S, R' waves are measured with respect to the QRS onset.

A sorting algorithm is then applied to all 12 onsets to determine the global QRS onset as follows. The two earliest onsets are excluded and the next onset that also lies within 10ms of two before that is then selected as the overall onset. The reverse process is used to find the overall QRS termination but the interval limit is changed from 10ms to 16ms. The isoelectric segment at the beginning of a QRS complex which is a flat segment between the globe QRS onset and individual lead QRS onset are exclude from the first component of the QRS, the same process is used for the isoelectric segment at the end of a QRS complex.

F.6 QRS components

Within the QRS complex, the amplitude and duration of the various Q, R, S, R' waves are then measured. In keeping with the CSE recommendations, the minimum wave acceptable has to have a duration >8 ms and an amplitude >20 ?V. The global QRS duration is from global QRS onset to the global QRS termination.

F.7 ST segment

The ST segment measurements are made at J point, and at equal intervals throughout the ST segment.

F.8 P and T waves

P wave is searched in the interval preceding the QRS complex. A P wave may not be found in certain arrhythmias. P onset and termination are determined basing on the amplitude and slope. The globe P onset and termination is used over all 12 leads because in many leads the p wave amplitude may be too low. The baseline for P wave amplitude measurement respect to P onset.

T termination is determined also depend on the amplitude and slope. The global T termination is derived similarly to the globe QRS termination. The other components of the ECG waveform (ST and T) amplitudes are also measured with respect to QRS onset.

F.9 Evaluation results of absolute interval and wave duration measurements

MEASUREMENT	Mean Difference (ms)	Acceptable standard (ms)	Standard Deviation (ms)	Acceptable standard (ms)
P DURATION	-10	±10	2.256	SD<=8
QRS DURATION	-0.143	±6	2.413	SD<=5
PR INTERVAL	-8.286	±10	1.729	SD<=8
QT INTERVAL	1.385	±12	6.501	SD<=10
Q DURATION	-0.108	±6	4.241	SD<=5
R DURATION	3.020	±6	2.710	SD<=5
S DURATION	-3.282	±6	3.396	SD<=5

F.10 Evaluation results of interval measurements on biological ECGs

Measurement	Mean Difference (ms)	Acceptable standard (ms)	Standard Deviation (ms)	Acceptable standard (ms)
P Duration	-2.708	±10	10.194	SD <=15
QRS Duration	-9.750	±10	6.676	SD <=10
PQ Interval	2.458	±10	7.182	SD <=10
QT Interval	-4.500	±25	14.483	SD <=30

F.11 Evaluation results of stability of measurements against noise

Global Measurement	Type of Added Noise	Disclosed Differences	
		Mean Difference (ms)	Standard Deviation (ms)
P Duration	High Frequency	1.4	9.192
P Duration	Line Frequency (50Hz)	-0.2	8.404
P Duration	Line Frequency (60Hz)	0.8	5.181
P Duration	Base-Line	4.2	8.244
QRS Duration	High Frequency	-0.6	2.119
QRS Duration	Line Frequency (50Hz)	0	0.943
QRS Duration	Line Frequency (60Hz)	0.4	1.265
QRS Duration	Base-Line	0.8	3.553

Global Measurement	Type of Added Noise	Disclosed Differences	
		Mean Difference (ms)	Standard Deviation (ms)
QT Interval	High Frequency	-2.2	6.070
QT Interval	Line Frequency (50Hz)	-1.4	6.867
QT Interval	Line Frequency (60Hz)	2.4	3.978
QT Interval	Base-Line	0.6	3.134

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G Units, Symbols and Abbreviations

G.1 Units

Abbreviation	In Full
µA	microampere
µV	microvolt
µs	microsecond
A	ampere
Ah	ampere hour
bpm	beat per minute
bps	bit per second
℃	centigrade
cc	cubic centimeter
cm	centimeter
dB	decibel
DS	dyne second
℉	Fahrenheit
g	gram
GHz	gigahertz
GTT	gutta
h	hour
Hz	hertz
in	inch
k	kilo
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

