

**BeneVision N1**

**Patient Monitor**

**Operator's Manual**





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

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### WARNING

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- **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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## Company Contact

Manufacturer:	Shenzhen Mindray Bio-Medical Electronics Co., Ltd.
Address	Mindray Building, Keji 12th Road South, High-tech Industrial Park, Nanshan, Shenzhen 518057, P.R.China
Website	<a href="http://www.mindray.com">www.mindray.com</a>
E-mail Address:	<a href="mailto:service@mindray.com">service@mindray.com</a>
Tel:	+86 755 81888998
Fax:	+86 755 26582680
EC-Representative:	Shanghai International Holding Corp. GmbH (Europe)
Address:	Eiffestraße 80, 20537 Hamburg, Germany
Tel:	0049-40-2513175
Fax:	0049-40-255726

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These events, include device-related death and serious injury or illness. In addition, as part of our Quality Assurance Program, SHENZHEN MINDRAY BIO-MEDICAL ELECTRONICS CO., LTD. requests to be notified of device failures or malfunctions. This information is required to ensure that SHENZHEN MINDRAY BIO-MEDICAL ELECTRONICS CO., LTD. provides only the highest quality products.

# 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.

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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.
- 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 exclusively rely on audible alarms for patient monitoring. Adjusting alarm volume to a low level or turning off alarm sound may result in patient hazards.
- Customize alarm settings according to patient situations and keep patients 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.
- Place and secure cables and tubings carefully to prevent from stumbling, entanglement and patient strangulation.
- If any measurement seems questionable, first check the patient's vital signs by alternate means and then check the equipment for proper functioning.

- Physiological data and alarm messages provided by the monitor should not be used as the only basis for diagnosis or therapy decisions. They must be used in conjunction with clinical signs and symptoms. Misinterpreting measured values or other parameters may result in patient hazards.
  - 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 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.
  - 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

























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### NOTE

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- Put the equipment in a location where you can easily view and operate the equipment.
  - The equipment uses a mains plug as isolation means to the mains power. Do not locate the equipment in a place difficult to operate the mains plug.
  - In normal use, the operator is expected to be in front of the equipment.
  - The software was developed in compliance with IEC62304.
  - This manual includes information related to all features of the monitor. Some features may not be available on your monitor.
  - 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
	Medical device		Unique device identifier
	General warning sign		Refer to instruction manual/booklet
	Serial number	<b>REF</b>	Catalogue number
	Date of manufacture		Manufacturer
	USB connector	<b>IPX1</b>	Protected against vertically falling water drops per IEC 60529
<b>IP44</b>	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	<b>IP22</b>	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°
	Direct current		Polarity of d.c. power connector
	Battery indicator		Alternating current
	Equipotentiality		Computer network
	DEFIBRILLATION-PROOF TYPE CF APPLIED PART		DEFIBRILLATION-PROOF TYPE BF APPLIED PART
	Calibration		Zero key
	Gas outlet		Gas inlet
	Video output		Input/output
	Start		Stop

Symbol	Description	Symbol	Description
	Unlocking		Locking
	Direction and angle of rotation		Lock; tighten
	Stacking limit by number		Keep dry
	This way up		Fragile, handle with care
	Humidity limitation		Atmospheric pressure limitation
	Temperature limit		Non-ionizing electromagnetic radiation
	Dispose of in accordance to your country's requirements		Plastic identification symbol
	Authorized representative in the European Community/European Union		TrueTymp™ is Mindray's new ear temperature measurement algorithm using infrared energy from the tympanic membrane, which can measure body temperature accurately, quickly and conveniently.
	The product bears CE mark indicating its conformity with the provisions of the REGULATION (EU) 2017/745 on medical devices and fulfills the general safety and performance requirements of Annex I of this regulation. The number adjacent to the CE marking (0123) is the number of the EU-notified body certified for meeting the requirements of the Regulation. Note: The product complies with the Council Directive 2011/65/EU, amended by Directive 2015/863/EU.		
	Stand-by		

General meaning of geometric shapes and safety colors are as follows:

Geometric shape	Meaning	Safety color	Contrast color	Graphical symbol color
	Mandatory action	Blue	White	White
	Warning	Yellow	Black	Black

# 2 Equipment Introduction

---

## 2.1 Intended Use

### 2.1.1 Intended Purpose Statement

The patient monitor is intended for monitoring, displaying, reviewing, storing, alarming and transferring of multiple physiological parameters.

### 2.1.2 Indications for Use

The BeneVision N1 patient monitors are intended to be used for monitoring, displaying, reviewing, storing, alarming and transferring of multiple physiological parameters including ECG (3-lead, 5-lead, 6-lead, and 12-lead selectable, arrhythmia detection, ST segment analysis, QT/QTc monitoring, and heart rate (HR)), respiration (Resp), temperature (Temp), pulse oxygen saturation (SpO2), pulse rate (PR), non-invasive blood pressure (NIBP), invasive blood pressure (IBP), carbon dioxide (CO2), oxygen (O2), continuous cardiac output (CCO).

The monitor also provides interpretation of resting 12-lead ECG and CrozFusion.

### 2.1.3 Medical Conditions

The product is expected to be used in medical institutions, and its application fields include: operating room, anesthesia induction and postoperative recovery, intensive care unit, emergency care, respiratory care, Cardiac Care Unit, neural care, dialysis care, neonatal care, elderly care, obstetric care, internal medicine and surgical care.

### 2.1.4 Intended Users

This monitor is to be used in healthcare facilities by clinical professionals or under their guidance.

### 2.1.5 Intended Patient Population

All the parameters can be monitored on single adult, pediatric, and neonatal patients with the exception of the following:

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

### 2.1.6 Contra-indications

The CrozFusion function is contraindicated in the following situations:

- Performing CPR
- Performing CPB or using V-A ECMO
- Using IABP
- Patients in persistent and regular restlessness

### 2.1.7 Side-effects

None.

According to the conclusion of clinical evaluation and residual risk evaluation, for the intended patients, there is no known side effects that can occur during or after the use of the medical device. And there is no need for the operator to make extra preparations. Thus, no residual risk associated with using the medical device should be disclosed.

## 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 the following 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”.
- As a multi-parameter module (MPM) for the BeneHeart DX or BeneHeart DM defibrillator/monitor.

In this manual, the N1 is generally referred to as “the monitor” except in the situation describing its use with a host monitor or the defibrillator/monitor, where it is referred to as “the N1”.

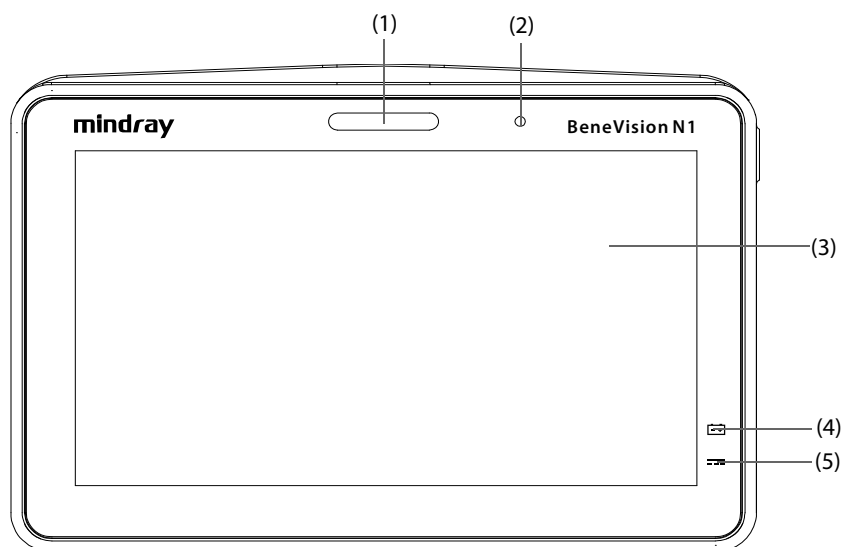
## 2.3 Applied Parts

The applied parts of the monitor are:

- ECG electrode and leadwire
- SpO<sub>2</sub> sensor
- Temp probe
- NIBP cuff
- IBP transducer
- PiCCO sensor
- CO<sub>2</sub> sampling line/nasal sampling cannula, water trap, and mask

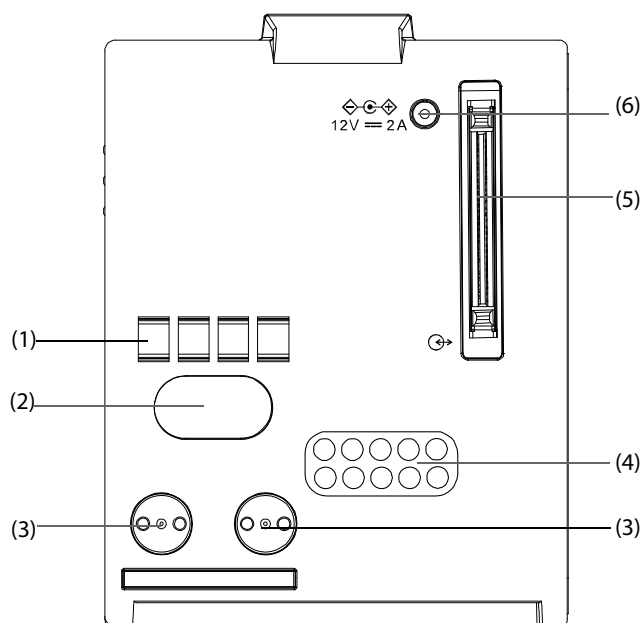
## 2.4 Main Unit

### 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 brightness 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

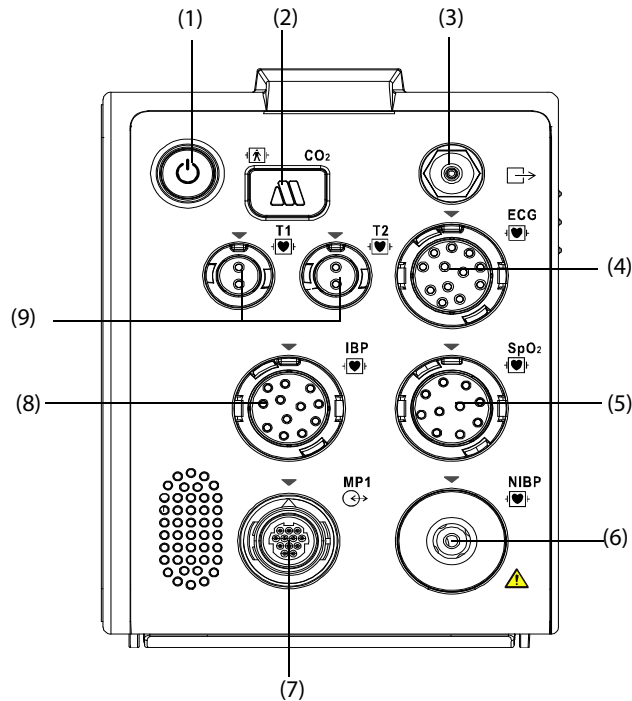


- (1) Communication interface: used for communication between the N1 and host monitor (BeneVision N series monitor).
- (2) Infrared filter: used for communication between the N1 and BeneView T series monitor; used for communication between the N1 and N series monitor if the communication interface does not work.
- (3) Contact: used for receiving power supply from the host monitor (BeneView T series monitor or BeneVision N series monitor).
- (4) Communication interface (optional): used for communication between the N1 and an the BeneHeart DX or BeneHeart DM defibrillator/monitor.
- (5) Multi-pin connector: connects the N1 to the Modular Rack or Dock.
- (7) External DC power input connector: connects the N1 to the AC adapter

## NOTE

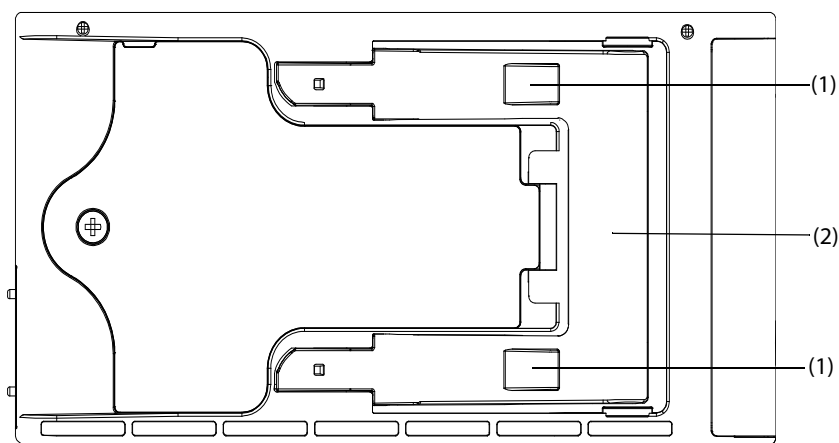
- Dry the Multi-pin connector of the N1 before connecting the N1 to the Modular Rack or Dock in case of water spray.

### 2.4.3 Right View



- |  |   |                         |
|--|---|-------------------------|
| (1) Power switch   | (2) Sample line connector of the sidestream CO <sub>2</sub> | (3) Gas outlet          |
| (4) ECG cable connector  | (5) SpO <sub>2</sub> 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



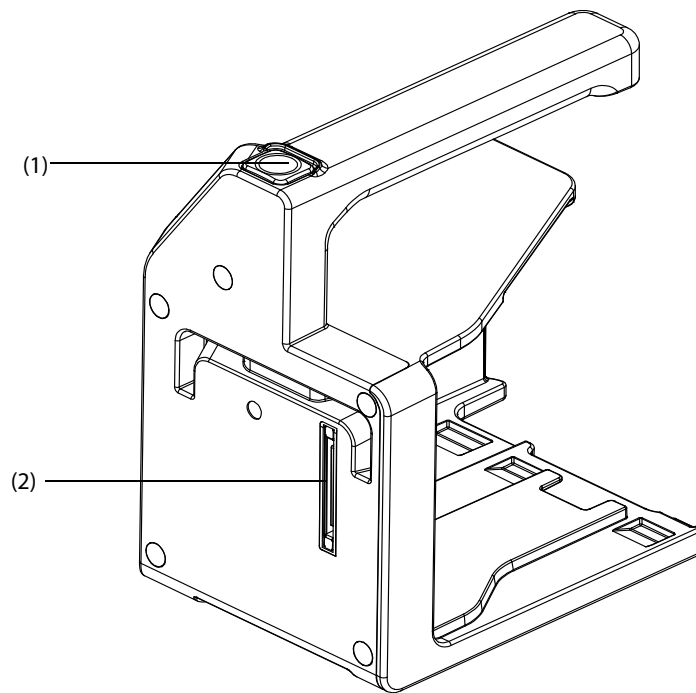
- |   |
|---|
| (1) Clip: fasten the N1 when N1 is in use with the host monitor, Dock or Modular Rack.  |
| (2) Latch: locks the N1 when the N1 is in use with the host monitor, Dock or Modular Rack. Pressing here releases the N1 so that you can remove the N1 from the host monitor, Dock or Modular Rack. |



## 2.5 Modular Rack

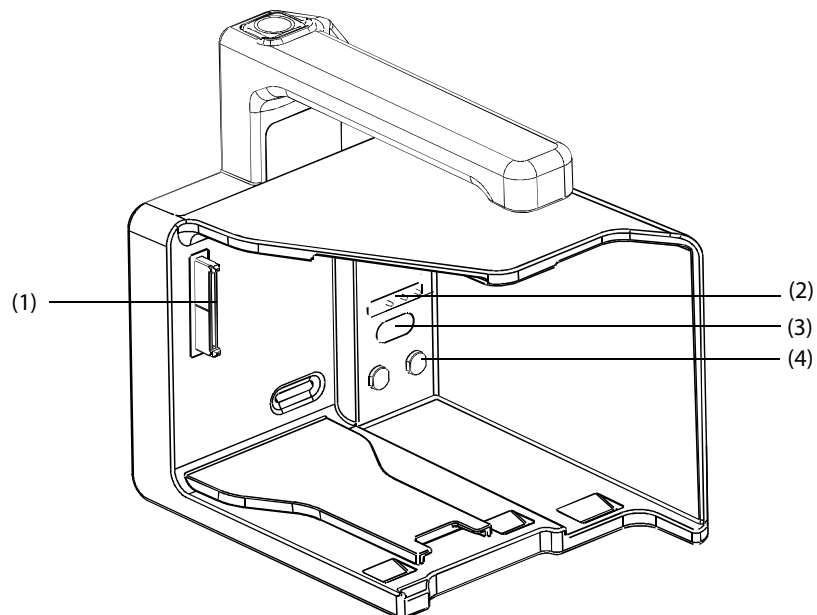
Modular Rack is used for connecting a N1 and an external parameter module.

### 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



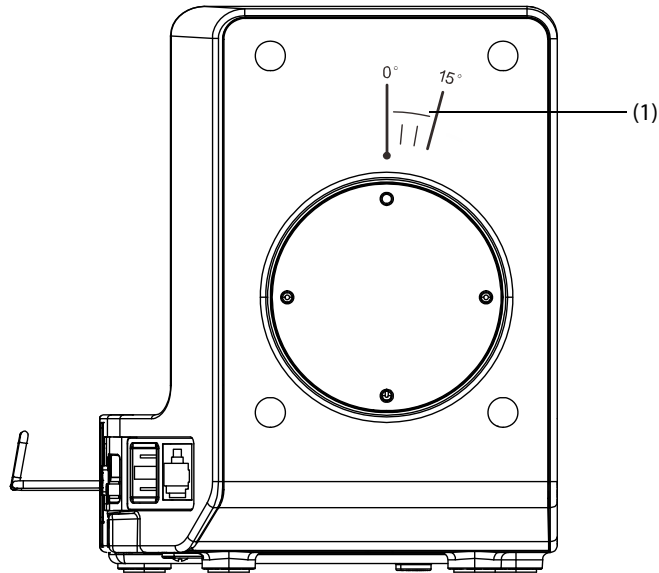
- (1) Multi-pin connector: connects the Modular Rack and N1.
- (2) Pogo pin: used for communication between the Modular Rack and external parameter module.
- (3) Infrared filter: used for communication between the Modular Rack and external parameter module.

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

## 2.6 Dock

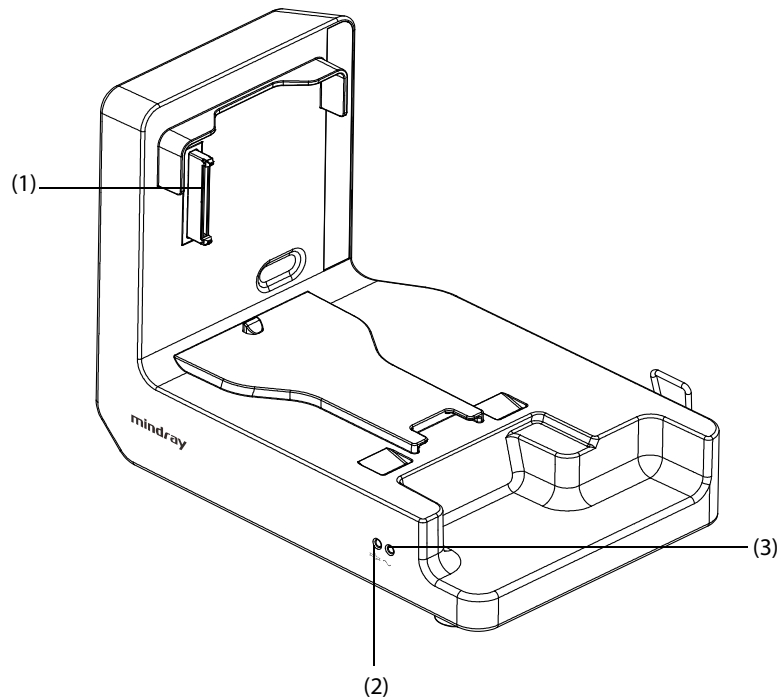
Dock is used to connect the N1 or Modular Rack.

### 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.

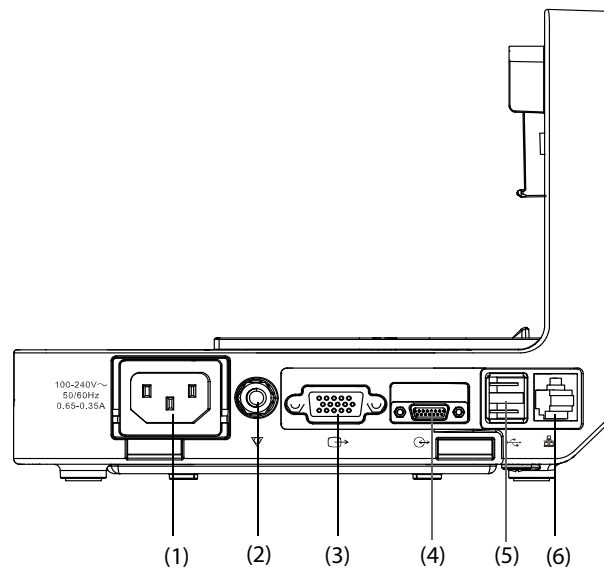
### 2.6.2 Right View



- (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.

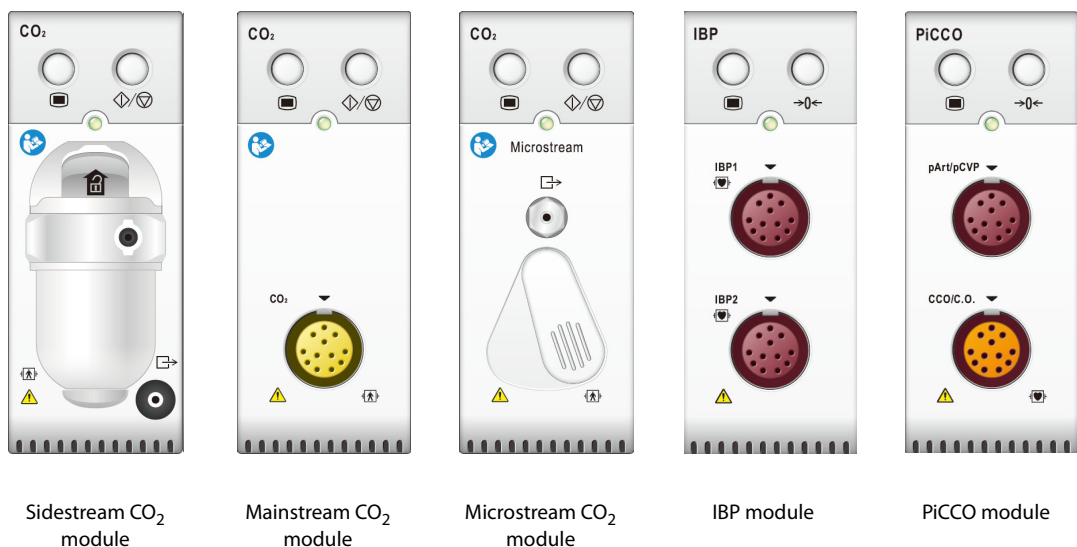
### 2.6.3 Rear View



- (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

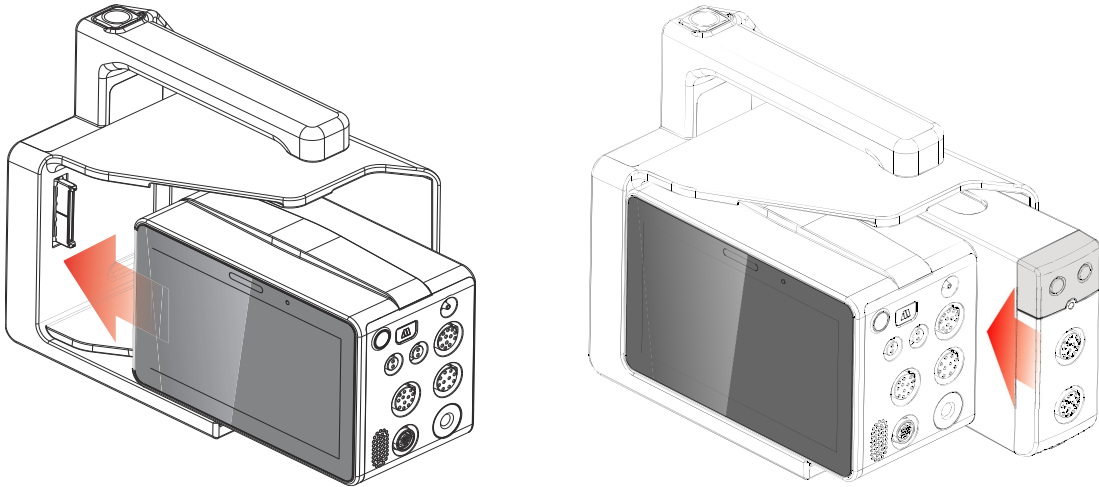
The monitor can connect the following external parameter modules to perform CO<sub>2</sub> monitoring, IBP monitoring, and CCO monitoring through the Modular Rack.



## 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.

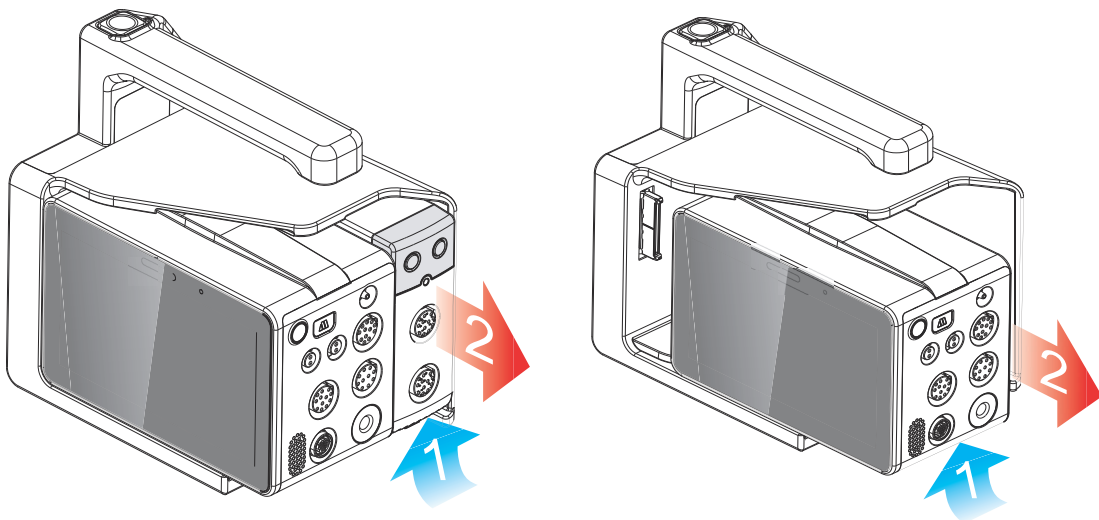
#### NOTE

- 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

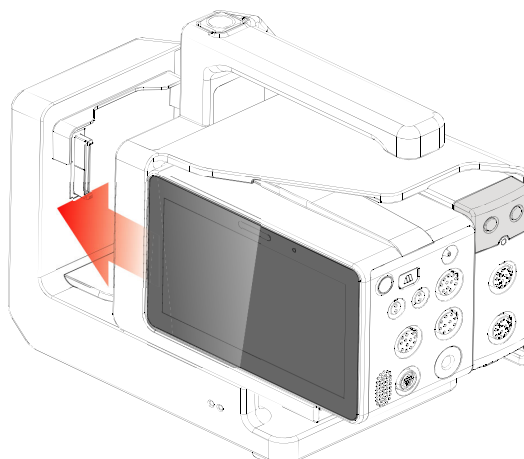
To remove the N1 or external parameter module, follow this procedure:

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:

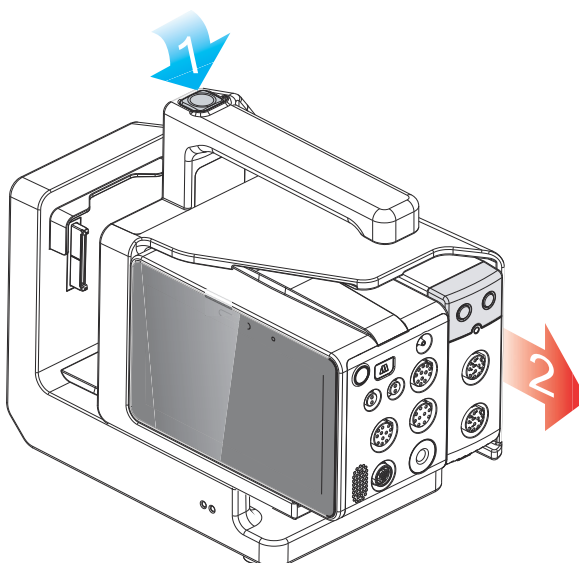


You hear a click when the Modular Rack is pushed into place.

### 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.



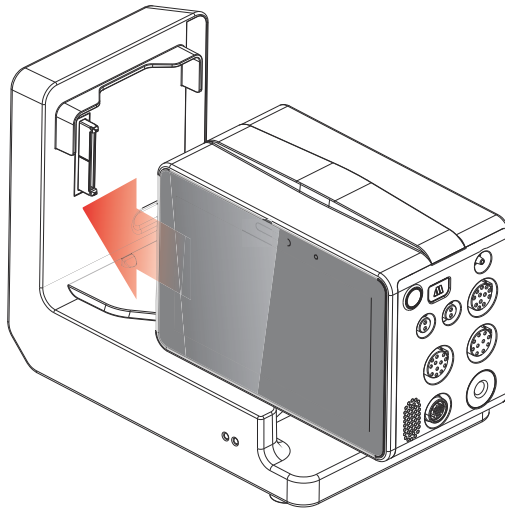
---

#### 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:

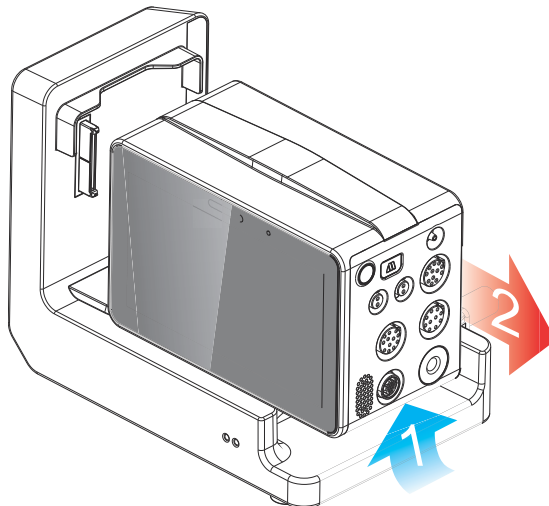


Firmly push N1 until you hear that the clip (refer to 2.4.4 *Bottom View*) engages the Dock. To ensure that N1 is properly connected, try to pull N1 outward. N1 properly engages the Dock if you cannot pull it out.

### 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.
- 

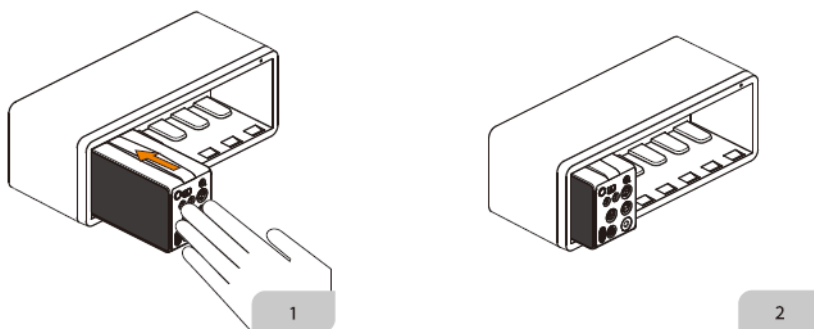
## NOTE

- 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 Defibrillator/Monitor

N1 can be connected with the BeneHeart DX or BeneHeart DM defibrillator/monitor through the optional communication interface or in a wireless way. When the N1 is connected to the defibrillator/monitor, the N1 works as a parameter module of the defibrillator/monitor. Data from the N1, including parameter values, waveforms, and events, are sent to the defibrillator/monitor. For more information, see section 3.7.2 *Module Mode*.

## 2.11 N1 in Use with the Transport Dock

N1 can 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: 046-011365-00) and the *Quick Guide for the Dock-T N1 Transport Dock (with DC Input)* (PN: 046-019005-00).

## WARNING

- If the N1 is configured with the CO2 module, only the N1 with the label  can be used with Transport Dock with DC input.
- 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.

## 2.12 Input Devices

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

## 2.13 Printing Devices

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



# 3

## Getting Started

---

### 3.1 Equipment Preparation Safety Information

---

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#### 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, contact Mindray.
  - The monitor and parameter monitoring accessories are suitable for use within the patient environment. For other equipment and accessories connected to the monitor, consult corresponding manufacturers for the suitability within the patient environment.
  - 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 graph strip or report is questionable, determine the patient's vital signs by alternative means. Verify that all equipment is working correctly.
- 

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#### CAUTION

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- 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.
  - Make sure that the equipment operating environment meets the specific requirements. Otherwise unexpected consequences, e.g. damage to the equipment, could result.
  - 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 packing cases and packaging material as they can be used if the equipment must be reshipped.
-

## 3.2 Monitor Installation

### 3.2.1 Unpacking and Checking

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

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

#### NOTE

- **If your monitor contains the internal CO<sub>2</sub> module, connect the CO<sub>2</sub> adapter to the CO<sub>2</sub> receptacle as soon as you unpack the monitor to avoid losing the CO<sub>2</sub> adapter.**

### 3.2.2 Environmental Requirements

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

The environment where the equipment is used shall be reasonably free from noises, vibration, dust, corrosive, flammable and explosive substances. 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.

## 3.3 Setting Up the Equipment

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

### 3.3.1 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.

#### 3.3.1.1 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.

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

### 3.3.2 Connecting the Input Devices

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

### 3.3.3 Installing the External Parameter Module

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

## 3.4 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.

When the monitor is turned on, the alarms are paused for two minutes. Then the alarm system is activated.

---

### CAUTION

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

### 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 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 Operations on the Screen

Screen elements include parameter values, waveforms, quick keys, menus, information area, alarms areas, and so on. Almost all screen elements are interactive.

You can access the same element in different ways. For example, you can enter 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 touch the screen or swipe across the screen with your fingers to operate the monitor.


### 3.5.1.1 Tapping the screen or Swiping across the Screen

- Tapping the screen
  - ◆ To select an item from menus or lists, tap on the item with your finger.
  - ◆ To select a quick key, tap on the key with your finger.
  - ◆ To enter a parameter menu, tap corresponding numeric area or waveform area. For example, select the ECG numeric area or waveform area to enter the **ECG** menu.
  - ◆ If an external display is connected and actively displaying information, tapping the screen of the N1 switches the active display to the N1. If the N1's display is active, tapping on the screen of the external display switches the active display to the external display.
- Swiping across the screen with a single finger:
  - ◆ To scroll through a list and a menu, swipe up and down.
  - ◆ If an external display is connected, to show or expand the Minitrends screen or the EWS screen on the external display, swipe right across the corresponding screen.
  - ◆ If an external display is connected, to contract or hide the Minitrends screen or the EWS screen on the external display, swipe left across the corresponding screen.
- Swiping across the screen with two fingers:
  - ◆ If an external display is connected, to switch to another screen, swipe left or right across the screen. For example, on the Normal screen, swipe with two fingers from left to right to switch to the Minitrends screen.
  - ◆ To discharge a patient, swipe from top to bottom.

### 3.5.1.2 Locking 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 Barcode Reader

The monitor supports both linear (1D) barcode reader and two-dimension (2D) barcode reader.

#### 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.**

### 3.5.2.1 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

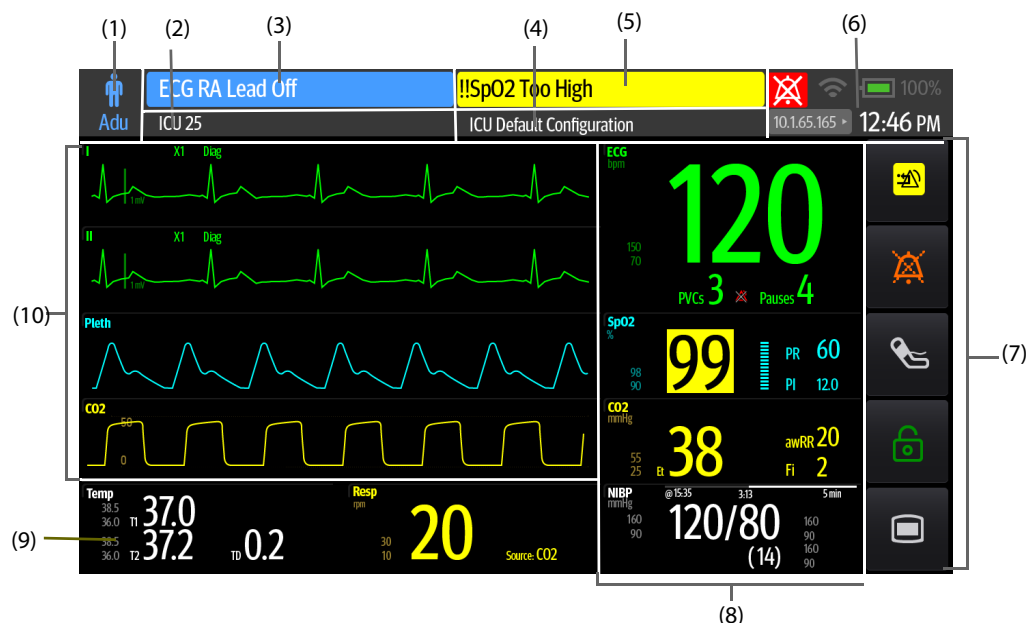
- **Contact the scanner manufacturer or Mindray to obtain the engineering barcodes for clearing data formats and containing the hospital's data format.**

### 3.5.2.2 Setting the Barcode Reader

For information on setting the barcode reader, see 22.15 *The Scanner Settings*.

## 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 5.3 *Managing 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 5.3 *Managing 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 3.6.1 *On-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 3.11.4 *Accessing Parameter Setup Menus*.
- (9) Parameter waveform/ numerics area: displays parameter waveforms or parameter values, alarm limits, and alarm status. Selecting a parameter waveform or numeric block enters corresponding parameter menu. For more information, see 3.11.4 *Accessing Parameter Setup Menus*.
- (10) Parameter waveform area: displays parameter waveforms. Select a waveform enters corresponding parameter menu. For more information, see 3.11.4 *Accessing Parameter Setup Menus*.

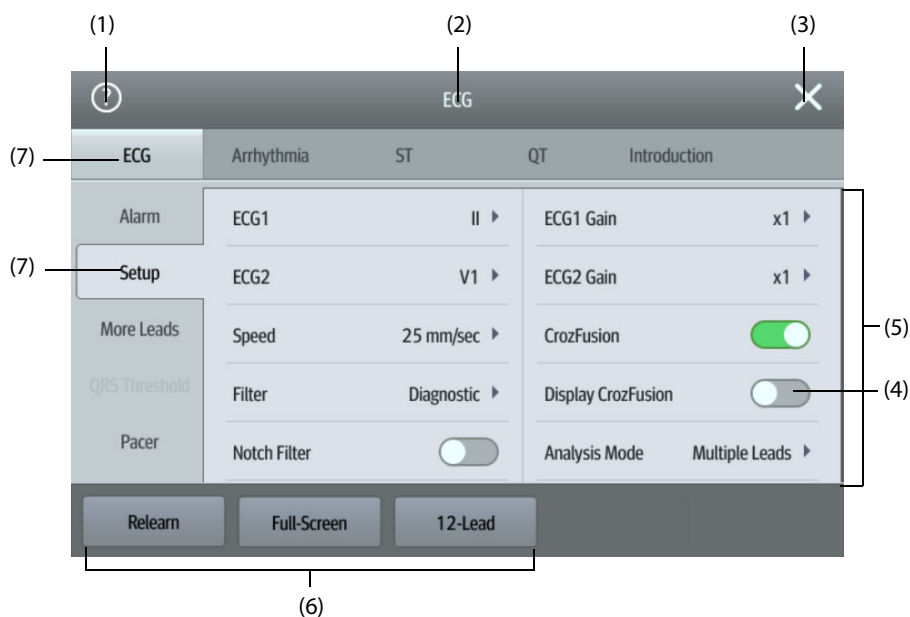
### 3.6.1 On-screen Symbols

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
	Neonate, male		Neonate, female
	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
	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.		Wireless network is connected. The solid part indicates network signal strength.
	Wireless network is not connected.		Wireless network is disabled.
	Wired network is connected.		Wired network is not connected.
	When the N1 is used with the defibrillator/monitor, the defibrillator/monitor is connected.		When the N1 is used with the defibrillator/monitor, the defibrillator/monitor is not connected.

### 3.6.2 Menus

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





- (1) Selecting the question mark can show help for a menu option. Some menu items come with help information. When the question mark is selected, it turns into cyan and corresponding menu items are followed by question marks. Then you can see help when these menu items are selected.
- (2) Menu heading
- (3) Exit button: closes the current menu page.
- (4) Switch:
  - Green: the switch is on.
  - Gray: the switch is off.
- (5) Main body area: includes menu items and options.
- (6) Operation buttons
- (7) Submenu tabs

### 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	Resets the alarm system.		Screen Setup	Enters the <b>Screen Setup</b> menu.
	Alarm Pause	Pauses the physiological alarm system.		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 <b>NIBP Measure</b> menu.

Symbol	Label	Function	Symbol	Label	Function
	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 or the defibrillator/monitor, the N1 enters the module mode. For connection of the N1 and the host monitor, see section 2.9 *N1 in Use with a Host Monitor*. For connection of the N1 and the defibrillator/monitor, see section 2.10 *N1 in Use with the Defibrillator/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, the host monitor, and the defibrillator/monitor will be synchronized. For data transfer strategy, see the corresponding operator's manual of the host monitor or the defibrillator/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 or the defibrillator/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 or the defibrillator/monitor.
- Turning on or off the host monitor or the defibrillator/monitor simultaneously powers on or off the N1.
- The main screen of the N1 is off when it is connected to the host monitor through the SMR or the module rack of the host monitor or the defibrillator/monitor.