Abbreviation	In Full
mmHg	millimeters of mercury
cmH2O	centimeters of water
ms	millisecond
mV	millivolt
mW	milliwatt
MΩ	megaohm
nm	nanometer
rpm	breaths per minute
s	second
V	volt
VA	volt ampere
Ω	ohm
W	watt

G.2 Symbols

Symbol	Explanation
–	minus
–	negative
%	percent
/	per; divide; or
~	to
+	plus
=	equal to
<	less than
>	greater than
≤	less than or equal to
≥	greater than or equal to
±	plus or minus
×	multiply
©	copyright

G.3 Abbreviations

Abbreviation	In Full
$AaDO_2$	alveolar-arterial oxygen gradient
AC	alternating current
Adu	adult
AG	anaesthesia gas
AHA	American Heart Association
Ao	aortic pressure
Art	arterial
ATMP	barometric pressure
AUC	area under the curve
aVF	left foot augmented lead
aVL	left arm augmented lead
aVR	right arm augmented lead
awRR	airway respiratory rate
BAP	brachial arterial pressure
BL	baseline
BT	blood temperature
BTPS	body temperature and pressure, saturated
CAA	Clinical Assistive Application
CaO_2	arterial oxygen content
CCI	continuous cardiac index
CCO	continuous cardiac output
CCU	cardiac (coronary) care unit
CE	Conformité Européenne
CFI	cardiac function index
C.I.	cardiac index
CIS	clinical information system
CISPR	International Special Committee on Radio Interference
CMOS	complementary metal oxide semiconductor
CMS	central monitoring system
C.O.	cardiac output
CO_2	carbon dioxide
COHb	carboxyhemoglobin
Compl	compliance
CPI	cardiac power index
CPO	cardiac power output
CVP	central venous pressure
DC	direct current

Abbreviation	In Full
Des	desflurane
Dia	diastolic
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
EE	Energy Expenditure
EEC	European Economic Community
EEG	electroencephalogram
EMC	electromagnetic compatibility
EMG	electromyograph
EMI	electromagnetic interference
Enf	enflurane
ESU	electrosurgical unit
Et	end-tidal
EtAA	end-tidal anesthetic agent
EtDes	end-tidal anesthetic agent
EtEnf	
EtHal	
EtIso	
EtSev	
$EtCO_2$	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
EWS	Early Warning Score
FAP	femoral arterial pressure
FCC	Federal Communication Commission
FDA	Food and Drug Administration
$FeCO_2$	Mixed Expired CO2 Concentration
Fi	fraction of inspired
FiAA	inspired anesthetic agent

Abbreviation	In Full
FiDes	inspired anesthetic agent
FiEnf	
FiHal	
FiIso	
FiSev	
FiCO2	fraction of inspired carbon oxygen
FiN_2O	fraction of inspired nitrous oxide
FiO_2	fraction of inspired oxygen
FPGA	field programmable gate array
FV	flow-volume
GCS	Glasgow Coma Scale
GEDV	global end diastolic volume
GEDI	global end diastolic volume index
GEF	global ejection fraction
Hal	halothane
Hb	hemoglobin
Hct	haematocrit
HIS	hospital information system
HR	heart rate
IBP	invasive blood pressure
IBW	ideal body weight
ICG	impedance cardiography
ICP	intracranial pressure
ICT/B	intracranial catheter tip pressure transducer
ICU	intensive care unit
ID	identification
I:E	inspiratory time: expiratory time ratio
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
IP	internet protocol
IPS	individual parameter score
Iso	isoflurane
ITBI	intrathoracic blood volume index
ITBV	intrathoracic blood volume
LA	left arm
LAP	left atrial pressure
LCD	liquid crystal display
LCW	left cardiac work
LCWI	left cardiac work index