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



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## WARNING

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- 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

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- 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.

You can switch on or off the night mode. This is password protected. For more information, see **Disable Night Mode** in 22.4.7 *The Other Tab*.

#### 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**.

---

## CAUTION

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- Verify the night mode settings before entering the night mode. Pay attention to potential risk in case of improper settings.
- 

#### 3.7.4.2 Setting the Auto Night Mode Switch

You can configure the monitor to automatically enter and exit the night mode. To do so, follow this procedure:

1. Select the **Main Menu** quick key → from the **Display** column select **Night Mode**.
2. Switch on or off **Auto Night Mode**.
  - ◆ **On**: the monitor automatically enters the night mode when the night mode period starts and exits the night mode when the night mode period ends. See the **Nighttime** setting from 22.10.1 *The Time Synchronization Tab*.
  - ◆ **Off**: the monitor will not automatically enter the night mode. To manually enter the night mode, see **Nighttime** from 3.7.4.1 *Entering the Night Mode*.

The Auto Night Mode switch is Off by default.

#### 3.7.4.3 Changing Night Mode Settings

To change night mode settings, follow this procedure:

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

- ◆ Screen brightness
- ◆ Alarm volume, QRS volume, key-striking volume, and reminder volume
- ◆ NIBP End Tone switch and Stop NIBP switch

#### 3.7.4.4 Muting All Monitor Sounds

To silence the monitor in the Night mode, switch on **All Mute** from the **Night Mode Setup** menu.

Local password for accessing the **Maintenance** menu is required for switching on **All Mute**.

After the monitor is silenced, the monitor will not generate the alarm tone, QRS tone, key tone, reminder tone, or NIBP end tone.

#### 3.7.4.5 Exiting the Night Mode

To exit the night mode, select the **Main Menu** quick key → from the **Display** column select **Exit Night Mode** → 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 stop 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.

If the monitor automatically enters the standby mode after a patient is discharged, choose any of the following ways to exit the standby mode:

- Select **Monitor** to exit the standby mode and admit a new patient.
- Select **Patient Management** to enter the patient information for preparing to admit a new patient.

When the monitor exists the standby mode and resumes monitoring, the alarms are paused for two minutes. Then the alarm system is activated.

### 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 22.11 *The 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 22.10 *The Time Settings* for details.

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.

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#### CAUTION

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- 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**.

#### NOTE

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- If you set **Brightness to Auto**, screen brightness automatically changes according to the ambient light level.
- 

### 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**.

### 3.8.4 Accessing the On-screen Guide

The monitor provides the on-screen guide to help you understand parameter monitoring functions. On-screen guide provides measurement principle, points to note, accessory connection, operating procedure, and so on.

To access the on-screen guide, follow this procedure:

1. Select the desired numerics area or waveform area to enter the parameter menu.
2. Select the **Introduction** tab.
3. Select a tab as required.

#### NOTE

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- The on-screen guide is not available for **Respiration and temperature monitoring**.
- 

## 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 sensors 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. If setting parameter switches is not password protected, follow this procedure to set parameter switches:

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 **Parameters On/Off Protected** of 22.11 *The 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.


### 3.11.3 Displaying the Parameter List

You can display trends of HR, SpO<sub>2</sub>, 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 front panel of the external module.
- Select the **Parameters 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 **Display** 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 **Parameters** 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 Initiating a Manual Event

To save a manual event, follow this procedure:

1. Select the **Manual Event** quick key to enter the **Manual Event** menu.
2. Select a name for this event, for example **Intubated**, or input a name.
3. Select **OK**.

To edit the name of preset event names, select  to enter the **Manual Event Setup** menu.

The selecting or editing manual event name functionality is available only if the **Manual Event Edit** switch is turned on. For more information, see 22.11 *The Other Settings*.

You can review the manual events. For more information, see 18.2.7 *Reviewing Events*.

## 3.13 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 four timers.

### 3.13.1 Displaying Timers

To display a timer, 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.

### 3.13.2 Controlling the Timer

The timer provides the following controls:

- **Start:** starts timing.
- **Pause:** pauses timing.
- **Resume:** continues timing after the timer is paused.
- **Reset:** clears the timer and end this timing episode.

---

#### WARNING

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- **Do not use the timers for tasks related to critical patients.**
- 

### 3.13.3 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.

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#### NOTE

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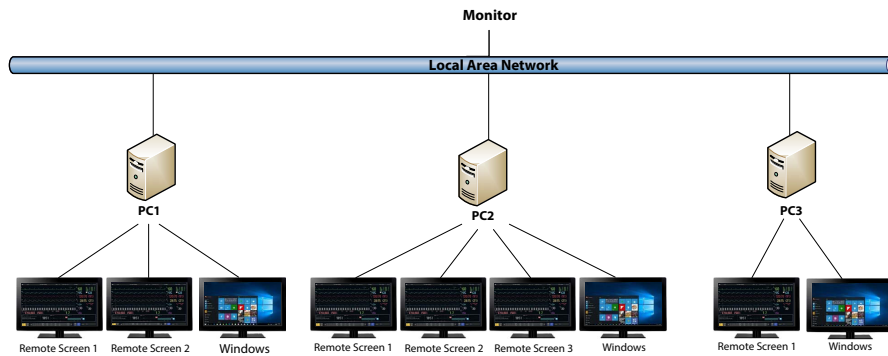
- **You cannot change timer settings when a timer is running.**
  - **You can set Direction, Run Time, and Reminder Volume only for normal, advanced, and cycled timers.**
- 

## 3.14 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. Do not rely the remote screens for alarm notification.
- Data displayed on remote screens may have a delay.

## NOTE

- A license is required for the nView function.

### 3.14.1 Recommended Hardware and Network Requirements

#### 3.14.1.1 Hardware Requirements

Recommended requirements for PCs and nView displays are as follows:

PC	Display
<ul style="list-style-type: none"> <li>• Hard disk: minimum 20 G</li> <li>• Memory: 600 M (for one remote screen), 1200M (for two remote screens), 1400 M (for three remote screens)</li> <li>• CPU: i5, dual-core (for one remote screen), quad-core (for two or three remote screens)</li> </ul>	Resolution: supports 1280×720 pixel

#### 3.14.1.2 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.
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.



Protocol	nView Port	Monitor Port	Function
TCP	6606	Any	Communicates with the monitor. 6606 is the default nView port. You can modify the port via the nView tool.

### 3.14.2 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.**

### 3.14.3 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 3.14.4 *Configuring 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 task bar.

### 3.14.4 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 language of the remote screen and nView Tool 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:** used 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.
  - ◆ **Shut Down PC When Monitor Shutdown:** selects the number of displays used for nView. When the PC connects multiple displays, the maximum number of displays for nView is 3.

- ◆ **Screen X Position:** selects where the remote screen is displayed. For example, if **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

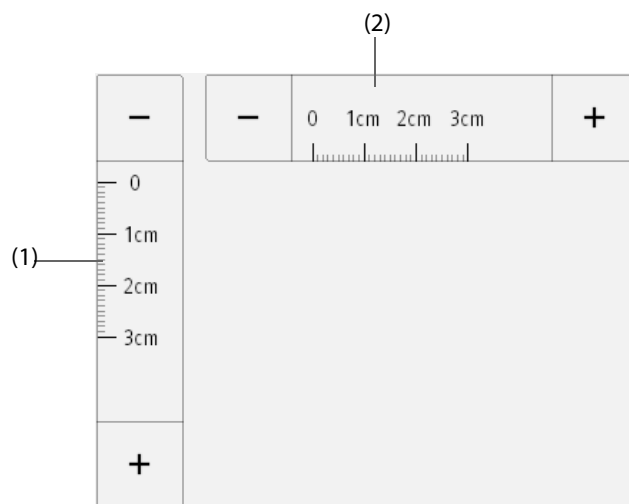
---

- **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.**
- 

### 3.14.5 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

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

### 3.14.6 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.

### 3.14.7 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**.

### 3.14.8 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**.

## 3.15 Checking Software Licenses

To run the following functions in your monitor, software licenses are required:

- BoA Dashboard
- SepsisSight
- Early Warning Score (EWS)
- CPR Quality Index (CQI)
- CPR Record
- ECG 24h Summary
- nView
- Numeric Data HL7 Output
- Waveform HL7 Output
- NeuroSight
- AF Summary

To check the licenses, select the **Main Menu** quick key → select **License** → **Local**.

To install the licenses, follow this procedure:

1. Connect the N1 and Dock.
2. Connect the USB drive with the licenses in to the Dock's USB connector.
3. Select the **Main Menu** quick key → select **License** → select **External**.
4. Select **Install**.

## 3.16 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.

Turning off the monitor does not disconnect the monitor from the AC mains. To completely disconnect the power supply, unplug the power cord.

---

## CAUTION

- **Press and hold the power switch for 10 seconds to forcibly shut down the monitor if it could not be shut down normally. This may cause loss of patient data.**

---

## NOTE

- **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.**
-

# 4 Using the External Display

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## 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 4.1.3 *Setting 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 Record
- ST Graphic
- Targeted Goal Screen
- SepsisSight

### 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 Using the Touchscreen of the External Screen

You can touch the screen or swipe across the screen with your fingers to operate the monitor. For more information, see 3.5.1 *Using the Touchscreen*.

### 4.1.3 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 22.17 *The Dock Setup Settings*.

## 4.1.4 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	<ul style="list-style-type: none"> <li>• Check that the external display is properly connected to the AC mains and is powered on.</li> <li>• Check that the VGA cable is properly connected.</li> <li>• Remove the N1 from the Dock and reconnect it if the problem persists.</li> </ul>
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.

## 4.1.5 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
	Main Menu	Enters the main menu.		More	Shows more quick keys.
	Alarm Setup	Enters the <b>Alarm</b> menu.		Alarm Reset	Resets the alarm system.
	Audio Pause	Pauses alarm tone.		Alarm Pause	Pauses the physiological alarms.
	Review	Enters the <b>Review</b> menu.		Standby	Enters the Standby mode.
	Patient Management	Enters the <b>Patient Management</b> menu.		Screen Setup	Enters the <b>Screen Setup</b> menu.
	NIBP Start/Stop	Starts an NIBP measurement or stops the current NIBP measurement.		NIBP Stop All	Stops all NIBP measurements.
	NIBP STAT	Starts a five-minutes continuous NIBP measurement.		NIBP Measure	Enters the <b>NIBP Measure</b> menu.

Symbol	Label	Function	Symbol	Label	Function
	PAWP	Enters the <b>PAWP</b> screen.		Venipuncture	Inflates the NIBP cuff to help venous puncture.
	Parameters Setup	Enters the <b>Parameters Setup</b> menu.		Remote View	Opens the <b>Remote View</b> window.
	Manual Event	Manually triggers and saves an event.		Minitrends	Enters the Minitrends screen.
	OxyCRG	Opens the OxyCRG screen.		ECG Full-Screen	Enters the 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 <b>Volume</b> menu.		Freeze	Freezes waveforms.
	Calculations	Enters the <b>Calculations</b> menu.		Load Config	Enters the <b>Load Config</b> menu.
	Print	Starts printing a real-time report.		Resus Mode	Enters the Resus mode.
	ECG Lead/Gain	Enters the <b>ECG Lead/Gain</b> menu.		ECG 24h Sum	Opens the <b>ECG 24h Summary</b> window.
	BoA Dashboard	Enters the <b>BoA Dashboard</b> screen.		EWS	Enters the EWS screen.
	GCS	Enters the <b>GCS</b> menu.		SepsisSight	Enters the <b>SepsisSight</b> menu.
	Discharge Patient	Enters the <b>Discharge Patient</b> dialog box.		Discharged Patients	Enters the <b>Discharged Patients</b> dialog box.
	End Case Report	Prints the selected end case reports		Targeted Goal	Enters the Targeted Goal screen.
	NeuroSight	Opens the <b>NeuroSight</b> window		AF Summary	Opens the <b>AF Summary</b> window
	Zero IBP	Starts IBP zero calibration.			

### 4.1.6 Configuring the Displayed Quick Keys

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

- Access **Quick Keys** 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**.
- 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.
- 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

To enter the Minitrends screen, choose any of the following methods:

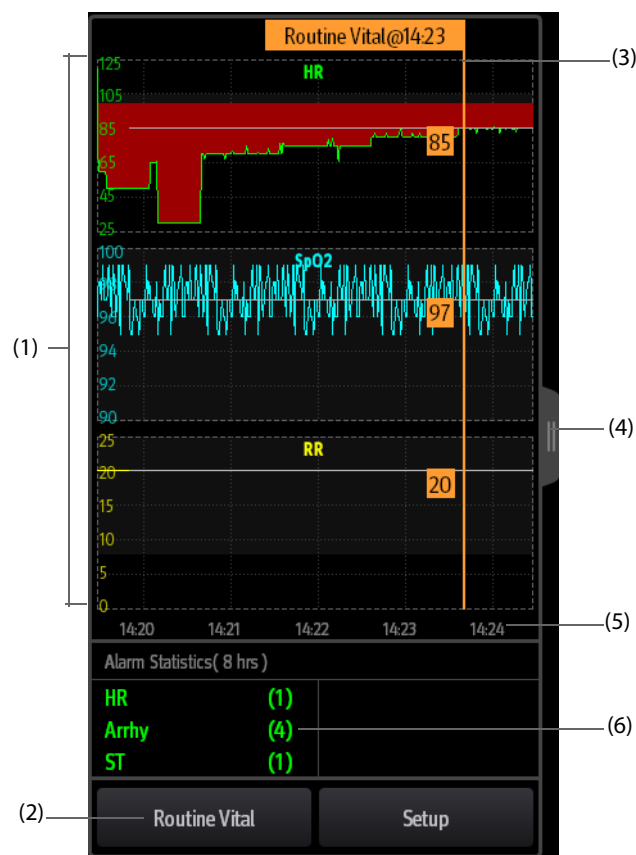
- Select the **Minitrends** quick key.
- Select the **Screen Setup** quick key → Select the **Choose Screen** tab → select **Minitrends**.
- Select the **Main Menu** quick key → from the **Display** column select **Choose Screen** → select **Minitrends**.

For adult and pediatric patients, when the Minitrends screen is hidden as , you can also choose one of the following methods to quickly enter the Minitrends screen.

- Swipe left or right across the touchscreen with two fingers until you switch to the Minitrends screen.
- Swipe right across the touchscreen with a single finger.
- Select the  button.

## 4.2.2 The Display of Minitrends Screen


The following figure shows the Minitrends screen.



- (1) Scale
- (2) **Routine Vital** button. If the department is set to **OR**, then the **Baseline** button is displayed.
- (3) Routine Vital/Baseline
- (4) Select this button to view the long trends, or contract the long trends screen to the Minitrends screen.
- (5) Time line
- (6) Alarm statistic area

## 4.2.3 Viewing the Long Trends

To expand the Minitrends screen to view the long trends, choose either of the following ways:

- Select the  button.



- Swipe right across the Minitrends screen with a finger.

#### 4.2.4 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**.

#### 4.2.5 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**.

#### 4.2.6 Setting the Alarm Statistics Switch

The Minitrends screen can be configured to display the statistic number of physiological alarms 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.

#### 4.2.7 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**.

#### 4.2.8 Switching on the Routine Vital/Baseline Function

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.

To switch on the Baseline function, select the **Setup** button, and then switch on **Baseline**.

To switch on the Routine vital function, follow this procedure:

1. Enter the Minitrends screen.
2. Select the **Setup** button.
3. Select the **Routine Vital** tab.
4. Select **Auto** or **Manual** from the dropdown list of **Routine Vital**.

##### 4.2.8.1 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

- The **Baseline** button or **Routine Vital** button is available only if the baseline function or routine vital function is switched on. For more information, see 4.2.8 Switching on the Routine Vital/Baseline Function.

### 4.2.8.2 Configuring Automatic Routine Vital Settings

The monitor can automatically 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 the **Routine Vital** tab.
4. Select **Auto** from the dropdown list of Routine Vital.
5. Select **Time** to set the time for marking the first routine vital sign values.
6. Select **Interval** to set the interval for marking the routine vital sign values.

## 4.3 The OxyCRG Screen

The monitor displays the OxyCRG screen by default when the neonatology department is selected. The OxyCRG screen is available in any department setting, but only when **Patient Category** is set to **Neo**. This screen displays 6-minute HR/btbHR, SpO<sub>2</sub> trends, CO<sub>2</sub>/Resp compressed waveform, ABD parameters, and the latest ABD events.

The OxyCRG function is intended for neonatal patients only.

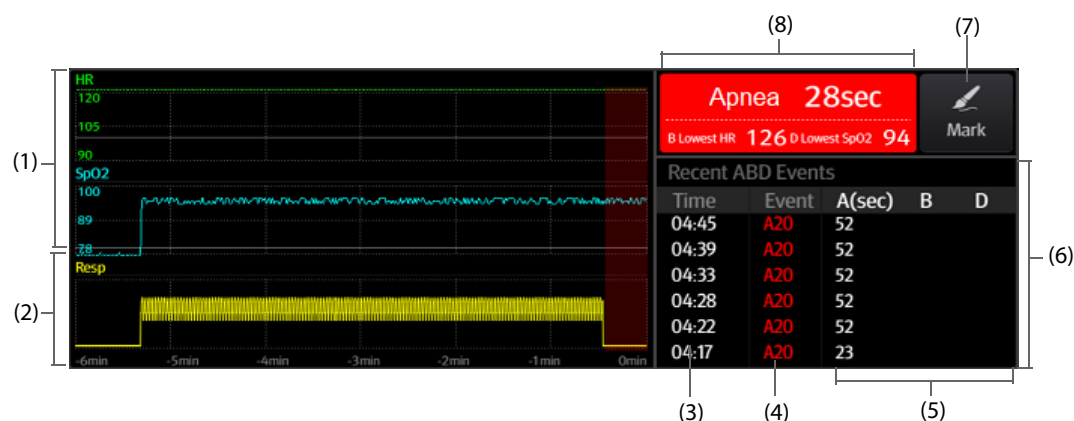
### 4.3.1 Entering the OxyCRG Screen

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

- Swipe left or right on the touchscreen with two fingers until you 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 The Display of the OxyCRG Screen

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



- (1) HR, SpO<sub>2</sub> trend
- (2) Resp/CO<sub>2</sub> compressed waveform
- (3) Event time
- (4) Event type
- (5) Parameter values of ABD events

- (6) ABD event list: displays the latest red ABD events. Selecting the ABD event list area enters the OxyCRG review page.
- (7) Mark button: opens the **Mark** menu to edit ABD event.
- (8) ABD event prompt area: displays parameter values of currently active OxyCRG events.

## 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 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. <ul style="list-style-type: none"> <li>A20: the apnea duration is greater or equal to 20 seconds.</li> <li>A15: the apnea duration is between 15 to 20 seconds (excluding 20 seconds).</li> <li>A10: the apnea duration is between 10 to 15 seconds (excluding 15 seconds).</li> </ul>	A20 is a red event
B	Bradycardia event: the duration of low heart rate, bradycardia, extreme bradycardia, or asystole exceeds the threshold.	/
D	Low SpO <sub>2</sub> event: the duration of SpO <sub>2</sub> Desat exceeds the threshold.	/
BD	Bradycardia and low SpO <sub>2</sub> happen at the same time.	/
AB	Apnea and bradycardia happens at the same time.	Red event
AD	Apnea and low SpO <sub>2</sub> happen at the same time.	Red event
ABD	Apnea, bradycardia, and low SpO <sub>2</sub> happen at the same time.	Red event

### 4.3.4 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.

### 4.3.5 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.

### 4.3.6 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.

### 4.3.7 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 Targeted Goal Screen

If you are concerned with specific parameters and their trends, you can use the Targeted Goal screen. The Targeted Goal screen focuses on the target parameter and displays parameter measurements in big numerics. You can easily identify whether parameter target is reached via a dashboard and review the statistics of the target parameter by sections.

The Targeted Goal screen displays parameter measurements and waveforms of ECG, SpO<sub>2</sub>, IBP, PI, PR, CO<sub>2</sub>, Resp, NIBP, and Temp. You can define the target parameter and secondary parameters. The measurements of these parameters displays in big numerics.

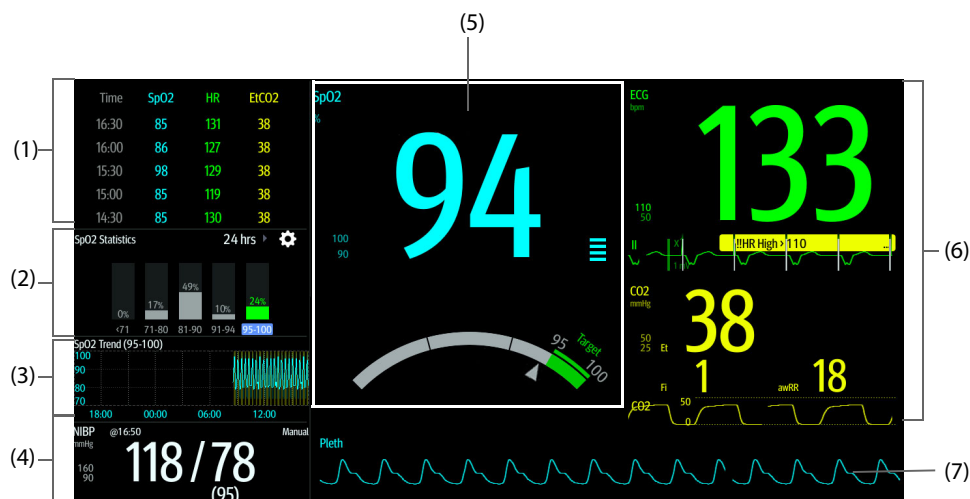
### 4.4.1 Entering the Targeted Goal Screen

To enter the Targeted Goal screen, choose any of the following ways:

- Select the **Targeted Goal** quick key.
- Select the **Screen Setup** quick key → select the **Choose Screen** tab → select **Targeted Goal**.
- Select the **Main Menu** quick key → from the **Display** column select **Choose Screen** → select **Targeted Goal**.
- If the **Patient Category** is set to **Neo**, swipe left or right on the touchscreen with two fingers to switch to the Targeted Goal screen.

### 4.4.2 The Display of the Targeted Goal Screen

The following figure shows the Targeted Goal screen.



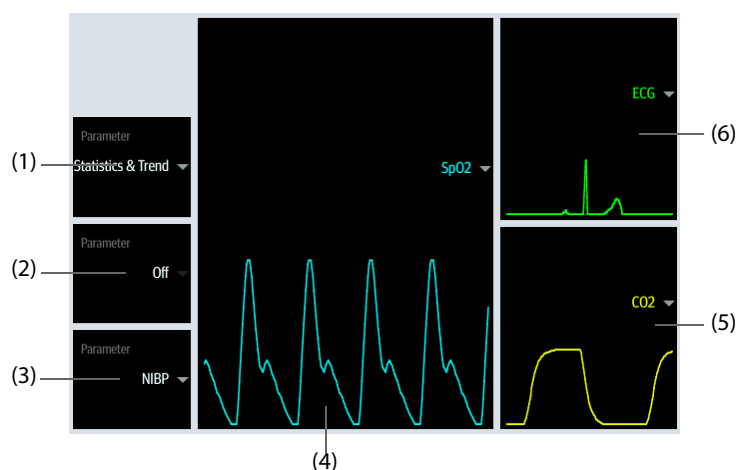
- (1) Parameter trends area: displays trends of the target parameter and secondary parameters. If the target parameter is Art, this area only lists the trend of arterial pressure. Selecting this area enters the **Tabular Trends** review page.
- (2) Target parameter statistics area: displays the statistics of the target parameter by sections.
- (3) Target parameter trends area: displays the graphic trends of the target parameter. If this area is not configured to display the trends of the target area, other selected parameter is displayed.
- (4) Other parameter area: displays parameter measurements and alarm limits of parameters other than the target parameter and secondary parameters.

- (5) Target parameter area: displays the measurement of the target parameter in big numerics, as well as its target range, and alarm limits.
  - If the target parameter is Resp or PR, parameter source is also displayed.
  - The dashboard shows the target range in green.
  - The  $\triangle$  pointer below the dashboard indicates the current measurement value.
  - Selecting this area enters the corresponding parameter setup menu.
- (6) Secondary parameters area: displays parameter measurement of secondary parameters in big numerics, as well as waveforms and alarm limits. If secondary parameters are Resp and PR, parameter sources are also displayed.
- (7) Target parameter waveform area: displays the waveform of the target parameter.
  - If the target parameter is Resp or PR, the waveform of the source parameter is displayed.
  - If the target parameter is ECG, the first ECG waveform is displayed by default.

### 4.4.3 Configuring the Targeted Goal Screen Layout

To configure the parameter numerics, waveforms, and their sequence displayed on the Targeted Goal screen, follow this procedure:

1. Access the Targeted Goal screen in either of the following ways:
  - ◆ Select the **Screen Setup** quick key → select the **Choose Screen** tab → select **Targeted Goal**.
  - ◆ Select the **Main Menu** quick key → from the **Display** column select **Choose Screen** → select **Targeted Goal**.
2. Select a parameter numeric area or waveform area, and then from the popup list select an element to display in this area. The parameters and waveforms not selected will not be displayed.



- (1) Select this area to define items to be displayed for the target parameter:
  - Statistics: this area displays the statistics of the target parameter by sections.
  - Statistics & Trend: this area displays the statistics of the target parameter by sections and the area below displays the graphic trends of the target parameter.
- (2) If the graphic trends of the target parameter is not displayed, select this area to define other parameter to be displayed.
- (3) Select this area to define other parameter (other than the target parameter and the secondary parameter) to be displayed.
- (4) Select this area to define the target parameter.
- (5) Select this area to define the secondary parameter.
- (6) Select this area to define the secondary parameter.

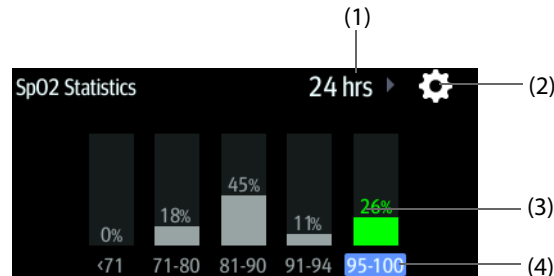
### 4.4.4 Setting Parameter Statistics

You can show the statistics of the target parameter for a defined period of time. To do so, follow this procedure:

1. Select  from the target parameter statistics area to enter the parameter statistics menu.

2. Select the range of each section: from the **To** column select the SpO<sub>2</sub> value at which corresponding section ends.
3. From the **Target** column select the target section. The target section is highlighted in green in the SpO<sub>2</sub> statistics area.
4. From the target parameter statistics area, select the duration to redefine the statistics duration.

The following figure shows the target parameter statistics area when SpO<sub>2</sub> is set as the target parameter:



- (1) Statistics duration: select here to change the statistics duration.
- (2) Statistics setup icon: select to enter the parameter statistics menu.
- (3) Statistics results: the percentage of parameter measurements falling into the corresponding section.
- (4) Sections for statistics: the section in green indicates the target range.

## 4.5 Remote View Screen

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 the realtime screen of one remote device (the main bed) on the external display.

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

From the **Remote View** screen you can watch the alarm status and alarm messages of up to 12 remote devices, as well as the realtime parameter values and waveforms from the main bed.

### 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.

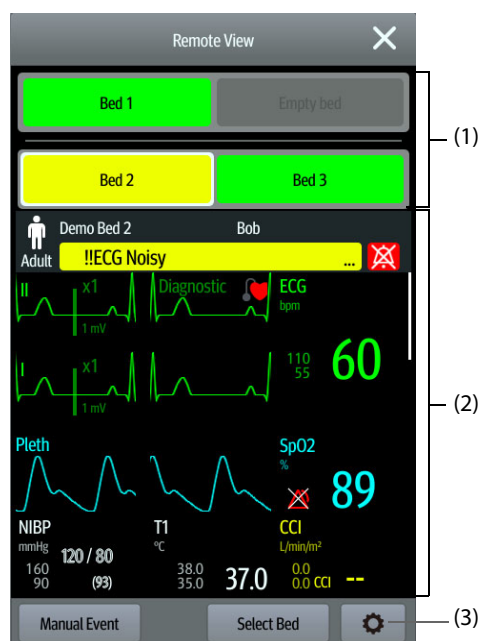
### 4.5.1 Entering the Remote View Screen

To enter the **Remote View** screen, 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 4.5.7.2 *Displaying 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**.


The **Remote View** screen displays parameter measurements and waveforms of the remote device.

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



(1) Alarm watch area


- ◆ Displays the room number and bed number of the remote bed if only one remote device is watched.
- ◆ Each bed cyclically displays room number, bed number, and alarm of the highest priority if multiple remote beds are watched.
- ◆ The background color of each bed indicates the status of this bed as follows:

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 currently is the highest alarm level on the bed. If the remote device is disconnected,  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 remote device is in the standby mode.
Black	The remote device is powered off.

- (2) Main body: displays the realtime parameters and waveforms from the main bed. Scrolling up and down can view more parameters and waveforms.
- (3) Remote view setup button: select it to enter the **Remote View** setup menu.

## 4.5.2 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** menu. To do so, choose either of the following ways:
  - ◆ On the **Remote View** screen, select **Select Bed**. For more information, see 4.5.1 *Entering the Remote View Screen* for entering the **Remote View** screen.
  - ◆ Select the setup icon  at the alarm watch tile if the tile is configured to display on the main screen.

2. In the **Select Bed** menu, select a desired department. All the beds under this department will be listed. To select beds in the same care group during the shift of care groups in the CMS, select **Select Beds By Care Group**.
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 alarm watch area and the alarm watch tile if configured.


## NOTE

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- The added bed is indicated by a check mark ( ✓ ) at the left of the bed list.
- 

### 4.5.3 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** menu. Choose either of the following ways:
  - ◆ In the **Remote View** screen, select **Select Bed**. For more information, see 4.5.1 *Entering the Remote View Screen* for entering the **Remote View** screen.
  - ◆ Select the setup icon  in the alarm watch tile if the tile is configured to display on the main screen.
2. In the **Select Bed** menu, select a bed at the A-W1, A-W2 or A-W3 areas, and then select **Clear Bed**. If you want remove all beds, select **Clear All Beds**.

### 4.5.4 Displaying the Main Bed

To watch the real time monitoring screen of a remote bed, select the bed from the alarm watch area. This bed is called the main bed.

### 4.5.5 Saving a Manual Event

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

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

### 4.5.6 Resetting Alarms for Remote Devices

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

## NOTE

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- You can reset remote device alarms only if the **Alarm Reset by Other Bed** switch is on at the remote devices. For more information, see 22.4.5 *The Combined Alarm Tab*.
- 

### 4.5.7 Alarm Watch

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

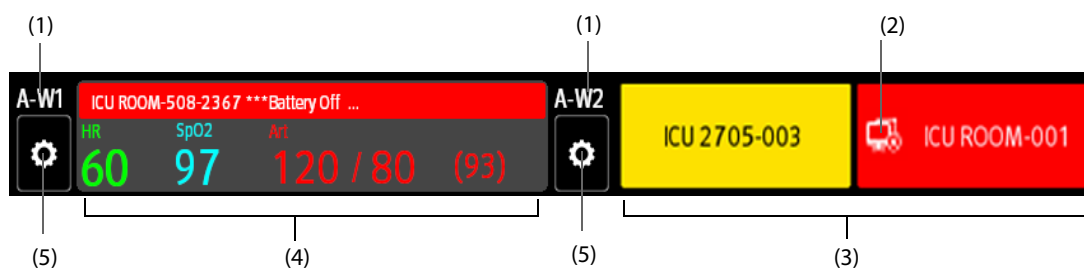
- The monitor sounds the highest priority alarm tone from all the monitored remote devices.
- The moitor displays the highest priority alarm in corresponding background color for each bed in the following areas:
  - ◆ At the top of the **Remote View** screen. For more information, see 4.5.1 *Entering the Remote View Screen* for details.
  - ◆ In the Alarm Watch tile on the main screen. For more information, see 4.5.7.1 *The Alarm Watch Tile on the Main Screen* for details.

#### 4.5.7.1 The Alarm Watch Tile on the Main Screen

The main screen can display up to three 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.





The alarm watch tile on the main screen is similar to the alarm watch area on the **Remote View** screen. For more

- (1) Alarm watch tile label
- (2) Disconnection icon: this icon displays when the remote device is disconnected and the background color of this tile turns red.
- (3) Bed area (multiple beds): if more than one bed is assigned to an alarm watch tile, each bed cyclically displays the bed number, room number, and the alarm of the highest priority. The background color of each bed indicated the status of this bed.
- (4) Bed area (one bed): if only one bed is assigned to an alarm watch area, this area displays the bed number, room number, parameter value, and alarm message from this bed, etc.
- (5) Bed selection button: select it to enter the **Select Bed** menu.

information, see 4.5.1 *Entering the Remote View Screen*.

#### 4.5.7.2 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**.

#### 4.5.8 Auto Displaying the New Alarm Bed

The monitor provides the function of automatically displaying the remote alarm bed. If this function is enabled, when a remote bed issues an alarm, the monitor automatically displays this bed as the main bed on the **Remote View** screen.

If multiple remote beds issue alarms, the monitor cyclically displays the alarm beds as per the preset interval and in the order of alarm time.

The auto displaying alarm bed function is disabled by default. To enable this function, follow this procedure:

1. From the **Remote View** screen, select the setup icon to enter the **Remote View** setup menu.
2. Switch on **Rollup Alarm Beds**.
3. Set **Rollup Interval**:
  - ◆ **Off**: do not cyclically display the remote alarm beds. Once a new alarm is issued, the monitor automatically switches to the new alarm bed.
  - ◆ **10 sec, 20 sec, or 30 sec**: If multiple remote beds issue alarms, the monitor cyclically displays the alarm beds as per the preset interval and alarm priority in the order of alarm time.
4. Set **Alarm Priority**:
  - ◆ **High Only**: Only when a high priority alarm is issued, the monitor automatically switches to the alarm bed.
  - ◆ **High & Med**: If **Rollup Interval** is set to **Off** and when a high priority alarm or medium priority alarm is issued, the monitor automatically switches to the alarm bed. If **Rollup Interval** is set to **10 sec, 20 sec, or 30 sec** and multiple remote beds issue alarms, the monitor cyclically displays the alarm beds with higher priority in the order of alarm time. For example, if both high priority alarms and medium priority alarm are issued, only beds with high priority alarms are cyclically displayed.

5. Set **Switch Bed Prompt Voice**. If this function is enabled, the monitor issues a reminding sound each time the main bed switches.

## 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 Resus Mode

### 4.6.2 Viewing Frozen Waveforms

To view the frozen waveforms, follow this procedure:

- Select the  or  button in the **Freeze** menu.
- 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 Resus Mode.

### 4.6.3 Unfreezing Waveforms

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

### 4.6.4 Printing Frozen Waveforms

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

# 5 Managing Patients

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## 5.1 Discharging a Patient

Before monitoring a new patient, discharge the previous patient. After the patient is discharged, the technical alarms is reset, and monitor settings return to their defaults. For more information, see *6.4 Setting Default Configuration*.

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

---

### CAUTION

- **Discharge the previous patient before starting monitoring a new patient. Otherwise there may be risk of mixing patient data.**
- 

### 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

To manually discharge a patient, follow this procedure:

1. Enter the **Discharge Patient** window 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, and then select **Discharge Patient**.
  - ◆ Select the **Main Menu** quick key → from the **Patient Management** column select **Discharge**.
2. Select the desired item from the popup box:
  - ◆ **Print End Case Report:** prints the end case report when the patient is discharged.
  - ◆ **Discharge:** clears the waveform data of the current patient. The monitor loads the default configuration and goes to the standby mode. The current patient becomes a discharged patient.
  - ◆ **Clear Patient Data:** discharges the current patient and clears the waveform data. The monitor loads the default configuration and does not go to the standby mode. The current patient becomes a discharged patient.

## 5.2 Admitting a Patient

The monitor admits a new patient in the following situations:

- After a patient is manually discharged, the monitor automatically admits a new patient.
- After being switched off for the selected time period, the monitor automatically discharges the previous patient and admits a new patient at startup.
- If the monitor has not detected certain patient vital signs (ECG, SpO2, 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, set **Paced** to **Yes**. Otherwise the monitor could mistake a pace pulse for a QRS complex and fail to generate alarms 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 patient information.

#### NOTE

- The monitor will reload the configuration if you change 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 Patients** 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.

Patients that can be searched for are configurable based on location. For more information, see *22.3.2 The Find Patient Tab*.

### 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 MLDAP.
  - 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*.

---

## CAUTION

- 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

You can export the demographic information and monitoring data of the current and discharged patients via a USB drive. For more information, see 22.7.4 *The Export Tab*.

## 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**.

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# 6 Managing Configurations

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## 6.1 Configuration Introduction

When continuously monitoring 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. System configuration items can be classified as: parameter configuration, alarm configuration, and user maintenance. Allowing you to configure the monitor more efficiently, the monitor provides different sets of configurations to accommodate various 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 any of the following department:

- 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 preset 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 the Latest Config**, the latest configuration is loaded when the monitor is started or a patient is admitted.
  - ◆ When you select **Load Specified Config**, the selected configuration of **Default Adult Config**, **Default Ped Config**, or **Default Neo Config** is loaded when the monitor is started or a patient is admitted. The specified configuration can be the factory default configuration, the age segments configuration, or a saved user defined configuration. As an example, select **Default Neo Config** and then select **Factory Default**, **Neo GA Segments**, or a user configuration. For more information on defining age segments, see *6.5 Defining Age Segments*.

## 6.5 Defining Age Segments


You must define age segments for any patient category you want to load configurations based on the patient's age. To do so, 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. Respectively select the edit icons  followed **Customize Configurations for Adult Age Segments**, **Customize Configurations for Ped Age Segments**, and **Customize Configurations for Neo Gestational Age Segments** to define the age segments for each patient category. The age segment of the neonatal patient is based on the baby's gestational age.

## 6.6 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.

## 6.7 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.**




## 6.8 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.


### 6.8.1 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**.


### 6.8.2 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**.

## 6.9 Printing Configurations

To print 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**.

## 6.10 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.

## 6.11 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**.

# 7 Networked Monitoring

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## 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

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### CAUTION

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- **Wireless network design, deployment, debugging, and maintenance should be executed by Mindray service personnel or authorized technicians.**
  - **Always deploy the wireless network according to local wireless regulations.**
  - **Using 5 GHz frequency band is recommended whenever possible. There are more interference sources in 2.4 GHz frequency band.**
  - **Private APs and wireless routers are not allowed. These devices may cause radio interference and result in monitor and CMS data loss.**
  - **To ensure network security and stability, data communication must be performed within a closed network or within a virtually isolated hospital network. The hospital is responsible for ensuring the security of the virtually isolated network.**
  - **WPA2-PSK and WPA2-Enterprise verification and encryption should be used if possible. Otherwise, the equipment may not be able to work or patient information may be leaked. WPA2-Enterprise and a long password are recommended.**
  - **Keep network authentication information, for example password, 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.**
  - **Maximum number of monitors connected to a single AP is 16. Too many monitors connected to the same AP may result in network disconnection.**
  - **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 reconnect the network 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.**
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## 7.3 Connecting the Monitor to the CMS

You can connect the monitor to the BeneVision CMS through wired LAN or wireless LAN. When connected to the CMS, the system provides the following function.

- The monitor can transmit 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 the operator's manual of corresponding central monitoring system.

Connect the monitor to the CMS through either of the following methods:

- Admit the monitor on the CMS.
  - Select the system status information area at the top right corner of the main screen. Select the desired CMS from the popup CMS list. For more information, see 22.16.2 *The Central Station Setup Tab*.
  - 
  - **You can select CMS only when the Select CMS switch is on. For more information, refer to 22.16.2 *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.
- The monitor can transmit parameter values and alarm settings getting from the connected external devices to the eGateway.
- Clock can be synchronized between the monitor and the eGateway.

## 7.5 MLDAP

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


The MLDAP server is connected with the hospital LDAP server. All monitoring devices are connected to the MLDAP server to implement identity and authentication for the following operations:

- Changing alarm settings
- Changing arrhythmia settings
- Accessing the **Maintenance** menu

For more information on setting the MLDAP server, see 22.16.8 *The MLDAP Tab*. For more information on selecting or changing the passwords, see 22.12 *The Authorization Setup Settings*


## 7.6 Connecting the Wireless Network

You can add up to five wireless networks for the monitor. If connecting the current wireless network fails, the monitor automatically connects other wireless networks in the order when they were added.


To manually switch the wireless network, from the system status information area on the top right corner of the screen select  , and select the desired wireless network.

## 7.7 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

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## 8.1 Alarm Introduction

This chapter describes alarm functions and alarm settings.

## 8.2 Alarm Safety Information

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### WARNING

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- 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 the care area may have different alarm settings to suit different patients. Before starting monitoring, check that alarm settings are appropriate for the patient. 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 level may predispose a premature infant to retrolental fibroplasia. Setting the SpO<sub>2</sub> high alarm limit to 100% is equivalent to switching off the SpO<sub>2</sub> alarm.
  - 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 exclusively rely on audible alarms for patient monitoring. Adjusting alarm volume to a low level or turning off alarm sound may result in patient hazards. 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 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: indicate a life threatening situation or a severe device malfunction. High priority alarms require an immediate response.
- Medium priority alarms: indicate 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.
- Prompts: provide additional information on the patient or the equipment.

### 8.3.3 Alarm Priority Escalation

Priority of some alarms can escalate to higher priority. An escalating alarm starts at a preset priority and will escalate to the next higher priority after a certain period of time if the alarm condition has not been resolved or certain alarms occurs at the same time.

- The priority of IBP-S Low alarm escalates from medium to high if any of the following alarms also present: HR Low, Brady, Tachy, ST-XX High, ST-XX Low, A-Fib, Vent Rhythm, Bigeminy, and Trigeminy.
- The priority of SpO2 Low escalates from medium to high if RR High or RR Low also presents and lasts for 0 to 10 minutes (configurable).
- The alarm message of SpO2 Desat changes to SpO2 Desat (with RR High) or SpO2 Desat (with RR Low) if RR High or RR Low also presents.

The following table lists alarm messages of escalated alarms.

Original Alarm Message	Alarm Messages after Escalation
IBP-S Low	IBP-S Low (with HR Low) IBP-S Low (with Tachy) IBP-S Low (with Brady) IBP-S Low (with A-Fib) IBP-S Low (with Vent Rhythm) IBP-S Low (with Bigeminy) IBP-S Low (with Trigeminy) IBP-S Low (with ST Low) IBP-S Low (with ST High)
SpO2 Low	SpO2 Low (with RR High) SpO2 Low (with RR Low)
SpO2 Desat	SpO2 Desat (with RR High) SpO2 Desat (with RR Low)

#### NOTE

- **The IBP-S low alarm escalates to IBP-S low (with XX) only when any of the following alarms presents before IBP-S Low occurs: Tachy, ST High, ST Low, A-Fib, Vent Rhythm, Bigeminy, or Trigeminy. XX refers to any of these alarms.**
- **The alarm priority escalation function only affects the currently active alarms. Future alarms of the same type will not be affected. New alarms of the same type will be generated at preset priority rather than at the escalated priority.**

### 8.3.4 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	Prompt
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
Audible tone pattern	Special alarm sound*	Repeat pattern of high-pitched single beep	None	None	None
	ISO	Repeat pattern of triple + double + triple + double beeps	Repeat pattern of triple beeps	Repeat pattern of single beep	None
	ISO2	Repeat pattern of triple + double + triple + double beeps	Repeat pattern of triple beeps	Repeat pattern of single beep	None
	ISO3	Repeat pattern of triple + double + triple + double beeps	Repeat pattern of triple beeps	Repeat pattern of double beeps	None
Alarm message		White text inside a red box	Black text inside a yellow box	Black text inside a cyan box	White text
Alarm priority indicator		!!!	!!	!	None
Parameter value		White text inside a flashing red box	Black text inside a flashing yellow box	Black text inside a flashing cyan box	None

## NOTE

- When multiple alarms of different priority levels occur simultaneously, the monitor selects 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, alarm messages are displayed circularly.
- The frequency of the alarm tone is different with those of the heart beat tone, pulse tone, and keystroke tone so that the alarm tone can be distinguished with other tones.

### 8.3.5 Alarm Status Symbols

Apart from the alarm indicators as described in **8.3.4 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 the alarm system is reset.

### 8.3.6 Highlighted Display of Alarm Messages (only available for the independent external display)

When some alarms are triggered, alarm messages are highlighted to indicate that the patient may be in a critical condition. When an alarm is highlighted, the alarm message covers both the physiological alarm area and the technical alarm area with enlarged word size. Messages of technical alarms and other physiological alarms are displayed at the left of the highlighted alarm.

Alarm messages of the following alarms can be highlighted:

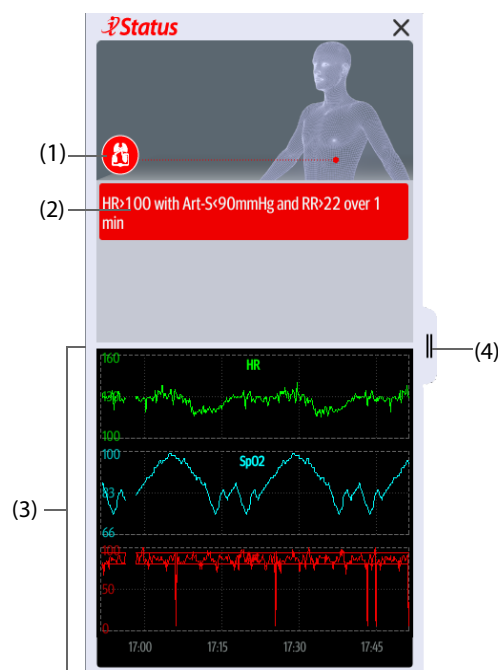
- Lethal arrhythmia alarms, including Asystole, V-Fib/V-Tach, V-Tach, Vent Brady, Extreme Tachy, and Extreme Brady.
- SpO2 Desat
- Apnea
- $HR > XX$  with  $IBP-S < XX$  and  $RR > XX$  over  $YY$  min, in which “XX” represents a parameter threshold and “YY” represents the alarm duration threshold.

## 8.4 *iStatus* Window (only available for the independent external display)

The *iStatus* window ( *iStatus* ) displays the current physiological alarms, alarmed systems or organs, and parameter trends over the last one hour.

If a combined alarm is configured to notify by popup, the *iStatus* window pops up when this combined alarm is triggered. For more information on alarm notification, see Notification from 22.4.5 *The Combined Alarm Tab*.

The following figure is an example of the *iStatus* window.



- (1) Currently alarmed systems or organs
- (2) Active alarms
- (3) Parameter trends of one hour
- (4) Select here or swipe to the right in the *iStatus* window with one finger to review longer parameter trends, additional parameters, and alarm statistics information. Swiping left on the longer trend window with one finger closes the extended trend window.

To close the *iStatus* window, select the close symbol X or swipe left with a single finger. If a combined alarm is active but the *iStatus* window is closed, the *iStatus* button or the *iStatus* button flashes at the left side in a color corresponding with the alarm priority. To open the *iStatus* window, select the *iStatus* button or the *iStatus* button.

## 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 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.

## 8.7 Alarm Limits

When a parameter measurement exceeds the alarm limit, the monitor generates an alarm according to the alarm priority setting.

### 8.7.1 Auto Alarm Limits

The monitor can 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. 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	Patient Category	Lower Limit	Upper Limit	Auto Limit Range
ECG	HR/PR (bpm)	Adult	HR $\times$ 0.8, or 40, or guard limit (whichever is greater, no greater than 70)	HR $\times$ 1.25 or 240, or guard limit (whichever is smaller, no less than 100)	35 to 240
		Pediatric	HR $\times$ 0.8 or 40, or guard limit (whichever is greater, no greater than 80)	HR $\times$ 1.25 or 240, or guard limit (whichever is smaller, no less than 120)	35 to 240
		Neonate	(HR - 30) or 90 (whichever is greater, no greater than 100)	(HR + 40) or 200 (whichever is smaller, no less than 160)	55 to 225
Resp	RR (rpm)	Adult/ Pediatric	RR $\times$ 0.5 or 6 (whichever is greater, no greater than 12)	(RR $\times$ 1.5) or 30, or guard limit (whichever is smaller, no less than 20)	6 to 55
		Neonate	(RR - 10) or 30 (whichever is greater, no greater than 40)	(RR + 25) or 85 or guard limit (whichever is smaller, no less than 70)	10 to 90
SpO <sub>2</sub>	SpO <sub>2</sub> (%)	All	Same as the default alarm limit	Same as the default alarm limit	Same as the measurement range

Module	Parameter	Patient Category	Lower Limit	Upper Limit	Auto Limit Range
NIBP	NIBP-S (mmHg)	Adult	(SYS × 0.68 + 10) or guard limit (whichever is greater, no greater than 110)	(SYS × 0.86 + 38), or guard limit (whichever is smaller, no less than 140)	45 to 270
		Pediatric	(SYS × 0.68 + 10 or guard limit (whichever is greater, no greater than 90)	(SYS × 0.86 + 38), or guard limit (whichever is smaller, no less than 100)	45 to 185
		Neonate	(SYS - 15) or 45 (whichever is greater, no greater than 60)	(SYS + 15) or 105 (whichever is smaller, no less than 80)	35 to 115
	NIBP-M (mmHg)	Adult	(Mean × 0.68 + 8) or guard limit (whichever is greater, no greater than 80)	(Mean × 0.86 + 35), or guard limit (whichever is smaller, no less than 100)	30 to 245
		Pediatric	(Mean × 0.68 + 8) or guard limit (whichever is greater, no greater than 60)	(Mean × 0.86 + 35), or guard limit (whichever is smaller, no less than 80)	30 to 180
		Neonate	(Mean - 15) or 35 (whichever is greater, no greater than 40)	(Mean + 15 or 95) (whichever is smaller, no less than 60)	25 to105
	NIBP-D (mmHg)	Adult	(Dia × 0.68 + 6) or guard limit (whichever is greater, no greater than 60)	(Dia × 0.86 + 32), or guard limit (whichever is smaller, no less than 80)	25 to 225
		Pediatric	(Dia × 0.68 + 6) or guard limit (whichever is greater, no greater than 50)	(Dia × 0.86 + 32), or guard limit (whichever is smaller, no less than 60)	25 to 150
		Neonate	(Dia - 15) or 20 (whichever is greater, no greater than 30)	(Dia + 15) or 80 (whichever is smaller, no less than 50)	20 to 90
Temp	Txx (°C)*	All	(Txx - 0.5)	(Txx + 0.5)	1 to 49
	*xx refers to temperature site.				
	ΔT (°C)	All	Same as the default alarm limit	Same as the default alarm limit	Same as the measurement range
IBP/PiCCO	IBP-S (mmHg)	Adult	SYS × 0.68 + 10 or guard limit (whichever is greater, no greater than 110)	SYS × 0.86 + 38 or guard limit (whichever is smaller, no less than 140)	45 to 270
		Pediatric	SYS × 0.68 + 10 or guard limit (whichever is greater, no greater than 90)	SYS × 0.86 + 38 or guard limit (whichever is smaller, no less than 100)	45 to 185
		Neonate	(SYS - 15) or 45 (whichever is greater, no greater than 60)	(SYS + 15) or 105 (whichever is smaller, no less than 80)	35 to 115
	IBP-M (mmHg)	Adult	Mean × 0.68 + 8 or guard limit (whichever is greater, no greater than 80)	Mean × 0.86 + 35 or guard limit (whichever is smaller, no less than 100)	30 to 245
		Pediatric	Mean × 0.68 + 8 or guard limit (whichever is greater, no greater than 60)	Mean × 0.86 + 35 or guard limit (whichever is smaller, no less than 80)	30 to180
		Neonate	(Mean - 15) or 35 (whichever is greater, no greater than 40)	(Mean + 15) or 95 (whichever is smaller, no less than 60)	25 to 105
	IBP-D (mmHg)	Adult	(Dia × 0.68 + 6) or guard limit (whichever is greater, no greater than 60)	(Dia × 0.86 + 32) or guard limit (whichever is smaller, no less than 80)	25 to 225
		Pediatric	(Dia × 0.68 + 6) or guard limit (whichever is greater, no greater than 50)	(Dia × 0.86 + 32) or guard limit (whichever is smaller, no less than 60)	25 to 150
		Neonate	(Dia - 15) or 20 (whichever is greater, no greater than 30)	(Dia + 15) or 80 (whichever is smaller, no less than 50)	20 to 90
IBP refers to arterial pressure only, including Art/pArt, Ao, UAP, BAP, FAP, LV, P1, P2, P3, P4. pArt is applied to adult and pediatric patients.					

Module	Parameter	Patient Category	Lower Limit	Upper Limit	Auto Limit Range
IBP	PA-S (mmHg)	All	SYS $\times$ 0.75, no less than guard limit and no greater than 15	SYS $\times$ 1.25, no greater than guard limit and no less than 25	3 to 120
	PA-M (mmHg)	All	Mean $\times$ 0.75, no less than guard limit and no greater than 5	Mean $\times$ 1.25, no greater than guard limit and no less than 10	3 to 120
	PA-D (mmHg)	All	Dia $\times$ 0.75, no less than guard limit and no greater than 5	Dia $\times$ 1.25, no greater than guard limit and no less than 6	3 to 120
	IBP-M	All	Mean $\times$ 0.75, no less than guard limit and no greater than 5	Mean $\times$ 1.25, no greater than guard limit and no less than 10	3 to 40
	IBP refers to venous pressure only, including CVP, LAP, RAP, UVP, P1, P2, P3, P4				
	CPP-M (mmHg)	Adult	CPP $\times$ 0.68 + 8, no less than 60	CPP $\times$ 0.86 + 35, no greater than 90	20 to 235
		Pediatric	CPP $\times$ 0.68 + 8, no less than 50	CPP $\times$ 0.86 + 35, no greater than 70	25 to 175
		Neonate	(CPP-15) or 35, (whichever is greater, no less than 40)	(CPP+15) or 95, (whichever is smaller, no greater than 70)	25 to 100
PiCCO	pCVP (mmHg)	Adult/ Pediatric	Mean $\times$ 0.75	Mean $\times$ 1.25	3 to 40
CO <sub>2</sub>	EtCO <sub>2</sub> (mmHg)	All	0 to 32: remains the same 33 to 35: 29 36 to 45: (EtCO <sub>2</sub> - 6) 46 to 48: 39 >48: remains the same	0 to 32: remains the same 33 to 35: 41 36 to 45: (EtCO <sub>2</sub> + 6) 46 to 48: 51 >48: remains the same	Same as the measurement range
	FiCO <sub>2</sub>	All	None	Same as the default alarm limit	Same as the measurement range
CO <sub>2</sub>	awRR (rpm)	Adult/ Pediatric	awRR $\times$ 0.5 or 6 (whichever is greater)	awRR $\times$ 1.5 or 30 (whichever is smaller)	6 to 55
		Neonate	(awRR - 10) or 30 (whichever is greater)	(awRR+25) or 85 rpm (whichever is smaller)	10 to 90

## 8.7.2 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.

## 8.7.3 Guard Limit

You can set guard limits for some parameters to prevent alarm limits from being set too high or too low. Setting guard limits is password protected. For more information, see 22.4.4 *The Guard Limits Tab*.

## 8.7.4 Alarm Limit Recommendations (only available for the independent external display)


If the base values of the patient's vital signs are abnormal or the patient's status has a tendency change, using the current alarm limits may continuously or frequently trigger alarms. When monitoring HR, PR, SpO<sub>2</sub>, RR, and arterial pressure, the monitor has a function of recommending alarm limits. If the alarm counts or the ratio of accumulated alarm duration reaches the preset value, or a parameter measurement frequently approaches the alarm limit, the monitor can recommend an alarm limit.

The alarm limit recommendation function is intended for adult and pediatric patients.

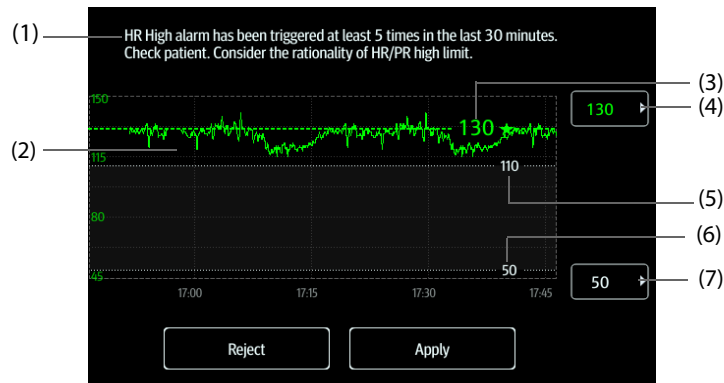
## NOTE

- The alarm limit recommendation function is not applied to the Resus mode, intubation mode and CPB mode.
- The alarm limit recommendation function is not applied to the operating room.
- The alarm limit recommendation function is not intended for neonatal patients.

### 8.7.4.1 Viewing Alarm Limit Recommendations

When an alarm limit recommendation is triggered, the alarm limit recommendation icon  **Alarm** is displayed above the quick key area. To view the alarm limit recommendation, select the **Alarm Setup** quick key.

The following figure is an example of the Alarm Limit Recommendation window:



- (1) Prompt and recommendation
- (2) Parameter trend of the last one hour
- (3) Recommended alarm limit
- (4) Select here to set alarm high limit
- (5) The current alarm high limit
- (6) The current alarm low limit
- (7) Select here to set alarm low limit

The value in green and followed by a green pentagram is the recommended alarm limit.


- Select **Apply** to apply the recommended alarm limit. You can also set an alarm limit as needed, and then select **Apply** to apply the new alarm limit.
- Select **Reject** to ignore the recommended alarm limit.

If an recommended alarm limit is accepted or rejected, the monitor starts a new alarm limit analysis window.

### 8.7.4.2 Configuring Alarm Limit Recommendation

The alarm limit recommendation function is enabled by default. However, you can switch it off. The monitor gives alarm limit recommendation only when this function is switched on.

To configure alarm limit recommendation, follow this procedure:

1. Select the **Main Menu** quick key → from the **Alarms** column select **Setup** to enter the  **Alarm** menu.
2. Verify that **Alarm Limits Recommendation** is switched on.
3. Set the criteria for providing alarm limit recommendation.
  - ◆ **Analysis Window:** sets the duration of alarm limit analysis.
  - ◆ **Alarm Count in Analysis Window:** the monitor recommends an alarm limit when the alarm count reaches the threshold within the analysis window.
  - ◆ **Alarm Duration Ratio in Analysis Window:** the monitor recommends an alarm limit when the ratio of accumulated alarm duration reaches the preset value within the analysis window.

## NOTE

- The monitor recommends an alarm limit when either the alarm count or alarm duration ration reaches the preset value within the analysis window.

### 8.7.5 Restoring the Default Alarm Limits Settings

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

1. Select the **Main Menu** quick key → from the **Alarm** column select **Limits**.
2. Select **Defaults** at the bottom.

## 8.8 Changing Alarm Settings

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

### 8.8.1 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**.
2. Select a parameter tab and set alarm properties as desired. Enter the password if required. For more information, refer to *22.12 The Authorization Setup Settings*.

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

### 8.8.2 Setting Alarm Tone Properties

#### 8.8.2.1 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.

#### 8.8.2.2 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*.

### 8.8.3 Enabling Special Alarm Sound

You can configure the monitor to give special alarm sound to indicate that the patient may be in a critical condition when any of the following alarms are triggered:

- Lethal arrhythmias, including Asystole, V-Fib/V-Tach, V-Tach, Vent Brady, Extreme Tachy, and Extreme Brady
- SpO2 Desat
- Apnea

This function is password protected. For more information, see Special Advanced Alarm Sound in 22.4.1 *The Audio Tab*.

## NOTE

- The special alarm sound is available only when Alarm Sound is set to ISO2. See Alarm Sound from 22.4.1 *The Audio Tab*.

### 8.8.4 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 22.4.7 *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.

## WARNING

- The alarm delay time can be set to a maximum of 15 seconds. Changing this setting to an inappropriate level could result in a hazard to the patient.

### 8.8.5 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.

### 8.8.6 Adjusting the Alarm Light Brightness

This setting is password protected. For more information, see 22.4.7 *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.

### 8.8.7 Configuring Combined Alarms

The monitor provides combined alarms of multiple parameter measurements and trends.


To set the properties of combined alarms, follow this procedure:

1. Select the **Main Menu** quick key → from the **Alarm** column select **Setup** → **Combined Alarm** tab.
2. Set alarm properties as desired.

From the Combined Alarm setup of the  **Alarm** menu, you can change the settings of parameter threshold, alarm switch, alarm priority, and alarm output switch.

The monitor has predefined some combined alarms. You can modify the settings of these alarms. You can also add up to 10 custom combined alarms.

The following operations are password protected:

- Selecting combined alarms that can be displayed and modified from the Combined Alarm setup of the  **Alarm** menu.
- Changing the default name of a combined alarm.
- Changing the notification type of a combined alarm.

- Changing the default delay time of a combined alarm.
- Adding and deleting custom combined alarms.
- Setting the refractory period for combined alarms.

## NOTE

- **The predefined combined alarm function is not intended for pediatric and neonatal patients.**
- **You can only change the default alarm priority of custom combined alarms.**
- **You can only select the icon type of the custom combined alarms. In the *iStatus* window, selected icon type is used to indicate the alarmed system or organ.**
- **You can only delete custom combined alarms.**

### 8.8.8 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. Set **Printing Duration On Alarm**.

### 8.8.9 Setting the Delay of SpO2 Low Alarm Escalation

To set the delay time of SpO2 Low Alarm escalation, follow this procedure:

1. Select the **Main Menu** quick key → from the **Alarm** column select **Setup**.
2. Set **SpO2 Low Escalation Time**.

## 8.9 Pausing Alarms/Pausing Alarm Tones

### 8.9.1 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*.

### 8.9.2 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.
- Except battery-related technical alarms, sounds of other technical alarms 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*.

### 8.9.3 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

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

### 8.9.4 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.

#### 8.9.4.1 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*.

#### 8.9.4.2 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*.

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#### NOTE

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

#### 8.9.4.3 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*.

#### 8.9.4.4 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

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



## 8.10 Resetting Alarms

Pressing the **Alarm Reset** quick key to 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.**

### 8.10.1 Resetting Physiological Alarms

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

- The alarm sound is silenced.
- A check mark ✓ appears before the alarm message.
- The color of the parameter numeric background corresponds with the alarm priority, but the parameter numeric does not flash.

### 8.10.2 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.

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

## 8.11 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 remain 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 remain 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.**

## 8.12 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.

### 8.12.1 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

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

### 8.12.2 Exiting the CPB Mode

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

## 8.13 Intubation Mode

Intubation mode is available for Resp and CO<sub>2</sub> 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<sub>2</sub> related physiological alarms are switched off.

### 8.13.1 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**.

### 8.13.2 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**.

## 8.14 Testing Alarms

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

## 8.15 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 *E Alarm Messages*.

# 9

## Monitoring ECG, Arrhythmia, ST and QT

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### 9.1 ECG Introduction

The electrocardiogram (ECG) measures and records the electrical activity of the heart. ECG monitoring provides 3-, 5-, 6-, and 12-lead ECG monitoring, ST-segment analysis, arrhythmia analysis, and QT/QTc measurements.

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

### 9.2 ECG Safety Information

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#### WARNING

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- 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.
- 

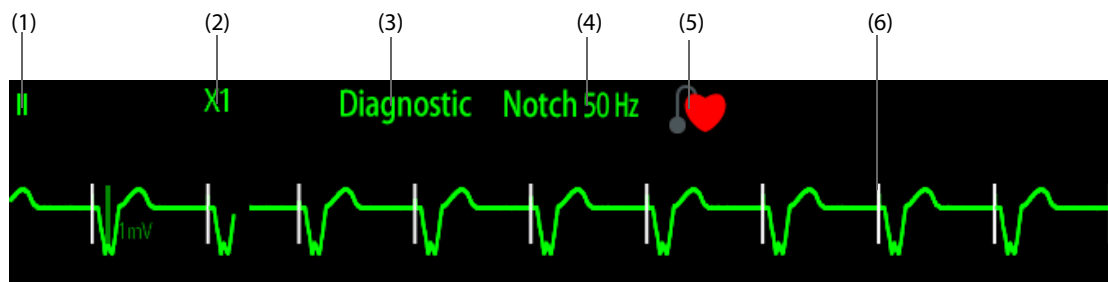
#### CAUTION

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- 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:





(1) ECG lead label of the displayed waveform, When 6-lead placement is used to derive 12-lead ECG (D12L), all derived leads are marked with a "d" in front of the lead label, for example "dV1".

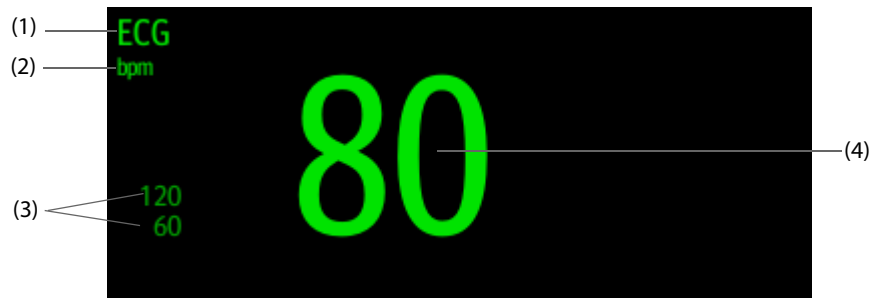
(2) ECG waveform gain

(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 "I" are displayed corresponding to detected pace pulse on each ECG waveform.



(1) Parameter label

(2) HR unit

(3) HR alarm limits

(4) HR value

### NOTE

- 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, 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 solution.
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
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

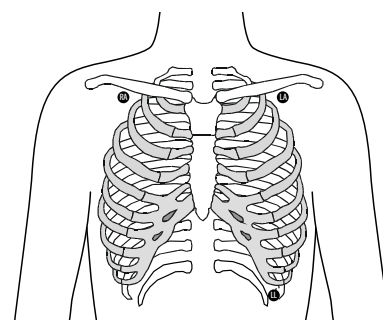
### 9.4.4 ECG Electrode Placement

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

#### 9.4.4.1 3-lead Electrode Placement

3-lead electrode placement is as follows::

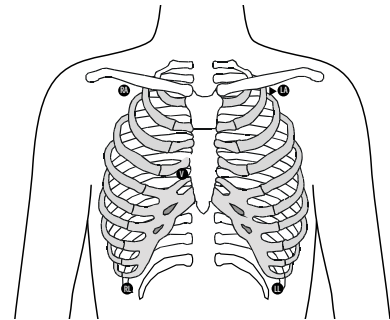
- RA: just below the clavicle and near the right shoulder.
- LA: just below the clavicle and near the left shoulder.
- LL: below the lower left edge of the rib cage.



#### 9.4.4.2 5-lead Electrode Placement

5-lead electrode placement is as follows:

- RA: just below the clavicle and near the right shoulder.
- LA: just below the clavicle and near the left shoulder.
- RL: below the lower right edge of the rib cage.
- LL: below the lower left edge of the rib cage.
- V: on the chest.



#### 9.4.4.3 6-lead Electrode Placement

For 6-lead electrode placement, you can use the position for the 5-lead placement but with two chest leads. Chest leads Va and Vb can be positioned at any two of the V1 to V6 positions. For more information, see 9.4.4.4 *Chest Electrode Placement*. The Va and Vb lead positions are configurable. For more information, see 9.6.4.4 *Changing Va and Vb Labels*.

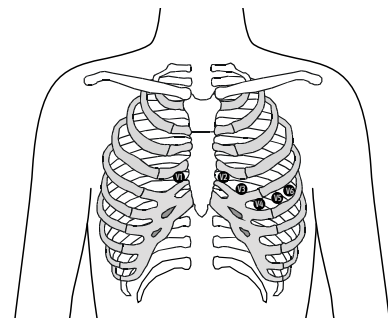
When 6-lead placement is used to derive 12-lead ECG, Va and Vb shall use any of the following combinations.

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

#### 9.4.4.4 Chest Electrode Placement

The chest electrode can be placed at the following positions:

- V1: on the fourth intercostal space at the right border of sternal.
- V2: on the fourth intercostal space at the left border of sternal.
- V3: midway between V2 and V4.
- V4: on the fifth intercostal space on the left midclavicular line.
- V5: on the left anterior axillary line at the same horizontal level as V4.
- V6: on the left midaxillary line at the same horizontal level as V4 and V5.

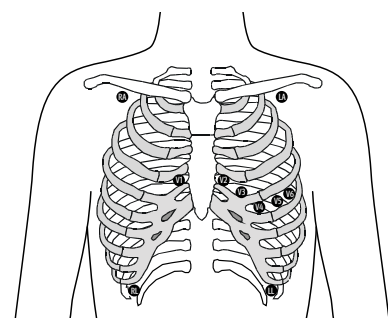


#### NOTE

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

#### 9.4.4.5 12-lead Electrode Placement

12-lead ECG monitoring uses 10 electrodes. The chest electrodes can be placed according to the physician's preference. The picture at the right side shows the conventional 12-lead electrode placement. For the placement of RA, RL, LA, and LL, see 9.4.4.2 *5-lead Electrode Placement*. For the placement of chest electrodes, see 9.4.4.4 *Chest Electrode Placement*.



#### 9.4.4.6 Lead Placement for Pacemaker Patients

The pacemaker patient usually requires a different electrode placement configuration than a non-pacemaker patient.

Do not place an ECG electrode directly over the pacemaker generator. Place the electrodes 5 cm to 7 cm away from the pacemaker generator area. For example, if the pacemaker generator is located in the left subclavian area, relocate the Left Arm electrode closer in towards the center of the chest.

#### 9.4.4.7 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

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- **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.**
  - **If the ESU is used, do not place ECG electrodes near the grounding plate of the ESU. Otherwise interference on ECG signals may occur.**
- 

#### 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

You should check the patient's paced status before monitoring ECG. The paced symbol  is displayed when **Paced** is set to **Yes**. The pace pulse markers "I" 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

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- **For paced patients, set Paced to Yes. Otherwise the monitor could mistake a pace pulse for a QRS complex and fail to generate alarms 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 heart 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 or 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 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. If 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.

To choose the desired screen configuration, follow this procedure:

1. Select the ECG numeric area or waveform area to enter the **ECG** menu.
2. From the bottom of the menu, select **Full-Screen** or **12-Lead** (for 12-lead ECG monitoring).

### 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

Analyzing multiple leads enhances detection sensitivity and reduces false alarms. The monitor supports ECG analysis using either four leads (ECG1 to ECG4) or a single lead (ECG1).

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

- **When most leads are noisy or with low amplitude, choosing the optimal lead as the calculation lead and setting Analysis Mode to Single Lead is recommended.**
- **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 analysis mode.**
- **When a 3-lead ECG cable is used, the monitor always uses a single lead as the 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 is tall and narrow.
- The QRS complex is completely above or below the baseline. It should not be biphasic.
- The amplitudes of P waves and T waves are less than 0.2 mV.

---

## 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.**
- 

## NOTE

- **If D12L is enabled, you cannot select the derived leads as ECG1 or ECG2.**
- 

### 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**: is used when ECG waveforms of diagnostic quality is required.
  - ◆ **Monitor**: is used in routine ECG monitoring.
  - ◆ **Surgery**: is used if ECG signals are distorted by high or low frequency noise. In the operating room, setting **Filter** to **Surgery** can reduce ESU interference. However, during normal ECG monitoring, selecting **Surgery** may suppress certain features or details of the QRS complexes.
  - ◆ **ST**: is 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 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<sub>2</sub> measurements are available, the monitor adjusts the pitch of QRS tone based on the SpO<sub>2</sub> value.

#### 9.6.7 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 CrozFusion™

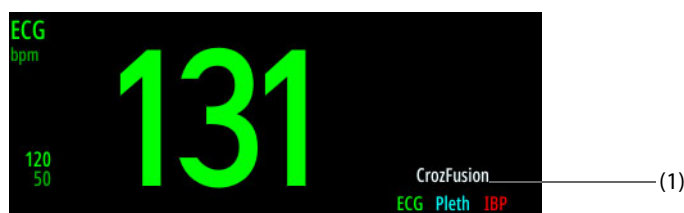
The monitor provides the CrozFusion™ function when the MPM module is used to monitor the patient's ECG, SpO2, and IBP.

The CrozFusion function analyzes ECG signals, SpO2 signals, and IBP signals together to achieve more accurate arrhythmia analysis results and improve the accuracy of HR/PR parameter measurement.

The CrozFusion™ function is intended for adult patients only.

### 9.7.1 CrozFusion™ Display

The ECG parameter area displays CrozFusion symbol and signal fusion status when the CrozFusion™ function is enabled, see the figure below:



(1) CrozFusion symbol and signal fusion status

The following table lists indications of different signal infusion status:



The quality of ECG signal, Pleth signal, and IBP signal are good. ECG signal, Pleth signal, and IBP signal are independently analyzed.



PR values may be inaccurate. ECG signal quality is better than Pleth and IBP signal quality. PR comes from HR.



HR parameter or arrhythmia may be inaccurate. Pleth signal quality is better than ECG signal quality. ECG and Pleth signal fusion to correct HR or suppress false arrhythmia result.



HR parameter or arrhythmia may be inaccurate. IBP signal quality is better than ECG signal quality. ECG and IBP signal fusion to correct HR or suppress false arrhythmia results.

## NOTE

- The CrozFusion function is not intended for pediatric and neonatal patients.
- The CrozFusion function is not applied to pacer not pacing and pacer not capture.
- The CrozFusion™ function uses ECG arrhythmia analysis leads according to the Analysis Mode setting. So the ECG signal quality indicates the signal quality of the ECG analysis leads. For more information, see 9.6.3 Setting the Analysis Mode.

- The CrozFusion™ function is available only when the MPM module or N1 is configured with Mindray SpO<sub>2</sub>.
- The CrozFusion™ function is available only when the MPM module is used to monitor IBP. If the pulse pressure difference is too small, ECG and IBP pulse signal fusion will not happen.
- The CrozFusion™ function is not recommended for patients in unstable hemodynamic status, such as low perfusion
- If the CrozFusion™ function is enabled, do not rely entirely on it. Always keep the patient under close surveillance for the vital parameter changes.

## 9.7.2 Disabling the CrozFusion™ Function

The CrozFusion™ function is enabled by default. However, in some situations the CrozFusion™ function may not be able to work properly, so you should disable the CrozFusion™ function.

The CrozFusion function is not intended for the following situations:

- Performing CPR
- Using an artificial heart-lung machine for extracorporeal circulation surgery or using V-A ECMO
- Using IABP
- Patients with persistent regular restlessness

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 **CrozFusion** tab.
3. Switch off **CrozFusion**.

---

### WARNING

- The monitor is used for one patient at a time.
  - ECG, Pleth, or IBP signals from different patients may result in incorrect signal fusion.
  - When the CrozFusion function is enabled, arrhythmia may be wrongly suppressed or interference may be ignored. In above situations, you may disable the CrozFusion function according to patient condition.
- 

## 9.8 Monitoring Arrhythmia

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

### 9.8.1 Arrhythmia Safety Information

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#### WARNING

- 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 may incorrectly identify the presence or absence of an arrhythmia. Therefore, a physician must analyze the arrhythmia information with other clinical findings.
  - Atrial fibrillation (A-Fib) detection function is not intended for pediatric and neonatal patients.
- 

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#### 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.

## 9.8.2 Arrhythmia Events

This section lists all arrhythmia events and their criteria.

### 9.8.2.1 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.

### 9.8.2.2 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.
Trigeminy*	A dominant rhythm of N, N, V, N, N, V, N, N, V.
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.

Arrhythmia message	Description
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%)
A-Fib	P wave is absent and normal beat RR intervals are irregular.
PVCs/min	PVCs/min exceeds high limit.
Pauses/min	Pauses/min exceeds high limit.
Irr Rhythm End	Irregular rhythm no longer detected within the irregular rhythm end delay time.
A-Fib End	Atrial fibrillation no longer detected within the Afib end delay time.
SVT	The number of consecutive SVCs is greater than or equal to the SVT SVCs limit, and the supraventricular HR is greater than or equal to the SVT HR limit.
SVCs/min	SVCs/min exceeds the high limit.

\*N: normal beat; V: ventricular beat

### 9.8.3 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**.

### 9.8.4 Changing Arrhythmia Settings

#### 9.8.4.1 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.
4. Set alarm properties as desired.

#### NOTE

- You can switch off lethal arrhythmia alarms only when you have configured the monitor to allow lethal arrhythmia alarms to be turned off. For more information, see 22.4.4 *The Guard Limits Tab*.
- The priority of lethal arrhythmia alarms is always high. It cannot be altered.

#### 9.8.4.2 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.
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.

### 9.8.4.3 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
SVT SVCs	3 beats to 99 beats
SVT HR	100 bpm to 300 bpm
SVCs/min	1 to 100

### 9.8.4.4 Setting Thresholds for PVC-Related Alarms

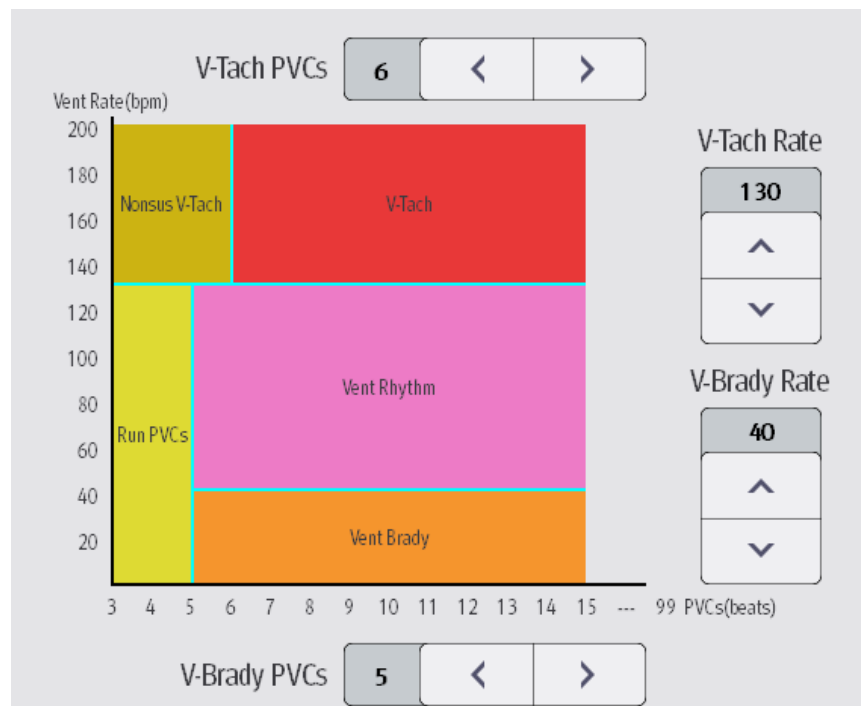
The monitor detects PVC-related alarms basing on the current PVC rate and the number of consecutive PVCs.

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

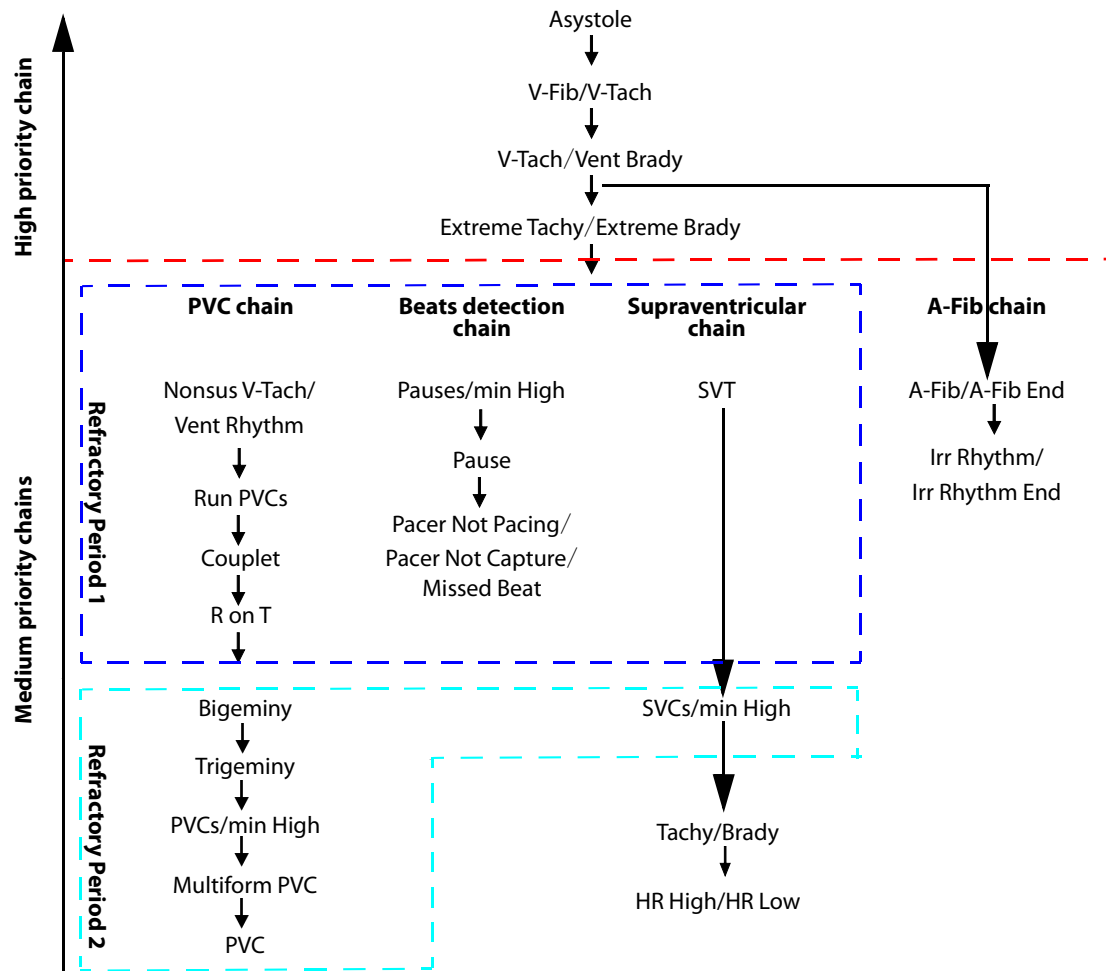
## 9.8.5 Deactivated Arrhythmia Alarms

The monitor generally issues an alarm once an arrhythmia condition is detected. However, the monitor can be configured to deactivate some arrhythmia alarms and disable alarm light and alarm tone for a designated period of time when certain arrhythmia alarms are detected. For more information, see *9.8.5.2 Arrhythmia Shielding Period* and *9.8.5.4 Setting Arrhythmia Refractory Periods*.

### 9.8.5.1 Arrhythmia Alarm Chains

If multiple arrhythmia conditions occur simultaneously, announcing all detected alarm conditions may be confusing. This may result in serious conditions being overlooked. So arrhythmia alarms are prioritized through alarm chains.

There are five arrhythmia alarm chains: one high priority chain and four medium priority chains, including PVC chain, beats detection chain, supraventricular chain, and A-Fib chain.



**Note:** The refractory periods have no impact on Tachy, Brady, HR High, and HR Low.

### 9.8.5.2 Arrhythmia Shielding Period

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

This function is password protected. For more information, see **Arrhy Shield Time** in 22.4.7 *The Other Tab*.