Abbreviation	In Full
LED	light emitting diode
LL	left leg
LVET	left ventricular ejection time
LVSW	left ventricular stroke work
LVSWI	left ventricular stroke work index
MAC	minimum alveolar concentration
MAP	mean arterial pressure
MetHb	methemoglobin
MEWS	Modified Early Warning Score
MRI	magnetic resonance imaging
MV	minute volume
MValv	Alveolar Minute Volume
$MVCO_2$	CO_2 minute production
MVe	expiratory minute volume
MVi	inspiratory minute volume
MVO_2	O_2 minute consumption
N/A	not applied
N_2	nitrogen
N_2O	nitrous oxide
Neo	neonate
NEWS	National Early Warning Score
NIBP	noninvasive blood pressure
NIF	negative inspiratory force
O_2	oxygen
O_2%	oxygen concentration
OR	operating room
oxyCRG	oxygen cardio-respirogram
PA	pulmonary artery
pArt	artery pressure
pArt-D	diastolic artery pressure
pArt-M	mean artery pressure
pArt-S	systolic artery pressure
Paw	airway pressure
PAWP	pulmonary artery wedge pressure
pCVP	central venous pressure
Ped	pediatric
PEEP	positive end expiratory pressure
PEF	peak expiratory flow
PEP	pre-ejection period

Abbreviation	In Full
PIF	peak inspiratory flow
PIP	peak inspiratory pressure
Pleth	plethysmogram
Pmean	mean pressure
PO_2	oxygen supply pressure
Pplat	plateau pressure
PPV	pulse pressure variation
PR	pulse rate
PVC	premature ventricular contraction
PVPI	pulmonary vascular permeability index
PVR	pulmonary vascular resistance
PVRI	pulmonary vascular resistance index
qSOFA	quick Sepsis-Related Organ Failure Assessment
RA	right arm
RAP	right atrial pressure
Raw	airway resistance
Rec	record, recording
Resp	respiration
RL	right leg
RM	respiratory mechanics
RQ	respiratory quotient
RR	respiration rate
RSBI	rapid shallow breathing index
SaO_2	arterial oxygen saturation
$ScvO_2$	central venous oxygen saturation
SEF	spectral edge frequency
Sev	sevoflurane
SI	stroke index
$SlopeCO_2$	Slope of the alveolar plateau
SMR	satellite module rack
SOFA	Sepsis-Related Organ Failure Assessment
SpO_2	arterial oxygen saturation from pulse oximetry
SQI	signal quality index
SR	suppression ratio
SSC	Surviving Sepsis Campaign
SSI	signal strength index
STR	systolic time ratio
SV	stroke volume
SVI	stroke volume index

Abbreviation	In Full
SVR	systemic vascular resistance
SVRI	systemic vascular resistance index
SVV	stroke volume variation
SvO_2	venous oxygen saturation
Sync	synchronization
Sys	systolic pressure
TB	Blood Temperature
TD	temperature difference
Temp	temperature
TFT	thin-film technology
TI	injectate temperature
TRC	tube resistance compensation
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	O_2 consumption for one breath
VO_2I	oxygen consumption index
VPB	ventricular premature beat per minute

H Declaration of Conformity

Declaration of Conformity V2.0

Declaration of Conformity

CE

Manufacturer:	Shenzhen Mindray Bio-Medical Electronics Co., Ltd. Mindray Building, Keji 12th Road South, Hi-tech Industrial Park, Nanshan, Shenzhen, 518057, P. R. China
EC-Representative:	Shanghai International Holding Corp. GmbH (Europe) Eiffestraße 80 20537 Hamburg, Germany
Product:	Patient Monitor (Including Accessories)
Model:	BeneVision N1

We herewith declare under our sole responsibility that the above mentioned products meet the provisions of the Council Directive 2014/53/EU concerning radio equipment. All supporting documentation is retained under the premises of the manufacturer.

Standards Applied:

☒ EN 60601-1:2006 / A1 :2013	☒ EN 60601-1-2:2015
☒ EN 62311:2008	☒ EN 301 489-1 V2.2.0
☒ EN 301 489-17 V3.1.1	☒ EN 300 328 V2.1.1
☒ EN 301 893 V2.1.1	☒ EN 50566:2013
☒ EN 62209-2:2010	

Start of CE-Marking:	**2017-10-25**
Place, Date of Issue:	Shenzhen, 2018.12.19
Signature:	
Name of Authorized Signatory:	Mr. Wang Xinbing
Position Held in Company:	Manager, Technical Regulation

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P/N:046-011407-00 (10.0)