#### NOTE

- The arrhythmia shielding period is only applicable to arrhythmias in the medium priority chains. For arrhythmias in the high priority chain, alarm tone and alarm light are generated as soon as an alarm condition is detected.
- The arrhythmia shielding period has no impact on HR High, HR Low, Tachy, Brady, A-Fib End, Irr Rhythm End.

### 9.8.5.3 Arrhythmia Alarm Shielding Rules

The following table explains how audible and visual alarm indicate during the arrhythmia shielding period.

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 the shielding period, alarm light and alarm tone are disabled. When the shielding period is reached, alarm light and alarm tone are reactivated.
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 the shielding period, alarm light and alarm tone are disabled. When the shielding period is reached, alarm light and alarm tone are reactivated.
	Alarm in the same medium priority chain, but with lower priority	During the shielding period, alarm light and alarm tone are disabled. When the shielding period is reached, alarm light and alarm tone are reactivated.
	Alarm in other medium priority chain	Alarm light and alarm tone

#### 9.8.5.4 Setting Arrhythmia Refractory Periods

For some arrhythmias in the medium priority chain, an arrhythmia and arrhythmias with lower priority in the same alarm chain can be deactivated in a designated period of time. This period is called refractory period. When an arrhythmia is detected, the refractory period automatically starts. During the refractory period, the same alarm condition does not trigger an alarm. If the condition of an arrhythmia with lower priority in the same alarm chain appears, the monitor does not generate an alarm either.

To set arrhythmia refractory periods, follow this procedure:

1. Access arrhythmia alarm setup by either of the following ways:
  - ◆ Select the ECG numeric area or waveform area to enter the **ECG** menu → select the **Arrhythmia** tab.
  - ◆ Select the **Alarm Setup** quick key → select the **Arrhythmia** tab.
2. Select the **Threshold** tab.
3. Set **Refractory Period 1** and **Refractory Period 2**. The default refractory period 1 is 3 minutes. The default refractory period 2 is 10 minutes. To disable a refractory period, set it to **Off**.

See the figure of arrhythmia alarm chain in 9.8.5.1 *Arrhythmia Alarm Chains* for arrhythmias applying to Refractory Period 1 and Refractory Period 2.

#### NOTE

- **Refractory periods are only applicable to arrhythmias in the medium priority chains.**
- **Refractory periods have no impact on Tachy, Brady, HR High, HR Low, A-Fib/A-Fib End, Irr Rhythm/Irr Rhythm End.**

## 9.9 ST Segment Monitoring

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

### 9.9.1 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 significance of the ST segment changes must be decided by the physician.**

## 9.9.2 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**.

ST analysis may not be reliable under the following situations. Consider switching off ST analysis in these cases:

- The patient is implanted with a ventricular pacemaker.
- The patient has left bundle branch block.
- Arrhythmias such as atrial fibrillation or flutter occur, which may cause irregular baseline.
- All ECG leads are noisy.

## 9.9.3 Displaying ST Numerics

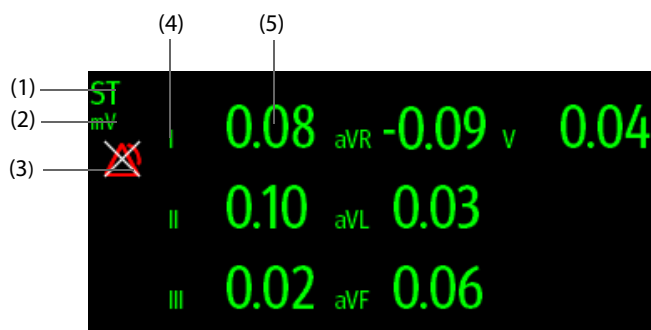
To display ST numerics and Segments, follow this procedure:

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 6-lead ECG placement to derive 12-lead ECG (D12L), the ST numeric area displays 12 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, in which two chest leads are directly measured and four are derived. The derived leads are marked with a "d" in front of the lead label, for example "dV1".
- When you are using the 12-lead ECG leadwires, the ST numeric area displays 12 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:



(1) Parameter label. When 6-lead placement is used to derive 12-lead ECG (D12L), all derived leads are marked with a "d" in front of the lead label, for example "dV1".

(2) ST unit

(3) ST alarm off symbol

(4) Lead labels

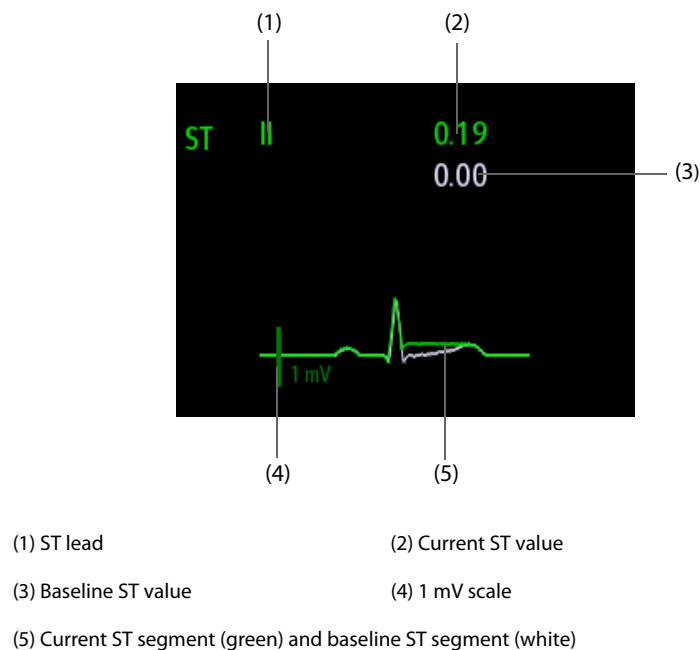
(5) ST numerics: a positive value indicates ST segment elevation, and a negative value indicates ST segment depression.

## 9.9.4 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 **ECG**→ **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.



## 9.9.5 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**.

### NOTE

- In the ST view, the derived leads are marked with a "d" in front of the lead label, for example "dV1".

## 9.9.6 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 set the ST baseline, follow this procedure:

1. From the **ST View** window, select **Set Baseline**.
2. From the pop-up dialog box, select **OK** to set the current ST segments and values as the baseline.

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.

## NOTE

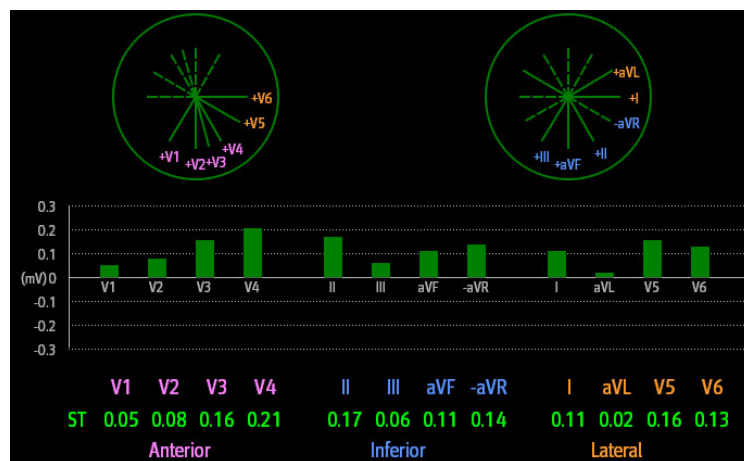
- If you set the ST baseline with D12L enabled, the baseline time is followed by "(D12L)", for example "Baseline 2017-04-06 20:30 (D12L)".

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

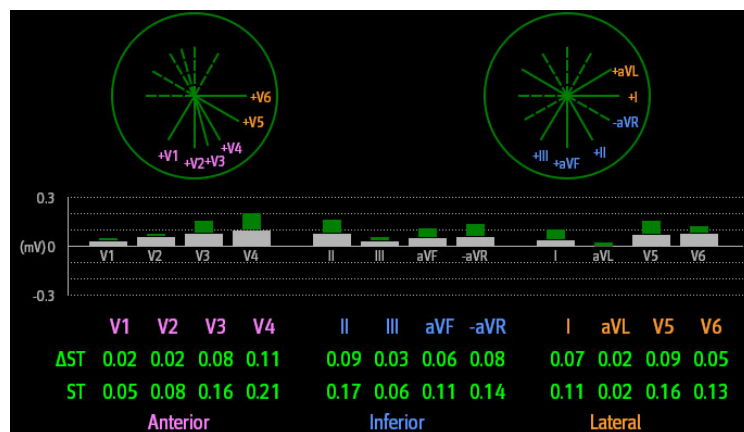
To display **ST Graphic** window, follow this procedure:

1. Select 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 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  $\Delta$ ST.



## NOTE

- In the ST Graphic, the derived leads are marked with a "d" in front of the lead label, for example "dV1".

### 9.9.8 Changing ST Settings

#### 9.9.8.1 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.

#### 9.9.8.2 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.

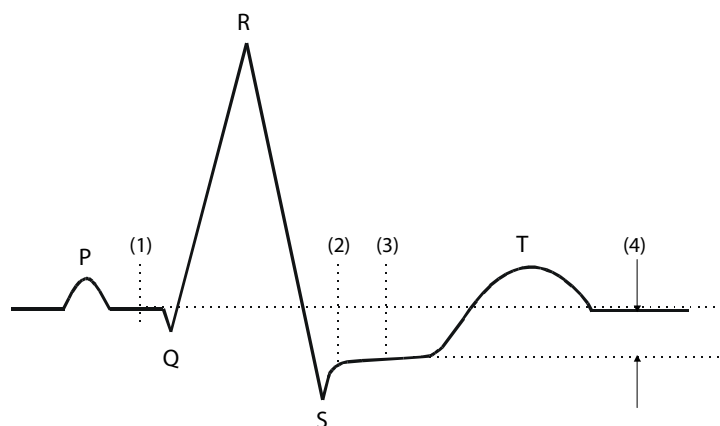
#### 9.9.8.3 Showing ISO Point, J Point, and ST Point Marks

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**.

### 9.9.9 ST Point, ISO Point, and J Point

The following figure shows the position of ST point, isoelectric (ISO) point, and J point:



- (1) ISO point: is located between the end of the P-wave and the onset of the QRS complex. The ISO point provides the baseline for ST deviation measurement.

- (2) J point: is located at the end of the QRS complex. The distance between the J point and ST point is fixed. So it helps correctly position the ST point.
- (3) ST point: is located at the midpoint of the ST segment.
- (4) ST deviation (ST elevation or depression): is the potential difference between the ISO point and the ST point.

### 9.9.10 Setting ST Point, ISO Point, and J Point

Make sure that the position of the ST point is correctly set for the patient. Incorrect setting of ST point may result in artifactual ST deviation. Adjust the ST point before starting monitoring, or if the patient's heart rate or ECG morphology changes dramatically.

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 ST point is positioned at a fixed distance from the J point. When **J+60/80ms** is selected, the ST point is positioned either 80 ms (HR≤120 bpm) or 60 ms (HR>120 bpm) from the J 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**.

- Put the ISO point in the middle of the flattest part between the P and Q waves.
- Put the J point at the end of the QRS complex and the beginning of the ST segment.

## 9.10 QT/QTc Interval Monitoring

The QT interval is from the beginning of the Q wave to the end of the T wave. QTc is the HR corrected QT interval. Monitoring QT interval helps detect the long QT syndrome.

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 QT numerics area, 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

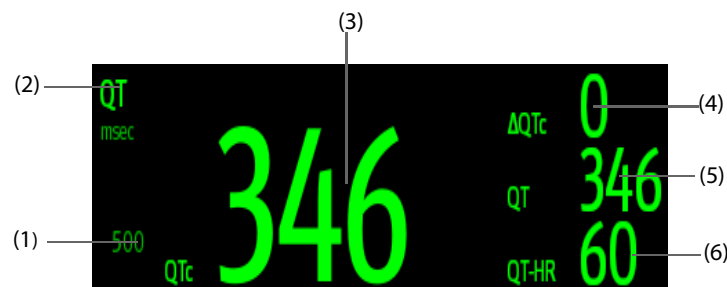
To display QT/QTc numerics and Segments, follow this procedure:

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:



- (1) QTc alarm limit (if QTc alarm is off, the alarm off symbol is displayed)
- (2) Parameter label
- (3) QTc value
- (4)  $\Delta$ QTc value (the difference between the current and baseline QTc values)
- (5) QT value
- (6) QT-HR value

### NOTE

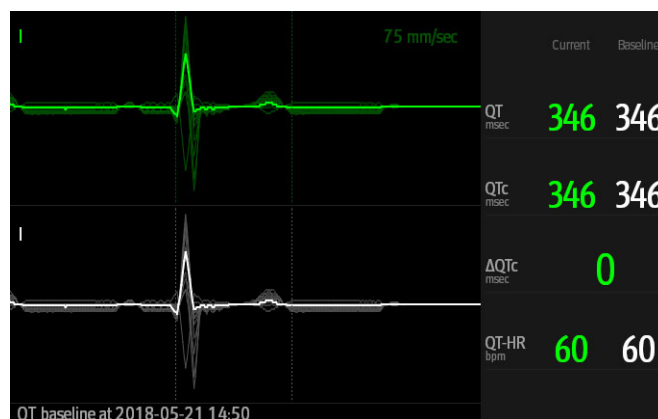
- **The display of the QT numeric area differs as related settings change.**

## 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 numerics area, ECG numeric area, or 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.

## NOTE

- In the QT view, the derived leads are marked with a "d" in front of the lead label, for example “dV1”.

### 9.10.5 Saving the Current QTc as Baseline

In order to quantify differences in the QTc value, you can set a QTc baseline. If you do not set a baseline within the first five minutes after getting valid QT values, the monitor will automatically set a baseline for this patient.

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. and the old baseline will be 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 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 numerics 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 numerics 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 Manually Initiating an ECG Relearning

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

- **Initiate ECG relearning only during periods of predominantly normal rhythm and when ECG signal is relatively free of noise. If ECG relearning occurs during arrhythmia, abnormal QRS complex may be incorrectly learned as normal QRS complex, resulting in missed detection of subsequent 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 a 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.**
  - **Before defibrillation, the user must ensure both defibrillator and monitor have 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	<ol style="list-style-type: none"> <li>1. Check that ECG is set to display in the <b>Screen Setup</b> menu. For more information, see 3.11.2 <i>Displaying Parameter Numerics and Waveforms</i>.</li> <li>2. Check that if the ECG parameter switch is enabled. If not, enable the ECG measurement. For more information, see 3.11.1 <i>Switching On or Off a Parameter</i>.</li> <li>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.</li> </ol>
Noisy ECG traces	<ol style="list-style-type: none"> <li>1. Check that electrodes are not detached or dry. Replace with fresh and moist electrodes if necessary.</li> <li>2. Check that leadwires are not defective. Replace leadwires if necessary.</li> <li>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.</li> </ol>
Excessive electrosurgical Interference	Use ESU-proof ECG cables. For more information, see 26.1 <i>ECG Accessories</i> .
Muscle Noise	<p>Inadequate skin preparation, tremors, tense subject, and/or poor electrode placement.</p> <ol style="list-style-type: none"> <li>1. Perform skin preparation again and re-place the electrodes. For more information, see 9.4.1 <i>Preparing the Patient Skin</i> and 9.4.2 <i>Applying Electrodes</i>.</li> <li>2. Apply fresh, moist electrodes. Avoid muscular areas.</li> </ol>
Intermittent Signal	<ol style="list-style-type: none"> <li>1. Check that cables are properly connected.</li> <li>2. Check that electrodes are not detached or dry. Perform skin preparation again as described in 9.4.1 <i>Preparing the Patient Skin</i> and apply fresh and moist electrodes.</li> <li>3. Check that the patient cable or leadwires are not damaged. Change them if necessary.</li> </ol>
Excessive alarms: heart rate, lead fault	<ol style="list-style-type: none"> <li>1. Check that electrodes are not dry. Perform skin preparation again and re-place the electrodes. For more information, see 9.4.1 <i>Preparing the Patient Skin</i> and 9.4.2 <i>Applying Electrodes</i>.</li> <li>2. Check for excessive patient movement or muscle tremor. Reposition the electrodes. Replace with fresh and moist electrodes if necessary.</li> </ol>
Low Amplitude ECG Signal	<ol style="list-style-type: none"> <li>1. Check that the ECG gain is not set too low. Adjust the gain as required. For more information, see 9.6 <i>Changing ECG Settings</i>.</li> <li>2. Perform skin preparation again and re-place the electrodes. For more information, see 9.4.1 <i>Preparing the Patient Skin</i> and 9.4.2 <i>Applying Electrodes</i>.</li> <li>3. Check electrode application sites. Avoid bone or muscular area.</li> <li>4. Check that electrodes are not dry or used for a prolonged time. Replace with fresh and moist electrodes if necessary.</li> </ol>
No ECG Waveform	<ol style="list-style-type: none"> <li>1. Check that the ECG gain is not set too low. Adjust the gain as required. For more information, see 9.6.3 <i>Setting the Analysis Mode</i>.</li> <li>2. Check that the leadwires and patient cables are properly connected.</li> <li>3. Change cable and lead wires.</li> <li>4. Check that the patient cable or leadwires are not damaged. Change them if necessary.</li> </ol>
Base Line Wander	<ol style="list-style-type: none"> <li>1. Check for excessive patient movement or muscle tremor. Secure leadwires and cable.</li> <li>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 <i>Preparing the Patient Skin</i> and 9.4.2 <i>Applying Electrodes</i>.</li> <li>3. Check for ECG filter setting. Set ECG Filter mode to <b>Monitor</b> to reduce baseline wander on the display.</li> </ol>

# 10 Resting 12-Lead ECG Analysis

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## 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 labeled 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 **High Freq 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

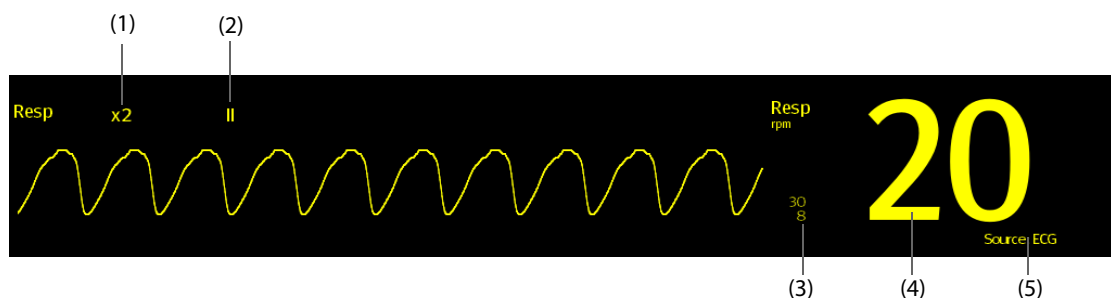
### WARNING

- When monitoring the patient's respiration, do not use ESU-proof ECG cables.
- 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.
- 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.
- 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.
- 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.

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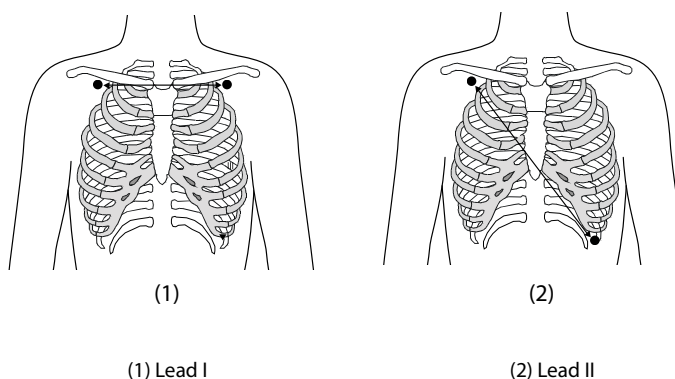
#### CAUTION

- **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 Placement*.



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#### CAUTION

- **To reduce cardiovascular artifact, apply the respiration electrodes so that the liver area and the ventricles of the heart are not in the line between the respiratory electrodes. This is especially important for neonatal patients.**
  - **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.**
  - **To optimize respiratory waveforms for patients breathing mainly abdominally, apply the LL electrode on the left abdomen at the point of maximum abdominal expansion.**
  - **For patients expand chests laterally (normally neonatal patients), to avoid negative intrathoracic pressure and optimize respiratory waveforms, respectively apply the electrodes in the right midaxillary and the left lateral chest areas at the maximum point of the breathing movement.**
  - **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.
- 

### 11.5.2 Setting the RR Source

To set the 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<sub>2</sub>, and then 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 adjust the Resp waveform threshold. For more information, see *11.5.7 Manually Adjusting the Resp Waveform Detection Threshold*.

In the auto detection mode, if ECG is switched off when you are monitoring respiration, the monitor cannot compare ECG and RR to detect cardiovascular artifact. To avoid cardiovascular artifact being interpreted as respiration, the respiration threshold is automatically set higher.

## 11.5.7 Manually Adjusting the Resp Waveform Detection Threshold

It is recommended to use the manual detection mode in the following situations:

- The patient has intermittent mandatory ventilation.
- The patient's respiration is weak.
- The patient's RR is close to HR.

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 you set the Resp waveform threshold, it will not automatically adapt to different respiration depths. In the manual detection mode, cardiovascular artifact can be mistakenly interpreted as respiration in certain situations. This results in higher respiration rate or undetected apnea. If you suspect the RR reading, adjust the Resp waveform threshold to raise the detection level. If you cannot adjust threshold because the Resp waveform is too small, consider optimize the electrode placement.

---

### CAUTION

- **Always remember that if the depth of breathing changes, you may need to change the detection level.**
  - **In the manual detection mode, if the respiration threshold is not correctly set, an apnea may not be detected. When the respiration threshold is set too low, the monitor may falsely interpret cardiac activity as respiratory activity in the case of apnea.**
- 

## 11.6 Resp Troubleshooting

For more information, see *E Alarm Messages*.

# 12 Monitoring Pulse Oxygen Saturation (SpO<sub>2</sub>)

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## 12.1 SpO<sub>2</sub> Introduction

Pulse Oxygen Saturation (SpO<sub>2</sub>) 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<sub>2</sub> monitoring is intended for adult, pediatric and neonatal patients.

The following types of SpO<sub>2</sub> can be configured for the N1 monitor:

- Mindray SpO<sub>2</sub>: the connector is blue and no logo is on the monitor.
- Nellcor SpO<sub>2</sub>: the connector is grey and the logo of Nellcor is on the monitor.
- Masimo SpO<sub>2</sub>: the connector is purple and the logo of Masimo SET is on the monitor.

### NOTE

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- **The SpO<sub>2</sub> extension cable should be compatible with the SpO<sub>2</sub> connectors. For example, you can only connect the Mindray SpO<sub>2</sub> extension cable to the Mindray SpO<sub>2</sub> connectors.**
  - **Measurement accuracy verification: The SpO<sub>2</sub> 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.**
  - **A functional tester or SpO<sub>2</sub> simulator can be used to determine the pulse rate accuracy.**
  - **A functional tester or SpO<sub>2</sub> simulator cannot be used to assess the SpO<sub>2</sub> accuracy.**
- 

## 12.2 SpO<sub>2</sub> Safety Information

### WARNING

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- **Do not use the monitor or SpO<sub>2</sub> sensors during MRI scanning or in an MRI environment. Induced current could potentially causes burns. The monitor may affect the MRI image, and the MRI device may affect the accuracy of the SpO<sub>2</sub> 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.**
  - **Setting alarm limits to extreme values may cause the alarm system to become ineffective. For example, high oxygen level may predispose a premature infant to retrolental fibroplasia. Setting the SpO<sub>2</sub> high alarm limit to 100% is equivalent to switching off the SpO<sub>2</sub> alarm.**
  - **SpO<sub>2</sub> is empirically calibrated in healthy adult volunteers with normal levels of carboxyhemoglobin (COHb) and methemoglobin (MetHb).**
  - **To protect from electric shock, always remove the sensor before bathing the patient.**
  - **The pulse oximetry function of the bedside monitor should not be used for apnea monitoring.**
  - **The pulse oximetry function of the bedside monitor should not be used for arrhythmia analysis.**
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## CAUTION

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- Change the application site or replace the sensor and/or patient cable when a persistent SpO<sub>2</sub> 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 "SpO<sub>2</sub> Sensor Off", "SpO<sub>2</sub> No Sensor", or "SpO<sub>2</sub> 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.
  - 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.
  - Use only SpO<sub>2</sub> sensors specified in this manual. Follow the instructions for use delivered with the SpO<sub>2</sub> sensor.
  - Do not place the patient monitor where the controls can be changed by the patient.
  - If using pulse oximetry during full body irradiation, keep the sensor out of the radiation field. If the sensor is exposed to the radiation, the reading might be inaccurate or the device might read zero for the duration of the active irradiation period.
- 

## NOTE

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- 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).
  - If the patient has a trend of deoxygenation, analyze the blood samples with a laboratory CO-oximeter to completely understand the patient's condition.
  - 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.
- 

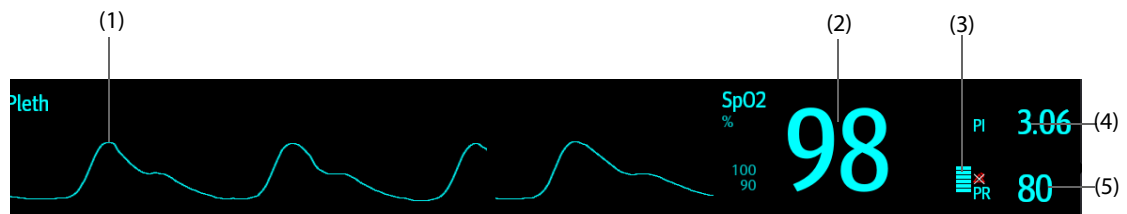
## 12.3 SpO<sub>2</sub> Measurement Limitations

The following factors may influence the accuracy of SpO<sub>2</sub> 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<sub>2</sub> sensor, or use of incorrect SpO<sub>2</sub> sensor
  - ◆ Cuff or arterial blood pressure measurement device on the same limb as the SpO<sub>2</sub> sensor.

## 12.4 SpO<sub>2</sub> Display



- (1) Pleth waveform (Pleth): indicates the blood pulsation at the measurement site. The waveform is not normalized.
- (2) Arterial oxygen saturation (SpO<sub>2</sub>): indicates the percentage of oxygenated hemoglobin relative to total hemoglobin.
- (3) Perfusion indicator: the pulsatile portion of the measured signal caused by arterial pulsation. The higher the bar, the better the perfusion quality.
- (4) Perfusion index (PI): indicates the percentage of pulsatile signal to non pulsatile signal. PI is an indicator of the pulsatile strength. You can also use it to assess the SpO<sub>2</sub> signal strength.

For Mindray SpO<sub>2</sub> module,

- ◆ Above 1 is optimal.
  - ◆ Between 0.3 and 1 is acceptable.
  - ◆ Below 0.3 indicates low perfusion. Reposition the SpO<sub>2</sub> sensor or find a better site. If low perfusion persists, choose another method to measure oxygen saturation if possible.
- (5) Pulse rate: indicates the number of pulsations per minute.

### NOTE

- PI is only available for Mindray SpO<sub>2</sub> and Masimo SpO<sub>2</sub>.

## 12.5 Preparing for SpO<sub>2</sub> Monitoring

To prepare to monitor SpO<sub>2</sub>, follow this procedure:

1. Select an appropriate sensor according to the module type, application site, patient category and weight.
2. Clean the contact surface of the reusable sensor.
3. Apply the sensor to the patient according to the instruction for use of the sensor.
4. Select an appropriate extension cable according to the connector type and plug the cable into the SpO<sub>2</sub> connector.

5. Connect the sensor to the extension cable.

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## CAUTION

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- Select proper SpO<sub>2</sub> sensor according to application site. Applying sensor too tight may severely obstruct circulation and lead inaccurate measurements. Loose application may result in measurement site exposing to ambient light.
  - Avoid placing the SpO<sub>2</sub> sensor on the same extremity with an NIBP cuff, arterial catheter, or intravascular line.
  - When monitoring SpO<sub>2</sub> at high ambient temperature, to avoid burns at the application site that is not well perfused, pay attention to prolonged SpO<sub>2</sub> sensor application.
- 

## 12.6 Changing the SpO<sub>2</sub> Settings

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### NOTE

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- The settings of in the SpO<sub>2</sub> module and SpO<sub>2</sub>b module are linked.
- 

### 12.6.1 Changing the SpO<sub>2</sub> Alarm Settings

To change the SpO<sub>2</sub> alarm settings, follow this procedure:

1. Select the SpO<sub>2</sub> 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<sub>2</sub> and SpO<sub>2</sub> Desat.

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### NOTE

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- You can switch off the SpO2 Desat alarm only when you have configured the monitor to allow the SpO2 Desat alarm to be turned off. For more information, see section 22.4.4 *The Guard Limits Tab*.
- 

### 12.6.2 Monitoring SpO<sub>2</sub> and NIBP Simultaneously

When monitoring SpO<sub>2</sub> and NIBP on the same limb simultaneously, you can switch on **NIBP Simul** to lock the SpO<sub>2</sub> alarm status until the NIBP measurement ends. If you switch off **NIBP Simul**, low perfusion caused by NIBP measurement may lead to inaccurate SpO<sub>2</sub> readings and therefore cause false physiological alarms.

To set the **NIBP Simul**, follow this procedure:

1. Select the SpO<sub>2</sub> numeric area or waveform area to enter the **SpO2** menu.
2. Select the **Alarm** tab.
3. Set **NIBP Simul**.

### 12.6.3 Sat-Seconds Alarm Management (for Nellcor SpO<sub>2</sub>)

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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> saturation may be outside the set limits before an alarm sounds.

The method of calculation is as follows: the percentage points of the SpO<sub>2</sub> saturation falling outside the alarm limit is multiplied by the number of seconds remaining outside the limit. This can be stated as the equation:

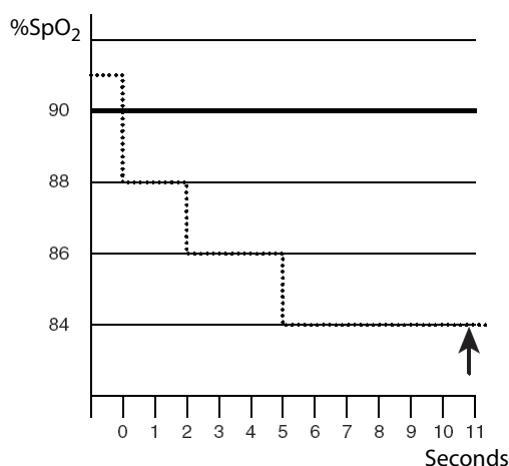
$$\text{Sat-Seconds} = \text{Points} \times \text{Seconds}$$



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<sub>2</sub> limit set at 90%. In this example, the patient SpO<sub>2</sub> 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 <sub>2</sub>	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<sub>2</sub> 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<sub>2</sub> points, both positive and negative, until either the Sat-Seconds limit is reached, or the patient SpO<sub>2</sub> re-enters the non-alarm range and remains there.

## NOTE

- The SpO<sub>2</sub> Too Low or SpO<sub>2</sub> Too High alarm is presented in the case that SpO<sub>2</sub> value violates the alarm limits for 3 times within one minute even if the setting of Sat-Seconds is not reached.

## 12.6.4 Setting the SpO<sub>2</sub> Sat-Seconds (for Nellcor SpO<sub>2</sub>)

To set the Sat-Seconds, follow this procedure:

1. Select the SpO<sub>2</sub> numeric area or waveform area to enter the **SpO2** menu.
2. Select the **Alarm** tab.
3. Set **Sat-Seconds**.

## 12.6.5 Setting SpO<sub>2</sub> Sensitivity (for Masimo SpO<sub>2</sub>)

For Masimo SpO<sub>2</sub>, select 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<sub>2</sub> sensitivity, follow this procedure:

1. Select the SpO<sub>2</sub> numeric area or waveform area to enter the **SpO2** menu.
2. Set **Sensitivity** to **Maximum, Normal, or APOD**.

---

## CAUTION

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- **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.**
  - **Configuring the monitor to "Load Latest Configuration" as the default configuration may result in Masimo SpO<sub>2</sub> being set to Maximum sensitivity mode on power up or after admitting a new patient. Maximum sensitivity is recommended for use during procedures or when clinician and patient contact is continuous, such as in higher acuity settings. Maximum sensitivity is not recommended for care areas where patients are not monitored visually as "Sensor Off" detection may be compromised. Refer to Section 6.4 Setting Default Configuration for managing configuration.**
- 

### 12.6.6 Enabling FastSAT (for Masimo SpO<sub>2</sub>)

FastSAT enables rapid tracking of arterial oxygen saturation changes as may be required in urgent situations. When FastSAT is switched on, the averaging algorithm evaluates all the SpO<sub>2</sub> values and provides an averaged SpO<sub>2</sub> value that is a better representation of the patient's current oxygen saturation status.

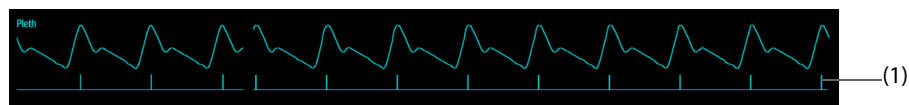
The reliability of FastSAT is dependent on the setting for the averaging time and the input signal. FastSAT is disabled by default. To enable FastSAT, follow this procedure:

1. Select the SpO<sub>2</sub> numeric area or waveform area to enter the **SpO2** menu.
2. Select the **Setup** tab.
3. Switch on **Fast SAT**.

### 12.6.7 Displaying SIQ (for Masimo SpO<sub>2</sub>)

The signal quality indicator (SIQ) displays below the Pleth waveform. The SIQ is conveyed by vertical bars. The height of the bar provides an assessment of the confidence in the displayed SpO<sub>2</sub> value. The SpO<sub>2</sub> SIQ can also be used to identify the occurrence of a patient's pulse.

The following picture shows the SpO<sub>2</sub> SIQ:



(1) Signal quality indicator (SIQ)

To show SpO<sub>2</sub> SIQ, follow this procedure:

1. Select the SpO<sub>2</sub> numeric area or waveform area to enter the **SpO2** menu.
2. Select the **Setup** tab.
3. Switch on **Display SIQ**.

### 12.6.8 Changing Averaging Time (for Masimo SpO<sub>2</sub>)

The SpO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> numeric area or waveform area to enter the **SpO2** menu.
2. Set **Averaging**.

## 12.6.9 Changing the Sensitivity (for Mindray SpO<sub>2</sub>)

The SpO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> numeric area or waveform area to enter the **SpO2** menu.
2. Select **Sensitivity**.

## 12.6.10 Showing/Hiding PI

You can set whether to display PI in the SpO<sub>2</sub> parameter area. To do so, follow this procedure:

1. Select the SpO<sub>2</sub> numeric area or waveform area to enter the **SpO2** menu.
2. Switch on or off **Display PI**.

## 12.6.11 Changing the Sweep Speed of the Pleth Wave

To set the sweep speed of Pleth waveform, follow this procedure:

1. Select the SpO<sub>2</sub> numeric area or waveform area to enter the **SpO2** menu.
2. 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<sub>2</sub> numeric area or waveform area to enter the **SpO2** menu.
2. Select the **PR Alarm** tab.
3. Enter the password if required.
4. Set the alarm properties as desired.

### 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<sub>2</sub> numeric area or waveform area to enter the **SpO2** menu.
2. Select the **PR** tab.
3. Select the **Setup** tab.
4. Set **QRS Volume**.

If the SpO<sub>2</sub> value is effective, the monitor also adjusts the QRS tone (pitch tone) according to the SpO<sub>2</sub> value.

### 12.7.3 Setting the PR Source

You can select the source of PR. The current PR source is displayed in the PR numeric area. PR from the current source is monitored as system pulse and generates alarms when you select PR as alarm source.

To set which pulse rate as PR source, follow this procedure:

1. Select the SpO<sub>2</sub> numeric area or waveform area to enter the **SpO2** menu.
2. Select the **PR** tab.
3. Select the **Setup** tab.
4. 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<sub>2</sub> parameter area. To do so, follow this procedure:

1. Select the SpO<sub>2</sub> 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<sub>2</sub> 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 *E Alarm Messages*.

Problem	Solution
Do not see SpO <sub>2</sub> numeric area or waveform area on the main screen	<ol style="list-style-type: none"> <li>1. Check that the SpO<sub>2</sub> is set to display in the <b>Screen Setup</b> menu. For more information, see 3.11.2 <i>Displaying Parameter Numerics and Waveforms</i>.</li> <li>2. Check that if the SpO<sub>2</sub> parameter switch is enabled. If not, enable the SpO<sub>2</sub> measurement. For more information, see 3.11.1 <i>Switching On or Off a Parameter</i>.</li> <li>3. Check that the cable connections of SpO<sub>2</sub> sensor and the extension cable are tight. Replace the SpO<sub>2</sub> sensor or the extension cable if needed.</li> </ol>
Dashes "--" display in place of numerics.	<ol style="list-style-type: none"> <li>1. Check that the cable connections of SpO<sub>2</sub> sensor and the extension cable are tight. Replace the SpO<sub>2</sub> sensor or the extension cable if needed.</li> <li>2. Reconnect the SpO<sub>2</sub> sensor if the alarm <b>SpO2 Sensor Off</b> appears.</li> <li>3. Check the PI value. If the PI value is too low, adjust the SpO<sub>2</sub> sensor, or apply the sensor to the site with better perfusion.</li> <li>4. Move the sensor to the place with weaker light, or cover the sensor with shade cloth if the alarm <b>SpO2 Sensor Off</b> appears.</li> </ol>
Low amplitude SpO <sub>2</sub> signal	<ol style="list-style-type: none"> <li>1. The SpO<sub>2</sub> sensor and NIBP cuff are placed on the same limb. Change a monitoring site if necessary.</li> <li>2. Check the PI value. If the PI value is too low. Adjust the SpO<sub>2</sub> sensor, or apply the sensor to the site with better perfusion.</li> <li>3. Check the sensor and its application site.</li> </ol>
SpO2 value is inaccurate	<ol style="list-style-type: none"> <li>1. Check the patient's vital signs.</li> <li>2. Check for conditions that may cause inaccurate SpO<sub>2</sub> readings. For more information, see 12.3 <i>SpO<sub>2</sub> Measurement Limitations</i>.</li> <li>3. Check the monitor, the SpO<sub>2</sub> module or the MPM for proper functioning.</li> </ol>

## 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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## 12.10 Masimo Information



### Masimo Patents

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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 two temperature sites and calculate the difference between the two sites.

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

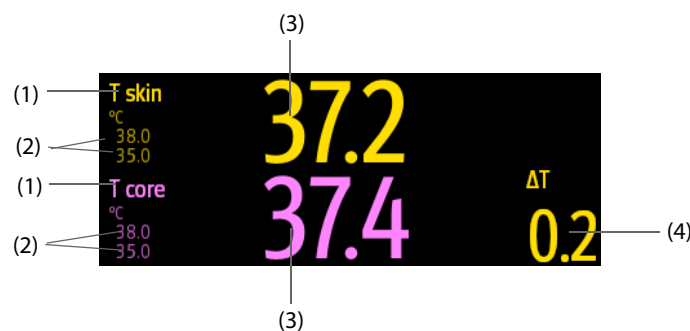
## 13.2 Displaying the Temp Numerics Area

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 temperature probe, connect it 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  $\Delta T$ . 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  $\Delta T$ .

## 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 *E Alarm Messages*.

Problem	Solution
Do not see Temp numeric area on the main screen	<ol style="list-style-type: none"><li>1. Check that the Temp is set to display in the <b>Screen Setup</b> menu. For more information, see 3.11.2 <i>Displaying Parameter Numerics and Waveforms</i>.</li><li>2. Check that if the Temp parameter switch is enabled. If not, enable the Temp measurement. For more information, see 3.11.1 <i>Switching On or Off a Parameter</i>.</li><li>3. Check that the connections of the temperature probe and the temperature cable are tight.</li></ol>
Measurement fails/'--' is displayed in the Temp numeric area	<ol style="list-style-type: none"><li>1. If you are using a disposable probe, check the connection between the probe and the temperature cable.</li><li>2. Try using a known good probe in case the sensor is damaged.</li></ol>



# 14 Monitoring Noninvasive Blood Pressure (NIBP)

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## 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 method measures the mean pressure and determines the systolic and diastolic pressures.

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

NIBP monitoring is intended for use with pregnant, including pre-eclamptic 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 measurements 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 measurements. Do not apply the higher adult settings for pediatric or neonatal patients. Otherwise, it may present a safety hazard.**
- **Do not perform NIBP measurements on patients with sickle-cell disease.**
- **To avoid further injury, do not apply the NIBP cuff on the limb with a wound.**
- **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.**
- **To avoid the risk of patient injury, do not apply the NIBP cuff on a limb that has an intravenous infusion or catheter in place. Apply the cuff on another limb if possible.**
- **Do not apply cuff on the arm on the side of a mastectomy or lymph node clearance.**
- **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.**
- **Taking NIBP measurements exert pressure on the patient's tissue. This can cause skin purpura, ischemia, and neuropathy. Periodically check the cuff site and the limb distal to the cuff for normal color, warmth and sensitivity. If there is a sign of skin change or poor distal circulation, move the cuff to another limb or stop NIBP measurements. Check more frequently when using the STAT mode or using the auto mode at short intervals. 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

- **Using IABP may cause NIBP, including PR, measurements inaccurate or failed.**

- **Only use parts and accessories specified in this manual. Follow the instructions for use and adhere to all warnings and cautions.**
  - **Accuracy of NIBP measurements 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

NIBP measurements may be inaccurate or impossible in the following situations:

- The patient is connected to a heart lung machine.
- Regular arterial pressure pulses are hard to detect.
- The patient has cardiac arrhythmias.
- The patient's blood pressure changes dramatically.
- The patient has poor circulation due to severe shock or hypothermia.
- NIBP cuff is applied on an limb with edematous extremity.
- The NIBP cuff is compressed by excessive movement such as shivering, seizures, or convulsions.
- The patient's blood pressure is out of measurement range.

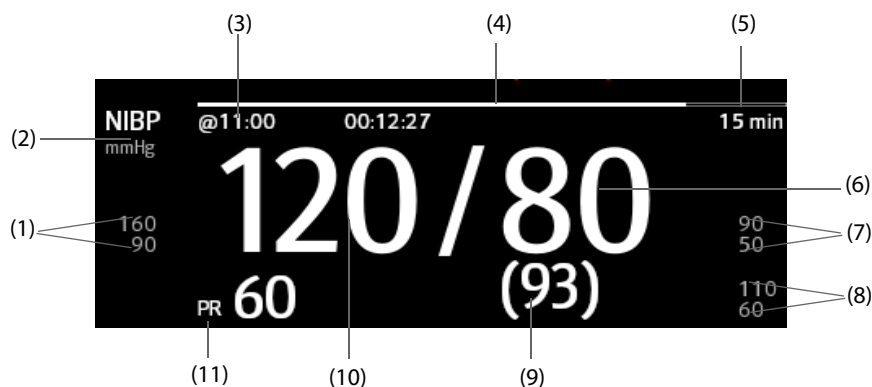
## 14.4 Measurement Modes

There are three NIBP measurement modes:

- Manual mode: measurement is taken on demand.
- Auto mode: repeated measurements are taken at set interval.
- STAT mode: continually rapid series of measurements are taken over a five-minute period.
- Sequence mode: continually automatic measurements are taken 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 limits

(8) Mean pressure alarm limits

(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. Apply the cuff around the patient's 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 cover at least 50% to 80% of the limb.
  - c Apply the cuff to the patient's upper arm or leg and make sure the  $\Phi$  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. Excessive tightness may cause discoloration and ischemia of the limb distal. Make sure that the cuff index line falls within the range markings on the cuff.
  - d Make sure that the middle of the cuff is at the level of the heart. Otherwise correct the measurement by referring the measurement correction formula. For more information, see *14.8.10 Correcting the NIBP Measurements*.
4. Connect the cuff to the air tubing. Check that the air tubing are not kinked or compressed, and air can pass unrestrictedly through the tubing.

---








## CAUTION

- Using a cuff of wrong size, or a cuff with twisted bladder and kinked air tubing, 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	<b>NIBP Start/Stop</b> quick key 	<b>Start NIBP</b> button
Start auto NIBP series	<b>NIBP Start/Stop</b> quick key  Make sure to set <b>Interval</b> before starting auto NIBP.	<b>Setup</b> tab → set <b>Interval</b> → <b>Start NIBP</b> button
	<b>NIBP Measure</b> quick key  → select <b>Interval</b>	
Start NIBP sequence measurement	<b>NIBP Measure</b> quick key  → <b>Sequence</b>	<b>Sequence</b> tab → set NIBP sequence → <b>Start NIBP</b> button
Start STAT measurement	<b>NIBP Measure</b> quick key  <b>STAT</b>	<b>STAT</b> button
Stop the current NIBP measurements	<b>NIBP Start/Stop</b> quick key 	<b>Stop NIBP</b> button
End auto NIBP series or NIBP Sequence	/	<b>NIBP Stop All</b> button
Stop STAT measurement and end series	<b>NIBP Start/Stop</b> quick key 	<b>Stop NIBP</b> or <b>NIBP Stop All</b> 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 displayed 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 *E Alarm Messages*.

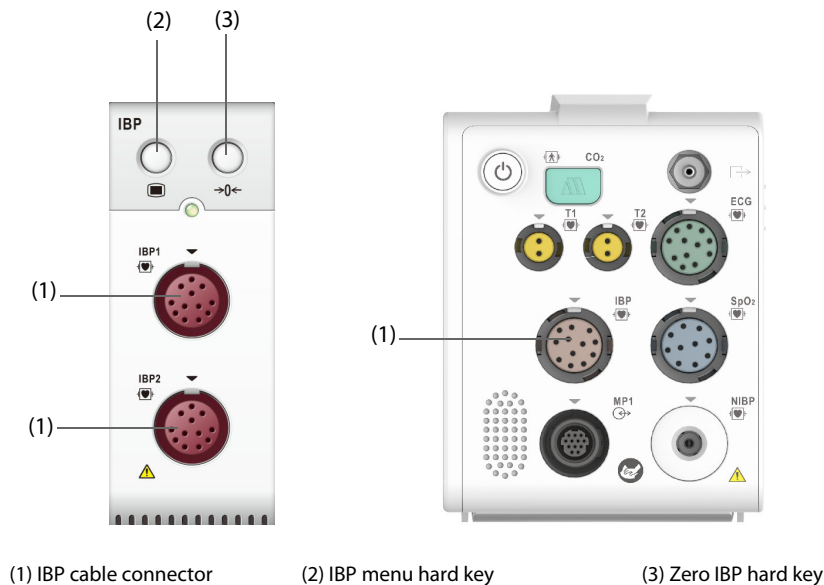
# 15 Monitoring Invasive Blood Pressure (IBP)

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## 15.1 IBP Introduction

This patient monitor can monitor four invasive blood pressures.

IBP monitoring is intended for adult, pediatric, and neonatal patients. PAWP monitoring is only intended for adult and pediatric patients. PAWP monitoring is available only for the external display.



### NOTE

- In order for the N1 to connect to the external IBP module and perform IBP monitoring, the N1 system software V02.25 and above is required.
- 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 (CCO from PiCCO Module)*.

## 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.

### CAUTION

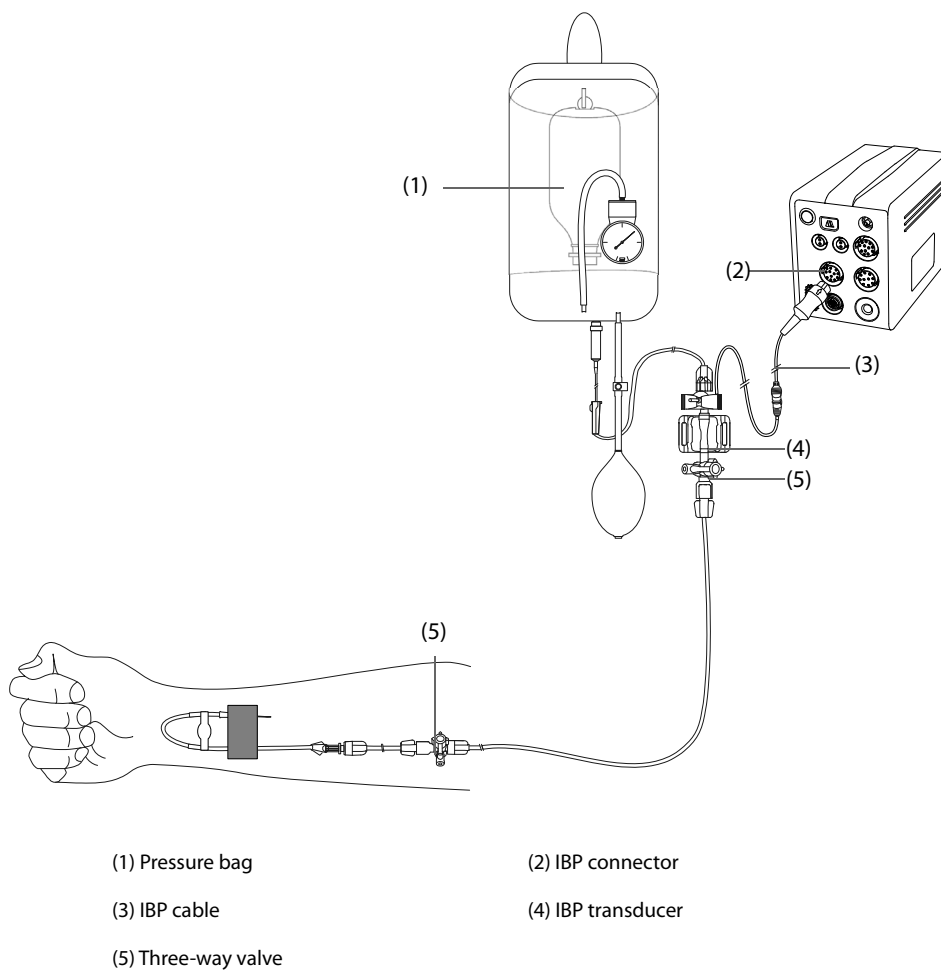
- Using IABP may cause IBP, including PR, measurements inaccurate or failed.
- Mechanical shock to the invasive blood pressure transducer may cause severe shifts in zero balance and calibration, and cause erroneous readings.

## NOTE

- When using accessories, their operating temperature should be taken into consideration. For more information, see instructions for use of accessories.
- Invasive procedures involve risks to the patient. Use aseptic technique and follow catheter manufacturer's instructions.

## 15.3 Preparing for IBP Monitoring

### 15.3.1 IBP Equipment to Patient Connection



### 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, 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.



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## CAUTION

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- **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.**
  - **When measuring ICP on a sitting patient, place the ICP transducer at the same level 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 IBP transducer should be zeroed in accordance with the 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. zero hard key → **0** ← 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. For more information, see *15.4.1 Zeroing the Codman ICP transducer*. If the target monitor does not support the Codman ICP transducer, do not use it for ICP monitoring.

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**.

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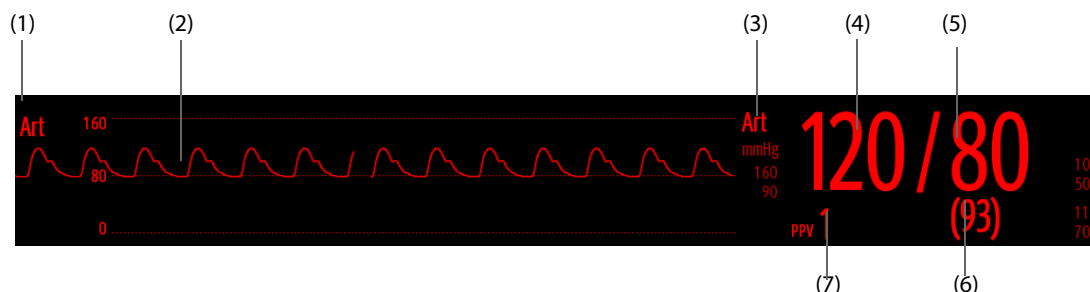
## CAUTION

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- **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    |                       |

## NOTE

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- **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

A pressure label is used to define 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 **Speed**.
4. Set the scale.
  - ◆ Enable **Auto Scale**: the size of the pressure's waveform will be adjusted automatically. Or,
  - ◆ Set **Upper Scale** and **Lower Scale** separately.

### 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 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

---


- **PPV measurement is reliable only for mechanically ventilated patients with no arrhythmias.**
  - **PPV measurements may be inaccurate for patients with a very low respiration rates, low tidal volumes during ventilation, and with acute cor pulmonale.**
  - **The PPV measurement is validated only on adult patients.**
  - **The clinical value of the PPV must be determined by the physician.**
-

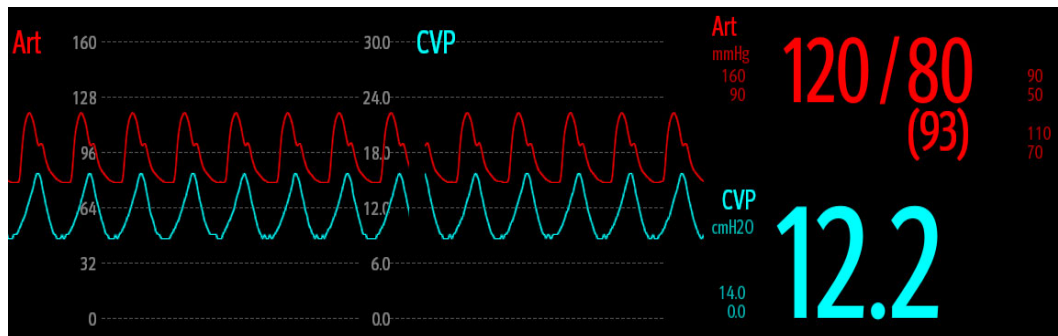
## NOTE

- The PPV measurement from IBP will automatically be switched off if PiCCO module is working. The monitor will measure PPV through PiCCO module.

### 15.6.9 Overlapping IBP Waveforms

The IBP waveforms can be displayed together. To combine IBP waveforms, follow this procedure:

1. Select the **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.

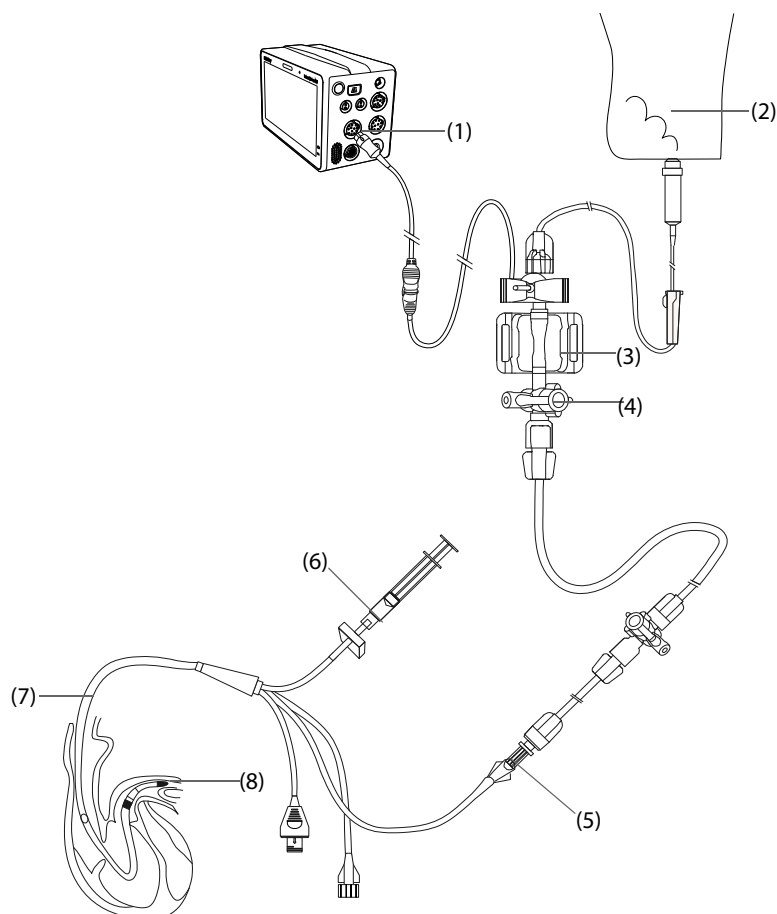
### 15.7 Measuring PAWP (Only Available for the Independent External Display)

PAWP reflects the pressure in the left ventricle at end-diastole. PAWP is derived from a pulmonary artery catheter when the pulmonary artery distal balloon is inflated and the catheter advances and occludes a distal pulmonary artery. PAWP values obtained at the end of the respiration cycle are the most accurate. At this time, the intrathoracic pressure is relatively constant and the respiration artifact is minimal.

## WARNING

- PAWP monitoring is not intended for neonatal patients.

### 15.7.1 PAWP Equipment to Patient Connection



- |                             |                             |
|-----------------------------|-----------------------------|
| (1) IBP connector           | (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

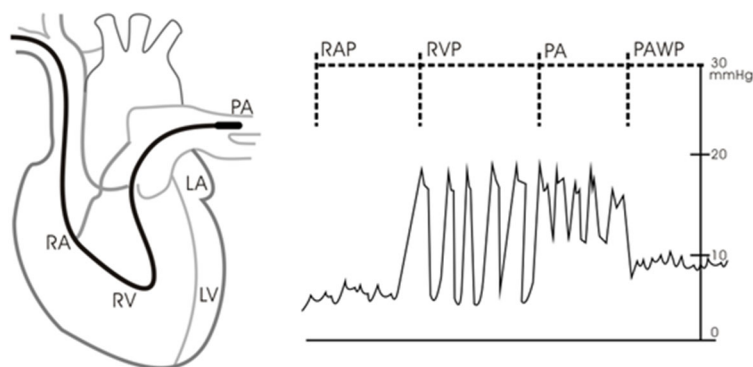
To prepare to monitor PAWP, follow this procedure:

1. Connect one end of the IBP cable to the IBP cable connector, and the other end to the IBP transducer. 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

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- **Follow manufacturer's suggested procedures and hospital policy for PAWP balloon inflation. Inflating the balloon for an extra long time could result in pulmonary hemorrhage or infarction, or both.**
  - **A PAWP value greater than the systolic PA may indicate rupture of the pulmonary artery. Deflate the balloon immediately and report this event according to hospital policy.**
- 

## NOTE

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- **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 Setting the Use PA-D as PAWP Switch

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*.

## 15.7.6 Performing Hemodynamic Calculation

On the **PAWP** screen, select **Hemo Calcs** to enter the **Hemo Calcs** 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 *E Alarm Messages*.

Problem	Solution
Cannot see IBP numeric area or waveform area on the main screen	<ol style="list-style-type: none"><li>1. Check that the IBP is set to display from the <b>Screen Setup</b> menu. For more information, see <i>3.11.2 Displaying Parameter Numerics and Waveforms</i>.</li><li>2. Check that if the IBP parameter switch is on. If not, enable the IBP measurement. For more information, see <i>3.11.1 Switching On or Off a Parameter</i>.</li><li>3. Check the connection of IBP cable, IBP transducer and monitor.</li><li>4. Check that the stopcock is turned to the correct position.</li><li>5. Check that the IBP transducer has been zeroed. For more information, see <i>15.3.3 Zeroing the IBP transducer</i>.</li></ol>
Cannot see systolic pressure and diastolic pressure for P1/P2/P3/P4	Set <b>Measure</b> to <b>All</b> in the P1/P2/P3/P4 setup menu. For more information, see <i>15.6.3 Setting the Pressure Type for Display</i> .
IBP readings seem unstable	<ol style="list-style-type: none"><li>1. Make sure there are no air bubbles in the transducer systems.</li><li>2. Check that the transducer is properly fixed.</li><li>3. Zero the transducer again.</li><li>4. Replace a transducer.</li></ol>
Zeroing of IBP channel(s) fails.	<ol style="list-style-type: none"><li>1. Ensure that the channels are open to air.</li><li>2. Perform zero calibration again. Do not sway the IBP transducer and tubing during zero calibration. For more information, see <i>15.3.3 Zeroing the IBP transducer</i>.</li><li>3. If zero calibration still fails, replace the transducer.</li></ol>



# 16 Monitoring Carbon Dioxide (CO<sub>2</sub>)

## 16.1 CO<sub>2</sub> Introduction

CO<sub>2</sub> monitoring is a continuous, non-invasive technique for determining the concentration of CO<sub>2</sub> in the patient's airway by measuring the absorption of infrared (IR) light of specific wavelengths. CO<sub>2</sub> has its own absorption characteristic and the amount of light passing the gas probe depends on the concentration of the measured CO<sub>2</sub>. When a specific band of IR light passes through respiratory gas samples, some of IR light will be absorbed by the CO<sub>2</sub> 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<sub>2</sub> is calculated.

The following two methods are used for CO<sub>2</sub> monitoring:

- Mainstream CO<sub>2</sub> method: the CO<sub>2</sub> sensor is inserted on the airway adapter which is directly connected to the patient's airway. The mainstream CO<sub>2</sub> measurement can be used, with specified accessories, with intubated patients.
- Sidestream/Microstream™ CO<sub>2</sub> method: a sample line is used to take the respiratory gas from the patient's airway. The CO<sub>2</sub> sensor is built into the CO<sub>2</sub> module. The sidestream and Microstream™ CO<sub>2</sub> modules can be used with intubated and non-intubated patients. With intubated patients, the respiratory gas is sampled from the patient's breathing circuit through an airway adapter and a airway sampling line. With non-intubated patients, the gas is sampled through a nasal simple line.

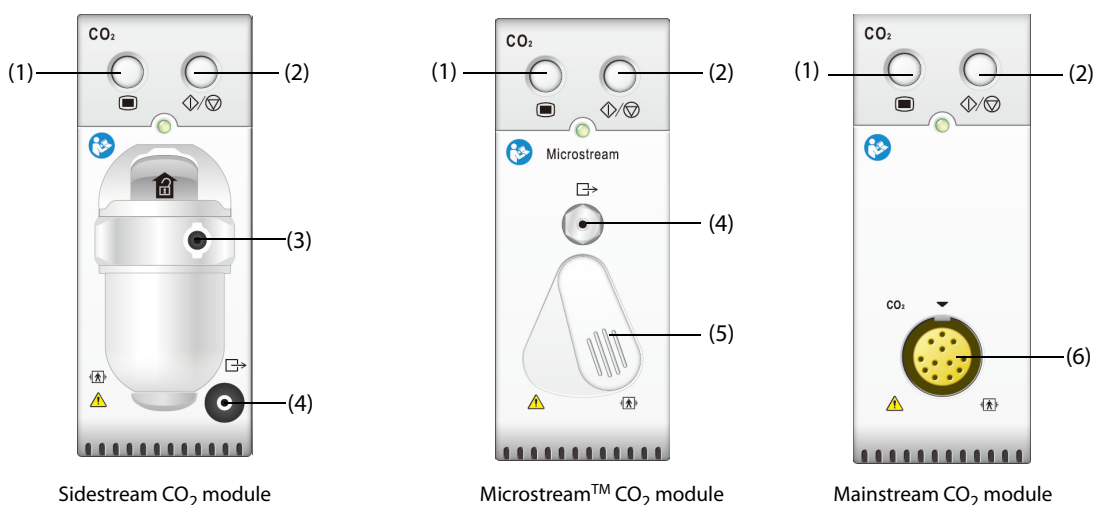
The sidestream CO<sub>2</sub> module can be configured with a paramagnetic oxygen sensor. The paramagnetic oxygen sensor measures oxygen relying on its paramagnetic properties.

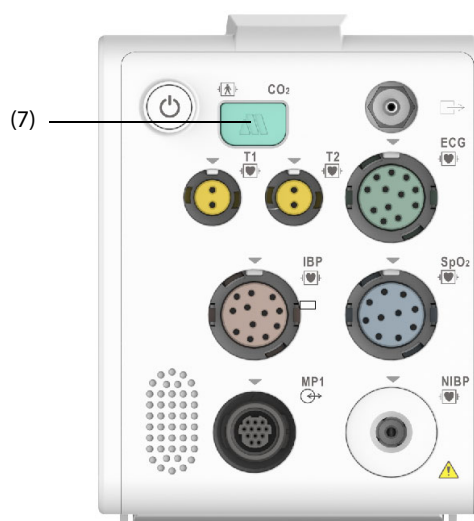
CO<sub>2</sub> monitoring is intended for adult, pediatric and neonatal patients.

### WARNING

- **N1 monitor does not support the CO<sub>2</sub> measurement when it is used for transporting patient through the rotary or fixed-wing ambulance.**
- **It is recommended not to measure O<sub>2</sub> when you're transferring patient with the N1 monitor. Shaking the CO<sub>2</sub> module during O<sub>2</sub> measurement may lead to distorted O<sub>2</sub> waveform or inaccurate O<sub>2</sub> measurement.**

To measure CO<sub>2</sub>, you can use either the internal CO<sub>2</sub> module or the external CO<sub>2</sub> module. The external CO<sub>2</sub> module is connected to the N1 through the Modular Rack. For the connection of the N1 and the external CO<sub>2</sub> module, see section 2.8.1 *Installing the N1 or External Parameter Module into the Modular Rack*.






- |                                       |  |
|---------------------------------------|--|
| (1) CO <sub>2</sub> menu hard key     | (2) CO <sub>2</sub> Measure/standby hard key |
| (3) CO <sub>2</sub> watertrap seat    | (4) Gas outlet                               |
| (5) Sample line connector             | (6) CO <sub>2</sub> sensor connector         |
| (7) CO <sub>2</sub> adapter connector |  |

## 16.2 CO<sub>2</sub> Safety Information

### WARNING

- Route all tubing away from the patient's throat to avoid strangulation.

### CAUTION

- If the N1 is configured with the CO<sub>2</sub> module, only the N1 with the label  can be used with Transport Dock with DC input.
- CO<sub>2</sub> readings and respiratory rate can be affected by certain ambient environmental conditions, and certain patient conditions.
- In high-altitude environments, etCO<sub>2</sub> values may be lower than values observed at sea level, as described by Dalton's law of partial pressures. When using the monitor in high-altitude environments, it is advisable to take this into account and to consider adjusting etCO<sub>2</sub> alarm settings accordingly.
- Remove the airway sample line from the patient's airway while nebulized medications are being delivered.
- EtCO<sub>2</sub> values measured from the CO<sub>2</sub> module may differ from those of from the blood gas analysis.
- Avoid mechanical shock to the sidestream CO<sub>2</sub> module configuring the paramagnetic oxygen sensor.

### NOTE

- The CO<sub>2</sub> module automatically suppresses physiological alarms until breathing waves have been detected. Make sure that a patient is properly connected when monitoring with the CO<sub>2</sub> module.

## 16.3 CO<sub>2</sub> 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<sub>2</sub>O)
- Other sources of interference, if any

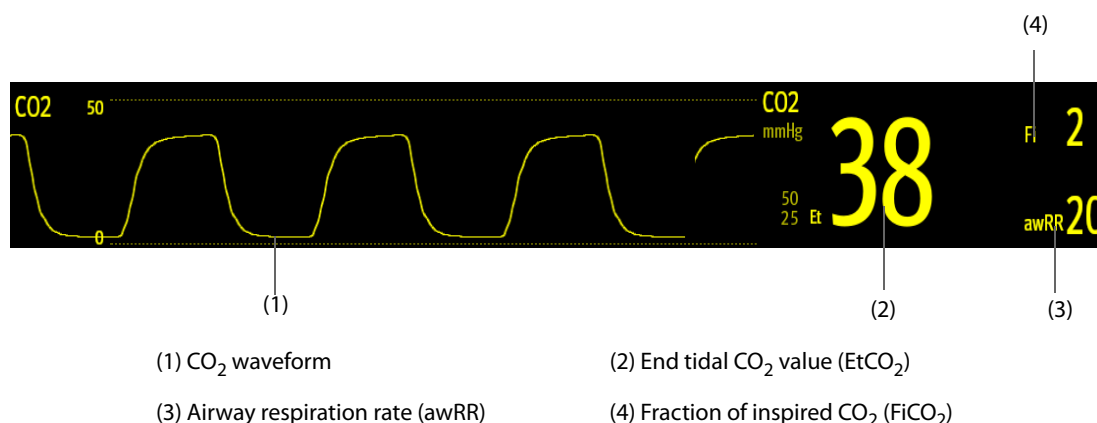
For more information, see *B.9 CO<sub>2</sub> Specifications*.

## CAUTION

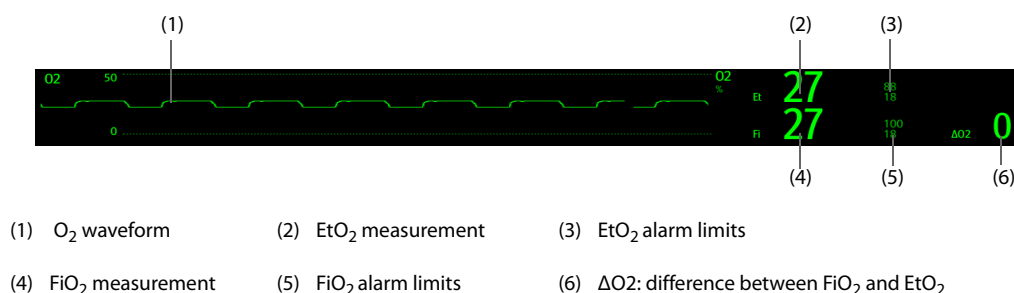
- **Measurement accuracy of the sidestream CO<sub>2</sub> module may be affected by the breath rate and inspiration/expiration (I/E) ratio.**
- **Measurement accuracy of the Microstream™ CO<sub>2</sub> module may be affected by the breath rate.**

## 16.4 CO<sub>2</sub> Display

The CO<sub>2</sub> numeric and waveform area provide FiCO<sub>2</sub> measurement, EtCO<sub>2</sub> measurement, awRR measurement, and a CO<sub>2</sub> waveform.



If your sidestream CO<sub>2</sub> module is configured with the oxygen sensor, O<sub>2</sub> waveform and parameters can be displayed as follows:

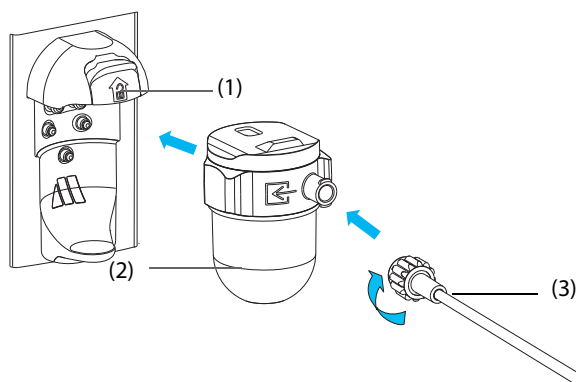


## 16.5 Measuring CO<sub>2</sub> Using Sidestream/Microstream™ CO<sub>2</sub> Module

### 16.5.1 Preparing to Measure CO<sub>2</sub> Using Sidestream CO<sub>2</sub> Module

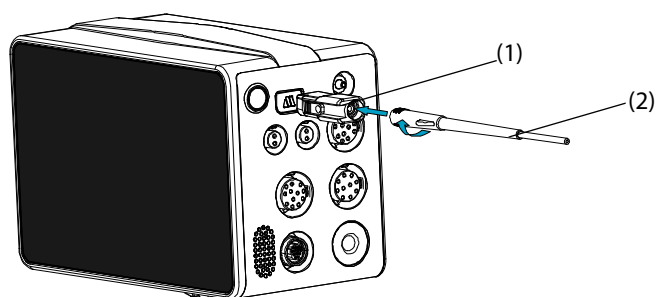
To prepare the CO<sub>2</sub> module for measurement, follow this procedure:

1. Select the appropriate gas sample line and watertrap according to the patient category.
2. Connect the gas sample line.
  - ◆ If you're using the sidestream CO<sub>2</sub> module, connect the watertrap to the CO<sub>2</sub> module, and connect the gas sample line to the watertrap.



(1) Watertrap receptacle      (2) Watertrap      (3) Gas sample line

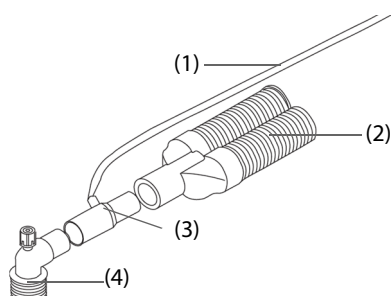
- ◆ If you're using the N1 monitor for CO<sub>2</sub> measure, connect the gas sample line to the CO<sub>2</sub> adapter.



(1) CO<sub>2</sub> 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. If the equipment is used in the presence of anesthetic gases, nitrous oxide or high concentrations of oxygen, connect the gas outlet to the scavenging system using an exhaust tube.

After the CO<sub>2</sub> module is connected, it enters measure mode by default and the monitor displays **CO2 Starting**. CO<sub>2</sub> can be measured after the start-up is complete.

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## WARNING

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- Do not apply adult or pediatric watertrap to the neonate patient. Otherwise, patient injury could result.
- 

---

## CAUTION

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- Check the compatibility of the CO<sub>2</sub> adapter and the sampling line before use. The CO<sub>2</sub> adapter is intended for connecting an Oridion CO<sub>2</sub> sampling line.
  - Leakage in the breathing or sampling system may cause the EtCO<sub>2</sub> reading significantly low. Always make sure that all the connections are tight and there is no leak in the system.
  - 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<sub>2</sub> measurement may cause inaccurate CO<sub>2</sub> reading or no reading.
  - If the equipment is used in the presence of anesthetic gases, nitrous oxide or high concentrations of oxygen, connect the gas outlet to the scavenging system when measuring CO<sub>2</sub> using the Sidestream CO<sub>2</sub> module.
  - To avoid blocking the airway, empty the DRYLINE II watertrap container whenever half full. Dispose of accumulated fluids in accordance with hospital policy or your local regulations.
  - 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. Replacing the DRYLINE II watertrap once a month is recommended.
- 

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## NOTE

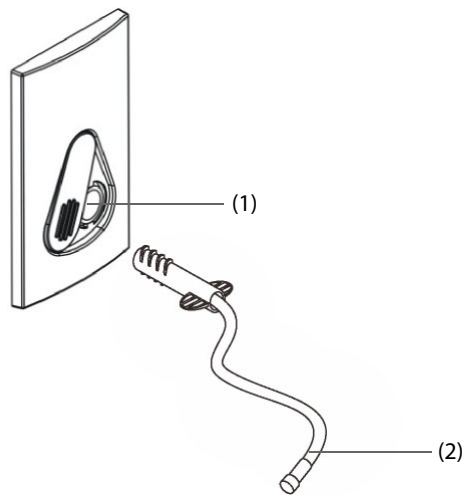
---

- It is recommended to replace the CO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> Using Microstream™ CO<sub>2</sub> Module

To prepare the CO<sub>2</sub> module for measurement, follow this procedure:

1. Connect one end of the sample line to the Microstream™ CO<sub>2</sub> 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. If the equipment is used in the presence of anesthetic gases, nitrous oxide or high concentrations of oxygen, connect the gas outlet to the a scavenging system using an exhaust tube.

After the CO<sub>2</sub> module is connected, it enters measure mode by default and the monitor displays **CO<sub>2</sub> Sensor Warmup**. CO<sub>2</sub> can be measured after the start-up is complete.

---

## CAUTION

- If the equipment is used in the presence of anesthetic gases, nitrous oxide or high concentrations of oxygen, connect the gas outlet to the scavenging system when measuring CO<sub>2</sub> using the Microstream™ CO<sub>2</sub> module.
  - When using a sampling line for intubated patients with a closed suction system, do not place the airway adapter between the suction catheter and endotracheal tube. This is to ensure that the airway adapter does not interfere with the functioning of the suction catheter.
  - The FilterLine may ignite in the presence of O<sub>2</sub> when directly exposed to laser, ESU devices, or high heat. When performing head and neck procedures involving laser, electrosurgical devices or high heat, use with caution to prevent flammability of the FilterLine or surrounding surgical drapes.
- 

## NOTE

- Sampling lines with H in their names include a moisture reduction component (Nafion® or its equivalent) for use in higher humidity environments where long duration use of CO<sub>2</sub> sampling is required.
  - Disconnect the sample line from the module when CO<sub>2</sub> monitoring is not required.
- 

### 16.5.3 Zeroing the Sidestream/Microstream™ CO<sub>2</sub> Module

The sidestream and Microstream™ CO<sub>2</sub> modules perform a zero calibration automatically when needed. Once the zero calibration is started, the CO<sub>2</sub> module stops measuring and "Zeroing" is displayed in the CO<sub>2</sub> numeric area.

After the zero calibration is completed, the CO<sub>2</sub> module reacquires the CO<sub>2</sub> readings. During the reacquisition period, "Zero Recovering" is displayed in the CO<sub>2</sub> numeric area. Valid data will reappear 30 seconds after the zero calibration is started. You can hide the display of the "Zero Recovering" message, but values displayed during the reacquisition period may not be accurate.

The automatic zero calibration will not start under the following conditions:

- Physiological alarms related to CO<sub>2</sub> are active.
- An apnea alarm is active.
- No breath has been detected for over 30 seconds.

You can also perform the zero calibration manually. For more information, see 22.6.2 *The CO<sub>2</sub> Tab*.

## NOTE

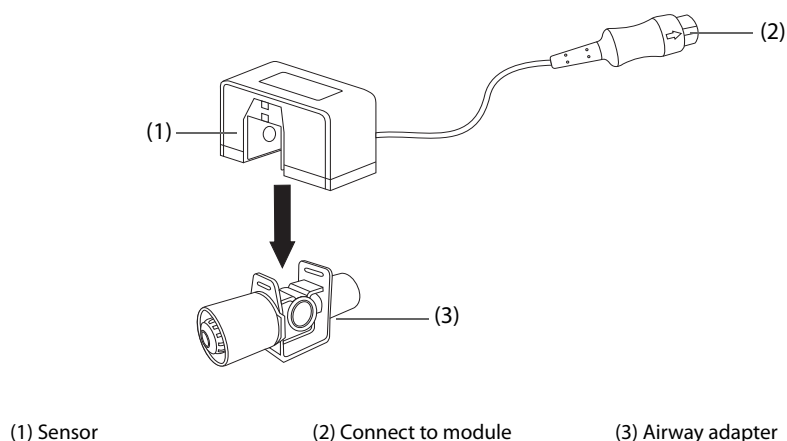
- **Periodic auto zero function compensates for drifts between components, changes in ambient temperature, and barometric conditions. This automatic process eliminates variances that might otherwise cause measurement drift.**

## 16.6 Measuring CO<sub>2</sub> Using Mainstream CO<sub>2</sub> Module

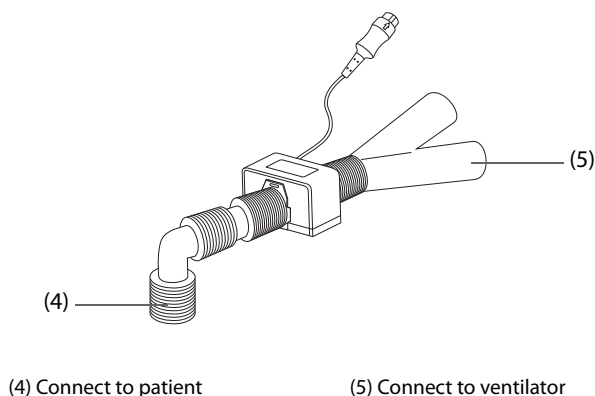
### 16.6.1 Preparing to Measure CO<sub>2</sub> Using Mainstream CO<sub>2</sub> Module

To prepare the CO<sub>2</sub> module for measurement, follow this procedure:

1. Connect the airway adapter to the sensor head.



2. Attach the sensor connector to the CO<sub>2</sub> connector on the mainstream CO<sub>2</sub> module.
3. Zero the sensor after the warm-up is finished. For details, see 16.6.2 *Zeroing the Mainstream CO<sub>2</sub> Sensor*.
4. After the zero calibration is finished, connect the airway as shown below.



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<sub>2</sub> module. Improper settings will result in erroneous CO<sub>2</sub> 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<sub>2</sub> Sensor

For mainstream CO<sub>2</sub> 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<sub>2</sub> 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.

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### WARNING

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- **When perform a zero calibration during the measurement, disconnect the sensor from the patient's airway first.**
  - **Do not rely on the readings during CO<sub>2</sub> zeroing.**
- 

## 16.7 Changing CO<sub>2</sub> Settings

### 16.7.1 Changing CO<sub>2</sub> Alarm Settings

To change the CO<sub>2</sub> alarm settings, follow this procedure:

1. Select the CO<sub>2</sub> 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<sub>2</sub> Waveform

To set the CO<sub>2</sub> waveform, follow this procedure:

1. Select the CO<sub>2</sub> numeric area or waveform area to enter the **CO2** menu.
2. Select the **Setup** tab.
3. Set **Waveform Type**, **Speed**, **Scale**, or **CO2 Scale** of the CO<sub>2</sub> waveform.

### 16.7.3 Setting the RR Source

To set the respiration rate (RR) source, follow this procedure:

1. Select the CO<sub>2</sub> 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 Manually Entering the Standby Mode

The default operating mode is **Measure**. If you do not use the CO<sub>2</sub> module, you can put the CO<sub>2</sub> module into the standby mode. This can prolong the service life of the CO<sub>2</sub> module. To enter the standby mode, follow this procedure:

1. Select the CO<sub>2</sub> 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<sub>2</sub> numeric area or waveform area to enter the **CO2** menu.
2. Select **Intubation Mode**.

For the details of the intubation mode, see 8.13 *Intubation Mode*.

## 16.7.6 Setting the Time Before Auto Standby (for Sidestream and Microstream™ CO<sub>2</sub> Module)

You can configure the CO<sub>2</sub> module to automatically enter the standby mode after a designated period of time if no respiration is detected since the last detected respiration. To set the time before auto standby, follow this procedure:

1. Select the CO<sub>2</sub> numeric area or waveform area to enter the **CO2** menu.
2. Select the **Setup** tab.
3. Set **Auto Standby**.

### NOTE

- For the Microstream™ CO<sub>2</sub> module, once the module have detected respiration, the module will not automatically stand by even if no breath is detected after the designated auto standby period. You can manually stand by the module if necessary, For more information, see 16.7.4 *Manually Entering the Standby Mode*.

## 16.7.7 Setting Humidity Compensation (for Sidestream and Microstream™ CO<sub>2</sub> Module)

The presence of humidity in breathing circuit may raise the CO<sub>2</sub> reading. For the sidestream and Microstream™ CO<sub>2</sub> module, you can switch humidity compensation on or off to correct the CO<sub>2</sub> reading according to actual condition.

- Body Temperature and Pressure Saturated Gas (BTPS), or wet gas
- Ambient Temperature and Pressure Dray (ATPD), or dry gas

The CO<sub>2</sub> partial pressure is calculated as follows:

- ATPD:  $P_{CO_2}(mmHg) = CO_2(vol\%) \times P_{amb}/100$
- BTPS (sidestream):  $P_{CO_2}(mmHg) = CO_2(vol\%) \times (P_{amb} - 47)/100$
- BTPS (Microstream™):  $P_{CO_2}(mmHg) = CO_2(vol\%) \times (1 - 0.03) \times P_{amb}/100$

Where,  $P_{CO_2}(mmHg)$  = partial pressure,  $vol\%$  = CO<sub>2</sub> concentration,  $P_{amb}$  = ambient pressure, and unit is mmHg.

To set the humidity compensation, follow this procedure:

1. Select the CO<sub>2</sub> 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.

### 16.7.8 Changing O<sub>2</sub> Alarm Settings (for Sidestream CO<sub>2</sub> Module Integrating O<sub>2</sub>)

To change the O<sub>2</sub> alarm settings, follow this procedure:

1. Select the CO<sub>2</sub> 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.

### 16.7.9 Setting the O<sub>2</sub> Waveform (for Sidestream CO<sub>2</sub> Module Integrating O<sub>2</sub>)

To set the O<sub>2</sub> waveform, follow this procedure:

1. Select the CO<sub>2</sub> numeric area or waveform area to enter the **CO2** menu.
2. Select the **Setup** tab.
3. Set **Speed** and **O2 Scale** of the O<sub>2</sub> waveform.

### 16.7.10 Setting the Gas Compensation (for Sidestream and Mainstream CO<sub>2</sub> Module)

The presence of interfering gas affects the CO<sub>2</sub> 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<sub>2</sub> module, gas compensations are not required.

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#### WARNING

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- **Make sure to use the appropriate compensations. Inappropriate compensations may cause inaccurate measurement values and result in misdiagnosis.**
- 

For the sidestream CO<sub>2</sub> module, follow this procedure to set the gas compensation:

1. Select the CO<sub>2</sub> 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<sub>2</sub> module, follow this procedure to set the gas compensation:

1. Select the CO<sub>2</sub> numeric area or waveform area to enter the **CO2** menu.
2. Select the **Setup** tab.
3. Set **Balance Gas**.
  - ◆ Select **Room Air** when air predominates in the ventilation gas mixture.
  - ◆ Select **N2O** when N<sub>2</sub>O predominates in the ventilation gas mixture.
  - ◆ Select **He** when He predominates in the ventilation gas mixture.
4. Set **O2 Compensation**.
  - ◆ Select **Off** when the amount of O<sub>2</sub> is less than 30%.
  - ◆ Select an appropriate setting according to the amount of O<sub>2</sub> in the ventilation gas mixture.
5. Set AG compensation. This could compensate for the effect of AG on the readings.
  - ◆ For the mainstream module configured with Respironics 1036698 CO<sub>2</sub> sensor, select **AG Compensation** and input the concentration of anesthetic gas present in the ventilation gas mixture.

- ◆ For the mainstream module configured with Mindray GA3701 CO<sub>2</sub> sensor, select **Gas Type**. Then select **AG Compensation** and input the concentration of anesthetic gas present in the ventilation gas mixture.

### 16.7.11 Choosing a Time Interval for Peak-Picking (for Microstream™ and Mainstream CO<sub>2</sub> Module)

For Microstream™ and mainstream CO<sub>2</sub> modules, you can select a time interval for picking the highest CO<sub>2</sub> as the EtCO<sub>2</sub> and the lowest as the FiCO<sub>2</sub>.

To set the time interval, follow this procedure:

1. Select the CO<sub>2</sub> 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<sub>2</sub> module is configured; toggle between **Single Breath, 10 s** and **20 s** if mainstream CO<sub>2</sub> module is configured.
  - ◆ **Single Breath:** EtCO<sub>2</sub> and FiCO<sub>2</sub> are calculated for every breath.
  - ◆ **10 s, 20 s, or 30 s:** EtCO<sub>2</sub> and FiCO<sub>2</sub> are calculated using 10, 20 or 30 seconds of data.

### 16.7.12 Changing Barometric Pressure (for Mainstream CO<sub>2</sub> Module)

Both sidestream and Microstream™ CO<sub>2</sub> 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<sub>2</sub> module does not have such function. For the mainstream CO<sub>2</sub> 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 22.11 *The Other Settings*.

---


#### WARNING

---

- **Be sure to set the barometric pressure properly before using the mainstream CO<sub>2</sub> module. Improper settings will result in erroneous CO<sub>2</sub> reading.**
- 

## 16.8 Performing the Leakage Test

When measuring CO<sub>2</sub> using the internal CO<sub>2</sub> module or the sidestream CO<sub>2</sub> module, leakage test is required every time before the CO<sub>2</sub> measurement. To perform the CO<sub>2</sub> leakage test, follow this procedure:

1. Connect the measuring accessories as per section 16.5.1 *Preparing to Measure CO<sub>2</sub> Using Sidestream CO2 Module*.
2. Wait until the startup finishes. Completely block the gas inlet on the sidestream CO<sub>2</sub> 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.

## 16.9 CO<sub>2</sub> Calibration

- For sidestream CO<sub>2</sub> modules, a calibration is needed every year or when the measured values have a great deviation.

- For Microstream™ CO<sub>2</sub> modules, initially calibrate after 1,200 operating hours, then once a year or after 4,000 operating hours, whichever comes first. The initial calibration should not occur before 720 hours of use. If the initial calibration is done before 720 hours of use, the module will reset to require its next calibration after 1200 hours, instead of after 4000 hours.
- For maintream CO<sub>2</sub> module, no calibration is needed.

To calibrate the CO<sub>2</sub> module, contact the service personnel.

---

## CAUTION

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- **Connect the gas outlet to the scavenging system when calibrating the CO<sub>2</sub> module.**
  - **If calibration does not take place as instructed, the monitor may be out of calibration. The monitor that is out of calibration may provide inaccurate results.**
- 

## 16.10 CO<sub>2</sub> 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 *E Alarm Messages*.**
- 

### 16.10.1 Troubleshooting the Sidestream/Microstream™ CO<sub>2</sub> Module

Problem	Solution
EtCO <sub>2</sub> measurements too low	<ol style="list-style-type: none"> <li>1. Ventilate the room if the environmental CO<sub>2</sub> concentration is too high.</li> <li>2. Check the sample line and connectors for leakage.</li> <li>3. Check the patient status.</li> </ol>

### 16.10.2 Troubleshooting the Mainstream CO<sub>2</sub> Module

Problem	Solution
Elevated baseline	<ol style="list-style-type: none"> <li>1. Check the patient status.</li> <li>2. Check the sensor.</li> </ol>

## 16.11 Oridion Information

### Microstream

Microstream is a trademark of a Medtronic company.

#### Oridion Patents

The list of relevant patents for the Microstream™ CO<sub>2</sub> module appears on US Patents: [www.covidien.com/patents](http://www.covidien.com/patents).

#### No Implied License

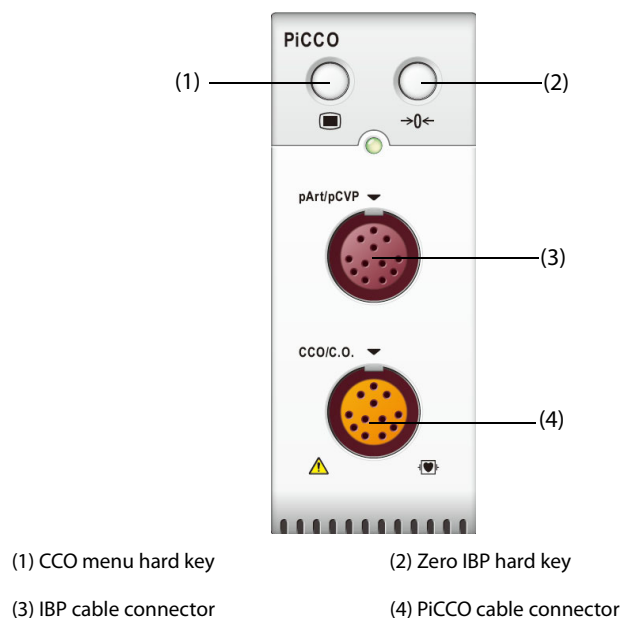
Possession or purchase of this device does not convey any express or implied license to use the device with unauthorized CO<sub>2</sub> sampling consumables which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device and/or CO<sub>2</sub> sampling consumable.

# 17 Monitoring Continuous Cardiac Output (CCO from PiCCO Module)

## 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 measured 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.



## 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.**

### CAUTION

- **Do not perform transpulmonary thermodilution measurement on patients undergoing IABP.**

## 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, IBP cable or module is reconnected.
- The monitor restarts.
- You doubt the readings.
- The monitor displays the prompt message **Zero Required**.

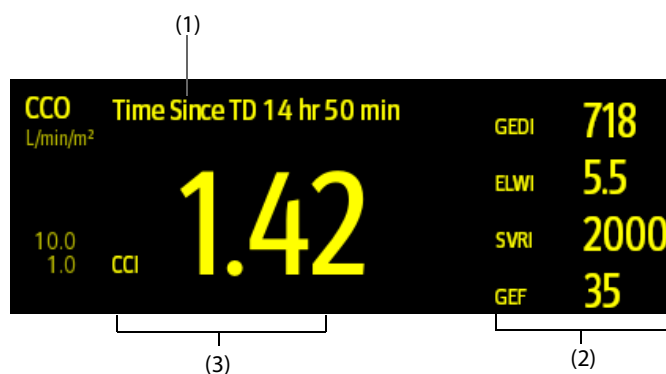
To zero the transducer, follow this procedure:

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*.



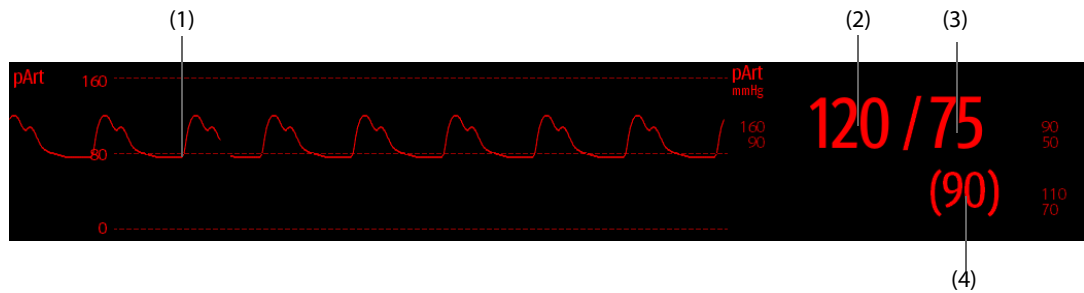
(1) Prompt message: the time since previous TD measurement

(2) Labels and values for secondary parameters

(3) Label and value for primary parameter

### 17.4.2 pArt Display

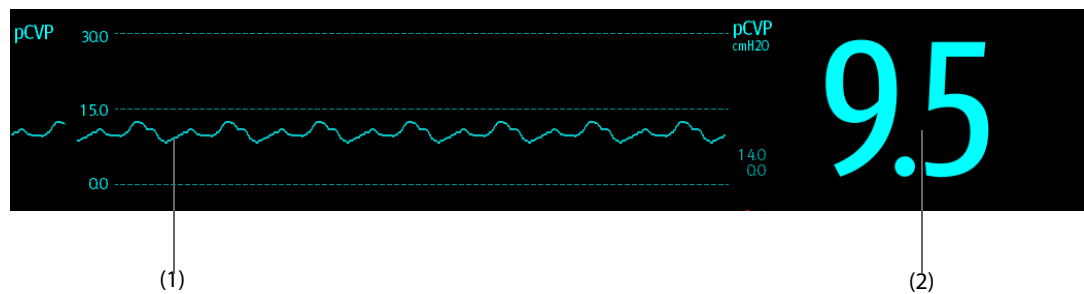
The artery pressure from the PiCCO module (pArt) is displayed on the monitor as a waveform and numeric pressures. The figure below shows the pArt waveform and numerics.



- (1) Waveform
- (2) Systolic pressure
- (3) Diastolic pressure
- (4) Mean pressure

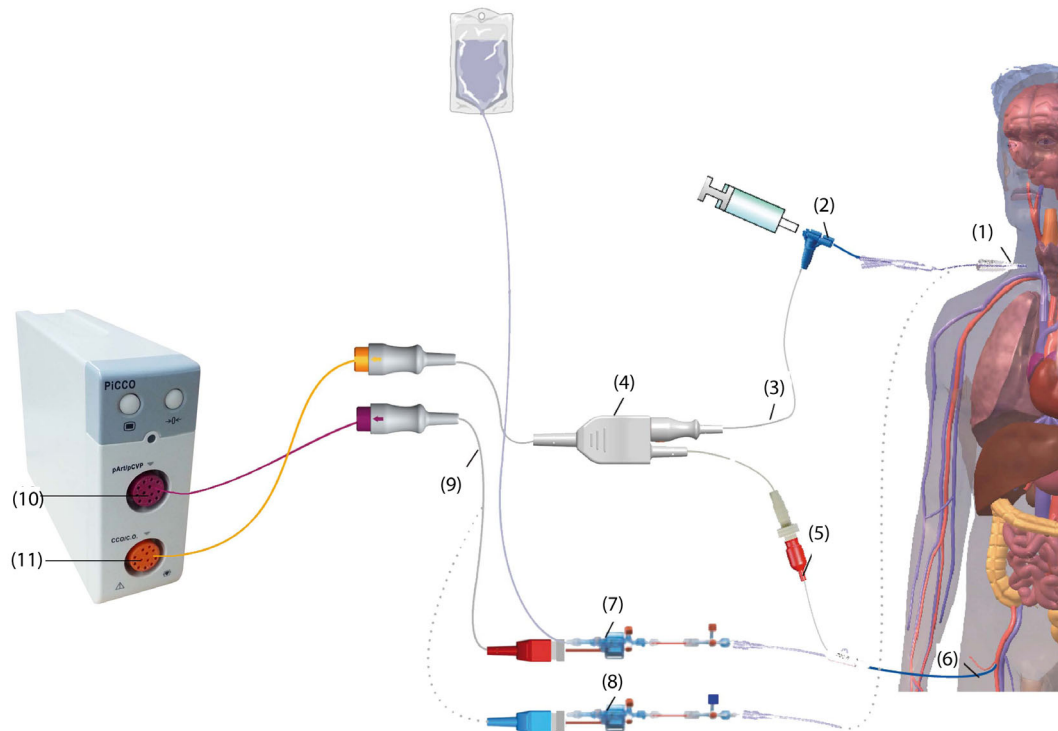
### 17.4.3 pCVP Display

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.

#### NOTE

- **Use the specified catheters and puncture locations.**
- **The arterial thermodilution catheter must be placed in one of the bigger systemic arteries, for example, the femoral, the brachial or the auxiliary artery.**

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

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- **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 **Setup** to enter the **Setup** page of the **CCO** menu.
3. Set 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 **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**.
9. Set **TD Reminder**. The CCO parameter area displays the time to last injection. After the set time is reached, the background of the time to last injection is highlighted in yellow to remind you.

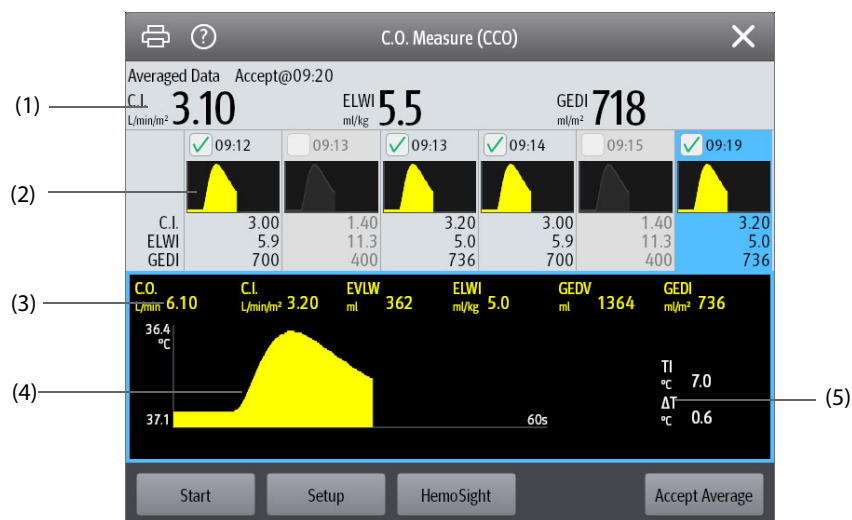
## NOTE

- **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) Average values
- (2) History window
- (3) Current measurements
- (4) Thermodilution curve
- (5) Variation of blood temperature ( $\Delta T$ )

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  $\Delta T$  value should be greater than 0.15°C to ensure high accuracy. A low  $\Delta T$  can be caused by a very high ELWI or an extreme low CI. If  $\Delta T$  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 thermodilution 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 <sup>2</sup>	3.0-5.0
	SV	Stroke Volume	ml	/
	SVI	Stroke Volume Index	ml/m <sup>2</sup>	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 <sup>2</sup>	680-800
	ITBV	Intrathoracic Blood Volume	ml	/
	ITBI	Intrathoracic Blood Volume Index	ml/m <sup>2</sup>	850-1000
	SVV	Stroke Volume Variation	%	0-10
	PPV	Pulse Pressure Variation	%	0-10
Afterload Volume	SVR	Systemic Vascular Resistance	DS/cm <sup>5</sup> or kPa-s/l	/
	SVRI	Systemic Vascular Resistance Index	DS-m <sup>2</sup> /cm <sup>5</sup> or kPa-s-m <sup>2</sup> /l	1700-2400
	pArt-M	Mean Artery Pressure	mmHg, kPa or cmH <sub>2</sub> O	70-90
	pArt-D	Diastolic Artery Pressure	mmHg, kPa or cmH <sub>2</sub> O	60-80
	pArt-S	Systolic Artery Pressure	mmHg, kPa or cmH <sub>2</sub> O	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 <sup>2</sup>	0.5-0.7
	PVPI	Pulmonary Vascular Permeability Index	no unit	1.0-3.0
	TB	Blood Temperature	°C	/

## 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 **Setup** to enter the **Setup** page of the **CCO** menu.
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 **Setup**.
3. Select the **Select Parameter** tab.
4. Select the primary and secondary parameters for display.

### 17.7.3 Setting the Normal Range of Hemodynamic Parameters

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**.
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 *E Alarm Messages*.

Problem	Solution
Do not see CCO numeric area on the main screen	<ol style="list-style-type: none"><li>1. Check that the CCO is set to display in the <b>Screen Setup</b> menu. For more information, see 3.11.2 <i>Displaying Parameter Numerics and Waveforms</i>.</li><li>2. Check that if the CCO parameter switch is enabled. If not, enable the CCO measurement. For more information, see 3.11.1 <i>Switching On or Off a Parameter</i>.</li><li>3. Check that the patient type is adult.</li><li>4. Check the connection of PiCCO cable, arterial thermodilution catheter and injectate temperature sensor.</li></ol>
CCO value is inaccurate	<ol style="list-style-type: none"><li>1. Check that the arterial thermodilution catheter is positioned properly.</li><li>2. Check that the catheter type is proper.</li><li>3. Inject solution rapidly and smoothly.</li><li>4. Finish injection within four to five seconds.</li><li>5. Inject more volume, or inject colder solution.</li><li>6. Check that the height and weight of patient is properly configured.</li><li>7. Check that the entered <b>Injectate Volume</b> is correct.</li></ol>
CCO measurement fails	<ol style="list-style-type: none"><li>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.</li><li>2. Finish injection within four to five seconds.</li><li>3. Check the connection of PiCCO cable, arterial thermodilution catheter and injectate temperature sensor.</li></ol>

Problem	Solution
<p>Message "Unstable baseline. Please wait." constantly appears.</p>	<ol style="list-style-type: none"> <li>1. Check if the patient's temperature changes rapidly. Wait till the patient's temperature is stable.</li> <li>2. Check if the patient is being transfused with large volume of fluid. Wait till transfusion stops.</li> <li>3. IBP cable fails or incorrectly connected. Check the cable and its connection. Replace the cable if necessary.</li> <li>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.</li> </ol>

# 18 Review

## 18.1 Review Overview

The monitor provides the patient's trends to help you evaluate how the patient's condition is developing.

## 18.2 Review Page

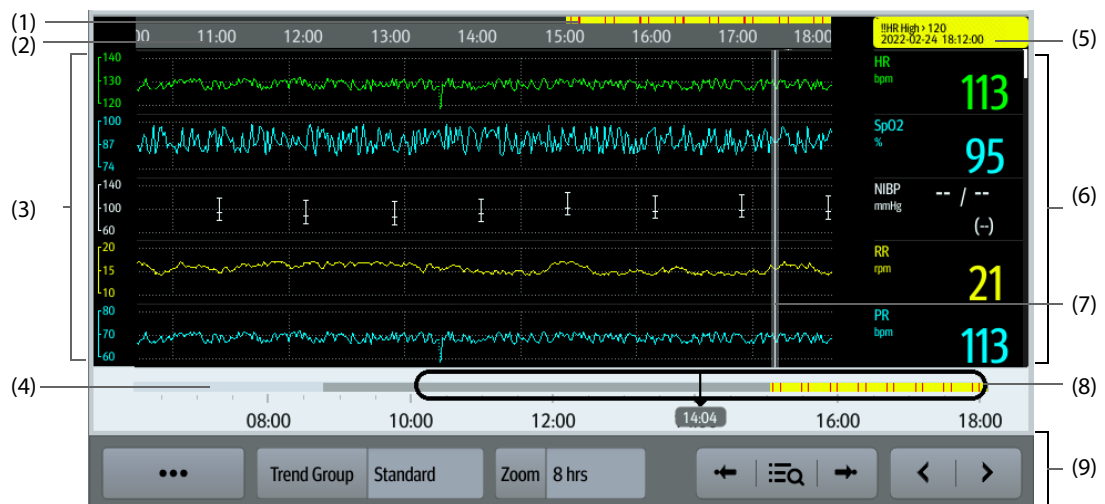
The **Review** page contains tabs to display trend data in tabular, graphic, or other forms.

### 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. If reviewing patient data is password protected, input the monitor's clinical password (local password).

### 18.2.2 Example Review Page

The review pages have similar structure. We take the **Graphic Trends** review page as an example.


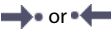




- (1) Event type indicator: different color blocks match different types of events:
  - ◆ Red: high priority alarm event
  - ◆ Yellow: medium priority alarm event
  - ◆ Cyan: low priority alarm event
  - ◆ Green: manual event
  - ◆ White: operation-related event
- (2) Current window time line: indicates the time length of the current window.
- (3) Waveform area: displays trend curves.
- (4) Time line: indicates the entire time length that trend data can be reviewed.
- (5) Event area: displays the event at the cursor time. Selecting the event accesses the event list. If there is no event at the cursor time, the cursor time is displayed.
- (6) Numeric area: displays numeric values at the cursor time. The background color of numeric values matches the alarm priority.
- (7) Cursor

- (8) 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 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.
	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 NIBP 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.

### 18.2.5 Reviewing the Tabular Trends

The **Tabular Trends** review page displays trend data in a tabular form.

#### 18.2.5.1 Entering the Tabular Trends Review Page

To enter the **Tabular Trends** review page, select the **Main Menu** quick key → from the **Review** column select **Tabular Trends**.

#### 18.2.5.2 Changing the Tabular Trend Group

To change the tabular trend group, follow this procedure:

1. Enter the **Tabular Trends** review page.



2. Set **Trend Group**.

### 18.2.5.3 Editing the Tabular Trend Group

The setting of the **Trend Group** defines the contents of displayed and printed trends. To edit the tabular trend group, follow this procedure:

1. Enter the **Tabular Trends** review page.
2. Select **Group Setup** → select the desired tab.

#### NOTE

- You cannot edit trend group 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.

### 18.2.5.4 Changing the Resolution of Trend Data


The resolution of tabular trends defines the interval of displaying trend data. Short interval is suit for patients, for example the neonate, whose clinical situation changes quickly. Longer interval is more appropriate for patients, for example the adult, whose status changes more gradually.

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.

### 18.2.5.5 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 to enter the **Print Setup** menu.
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.

### 18.2.6.1 Entering the Graphic Trends Review Page

To enter the **Graphic Trends** review page, select the **Main Menu** quick key → from the **Review** column select **Graphic Trends**.


### 18.2.6.2 Changing the Graphic Trend Group

To change the graphic trend group, follow this procedure:

1. Enter the **Graphic Trends** review page.
2. Select  and set **Trend Group**.

### 18.2.6.3 Editing the Graphic Trend Group

The setting of the **Trend Group** defines the contents of displayed and printed trends. To edit the graphic trend group, follow this procedure:

1. Enter the **Graphic Trends** review page.
2. Select  → select **Group Setup** → select the desired tab.

## 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.**
- 


### 18.2.6.4 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.

### 18.2.6.5 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**.

### 18.2.6.6 Printing a Graphic Trends Report

Before print a graphic trends report, set the **Graphic Trends** report as described in *21.6.3 Setting Tabular Trends Reports*.

To print a **Graphic Trends** report, follow this procedure:

1. Enter the **Graphic Trends** review page.
2. Select  at the upper left corner to enter the **Print Setup** menu.
3. Select **Print**.

### 18.2.7 Reviewing Events

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

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- **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 **Events** 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 to facilitate event review. To configure the filter, follow this procedure:

1. Enter the **Events** page.
2. Select **Filter**. From the drop-down list, select the desired item.


You can customize two criteria. To do so, follow this procedure:

1. From the **Filter** drop-down list, select **Custom 1** or **Custom 2** to enter the **Filter Setup** menu.
2. Select the **Name** field to edit the name of the custom criterion.
3. Select desired items.

If you want to review events happened around certain time, select the  button → set the time → select **OK**. Then the cursor jumps to the event happened closest to the defined time.

### 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.
  - ◆ **Rename**: allow renaming an event name. Only manual events and arrhythmia events can be renamed if enabled by the hospital's settings. For more information, see 22.7.2 *The Event Tab*.

### 18.2.7.4 Viewing Event Details

To view waveforms and parameter values at the event time, follow this procedure:


1. Enter the **Events** review 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 to enter the **Print Setup** menu.

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 Reviewing Full Disclosure


You can review up to 48-hour waveform data on the **Full Disclosure** review page. You can view both the compressed waveforms, full waveforms and numeric values.

### 18.2.8.1 Entering the Full Disclosure Review Page

To enter the **Full Disclosure** review page, select the **Main Menu** quick key → from the **Review** column select **Full Disclosure**.

### 18.2.8.2 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  → **Setup** to enter the **Select Waveform** page.
3. Select the **Storage** tab and set the desired waveforms to be stored in the monitor. 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.**

In case of alarms, the background of compressed waveform at the alarm time is highlighted as follows:

- Red: high alarm priority
- Yellow: medium alarm priority
- Cyan: low alarm priority

### 18.2.8.3 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 , and then select **Scale** to set ECG waveform gain.
3. Select **Duration** to set the length of displayed waveforms.

### 18.2.8.4 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 **Detail**.

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*.
- Set **Speed** and **ECG Gain**, or **Save As Event**.
- Select  and set **Save As Event**.
- Select  and set **Speed** and **ECG Gain**, or **Save As Event**.
- Select **Overview** to switch to the compressed waveform page.

### 18.2.8.5 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 of 4-minute 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 any of the following methods to enter the OxyCRG review page:

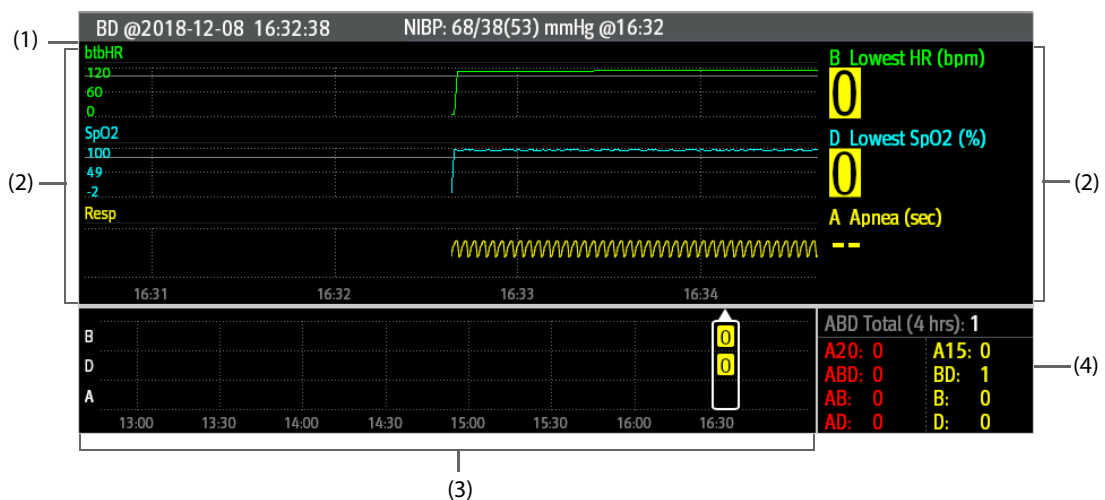
- From the OxyCRG screen, select the ABD events list area.
- Select the **Main Menu** quick key → from the **Review** column select **OxyCRG**.

#### 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 Editing Patient Information for 12-Lead Report

On the 12-lead ECG review page, you can edit patient information if needed. To do so, follow this procedure:

1. Enter the 12-lead review page.
2. Select  in the patient information area.
3. Edit patient information as required.

##### 18.2.10.5 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 Details 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**. If viewing discharged patients is password protected, input the user name and password (the user name and password saved in the MLDAP server).
2. From the patient list select the desired patient. Select **Detail**. If reviewing patient data is password protected, input the monitor's clinical password (local password).

### 18.3.2 Checking Patient Demographics 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**. If viewing discharged patients is password protected, input the user name and password (the user name and password saved in the MLDAP server).
2. From the patient list select the desired patient. Select **Detail**. If reviewing patient data is password protected, input the monitor's clinical password (local password).
3. Select the  icon to enter the **Patient Management** dialog box.
4. Select **OK** to exit the **Patient Management** dialog box.

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# 19 Clinical Assistive Applications (CAA) (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 is not intended to replace the competent judgment of a clinician. It must be used in conjunction with observation of clinical signs and symptoms.

## 19.1 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

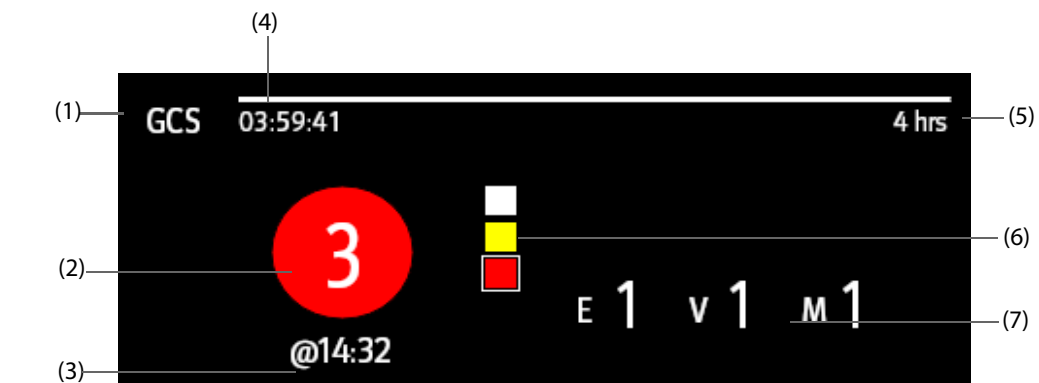
- **GCS is intended as an adjunct in patient assessment and must be used in conjunction with observation of clinical signs and symptoms.**
- **GCS is not applied to patients that are sedated, muscularly relaxed, with artificial airway, drunk, or in status epilepsies.**
- **GCS is not applied to deaf 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.**

### 19.1.1 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:



(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) Risk level indicator. The level of risk increases from top down. The current level is enclosed by a white square frame.
- (7) Subscores
  - ◆ E: eye opening
  - ◆ V: verbal response
  - ◆ M: motor response

### 19.1.2 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**.

GCS		
* Eye Opening	* Verbal Response	* Motor Response
Eyes Opening Spontaneously (4)	Oriented and Converses (5)	Obeys Verbal Commands (6)
Eyes Opening to Verbal Command (3)	Disoriented and Converses (4)	Localize to Pain (5)
Eyes Opening Only with Painful Stimuli (2)	Inappropriate Words (3)	Withdraw from Pain (4)
No Eye Opening (1)	Incomprehensible Sounds (2)	Flexor Response to Painful Stimuli (3)
	No Verbal Response (1)	Extensor Response to Painful Stimuli (2)
		No Motor Response (1)
Total Score 14		
Interval 4 hrs Review OK Cancel		

(1) Subscore (2) Total score

### 19.1.3 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	13-15	White	The brain function is normal or mildly damaged.
Moderate	9 - 12	Yellow	The brain function is suffered from moderate to severe damage.
Severe	3 - 8	Red	Can be brain death or remain vegetative.

## 19.1.4 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.

## 19.1.5 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**.

## 19.2 SepsisSight™

The SepsisSight™ function is based on Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) and Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016 (SSC Guidelines 2012 and 2016).

The monitor provides SSC screening and recommendations, as well the patient's parameter trends to help you recognize the early signs and symptoms of sepsis.

SepsisSight™ is intended for adult patients suffering from sepsis or suspicious of sepsis.

---

### CAUTION

- **SepsisSight is not a tool for Sepsis diagnosis and treatment. It cannot replace the physician's judgment.**

---

### NOTE

- **The recommendations may not be as detailed as the SSC guidelines due to limited screen size.**
  - **A License is required for the SepsisSight function.**
- 

### 19.2.1 Accessing the SepsisSight Menu

Enter the SepsisSight menu in any of the following ways:


- Select the **SepsisSight** quick key.
- Select the **Main Menu** quick key → from the **CAA** column select **SepsisSight**.

### 19.2.2 Screening

As per Sepsis-3, SepsisSight supports quick Sepsis-Related Organ Failure Assessment (qSOFA, or quick SOFA) and Sepsis-Related Organ Failure Assessment (SOFA). qSOFA is intended for quickly screening, while SOFA is intended for further screening patients suspicious of sepsis. SOFA is the default assessment tool for ICU, while qSOFA is the default for other departments.

#### 19.2.2.1 Performing qSOFA

qSOFA evaluate the patient's respiration rate, systolic blood pressure and altered mental status.

RR and BP-S being monitored are automatically obtained. You can also manually enter these values by selecting the  symbol. Select whether the patient's mental status is altered. Then qSOFA score is calculated. Select **Confirm** to record the calculation time.

If the qSOFA score is greater than or equal to 2, or sepsis is suspected, select **SOFA >>** to perform SOFA.

---

### NOTE

- **The keyboard symbol indicates that the parameter value is manually entered.**
  - **The question mark (?) in the score circle indicates that more parameter values are required.**
-

### 19.2.2.2 Performing SOFA

SOFA score is used to identify sepsis-related organ failure.

To perform SOFA, enter the value or select a range for each item, SOFA score will be automatically calculated. Select **Confirm** to record the calculation time.

If Sepsis criteria is met, make a comprehensive judgement on the clinical features.

### 19.2.2.3 Clearing the Current Score

To clear the current qSOFA score or SOFA score, select **Reset**.

### 19.2.2.4 Changing Screening Settings

From the **Screening** page select **Setup**. You can change the following settings:


- In the **Screening** area, set **RR (rpm)** high limit and **BP-S (mmHg)** low limit for qSOFA scoring.
- In the **Unit** area, set the unit of **Bilirubin** and **Creatinine**.

## 19.2.3 Recommendations

The **SSC Bundles** page lists goals and treatments to be completed in the defined time. Pages **Treatment I** and **Treatment II** list graded recommendations as per the SSC Guidelines 2016.

You can define the time and goals for initial resuscitation, as well as treatments to be completed in one hour, 3 hours, and 6 hours. For more information, see *22.5.3 The SepsisSight Tab*.

### 19.2.3.1 Viewing Detailed Recommendations


On the Pages **Treatment I** and **Treatment II** select the arrow symbol  at the right side of each item to view detailed recommendations of SSC Guideline 2016. The star symbol ★ indicates the grade of recommendation:

- ★ ★ : strong recommendation
- ★ : weak recommendation
- No star symbol: best practice statement

To hide the detailed recommendations, select the arrow symbol .

### 19.2.3.2 Marking Implemented Items

Select the implemented items to mark it as completed. Then the time and date are automatically recorded and displayed.

- You can select the  symbol to change the date and time.
- Select **Reset** to clear the current results.

## 19.2.4 Reviewing SepsisSight Trend Data

Select the **Graphic Trends** tab to view the trend of parameters of resuscitation.

When a recommended treatment is checked off on pages **Treatment I** and **Treatment II**, relevant event is marked in the tabular trend. Vertical lines of different colors indicate the event type:

- White: inspection performed
- Blue: medication
- Green: goal achieved
- Purple: other treatment

## 19.3 BoA Dashboard

The Balance of Anesthesia (BoA) Dashboard provides a view of the patient's anesthesia status, brain function status, and trends of related parameters. It helps understanding the patient's status during surgical procedure.

## NOTE

- **BoA Dashboard is only available when Department is set to OR.**
- **A License is required for the BoA Dashboard function.**

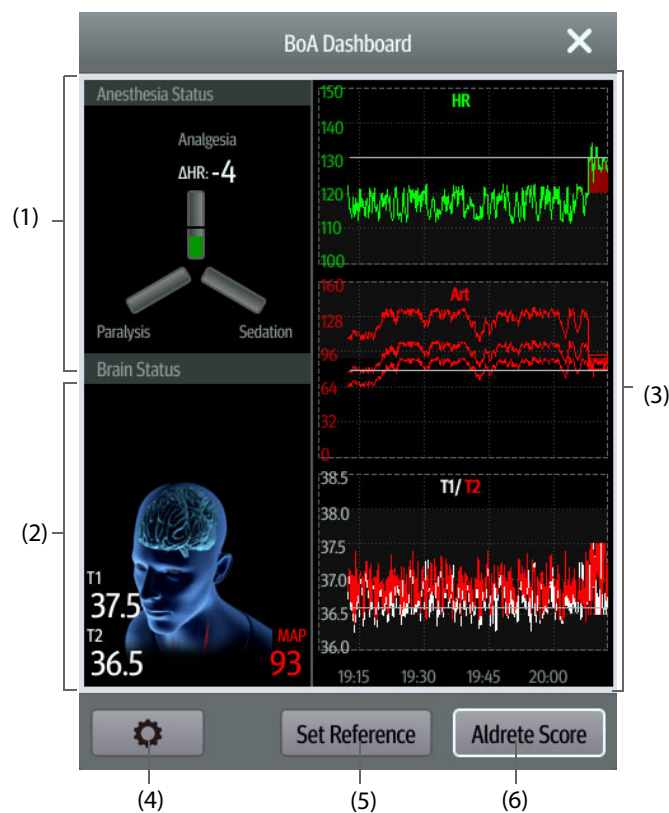
### 19.3.1 Opening the BoA Dashboard window

To open the BoA Dashboard window, choose any of the following ways:

- Select the **BoA Dashboard** 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**.

### 19.3.2 BoA Dashboard Display

The following figure is an example of the BoA Dashboard window.



- (1) Anesthesia status area:  
The three arms of the anesthesia status indicator respectively indicate the patient's status of pain (Analgesia), consciousness (Sedation), and neuromuscular blockage (Paralysis).  
The black line or lines on each parameter arm indicate the normal range of corresponding parameter.  
The filling length of each parameter indicates the value of corresponding parameter.  
The color of the arm indicates parameter status: green indicates that the parameter value is within normal range. Red or yellow indicates that the parameter value is beyond normal range. Gray indicates that the parameter value is unavailable or invalid.
- (2) Brain status area: displays brain status related parameters.
- (3) Minitrends area: displays the trends of related parameters.
- (4) The setup button: selecting this button enters the BoA Dashboard menu.
- (5) The Set Reference button: for more information, see 19.3.4 Setting Parameter References.
- (6) The Aldrete Score button: for more information, see 19.3.3 Aldrete Score.

### 19.3.3 Aldrete Score

Select **Aldrete Score** to view the latest Aldrete score and scoring time. You can also change desired subscores according to the patient's current status, and then select **OK** to get a new Aldrete score.

To exit the **Aldrete Score** menu, select **Cancel** or the exit button **X**.

#### NOTE

- **Aldrete scores should not be used as the sole basis for diagnosis or therapy decisions. It is not intended to replace the competent judgment of a clinician. The Aldrete scores and recommended actions must be used in conjunction with observation of clinical signs and symptoms.**

### 19.3.4 Setting Parameter References


In the minitrends area, the recently set parameter references are displayed as white lines. To change parameter references, follow this procedure:

1. Select **Set Reference**.
2. To set the current measurements as references, select **OK**. Or input new references, and then select **OK** to save new references.

### 19.3.5 Selecting Parameters for Anesthesia Status Indicator


The three arms of the anesthesia status indicator respectively indicate the patient's status of pain (Analgesia), consciousness (Sedation), and neuromuscular blockage (Paralysis). The pain status can be evaluated by the changes of heart rate and systolic pressure.

To select parameters for the anesthesia status indicator, follow this procedure:

1. Select the setup button  to enter the **BoA Dashboard** menu.
2. Set **Analgesia**.
3. Set parameter thresholds. **ΔHR** and **ΔBP-S** respectively refer to the changes of heart rate and systolic pressure as compared with reference values.


### 19.3.6 Setting BoA Dashboard Parameter Trends

You can view the minitrends of related parameters through the **BoA Dashboard** window. The displayed parameters and trend time are configurable. To do so, follow this procedure:

1. Select the setup button  to enter the **BoA Dashboard** menu.
2. Select the **Minitrends** tab.
3. Select parameters for display.
4. Set **Minitrend Length**.

### 19.3.7 Restoring Default BoA Dashboard Settings

To restore default BoA Dashboard settings, follow this procedure:

1. Select the setup button  to enter the **BoA Dashboard** menu.
2. Select the desired tab.
3. Select **Defaults**. Then all the settings in the corresponding menu are restored to default values.

## 19.4 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. Recommendations are provided according to the score.

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 sum of subscores. A subscore is given for each parameter based on the measured or input value. When all the required parameters are measured or input, the subscores are added together to calculate the total 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 configuration.

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)*.

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## WARNING

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- **EWS should not be used as the sole basis for diagnosis or therapy decisions. It is not intended to replace the competent judgment of a clinician. The EWS scores and recommended actions must be used in conjunction with observation of clinical signs and symptoms.**
  - **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.**
- 

## NOTE

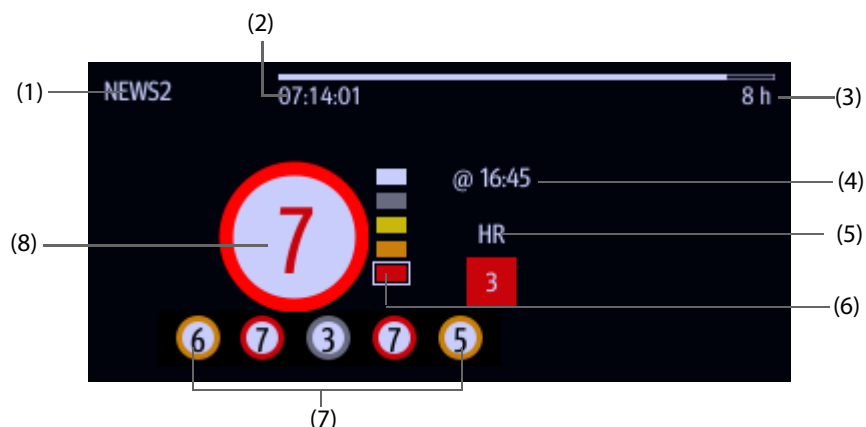
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- **A License is required for the EWS function.**
- 

### 19.4.1 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) Scoring countdown: time to the next scoring.


- (3) Scoring interval
- (4) The current scoring time
- (5) Single parameter whose score reaches 3
- (6) 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.
- (7) History total score. The rightmost one is the latest history score.
- (8) 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.

## 19.4.2 Accessing the EWS Screen

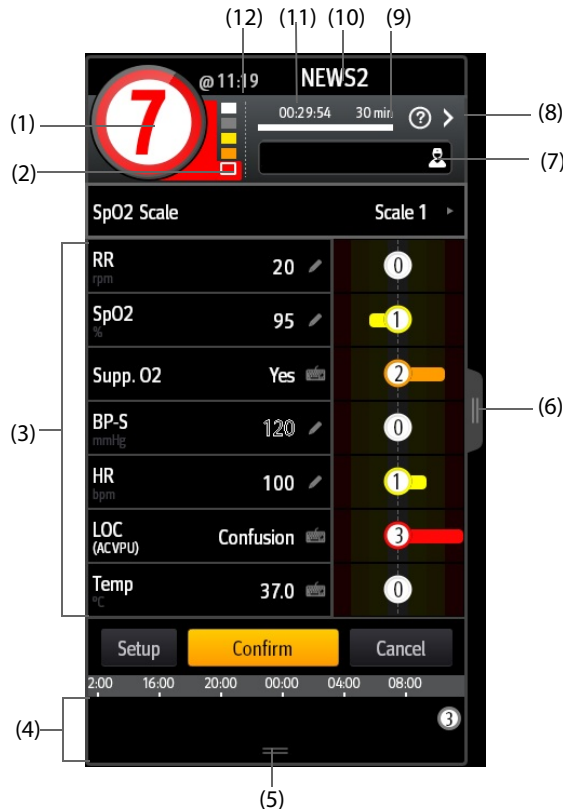
Access the EWS window in any of the following ways:

- 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**.

If the EWS screen is hidden as , you can also choose one of the following methods to quickly enter the EWS screen.

- Swipe left or right across the touchscreen with two fingers until you switch to the EWS screen.
- Swipe right across the touchscreen with a single finger,
- Select the  button,

The following figure shows the EWS screen when the NEWS2 score is used. 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 area: selecting this area or swiping up with a finger can review the trends of total score and each subscore.
- (5) Selecting this button can review the trends of the total score and each subscore.
- (6) Selecting this button or swiping right on the screen with a finger can review the trends of total score and parameter values for scoring.
- (7) Clinician ID (displays only when the Clinician ID is enabled): allows inputting the Clinician ID to associate with the EWS score.
- (8) Select this button to see the clinical response to the current score
- (9) Scoring interval
- (10) EWS protocol label
- (11) Scoring countdown: time to the next scoring.
- (12) The scoring time

### 19.4.3 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 the clinician ID is enabled, input the clinician information by selecting , and then manually entering the information, or by scanning the clinician's barcode.
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 19.4.5.2 *Setting the Scoring Confirmation Switch* for more information.

---

#### CAUTION

- **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.**
- 

#### NOTE

- **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.**
  - **When a patient is discharged or the monitor is turned off, the clinician ID is cleared.**
- 

### 19.4.4 EWS Alarm

If enabled, the monitor can automatically give alarms and refreshes the score.

#### 19.4.4.1 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.

#### 19.4.4.2 Auto Refreshing Scores

If enabled, the monitor can automatically refresh the 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 screen select **Setup**.
2. Select the **Alarm** tab.
3. Turn on the **Auto Refresh Scores** switch.

### 19.4.5 Changing EWS Settings

#### 19.4.5.1 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**.

#### 19.4.5.2 Setting the Scoring Confirmation Switch

To select if confirmation is required before saving score, follow this procedure:

1. From the EWS page select **Setup**.
2. Set **Score 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.

#### 19.4.5.3 Setting the Manual Data Timeout

The manually input parameter data becomes 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.

#### 19.4.5.4 Setting Auto Scoring

The monitor automatically starts scoring at the preset interval. To set auto scoring, follow this procedure:

1. From the EWS screen 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.

#### 19.4.5.5 Setting Auto Scoring Interval

To set the interval for automatically initiating scoring, follow this procedure:

1. From the EWS screen 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.

#### 19.4.6 Viewing History Scores


From the EWS screen, you can view the total score or subscores of the recent 24 hours. To do so, choose either of the following ways:

- Select the history total score area.
- From the history total score area, swipe up with one finger.

Refer to *19.4.2 Accessing the EWS Screen* for the position of the history total score area.

#### 19.4.7 Viewing Parameter Trends

From the EWS screen, you can view the 24-hour graphic trends of each parameter used for scoring. To do so, choose either of the following ways:

- Select the  button.
- Swipe right across the EWS screen with one finger.

Refer to *19.4.2 Accessing the EWS Screen* for the position of the  button.

### 19.5 NeuroSight

The NeuroSight provides a view of the patient's brain function. It displays parameters and trends related to the patient's cerebral blood flow, regional oxygen saturation, and cerebral function. It helps understanding the patient's brain status.

#### NOTE

- A License is required for the NeuroSight function.

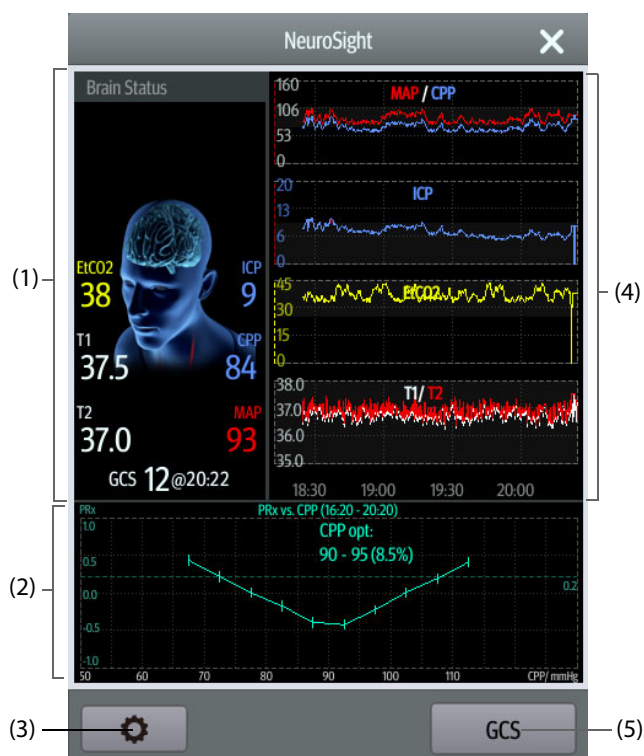
#### 19.5.1 Opening the NeuroSight Window

To open the **NeuroSight** window, choose any of the following ways:

- Select the **NeuroSight** quick key.
- Select the **Screen Setup** quick key → select the **Choose Screen** tab → select **NeuroSight**.
- Select the **Main Menu** quick key → from the **CAA** column select **NeuroSight**.

#### 19.5.2 NeuroSight Display

The following figure is an example of the NeuroSight window:



- (1) Brain status area
- (2) PRx area: displays the PRx trend or the PRx vs CPP relationship curve.
- (3) The setup button: selecting this button enters the NeuroSight menu.
- (4) Minitrends area: displays the trends of related parameters.
- (5) The GCS button: selecting this button enters the **GCS** window. For more information, see *19.1 Glasgow Coma Scale (GCS)*.

### 19.5.3 PRx

The pressure reactivity index (PRx) reflects the real-time change in the auto adjustment ability of cerebral vessels. If Art and ICP are being monitored, you can view the PRx trend and the PRx vs CPP relationship curve from the NeuroSight window. With the PRx vs CPP relationship curve, you can continuously and dynamically monitor the patient's cerebrovascular reactivity. This helps finding the optimal CPP value.


The PRx area displays the PRx trend by default. Selecting this area switches between the PRx trend and the PRx vs CPP relationship curve.

#### NOTE

- The PRx vs CPP curve is not available if the patient is monitored for less than four hours.

### 19.5.4 Setting NeuroSight Parameter Trends

You can view the minitrends of related parameters through the **NeuroSight** window. The displayed parameters and trend time are configurable. To do so, follow this procedure:

1. Select the setup button  to enter the **NeuroSight** menu.
2. Select parameters for display.
3. Set **Zoom**.

### 19.5.5 Setting PRx

To set PRx, follow this procedure:

1. Select the setup button  to enter the **NeuroSight** menu.

2. Set **Relationship Curve Duration** and **PRx Threshold**.

### 19.5.6 Restoring Default NeuroSight Settings

To restore default NeuroSight settings, follow this procedure:

1. Select the setup button  to enter the **NeuroSight** menu.
2. Select **Defaults**.

## 19.6 Resus Mode

You can put the monitor into the Resus mode when rescuing a patient. The Resus mode has the following features:

- Displaying resuscitation-related parameter values and waveforms.
- Monitoring CPR quality (available for N1 equipped with Mindary SpO<sub>2</sub>).
- Recording drugs and treatments through the CPR Record.

The Resus mode is intended for adult, pediatric, and neonatal patients.

### NOTE

- In the Resus mode, all physiological alarms and some of technical alarms are disabled.
- Exit the Resus mode as soon as the resuscitation ends to resume normal patient monitoring.

### 19.6.1 Entering the Resus Mode

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

- Select the **Resus Mode** quick key → select **OK**.
- Select the **Main Menu** quick key → from the **Alarm** column select **Resus Mode** → select **OK**.

### 19.6.2 CPR Record

The CPR Record helps you record the process of patient resuscitation. You can record the following items through the CPR Record:


- The time resuscitation starts and ends.
- Drug names and doses.
- Resuscitation treatments.

### NOTE

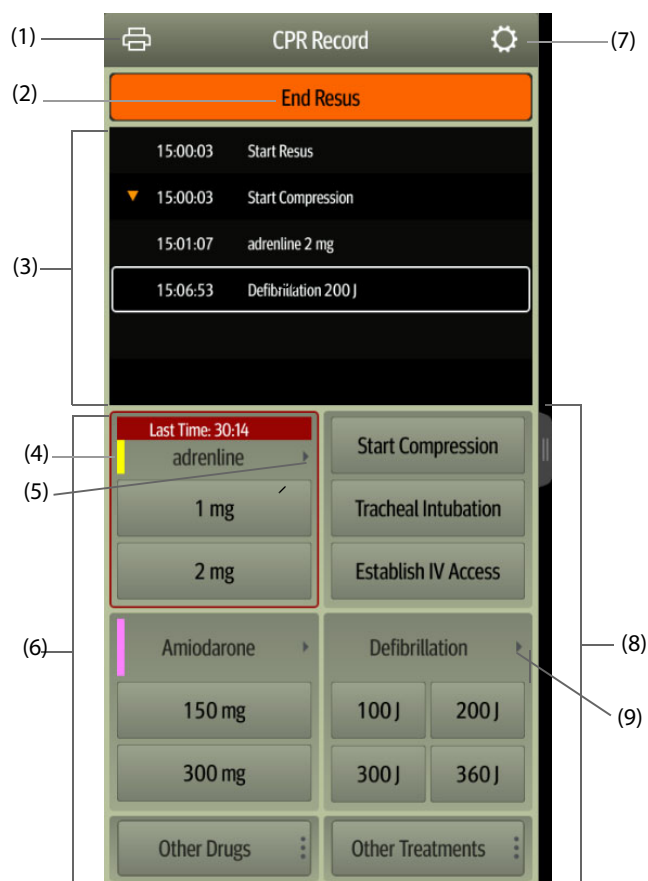
- A license is required for the CPR Record function.

#### 19.6.2.1 Accessing the CPR Record

The CPR Record automatically displays when you enter the Resus mode. If the CPR Record is closed, choose either of the following ways to open it:

- Select the **Main Menu** quick key → from the **CAA** column select **CPR Record**.
- Select the  button at the left of the screen and swipe right.


The following figure shows the CPR Record:



- (1) Press this key to output the resuscitation report through the printer.
- (2) Press this key to record the resuscitation start time/end time and result. The monitor automatically records the resuscitation start time when you enters the Resus mode.
- (3) Event area: lists drugs and treatments. Select any event to add an event, edit or delete this event. The resuscitation record saves automatically.
- (4) Drug color mark: is used to distinguish the type of drugs.
- (5) Press this key to select other doses. If adrenalin is used, you can define the injection interval. If the injection time is approaching, the time to the last injection will be highlighted in red, reminding that injection is required.
- (6) Drug record area: quickly records the names and doses of drugs used for patient resuscitation. Select **Other Drugs** to record other drugs or temporary drugs not included. You can edit these drugs later.
- (7) Press this key to enter the **Setup** menu. You can customize drugs and treatments.
- (8) Treatment record area: quickly records the treatments. Select **Other Treatments** to record other treatments. If an undefined treatment is selected, you can edit it later.
- (9) Press this key to select other defibrillation energy and the type of defibrillation waveform.

### 19.6.2.2 Customizing Drugs


You can customize drugs frequently used for resuscitation. To do so, follow this procedure:

1. From the **CPR Record** screen, select the  button to enter the **Setup** menu.
2. Define the name, unit, dose, and color of each drug as needed.

The CPR Record can list up to six frequently used drugs. The first two drugs directly shown on the **CPR Record** screen are the most frequently used. The other four drugs are displayed by selecting **Other Drugs**.

### 19.6.2.3 Customizing Treatment

Besides **Start Compression, Tracheal Intubation, Establish IV Access, Defibrillation, Mechanical Ventilation, Place Urinary Catheter**, you can customize defibrillation energy and two additional treatments. To do so, follow this procedure:

1. From the **CPR Record** screen, select the  button to enter the **Setup** menu.
2. Select the **Customized Treatment** tab to define the defibrillation energy and the names of two additional treatments.


### 19.6.2.4 Recording the Resuscitation Result

After the resuscitation is completed, select **End Resus** to record the resuscitation end time and result.

### 19.6.2.5 Outputting the Current Resuscitation Report

The resuscitation report automatically saves. You can output the report through the recorder or printer.

You can also export the resuscitation report using a USB drive. To do so, follow this procedure:


1. Connect the N1 to the Dock.
2. Connect the USB drive to the Dock's USB connector.
3. From the top of the **CPR Record** screen, select the  button to enter the **Print Setup** menu.
4. Select **Print Preview** → **Export to USB**.

### 19.6.2.6 Closing the CPR Record

The **CPR Record** automatically closes when you exit the Resus mode. You can select the  button at the right of the **CPR Record** screen and swipe left to close the **CPR Record**.

## 19.6.3 Monitoring CPR Quality (CQI<sup>®</sup>)

If the monitor is configured with Mindray SpO<sub>2</sub>, the CQI monitoring function is available. The CQI function is on the basis of SpO<sub>2</sub> monitoring. The CQI monitoring unit obtains the pulsation signal of the patient's peripheral vessel through the SpO<sub>2</sub> sensor, generates the pleth waveform, and calculates CQI through further analysis. The monitor also provides CQI trend.

The monitor incorporating the CQI function has the CQI label .

The CQI function is intended for evaluating the CPR effect for adult patients. CQI should be used in conjunction with the patient's medical history, the cause of heart attack, as well as the clinical judgment.

CQI monitoring is intended for adult patient suffering from heart attack and requiring CPR.

CQI monitoring is contraindicated for the patients not suitable for SpO<sub>2</sub> monitoring.

For the patients suffering from the following condition, CQI monitoring should be used with caution.

- Fingertip defect
- Dyes in the measurement site, such as methylene blue, indigo carmine, nail polish, and etc
- Arterial blood flow too low to be measured due to vasoconstriction drug or Raynaud's phenomenon, and etc
- Severe anemia
- High carboxyhemoglobin (COHb) and methemoglobin (MetHb) level

The clinician should make a judgment in conjunction with the patient's clinical signs and symptoms.

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### WARNING

- **The CQI monitoring function is not intended for periatric and neonatal patients.**

---

### CAUTION

- **Use recommended SpO<sub>2</sub> sensor and apply it to a proper site.**

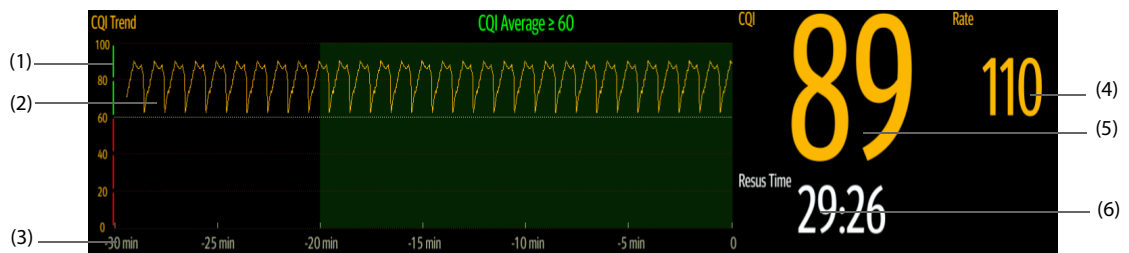
- **Avoid moving the measurement site.**
- **Apply the SpO<sub>2</sub> sensor properly. If the SpO<sub>2</sub> sensor is improperly applied or a wrong SpO<sub>2</sub> sensor is used, erroneous CQI could result. For more information, refer to 12.3 SpO<sub>2</sub> Measurement Limitations\***

## NOTE

- **A license is required for the CQI function.**

### 19.6.3.1 CQI Display

CQI monitoring displays the compression rate, CQI value, and trend as follows:



- (1) CQI scale: CQI scale lower than 60 indicates that the patient's peripheral circulation and CPR quality are not good; while CQI scale higher than 60 indicates that the patient's peripheral circulation and CPR quality are good.
- (2) CQI trend: indicates the change of CQI value.
- (3) CQI trend length: indicates the period of time to the current time. The monitor displays up to 30 minutes of CQI trend.
- (4) Rate value: times of chest compression per minute.
- (5) CQI value: CPR quality index. It indicates the compression quality. The greater the CQI value, the better the patient's peripheral circulation and compression quality.
- (6) Resuscitation timer: indicates the total time from resuscitation start to resuscitation end.

### 19.6.4 Exiting the Resus Mode

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

- Select the **Exit Resus Mode** quick key.
- Select the **Main Menu** quick key → from the **Alarm** column select **Exit Resus Mode**.

Exit the Resus mode as soon as resuscitation ends to return to normal patient monitoring.

### 19.6.5 Reviewing the Resuscitation Events

You can review the details of resuscitation events after exiting the Resus mode. To do so, follow this procedure:

1. Enter the **Events** page by choosing either of the following ways:
  - ◆ Select the **Review** quick key → select the **Event** tab.
  - ◆ Select the **Main Menu** quick key → from the **Review** column select the **Event** tab.
2. From the events list select the desired resuscitation event, and then select **Detail**.

#### 19.6.5.1 Editing an Resuscitation Event


You can edit the history resuscitation event and result. To do so, follow this procedure.

1. Enter the **Events** page.
2. From the events list select the desired resuscitation event, and then select **Detail**.
3. Select any event to add an event, edit or delete this event.



### 19.6.5.2 Outputting History Resuscitation Record

You can print or export the history resuscitation record through event review. To do so, follow this procedure:

1. Enter the **Events** page.
2. From the events list select the desired resuscitation event, and then select **Detail**.
3. Select the  button to enter the **Print Setup** menu.
4. Print or export the resuscitation report:
  - ◆ Select **Print Preview** → **Print** to print this report.
  - ◆ Select **Print Preview** → **Export to USB** to export this report.

## 19.7 AF Summary

The AF Summary provides statistics of AF events that last more than 30 seconds as well as trends of vital signs.

The AF Summary function is intended for adult patients only.

### NOTE

- **A License is required for the AF Summary function.**
- **The AF Summary function is intended for the current patient. It is not intended for discharged patients.**
- **Data displayed in the AF Summary is not recalculated.**

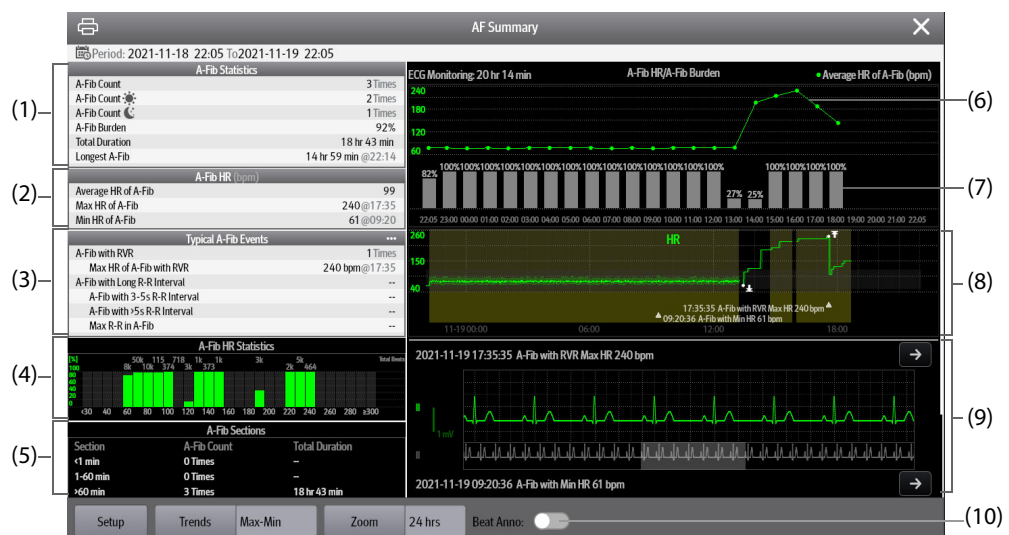
### 19.7.1 Opening the AF Summary Window

To open the AF Summary window, choose either of the following ways:

- Select the **AF Summary** quick key.
- Select the **Main Menu** quick key → from the **Summary** column select **AF Summary**.

### 19.7.2 AF Summary Display

The following figure is an example of the AF Summary window:



- (1) A-Fib statistics
- (2) A-Fib HR statistics: shows statistics of heart rates when A-Fib events occur.
- (3) Statistics of typical A-Fib events: selecting this area goes to statistics review.

- (4) A-Fib HR distribution: shows the distribution of A-Fib heart rates over the statistical period.  
Horizontal axis: heart rate  
Vertical axis: percentage  
Total beats: the total beats in corresponding HR range  
Green bar: A-Fib HR as a percentage of total beats in corresponding HR range
- (5) Statistics of A-Fib sections: shows A-Fib counts in different A-Fib duration sections.
- (6) Average A-Fib HR: shows hourly average A-Fib HR.
- (7) Hourly AF burden. The AF burden is the cumulative duration of AF events over the statistical period as the percentage of effective monitoring time.
- (8) Graphic trends: shows the trends of mean parameter value or maximum/minimum parameter value. The shaded part indicates that there is an A-Fib event. The triangular symbol ? indicates the occurrence time of the typical AF event or the maximum/minimum AF heart rate.
- (9) A-Fib waveform: shows ECG waveforms corresponding to the typical AF event or the maximum/minimum AF heart rate. Selecting the arrow on the upper right corner can review full disclosure ECG waveforms.
- (10) The Beat Anno: switch. To display beat labels on the first ECG waveform, switch on Beat Anno:. For more information, see *18.2.7.4 Viewing Event Details*.

### 19.7.3 Setting A-Fib Statistical Duration

You can view up to 24 hours of A-Fib statistics from the AF Summary window. Select **Zoom** to set statistical duration.

### 19.7.4 Setting Trend Parameters for the AF Summary

Select **Setup** to set parameters to be displayed in the AF Summary.

### 19.7.5 Setting the Type of Trend for the AF Summary

Select **Trends** to set whether the trend of maximum/minimum values or the trend of average values is displayed.

### 19.7.6 Printing the AF Summary Report

Select the printer symbol  to print the AF Summary report.

## 19.8 ECG 24h Summary

The ECG 24h Summary provides ECG statistics of the current patient over the latest 24 hours. It also displays the patient's typical ECG strips.

### NOTE

- **The ECG 24h Summary function is intended for the current patient. It is not intended for discharged patients.**
- **Pacer statistics is intended for paced patients. Pacer statistics is available only when the Paced setting is Yes.**
- **ST statistics is available only when ST analysis is switched on.**
- **QT statistics is available only when QT analysis is switched on.**
- **Data displayed in the ECG 24h Summary is not recalculated.**
- **A License is required for the ECG 24h Summary function.**

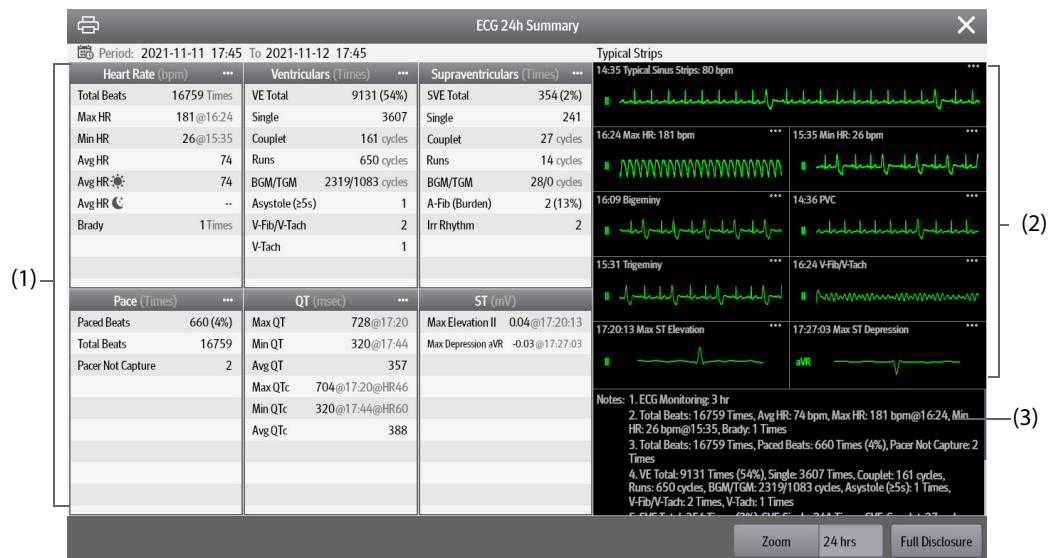
### 19.8.1 Opening the ECG 24h Summary Window

To open the ECG 24h Summary window, choose either of the following ways:

- Select the **ECG 24h Sum** quick key.
- Select the **Main Menu** quick key → from the **Summary** column select **ECG 24h Summary**.

## 19.8.2 The Display of ECG 24h Summary


The following figure is an example of the ECG 24h Summary window:



- (1) ECG statistics, including the following items:
  - Statistics of heart rates
  - Statistics of ventricular beats and ventricular events
  - Statistics of supraventricular beats and supraventricular events
  - Statistics of QT/QTc measurements
  - Statistics of maximum ST elevations and depressions
  - Statistics of pace
- (2) Typical ECG strips
- (3) Notes: includes additional information on the ECG 24h Summary

## 19.8.3 Selecting Typical ECG Strips

Taking V-Tach as an example, to select typical V-Tach waveform, select the currently displayed V-Tach waveform, from the popup list select the desired waveform as typical V-Tach waveform.

If no V-Tach occurs to the patient within 24 hours, an add symbol  is displayed in the V-Tach area. You can select the add symbol to display a typical ECG waveform of other event in this area.

## 19.8.4 Setting the Statistical Duration of the ECG 24h Summary

You can view a maximum of 24 hours of ECG statistics through the ECG 24h Summary. To select the statistical duration, select **Zoom**.

## 19.8.5 Reviewing the ECG Summary

Selecting any of the statistic area can access corresponding trends and events review. Selecting **Full Disclosure** can review ECG full disclosure waveforms. For more information, see *18 Review*.

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# 20 Calculation (only available for the independent external display)

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## 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

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### WARNING

- **Drug calculations are basing on input values. Always check the correctness of input parameters and the appropriateness of the calculations. Choice and dosage of drugs administered to patients must be decided by the physician in charge.**
- 

### NOTE

- **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 Management 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 × Weight/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

Description	Unit	Formula
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:

- 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**.
- Enter the known values. For a patient who is being monitored, the currently measured values are automatically taken.
- 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 15.7.5 Setting the Use PA-D as PAWP Switch.

### 20.4.3 Calculated Parameters and Formulas for Hemodynamic Calculations

Calculated Parameters	Label	Unit	Formula
cardiac index	C.I.	L/min/m <sup>2</sup>	C.I. (L/min/m <sup>2</sup> ) = C.O. (L/min)/BSA (m <sup>2</sup> )

Calculated Parameters	Label	Unit	Formula
body surface area	BSA	m <sup>2</sup>	$BSA (m^2) = Wt^{0.425} (kg) \times Ht^{0.725} (cm) \times 0.007184$
stroke volume	SV	ml	$SV (ml) = 1000 \times C.O. (L/min) / HR (bpm)$
stroke index	SVI	ml/m <sup>2</sup>	$SVI (ml/m^2) = SV (ml) / BSA (m^2)$
systemic vascular resistance	SVR	DS/cm <sup>5</sup>	$SVR (DS/cm^5) = 79.96 \times [PAMAP (mmHg) - CVP (mmHg)] / C.O. (L/min)$
systemic vascular resistance index	SVRI	DS•m <sup>2</sup> /cm <sup>5</sup>	$SVRI (DS \cdot m^2/cm^5) = SVR (DS/cm^5) \times BSA (m^2)$
pulmonary vascular resistance	PVR	DS/cm <sup>5</sup>	$PVR (DS/cm^5) = 79.96 \times [PAMAP (mmHg) - PAWP (mmHg)] / C.O. (L/min)$
pulmonary vascular resistance index	PVRI	DS•m <sup>2</sup> /cm <sup>5</sup>	$PVRI (DS \cdot m^2/cm^5) = PVR (DS/cm^5) \times BSA (m^2)$
left cardiac work	LCW	kg•m	$LCW (kg \cdot m) = 0.0136 \times PAMAP (mmHg) \times C.O. (L/min)$
left cardiac work index	LCWI	kg•m/m <sup>2</sup>	$LCWI (kg \cdot m/m^2) = LCW (kg \cdot m) / BSA (m^2)$
left ventricular stroke work	LVSW	g•m	$LVSW (g \cdot m) = 0.0136 \times PAMAP (mmHg) \times SV (ml)$
left ventricular stroke work index	LVSWI	g•m/m <sup>2</sup>	$LVSWI (g \cdot m/m^2) = LVSW (g \cdot m) / BSA (m^2)$
right cardiac work	RCW	kg•m	$RCW (kg \cdot m) = 0.0136 \times PAMAP (mmHg) \times C.O. (L/min)$
right cardiac work index	RCWI	kg•m/m <sup>2</sup>	$RCWI (kg \cdot m/m^2) = RCW (kg \cdot m) / BSA (m^2)$
right ventricular stroke work	RVS	g•m	$RVS (g \cdot m) = 0.0136 \times PAMAP (mmHg) \times SV (ml)$
right ventricular stroke work index	RVSWI	g•m/m <sup>2</sup>	$RVSWI (g \cdot m/m^2) = RVS (g \cdot m) / BSA (m^2)$
ejection fraction	EF	%	$EF (\%) = 100 \times SV (ml) / EDV (ml)$
End-diastolic volume index	EDVI	ml/m <sup>2</sup>	$EDVI (ml/m^2) = EDV (ml) / BSA (m^2)$
End-systolic Volume	ESV	ml	$ESV (ml) = EDV (ml) - SV (ml)$
End-systolic Volume index	ESVI	ml/m <sup>2</sup>	$ESVI (ml/m^2) = ESV (ml) / BSA (m^2)$

## 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:

- 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**.
- Enter the known values. For a patient who is being monitored, the currently measured values are automatically taken.
- 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 <sub>2</sub>	%
partial pressure of oxygen in the arteries	PaO <sub>2</sub>	mmHg, kPa
partial pressure of carbon dioxide in the arteries	PaCO <sub>2</sub>	mmHg, kPa
arterial oxygen saturation	SaO <sub>2</sub>	%
partial pressure of oxygen in venous blood	PvO <sub>2</sub>	mmHg, kPa
venous oxygen saturation	SvO <sub>2</sub>	%
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 <sup>2</sup>	$BSA (m^2) = Wt^{0.425} (kg) \times Ht^{0.725} (cm) \times 0.007184$
oxygen consumption	VO <sub>2</sub>	ml/min	$VO_2 (ml/min) = C(a-v)O_2 (ml/L) \times C.O. (L/min)$
arterial oxygen content	CaO <sub>2</sub>	ml/L, ml/dL	$CaO_2 (ml/L) = 10 \times (0.0134 \times Hb (g/dl) \times SaO_2 (\%) + 0.031 \times PaO_2 (mmHg))$
venous oxygen content	CvO <sub>2</sub>	ml/L, ml/dL	$CvO_2 (ml/L) = 10 \times (0.0134 \times Hb (g/dl) \times SvO_2 (\%) + 0.031 \times PvO_2 (mmHg))$
arteriovenous oxygen content difference	C(a-v)O <sub>2</sub>	ml/L, ml/dl	$C(a-v)O_2 (ml/L) = CaO_2 (ml/L) - CvO_2 (ml/L)$
oxygen extraction ratio	O <sub>2</sub> ER	%	$O_2ER (\%) = 100 \times C(a-v)O_2 (ml/L) / CaO_2 (ml/L)$
oxygen transport	DO <sub>2</sub>	ml/min	$DO_2 (ml/min) = C.O. (L/min) \times CaO_2 (ml/L)$
partial pressure of oxygen in the alveoli	PAO <sub>2</sub>	mmHg, kPa	$PAO_2 (mmHg) = [ATMP (mmHg) - 47 mmHg] \times FiO_2 (\%) / 100 - PaCO_2 (mmHg) \times [FiO_2 (\%) / 100 + (1 - FiO_2 (\%) / 100) / RQ]$
alveolar-arterial oxygen difference	AaDO <sub>2</sub>	mmHg, kPa	$AaDO_2 (mmHg) = PAO_2 (mmHg) - PaO_2 (mmHg)$
capillary oxygen content	CcO <sub>2</sub>	ml/L, ml/dl	$CcO_2 (ml/L) = Hb (g/L) \times 1.34 + 0.031 \times PAO_2 (mmHg)$

Calculated Parameters	Label	Unit	Formula
venous admixture	QS/QT	%	$QS/QT (\%) = 100 \times [1.34 \times Hb (g/L) \times (1 - SaO_2 (\%)/100) + 0.031 \times (PAO_2 (mmHg) - PaO_2 (mmHg))] / [1.34 \times Hb (g/L) \times (1 - SvO_2 (\%)/100) + 0.031 \times (PAO_2 (mmHg) - PvO_2 (mmHg))]$
oxygen transport index	DO <sub>2</sub> I	ml/min/m <sup>2</sup>	$DO_2I (ml/min/m^2) = CaO_2 (ml/L) \times (C.O. (L/min)/BSA (m^2))$
oxygen consumption	VO <sub>2</sub> I	ml/min/m <sup>2</sup>	$VO_2I (ml/min/m^2) = C (a-v) O_2 (ml/L) \times (C.O. (L/min)/BSA (m^2))$

## 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:

- 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**.
- 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.
- 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 <sub>2</sub>	%
respiration rate	RR	rpm
partial pressure of mixed expiratory CO <sub>2</sub>	PeCO <sub>2</sub>	mmHg, kPa
partial pressure of carbon dioxide in the arteries	PaCO <sub>2</sub>	mmHg, kPa
partial pressure of oxygen in the arteries	PaO <sub>2</sub>	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 <sub>2</sub>	mmHg, kPa	$PAO_2 \text{ (mmHg)} = [ATMP \text{ (mmHg)} - 47 \text{ mmHg}] \times FiO_2 \text{ (\%)/100} - PaCO_2 \text{ (mmHg)} \times [FiO_2 \text{ (\%)/100} + (1 - FiO_2 \text{ (\%)/100})/RQ]$
alveolar-arterial oxygen difference	AaDO <sub>2</sub>	mmHg, kPa	$AaDO_2 \text{ (mmHg)} = PAO_2 \text{ (mmHg)} - PaO_2 \text{ (mmHg)}$
oxygenation ratio	Pa/FiO <sub>2</sub>	mmHg, kPa	$Pa/FiO_2 \text{ (mmHg)} = 100 \times PaO_2 \text{ (mmHg)}/FiO_2 \text{ (\%)}$
arterial to alveolar oxygen ratio	a/AO <sub>2</sub>	%	$a/AO_2 \text{ (\%)} = 100 \times PaO_2 \text{ (mmHg)}/PAO_2 \text{ (mmHg)}$
minute volume	MV	L/min	$MV \text{ (L/min)} = [TV \text{ (ml)} \times RR \text{ (rpm)}]/1000$
volume of physiological dead space	Vd	ml	$Vd \text{ (ml)} = TV \text{ (ml)} \times [1 - PaCO_2 \text{ (mmHg)}/PaCO_2 \text{ (mmHg)}]$
physiologic dead space in percent of tidal volume	Vd/Vt	%	$Vd/Vt \text{ (\%)} = 100 \times Vd \text{ (ml)}/TV \text{ (ml)}$
alveolar volume	VA	L/min	$VA \text{ (L/min)} = [TV \text{ (ml)} - Vd \text{ (ml)}] \times RR \text{ (rpm)}/1000$

## 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:

- 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**.
- Enter the known values. .
- 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 potassium	URK	mmol/L
urinary sodium	URNa	mmol/L
urine	Urine	ml/24 hrs
plasma osmolality	Posm	mOsm/kgH <sub>2</sub> O
urine osmolality	Uosm	mOsm/kgH <sub>2</sub> O
serum sodium	SerNa	mmol/L
creatinine	Cr	μmol/L
urine creatinine	UCr	μmol/L

Input Parameter	Label	Unit
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	$\text{URNaEx (mmol/24 hrs)} = \text{Urine (ml/24 hrs)} \times \text{URNa (mmol/L)} / 1000$
urine potassium excretion	URKEx	mmol/24 hrs	$\text{URKEx (mmol/24 hrs)} = \text{Urine (ml/24 hrs)} \times \text{URK (mmol/L)} / 1000$
sodium potassium ratio	Na/K	%	$\text{Na/K (\%)} = 100 \times \text{URNa (mmol/L)} / \text{URK (mmol/L)}$
clearance of sodium	CNa	ml/24 hrs	$\text{CNa (ml/24 hrs)} = \text{URNa (mmol/L)} \times \text{Urine (ml/24 hrs)} / \text{SerNa (mmol/L)}$
creatinine clearance rate	Clcr	ml/min	$\text{Clcr (ml/min)} = \text{Ucr (\mu mol/L)} \times \text{Urine (ml/24 hrs)} / [\text{Cr (\mu mol/L)} \times (\text{BSA (m}^2\text{)} / 1.73) \times 1440]$
fractional excretion of sodium	FENa	%	$\text{FENa (\%)} = 100 \times \text{URNa (mmol/L)} \times \text{Cr (\mu mol/L)} / [\text{SerNa (mmol/L)} \times \text{Ucr (\mu mol/L)}]$
osmolar clearance	Cosm	ml/min	$\text{Cosm (ml/min)} = \text{Uosm (mOsm/kgH}_2\text{O)} \times \text{Urine (ml/24 hrs)} / (\text{Posm (mOsm/kgH}_2\text{O)} \times 1440)$
free water clearance	CH <sub>2</sub> O	ml/hr	$\text{CH}_2\text{O (ml/hr)} = \text{Urine (ml/24 hrs)} \times [1 - \text{Uosm (mOsm/kgH}_2\text{O)} / \text{Posm (mOsm/kgH}_2\text{O)}] / 24$
urine to plasma osmolality ratio	U/P osm	None	$\text{U/P osm} = \text{Uosm (mOsm/kgH}_2\text{O)} / \text{Posm (mOsm/kgH}_2\text{O)}$
blood urea nitrogen creatinine ratio	BUN/Cr*	Mmol/L	$\text{BUN/Cr} = 1000 \times \text{BUN (mmol/L)} / \text{Cr (\mu mol/L)}$
urine-serum creatinine ratio	U/Cr	None	$\text{U/Cr (mmol/L)} = \text{Ucr (\mu mol/L)} / \text{Cr (\mu mol/L)}$

\*: BUN/Cr is a ratio at mol unit system.

# 21 Printing

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The monitor can output patient reports via network printer or print server.

## 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
- HP LaserJet M507dn

### 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 *Setting 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  to print a realtime report. You can also print a realtime report from the **Report Setup** page. For more information, see 21.3.3 *Printing Common Reports*.

#### 21.3.3 Printing Common Reports

You can print the following common reports:

- ECG Report
- Realtime Report
- Tabular Trends Report
- Graphic Trend Report

To print the 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 **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	<b>On:</b> automatically adjusts the space between waveforms to avoid overlapping. <b>Off:</b> each waveform area has the same size on a printout.
	Note: This setting is only relevant when <b>12x1</b> is selected for <b>12-Lead Format</b> .	
12-Lead Format	Select the format of 12-lead ECG waveforms on a printout.	<b>12x1:</b> displays 12-lead ECG waveforms on one page in one column. <b>6x2:</b> displays 12-lead ECG waveforms on one page in two columns, with 6 lines in each column. <b>6x2+1:</b> 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. <b>3x4+1:</b> 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. <b>3x4+3:</b> 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 <b>6x2+1</b> , <b>3x4+1</b> , or <b>3x4+3</b> is selected for <b>12-Lead Format</b> .	
Format Sequence	Select the recording method of ECG report generated by auto measurement	<b>Sequential:</b> 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. <b>Simultaneous:</b> 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**.
2. Select **Realtime Report**.
3. Set the desired options. The following table only lists some of the options.

Menu item	Function	Description
Select Waveform	Select the desired waveform to print	<b>Current Waveforms:</b> prints the realtime report for current waveforms. <b>Selected Waveforms:</b> 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 lists some of the options.

Menu Item	Function	Description
Period	Select the period during which a tabular trends report will be printed.	<b>Auto:</b> one page of a tabular trends before the current time will be printed at the selected <b>Interval</b> . <b>All:</b> all stored tabular trends will be printed at the selected <b>Interval</b> . <b>30 min to 96 hrs:</b> 30 min to 96 hrs of tabular trends before the selected <b>Time</b> will be printed at the selected <b>Interval</b> .
Interval	Select the resolution of the tabular trends printed on a report.	<b>NIBP, EWS, GCS:</b> at an interval of acquiring the values of selected parameter. <b>Auto:</b> using the <b>Interval</b> setting of the <b>Tabular Trends</b> review page. <b>5 sec to 3 hrs:</b> the tabular trends will be printed at the selected <b>Interval</b> .
Report Format	Select the printing principle.	<b>Parameter Oriented:</b> parameter values are listed vertically and trend time is listed horizontally.. <b>Time Oriented:</b> trend time is listed vertically and parameter values are listed horizontally.

## 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 the **Graphic Trends Report** tab.
3. Set the desired options.

Menu Item	Function	Description
Period	Select the period during which a graphic trends report will be printed.	<b>Auto:</b> one page of a graphic trends before the current time will be printed. <b>All:</b> all stored graphic trends will be printed.. <b>30 min to 96 hrs:</b> 30 min to 96 hrs of graphic trends before the selected <b>Time</b> will be printed.



## 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 print 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. The monitor provides different maintenance menus for different user types. The following table lists the access authorization of different users.


User Type	Menu
Clinical professional	Device Location, Patient Management, Alarm, CAA, Module, Review, Print, Unit, Time, Other,
Biotechnical personnel	Device Location, Patient Management, Alarm, CAA, Module, Review, Print, Unit, Time, Other, Authorization Setup, Version, Battery Information, Scanner, Network Setup,
Service personnel	Device Location, Patient Management, Alarm, CAA, Module, Review, Print, Unit, Time, Other, Authorization Setup, Version, Battery Information, Scanner, Network Setup, Factory Maintenance.

## 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	Description
Monitor Name	/	/
Facility		
Department		
Location	Fixed	<ul style="list-style-type: none"><li>• <b>Fixed:</b> the <b>Patient Management</b> menu displays Bed No. and Room No., but you cannot change them.</li><li>• <b>Unfixed:</b> you can change Bed No. and Room No. from the <b>Patient Management</b> menu. Bed No. and Room No. are cleared each time you discharge a patient.</li></ul>
Room No.	/	/
Bed No.		

## 22.3 The Patient Management Settings

### 22.3.1 The Field Tab

Menu Item	Default Setting	Description
Room No	Unselected	Selects which items can be displayed and edited from the <b>Patient Management</b> menu.
Visit Number	Unselected	
Patient ID	Selected	
Middle Name	Unselected	
Race	Unselected	
Age (Gestational Age: Neo)	Selected	
Custom Field 1- Custom Field 4	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 Find Patient Tab

Menu Item		Default Setting	Description
Find Patient		All Patients	Selects which patient can be found in the CMS or the ADT server. <b>All Patients:</b> searches from all patients in the CMS or ADT server. <b>Current Department Patients:</b> searches from the current department in the CMS or ADT server.
ADT Query	Facility	Unselected	Selects which criteria are used to search patients in the ADT server.  If <b>Find Patient</b> is set to <b>All Patients</b> , you can search from all patients in the ADT server.  If <b>Find Patient</b> is set to <b>Current Department Patients</b> , you can only search from the current department 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. <b>Never:</b> not discharge a patient no matter for how long the monitor has been switched off.
Auto delete discharged patients when storage space is full	On	/
Prompt on patient auto deleted	On	<b>On:</b> an alarm is issued when the monitor automatically deletes earlier discharged patients.

Menu Item	Default Setting	Function
Prompt Alarm When Storage Is Nearly Full	Med	Selects whether an alarm is issued when the monitor memory is very low and the priority of this alarm.
Include Patient Demographics When Exporting Patient Data	Off	Selects whether patient demographics is included when exporting the patient data.
Auto Delete Patient Data if Discharged	Auto	<p>Selects whether patient data is deleted when the patient is discharged.</p> <ul style="list-style-type: none"> <li>• <b>Auto:</b> not delete patient data when the patient is discharged. Discharged patient will be deleted when the storage space of the monitor is full.</li> <li>• <b>Right Now:</b> deletes patient data as soon as the patient is discharged.</li> <li>• <b>7 days:</b> deletes patient data seven days after the patient is discharged.</li> <li>• <b>1 Month:</b> deletes patient data one month after the patient is discharged</li> </ul>
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	Description
Location 1 - Location 10	/	Selects where the patient goes after patient monitoring stops.

#### 22.3.5 The Display Tab

Menu Item	Default Setting	Description
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.
Primary Screen Display Full Patient ID	Off	Selects whether patient ID is displayed in the patient information area on the primary display.
Secondary Screen Display Full Patient ID	Off	Selects whether patient ID is displayed in the patient information area on the secondary display, if configured.

## 22.4 The Alarm Settings

### 22.4.1 The Audio Tab

Menu Item	Default Setting	Description
Minimum Alarm Volume	2	/
Alarm Sound	ISO2	Defines the alarm tone pattern. When ISO2 is selected, the monitor can generate special alarm sound.
High Alarm Interval	3 sec	Defines the interval between alarm tones for the ISO mode and ISO2 mode.
Med Alarm Interval	8 sec	
Low Alarm Interval	20 sec	
Auto Increase Volume	2 Steps	<ul style="list-style-type: none"><li>• <b>2 Steps:</b> if an alarm is not reset within the designated delay time after the alarm occurs, the alarm volume automatically increases by two levels.</li><li>• <b>1 Step:</b> if an alarm is not reset within the designated delay time after the alarm occurs, the alarm volume automatically increases by one level.</li><li>• <b>Off:</b> if an alarm is not reset within the designated delay time after the alarm occurs, the volume of the alarm tone does not change.</li></ul>
Increase Volume Delay	20 sec	Defines the delay time of alarm volume escalation
Special Advanced Alarm Sound (Asystole, V-Fib/V-Tach, V-Tach, Vent Brady, Extreme Tachy, Extreme Brady, SpO2 Desat, Apnea)	Unselected	If ISO2 alarm sound mode is selected, the monitor gives special alarm sound to indicate that the patient may be in a critical condition when an selected alarm is triggered.

#### 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	Description
Pauses	Pause	Alarm Pause	Selects the pause function. <ul style="list-style-type: none"> <li>• <b>Alarm Pause:</b> pauses alarms.</li> <li>• <b>Audio Pause:</b> pauses alarm tones.</li> </ul>
	Pause Time	2 min	Selects the alarm pause time. The alarm pause time can be set to <b>1 min, 2 min, 3 min</b> , or <b>Permanent</b> .
	Pause Priority	All	Selects alarms of what priority can be paused. <ul style="list-style-type: none"> <li>• <b>All:</b> pressing the <b>Alarm Pause</b> quick key pauses all alarms.</li> <li>• <b>Med &amp; Low:</b> pressing the <b>Alarm Pause</b> quick key pauses alarms of medium and low priority. The high priority alarms will not be paused.</li> <li>• <b>Disabled:</b> the <b>Alarm Pause</b> quick key is disabled.</li> </ul>
	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	<ul style="list-style-type: none"> <li>• <b>On When Reset:</b> when the alarm system is reset, the alarm tones of the current alarms are switched off, but the alarm lamp remains flashing.</li> <li>• <b>Off When Reset:</b> when the alarm system is reset, both the alarm tone and alarm lamp of the current alarms are switched off.</li> </ul>
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. <ul style="list-style-type: none"> <li>• <b>On:</b> the monitor issues reminder tones at a designated interval.</li> <li>• <b>Re-alarm:</b> if the alarm condition persists, the alarms marked with “√” will be regenerated after the designated reminder tone interval.</li> <li>• <b>Off:</b> the monitor does not issue reminder tones at a designated interval. The alarms marked with “√” will be silenced.</li> </ul>
	Alarm Off Reminder	On	/
	Reminder Interval	5 min	<ul style="list-style-type: none"> <li>• <b>10 min:</b> the monitor issues reminder tones every 10 minutes.</li> <li>• <b>5 min:</b> the monitor issues reminder tones every five minutes.</li> <li>• <b>3 min:</b> the monitor issues reminder tones every three minutes.</li> <li>• <b>2 min:</b> the monitor issues reminder tones every two minutes.</li> <li>• <b>1 min:</b> the monitor issues reminder tones every one minute.</li> </ul>



### 22.4.3 The Latching Tab

Menu Item		Default Setting	Description
Lethal	Visible	Unselected	Selects alarm latching rules: <ul style="list-style-type: none"> <li>If <b>Visible</b> is selected, you can separately latch visual alarm signal.</li> <li>Latching audible alarm signal simultaneously latches visual signal.</li> <li>Selecting alarms of lower priority simultaneously latches higher priority alarms.</li> </ul>
	Audible		
High	Visible		
	Audible		
Med	Visible		
	Audible		
Low	Visible		
	Audible		

### 22.4.4 The Guard Limits Tab

Menu Item	Default Setting	Description
Disable Off	Lethal Arrhy, SpO2 Desat, Apnea: On Others: Off	<b>On:</b> the alarm cannot be switched off. <b>Off:</b> the alarm can be switched off from the  <b>Alarm</b> menu.
Highest	/	The alarm high limit cannot be set higher than this setting.
Lowest	/	The alarm low limit cannot be set lower than this setting.
Priority	RR, Temp: ≥Low Others: ≥Med	The alarm priority setting cannot be lower than this setting.
Clear	/	Selecting <b>Clear</b> can resume default guard limits
Patient Category	Adult	Sets patient category.

### 22.4.5 The Combined Alarm Tab

Menu Item	Description
Check box	Selects combined alarms that can be displayed and modified from the Combined Alarm setup of the  <b>Alarm</b> menu.
Name	Selects the alarm name to change the default name of corresponding alarm.
Icon Type	In the Patient Status window, the selected icon is used to indicate the alarmed system or organ. You can only select icon type of a custom combined alarm.
Notification	<ul style="list-style-type: none"> <li><b>Only Alarm:</b> when a combined alarm occurs, alarm message is displayed in the physiological alarm area.</li> <li><b>Only Popup:</b> when a combined alarm occurs, the Patient Status window pops up.</li> <li><b>Alarm+Popup:</b> when a combined alarm occurs, alarm message is displayed in the physiological alarm area and the Patient Status window pops up.</li> </ul>
Delay	Sets the default delay of the combined alarm.
Combined Alarm Refractory Period	Sets the refractory period of combined alarms. In the refractory period, the alarm will not be presented even if the alarm condition occurs again.
Add	Adds custom combined alarms and sets alarm properties. To delete an custom alarm, select the editing symbol  to enter the <b>Custom Combined Alarm</b> menu and select <b>Delete</b> .

The following table lists the predefined combined alarms and their default settings:



Name	Icon Type	Default Notification Type	Default Delay Time
HR>100 with IBP-S<90 and RR>22 over 1 min	Circulatory	Alarm+Popup	1 min
qSOFA score $\geq 2$ over 1 min	Infection	Only Popup	1 min
ICP-M > 20 over 5 min	Neuro	Alarm+Popup	5 min
CPP > 95 over 5 min	Neuro	Alarm+Popup	5 min
CPP < 60 over 5 min>	Neuro	Alarm+Popup	5 min
EtCO <sub>2</sub> $\leq 15$ over 3 min, or EtCO <sub>2</sub> $\geq 60$ over 3 min, or RR $\leq 5$ over 3 min, or SpO <sub>2</sub> $\leq 85$ over 3 min	Respiratory	Only Popup	3 min
Sys $\downarrow$ 20% within 30 min, or Sys $\uparrow$ 20% within 30 min	Circulatory	Only Popup	30 min
HR/PR $\downarrow$ 20% within 30 min, or HR/PR $\uparrow$ 20% within 30 min	Circulatory	Only Popup	30 min
A-Fib with RVR over 1 min	Heart	Alarm+Popup	1 min
A-Fib with Long R-R Interval	Heart	Alarm+Popup	/
R on T with QT Prolonged	Heart	Alarm+Popup	/
Freq. PVCs with QT Prolonged	Heart	Alarm+Popup	/

## 22.4.6 The Remote View Tab (Only available for the independent external display)

Menu Item	Default Setting	Description
Reset Remote Bed Alarms	Off	Selects whether you can reset alarms occurring to the remote devices from your monitor. <b>On:</b> the <b>Alarm Reset</b> button appears on the bottom left of the <b>Remote View</b> screen.
Alarm Reset By Other Bed	On	<b>On:</b> alarms on your monitor can be reset by remote devices.
Alarm Reminder	Visible+Audible	Selects what alarm indicators are necessary for the remote devices. <ul style="list-style-type: none"> <li><b>Visible+Audible:</b> the monitor provides visual alarm indication, and continuous audible alarm indication if the alarm persists at the remote device.</li> <li><b>Visible+Single Tone:</b> the monitor provides visual alarm indication, and a single tone when the alarm occurs at the remote device.</li> <li><b>Visible Only:</b> the monitor only provides visual alarm indication.</li> </ul>
Alarm Priority	All	Selects what priority of remote device alarms are presented for audible notification <ul style="list-style-type: none"> <li><b>All:</b> the monitor sounds if an alarm occurs.</li> <li><b>High &amp; Med:</b> the monitor sounds if a high or medium priority alarm occurs.</li> <li><b>High Only:</b> the monitor sounds only if a high priority alarm occurs.</li> </ul>
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.

## 22.4.7 The Other Tab

Section	Menu Item	Default Setting	Description
Alarm Priority	ECG Lead Off	Low	Selects the priority of the ECG lead off alarm.
	SpO2 Sensor Off	Low	Selects the priority of the SpO <sub>2</sub> sensor off alarm.
	IBP No Sensor	Med	Selects the priority of the IBP No Sensor alarm.
	CMS/eGW Disconnected	Low	Selects the priority of the CMS and eGateway disconnection alarm.
Alarm Delay	Alarm Delay	12 sec	<p><b>1sec - 15 sec:</b> for continuously measured parameters, the monitor does not present the alarm if the alarm condition is resolved within the delay time.</p> <p><b>Off:</b> an alarm is always presented.</p> <p>The setting of <b>Alarm Delay</b> is not applied to the pArt alarms, apnea alarms, and the ST alarms.</p>
	ST Alarm Delay	30 sec	The monitor does not present the ST alarm if the alarm condition is resolved within the delay time.
Other	Arrhy Shield Time	2 min	<p>Alarm light and alarm tone will be disabled for designated period of time when certain arrhythmia alarms are detected.</p> <p><b>0:</b> disables this function.</p>
	Intubation Mode Period	2 min	Selects the time for intubation.
	Battery Off Alarm	On	/
	CMS/eGW Disconnected Alarm	Off	<p>Selects whether an alarm is issued when the monitor is not connected or disconnected from the CMS/eGateway.</p> <p><b>Off:</b> the "Offline" alarm is not presented when the monitor is not connected or disconnected from the CMS/eGateway.</p>
	Alarm Escalation	On	Select whether the alarm escalation function is available.
	Disable Night Mode	Off	<p>Select whether the night mode function is available.</p> <p><b>On:</b> the night mode function is not available.</p> <p><b>Off:</b> the night mode function is available.</p>
	Notify Alarm Setting Change	Off	Select whether the monitor gives an prompt when alarm settings, including alarm limits, priorities, and switches, are changed from the CMS.

## 22.5 The CAA Settings

### 22.5.1 The EWS Tab

Menu Item	Default Setting	Description
Clinician ID	Off	Selects whether to allow inputting the clinician ID to associate with the EWS score.
Clinician ID Timeout	10 min	Selects how long the clinician ID will remain valid
Default Adult Score	NEWS	Selects the default scoring tool for different patient categories.
Default Ped Score	/	
Default Neo Score	/	

Menu Item		Default Setting	Description
Manage Score	Local	/	<b>Delete:</b> deletes the selected scoring tools. The monitor provide MEWS and NEWS by default. You cannot delete them.
	USB Drive	/	<b>Import:</b> imports the desired scoring tools to the monitor.

## 22.5.2 The GCS Tab

Menu Item		Default Setting	Description
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 SepsisSight Tab

Menu Item	Default Setting	Description
The first of resuscitation	1 hr	Select desired period of initial resuscitation. Select and edit the goals for initial resuscitation.
Bundles	1hr	Select and edit treatments to be completed in 1 hour, 3 hour, and 6 hours.

## 22.6 The Module Settings

### 22.6.1 The ECG Tab

Menu Item	Default Setting	Description
ECG Standard	AHA	Selects the ECG standard according to the leadwires you are using.
QTc Formula	Hodges	<p>Selects the QTc formula used to correct the QT interval for heart rate.</p> <ul style="list-style-type: none"> <li><b>Hodges:</b>  <math display="block">QTc = QT + (1.75) \times (HeartRate - 60)</math> </li> <li><b>Bazett:</b>  <math display="block">QTc = QT \times \left(\frac{HeartRate}{60}\right)^{\frac{1}{2}}</math> </li> <li><b>Fridericia:</b>  <math display="block">QTc = QT \times \left(\frac{HeartRate}{60}\right)^{\frac{1}{3}}</math> </li> <li><b>Framingham:</b>  <math display="block">QTc = QT + 154 \times \left(1 - \frac{60}{HeartRate}\right)</math> </li> </ul>

Menu Item	Default Setting	Description
12-Lead Order	No	Selects whether to send the order of 12-lead interpretation report to the hospital information system while saving the report.
CrozFusion Sync Time	Off	Sets whether to enable arrhythmia suppress when CrozeFusion is on. If enabled, suspicious arrhythmia alarms will not be reported.
Arrhy Suppress Event	Off	Sets whether to save an event when an arrhythmia alarm is suppressed. If saved, this event can be reviewed when needed.
Calibration	/	Select this button to calibrate the ECG module.

### 22.6.2 The CO<sub>2</sub> Tab

Menu Item	Default Setting	Description
Zero Recovery For 30s	On	<p><b>On:</b> After the zero calibration is completed, the CO<sub>2</sub> module reacquires the CO<sub>2</sub> readings. During the reacquisition period, "Zero Recovering" is displayed in the CO<sub>2</sub> numeric area.</p> <p><b>Off:</b> After the zero calibration is completed, the CO<sub>2</sub> module reacquires the CO<sub>2</sub> readings. During the reacquisition period, "Zero Recovering" is not displayed in the CO<sub>2</sub> numeric area.</p>
Zero	/	Select this button to start zeroing the CO <sub>2</sub> module.

### 22.6.3 The Other Tab

Menu Item	Default Setting	Description
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	
CO <sub>2</sub> Flow Rate For Neo (For Sidestream CO <sub>2</sub> Module Without O <sub>2</sub> )	90 ml/min	Selects flow rate when using the sidestream CO <sub>2</sub> without the O <sub>2</sub> monitoring function to monitor a neonatal patient.
Outline Font for Suspected Values	On	Selects whether unreliable HR and SpO <sub>2</sub> measurements are displayed in outline font. This prevents unreliable measurements from being misinterpreted as normal measurements,
IBP Interference Refractory Period	60 sec	<p>Within the designated period of time, when interferences occur to the arterial pressure (except for PA) from a certain IBP channel, the monitor only displays the mean pressure value of this arterial pressure. Physiological alarms related to this IBP channel and technical alarms, including "XX No Pulse" and "XX Searching Pulse", are inactivated.</p> <p>XX represents corresponding IBP label.</p>

## 22.7 The Review Settings

### 22.7.1 The Tabs Tab

Menu Item	Default Setting	Description
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	Description
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.

### 22.7.4 The Export Tab

From the **Export** page, select **Export Patient Data**, and then select desired patients from the patient list to export data of selected patients via a USB drive.

## 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	

Menu Item		Default Setting	Description
Print Server Address		/	For print server only. If the CMS is used as the printer server, set the <b>Port</b> 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.

## NOTE

- **General reports refer to the reports other than the end case report and realtime alarm report.**

### 22.8.2 The Report Layout Tab

Menu Item	Default Setting	Description
Report Layout	/	Selects the contents and location of the patient information included in non-ECG reports. <b>N/A:</b> 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	Description
Patient Name/Age (Gestational Age: Neo)/ Gender	/	Selects the patient information you want to display on ECG reports.
Patient ID	Selected	
Visit Number/DOB/Race/Medication/Class/ Physician/Technician/Department/Room No/ Bed No/12-Lead Order	Unselected	

## 22.8.4 The PDF File Name Tab

Menu Item	Default Setting	Description
PDF File Name	/	Selects the name of PDF files. <b>N/A:</b> refers to no information.

## 22.8.5 The Other Tab

Menu Item	Default Setting	Description
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	Description
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 <sup>5</sup>	

## 22.10 The Time Settings

### 22.10.1 The Time Synchronization Tab

Section	Menu Item	Default Setting	Description
Nighttime	From	22:00	Defines the night time period.
	To	06:00	
/	Start NTP Time Sync	Off	<b>On:</b> enables synchronizing the monitor time with the NTP server time.
/	Interval	1 hr	Select the time interval for synchronizing the monitor time with the NTP server time.
/	Time Server Address	/	The domain name of the time server.
/	Time Server	/	The IP address of the time server.
/	Network Test	/	Tests whether the NTP server is properly connected.

## 22.10.2 The Daylight Savings Time Tab

Section	Default Setting	Description
Auto Daylight Savings Time	Off	<b>On:</b> auto starts the daylight saving time.

## 22.11 The Other Settings

Menu Item	Default Setting	Description
Barometric Pressure	760 mmHg	For the mainstream CO2 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: <ul style="list-style-type: none"> <li><b>Manual:</b> Select the <b>Main Menu</b> quick key, then from the <b>Display</b> column select <b>Enter Outdoor Mode</b> to enter the outdoor mode.</li> <li><b>Auto:</b> The monitor enters the outdoor mode automatically if the strength of ambient light is greater than the threshold.</li> </ul>
Clear CMS IP at startup	On	/
Manual Event Edit	OR: Off Other departments: On	Selects whether selecting and editing the name of a manual event is allowed.
Screenshot (only available when the N1 is used with the independent external display)	Off	<b>On:</b> the screen capture function is available. <b>Off:</b> the screen capture function is not available.
SpO2 Tone	Mode 1	Selects the SpO <sub>2</sub> tone mode. The monitor adjusts the QRS tone (pitch tone) according to the SpO <sub>2</sub> values. The same SpO <sub>2</sub> tone mode shall be used for the same monitors in a single area.
Language	/	/
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	/	Selects what parameters can be monitored.
Browse System Log		Selects this button to enter the <b>System Log</b> page, and then select the log classifications you want to view. Selecting <b>Search</b> to view the selected logs. To view logs of certain date and time, select <b>Jump To</b> and define the date and time.  System log can store 15,000 events. Earlier events will be overwritten by later ones if the capacity is reached. A total loss of power has no impact on system log.
Export System Log		Selects this button to export the system log to the USB drive.



## 22.12 The Authorization Setup Settings

Section	Menu Item	Default Setting	Description
/	Automatic Logout 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.
Maintenance	User Maintenance	Local Password	Selects the password for accessing the monitor's <b>Maintenance</b> menu. <ul style="list-style-type: none"> <li>• <b>Local Password:</b> the monitor's password for accessing the <b>Maintenance</b> menu is required.</li> <li>• <b>User Password:</b> the user name and password saved in the MLDAP server are required.</li> </ul>
	Modify Local Password	/	Changes the monitor's password for accessing the <b>Maintenance</b> menu.
Clinic	Alarm Setup	No Password	Selects the password for changing alarm settings. <ul style="list-style-type: none"> <li>• <b>No Password:</b> changing alarm settings is not password protected.</li> <li>• <b>Local Password:</b> changing alarm switch, alarm limit, and alarm priority is password protected. The monitor's clinic password is required.</li> <li>• <b>User Password:</b> changing alarm switch, alarm limit, and alarm priority is password protected. The user name and password saved in the MLDAP server are required.</li> </ul>
	Arrhythmia	No Password	Selects the password for changing arrhythmia settings. <ul style="list-style-type: none"> <li>• <b>No Password:</b> changing arrhythmia settings is not password protected.</li> <li>• <b>Local Password:</b> changing arrhythmia switch, alarm priority, and arrhythmia threshold is password protected. The monitor's clinic password is required.</li> <li>• <b>User Password:</b> changing arrhythmia switch, alarm priority, and arrhythmia threshold is password protected. The user name and password saved in the MLDAP server are required.</li> </ul>
	View Discharged Patients	No Password	Selects the password for viewing discharged patients. <ul style="list-style-type: none"> <li>• <b>No Password:</b> viewing discharged patients is not password protected.</li> <li>• <b>User Password:</b> viewing discharged patients is password protected. The user name and password saved in the MLDAP server are required.</li> </ul>
	Viewing Patient Review Data	No Password	Selects the password for reviewing patient data. <ul style="list-style-type: none"> <li>• <b>No Password:</b> reviewing patient data is not password protected.</li> <li>• <b>Local Password:</b> reviewing patient data is password protected. The monitor's clinic password is required.</li> </ul>
	Modify Local Password	/	Changes the monitor's clinic password.

Section	Menu Item	Default Setting	Description
Remote Screen	Remote Screen	Enable	<p>Selects the password for starting remote screens.</p> <ul style="list-style-type: none"> <li>• <b>Disable:</b> you cannot start remote screens for this monitor.</li> <li>• <b>Enable:</b> starting remote screens is not password protected.</li> <li>• <b>Local Password:</b> starting remote screens is password protected. The monitor's password for remote screens is required.</li> <li>• <b>User Password:</b> starting remote screens is password protected. The user name and password saved in the MLDAP server are required.</li> </ul>
	Modify Local Password	/	Changes the monitor's password for starting remote screens.

## 22.13 The Version Settings

Tab	Default Setting	Description
Version	/	Displays system software version, module hardware and software version, and firmware version.

## 22.14 The Battery Information Settings

Tab	Default Setting	Description
Battery1	/	Displays battery information.
Battery2	/	

## 22.15 The Scanner Settings

### 22.15.1 The 2D Barcode Tab (for the Mindray Custom 2D Barcode Reader)

Tab	Default Setting	Description
2D Barcode	/	<p>Establishes the relationship between the monitor data and barcode data for selectable patient demographics.</p> <p>For example, the monitor has an option of <b>Ped</b> for patient category. In your hospital barcode, the text may read as <b>Pediatric</b>. You need to input <b>Pediatric</b> for the field <b>Ped</b> to establish their relationship.</p>

### 22.15.2 The 1D Barcode Tab

Menu Item	Default Setting	Description
Content Fill to	Patient ID	/

### 22.15.3 The Scanner Information Tab

Menu Item	Default Setting	Description
Scanner Type	2D Scanner	<ul style="list-style-type: none"><li>• <b>1D Scanner:</b> select this option when you are using a 1D scanner or a 2D scanner other than the Mindray custom 2D scanner.</li><li>• <b>2D Scanner:</b> select this option when you are using the Mindray custom scanner.</li></ul>
Data Encoding Type	UTF8	When you set <b>Scanner Type</b> to <b>2D Scanner</b> , default settings are applied to <b>Data Encoding Type</b> and <b>Data Parse Mode</b> . 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	Description
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	Description
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 (Gestational Age: Neo)/Department/Custom Field 1 - 4	Unselected	

## 22.16 The Network Setup Settings

### 22.16.1 The WLAN Tab

Menu Item		Default Setting	Description
WLAN IP		/	Add wireless network and set the network in the pop-up menu.
WLAN	Name	/	Input the name of the wireless network.
	SSID	/	/
	Security	WEP OFF	Selects the security method.
	Password	/	Input the password for entering the wireless network.

Menu Item		Default Setting	Description
WLAN IP	Obtain IP Address Automatically	On	Selects whether to enable the function of automatically getting the IP address.
	Use the Following Address	Off	Selects whether inputting the <b>IP Address</b> , <b>Subnet Mask</b> , and <b>Gateway</b> 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	Selects whether inputting the IP address of <b>Preferred DNS Server</b> and <b>Alternate DNS Server</b> is required.
	Preferred DNS Server	0.0.0.0	
	Alternate DNS Server	0.0.0.0	
WLAN Setup	WLAN Band	Auto	<b>Auto:</b> automatically identifies the WLAN band.
	2.4G Channel	All	Selects the 2.4 GHz channels.
	5G Channel	All	Selects the 5 GHz channels.
Network Test		/	Tests whether the wireless network is properly connected.
Certificate Management	Local	/	<b>Delete:</b> delete the selected certifications.
	USB Drive	/	Select certifications you want to import from the USB memory, and then select <b>Import:</b> import the desired certifications from the USB memory.

## 22.16.2 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. You can add up to 30 CMSs for the monitor.

## 22.16.3 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	Description
Multicast TTL	1	/
Multicast Address	225.0.0.8	
Master Server Address	/	/
Master Server IP Address	0.0.0.0	
Connected Status	Disconnected	
Network Test	/	Tests whether the master server is properly connected.

## 22.16.4 The QoS Tab

Menu Item	Default Setting	Description
QoS Level For Realtime 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.

## 22.16.5 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	Description
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.

## 22.16.6 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. Licenses are required for sending data, waveforms, and alarms via HL7.

Section	Menu Item	Default Setting	Description
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	
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	
Compatibility	HL7 Protocol Version	HL7 Protocol Version 1.0	Selecting the version of the HL7 protocol.

## 22.16.7 The Information Security Tab

Menu Item	Default Setting	Description
Encryption Connection Type	Only Private Encryption	<ul style="list-style-type: none"><li>• <b>Only Private Encryption:</b> Mindray private encryption is used to encrypt the transmitted data. You cannot connect devices supporting SSL (secure sockets layer) encryption.</li><li>• <b>SSL Encryption Priority:</b> 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.</li></ul>
Broadcast Patient Demographics	On	<ul style="list-style-type: none"><li>• <b>On:</b> when viewing other patients, device location and patient information of remote devices are displayed in the remote device list.</li><li>• <b>Off:</b> patient information does not display in the remote device list.</li></ul>
TLS Certificate Management	/	Selects this button to access the <b>TLS Certificate Management</b> menu. You can check or delete local CA certificates or user certificates. You can also import certificates from a USB drive.

## 22.16.8 The MLDAP Tab

Menu Item	Default Setting	Description
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	<ul style="list-style-type: none"><li>• <b>Dock Mode:</b> 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 <b>Device Location</b>, <b>Print</b>, or <b>Authorization Setup</b> page from the Independent menu.</li><li>• <b>Host Mode:</b> 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 <b>Device Location</b>, <b>Print</b>, or <b>Authorization Setup</b> page from the <b>Dock Setup</b> page.</li></ul>

Menu Item	Default Setting	Function
Net Setting Type	Use current N1 net setting	<ul style="list-style-type: none"> <li>• <b>Use current N1 net setting:</b> the IP and WLAN settings are from the N1. You can change these settings on <b>Network Setup</b> page from the <b>Maintenance</b> menu.</li> <li>• <b>Use current N1 net setting:</b> the IP and WLAN settings are from the Dock. You can change these settings on <b>IP</b>, or <b>WLAN</b> tab from the <b>Dock Setup</b> page.</li> </ul>
External Screen Contents	Independent	<ul style="list-style-type: none"> <li>• <b>Mirrored:</b> the contents of the external display is exactly the same with the monitor.</li> <li>• <b>Independent:</b> you can separately configure the contents and layout of the monitor and external display.</li> </ul>

### 22.17.2 The Location Tab

Menu Item	Default Setting	Function
Facility	/	/
Department		
Location	Fixed	<ul style="list-style-type: none"> <li>• <b>Fixed:</b> the <b>Patient Management</b> dialog displays Bed No. and Room No., but you cannot change them.</li> <li>• <b>Unfixed:</b> you can change Bed No. and Room No. from the <b>Patient Management</b> dialog.</li> </ul>
Room No	/	/
Bed No		

### 22.17.3 The IP Tab

Menu Item	Default Setting	Function
Network Type	LAN1 IP	/
Obtain IP Address Automatically	Unelected	Automatically gets the IP address.
Use the Following Address	Selected	<b>IP Address</b> , <b>Subnet Mask</b> , and <b>Subnet Mask</b> 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
Using the Following DNS Address	Selected	IP addresses of <b>Preferred DNS Server</b> and <b>Alternate DNS Server</b> are required.
Preferred DNS Server	0.0.0.0	
Alternate DNS Server	0.0.0.0	

### 22.17.4 The WLAN Tab

Menu Item	Menu Item	Default Setting	Function
SSID		/	/
Security		WEP OFF	Select the security method.
Password		/	/

Menu Item	Menu Item	Default Setting	Function
WLAN Setup	WLAN Band	Auto	<b>Auto:</b> automatically identifies the WLAN band.
	2.4G Channel	All	Selects the 2.4G channels.
	5G Channel	All	Selects the 5G channels.
Network Test		/	Tests whether the wireless network is properly connected.

### 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	/	<p>Selects the password for accessing the monitor's <b>Maintenance</b> menu.</p> <ul style="list-style-type: none"> <li>• <b>Local Password:</b> the monitor's password for accessing the <b>Maintenance</b> menu is required.</li> <li>• <b>User Password:</b> the user name and password saved in the MLDAP server are required.</li> </ul>
Others	Alarm Setup	No Password	<p>Selects the password for changing alarm settings.</p> <ul style="list-style-type: none"> <li>• <b>No Password:</b> changing alarm settings is not password protected.</li> <li>• <b>Local Password:</b> changing alarm switch, alarm limit, and alarm priority is password protected. The monitor's password for changing alarm settings is required.</li> <li>• <b>User Password:</b> changing alarm switch, alarm limit, and alarm priority is password protected. The user name and password saved in the MLDAP server are required.</li> </ul>
	Arrhythmia	No Password	<p>selects the password for changing arrhythmia settings.</p> <ul style="list-style-type: none"> <li>• <b>No Password:</b> changing arrhythmia settings is not password protected.</li> <li>• <b>Local Password:</b> changing arrhythmia switch, alarm priority, and arrhythmia threshold is password protected. The monitor's password for changing arrhythmia settings is required.</li> <li>• <b>User Password:</b> changing arrhythmia switch, alarm priority, and arrhythmia threshold is password protected. The user name and password saved in the MLDAP server are required.</li> </ul>
	Modify Local Password	/	Changes the monitor's password for accessing alarm settings and arrhythmia settings.



# 23 Battery

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## 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

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### WARNING

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- **Keep batteries out of children's reach.**
  - **Use only specified battery. Use of a different battery may present a risk of fire or explosion.**
  - **Keep the batteries in their original package until you are ready to use them.**
  - **Do not expose batteries 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.**
  - **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 batteries, heat batteries above 60 °C, incinerate batteries, or short battery terminals. They may ignite, explode, leak or heat up, causing personal injury.**
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### CAUTION

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- **Remove the battery if it will not be used for an extended period of time.**
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## 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.

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### WARNING

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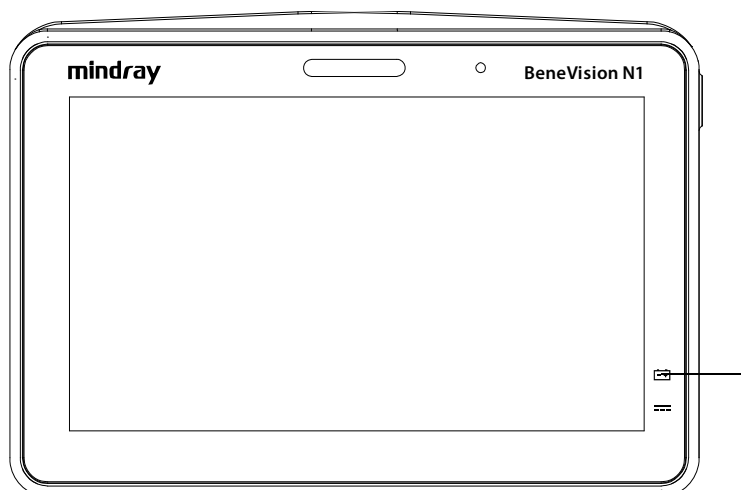
- **Lithium batteries replaced by inadequately trained personnel could result in a HAZARD (such as excessive temperatures, fire or explosion).**
- 

## 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.









(1) Battery LED

The battery LED indications are as follows:

- Green: the battery is fully charged.
- Yellow: the battery is being 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 battery symbols indicate 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 power to run 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 aged, replace the battery.** 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 *E 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 or the defibrillator/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 batteries deteriorates over time. You should condition the batteries every three months.

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.

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

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- **Do not use the monitor to monitor the patient during battery conditioning.**
  - **Do not interrupt battery conditioning.**
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### 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 shortened. 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 three 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

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

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

Condition the stored batteries every three months. For more information, see *23.6.1 Conditioning the Battery*.

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### 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 batteries at high temperature for an extended period of time will significantly shorten their life expectancy.**
  - **Storing batteries in a cool place can slow the aging process. Ideally the batteries should be stored at 15 °C.**
- 

## 23.8 Recycling Batteries

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 its service time.

Properly dispose of batteries according to local regulations.

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### WARNING

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

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## 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

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### WARNING

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- Use only cleaners, disinfectants and methods specified in this chapter. Using unapproved substances or methods may damage the equipment and void the warranty.
  - Do not mix disinfecting solutions, as hazardous gases may result.
  - Mindray is not liable for the efficacy of the specified cleaners, disinfectants, or methods as a means for controlling infection. Refer to your hospital for infection controlling.
  - 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.
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### CAUTION

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- 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.
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## 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.
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.

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## CAUTION

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- 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.
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## 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 Towelette	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® Sporidical 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 this symbol, only the cleaners and disinfectants marked with "\*" are available for use.

## 24.5 Cleaning and Disinfecting the Accessories

To clean and disinfect the following accessories, using cleansers, disinfectants, and methods described in this manual:

- NIBP air hose
- Mindray SpO<sub>2</sub> cable
- Masimo SpO<sub>2</sub> cable
- Nellcor SpO<sub>2</sub> cable

For other accessories, consult instructions for use 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 waste.
- 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 on a regular basis. Before cleaning the accessories, consult your hospital's regulations for cleaning the accessories.

To clean the accessories, follow this procedure:

- Clean the accessories with a soft cloth moistened with water or ethanol (70%).
- Wipe off all the cleaner residue with a dry cloth.
- Allow the accessories to air dry.

### 24.5.2 Disinfecting the Accessories

We recommend that the accessories 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 Towelette	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<sub>2</sub> Cable

The following table lists approved disinfectants for the Mindray and Nellcor SpO<sub>2</sub> 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 Towelette	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<sub>2</sub> cable cleaning and disinfecting agents:

Product Name	Product Type	Active Ingredients
Isopropanol	Liquid	Isopropanol 70%

## 24.6 Sterilization

Do not sterilize the monitor, accessories, or supplies unless otherwise specified in the instructions for use delivered with the accessories and 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

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## 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

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### WARNING

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- 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.
  - Follow the maintenance and testing schedule or local regulations to perform testing and maintenance. Not implementing the maintenance schedule may cause 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.
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### CAUTION

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- The equipment and accessories shall not be served or maintained while in use with a patient.
  - If a problem occurs to the equipment, contact the service personnel.
  - 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.
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### NOTE

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- If needed, contact the manufacture for circuit diagrams, component part lists, descriptions, calibration instructions, or other information concerning the repair of the equipment.
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## 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
<b>Performance Tests</b>		
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 the Sidestream CO <sub>2</sub> tests.  4. For Microstream™ CO <sub>2</sub> modules, initially calibrate after 1,200 operating hours, then once a year or after 4,000 operating hours, whichever comes first. 5. 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.
<b>Electrical Safety Tests</b>		
Electrical safety tests		Once every two years.
<b>Other Tests</b>		
Power-on test		Before use.
Network printer tests		1. When first installed. 2. Follow any 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 check system software version, module hardware and software version, and firmware version. For more information, see 22.13 *The Version Settings*.

## 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 use 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 damage.
- 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 products.

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#### **WARNING**

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- **Unless otherwise specified, dispose of parts and accessories in accordance with 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
1050NPSMKittycat	0681-00-0098-01	NEO Pre-wired Electrode radio Opaque	Neonate
1051NPSMKittycat	0681-00-0098-02	NEO Pre-wired Electrode radio Translucent	Neonate
SF06	040-002711-00	Electrode, 5 pcs/package	Adult
SF07	040-002833-00	Electrode, Intco	Pediatric, neonate
31.1245.21	900E-10-04880	Electrode, Kendall, 50 pcs/package	Neonate
EMG-SN10-20×20	040-003254-00	NEO Pre-wired Electrode radio Translucent, AHA, disposable	Neonate

### 26.1.2 12-Pin Trunk Cables

Model	PN	Description	Applicable patient
EV6201	0010-30-42719 009-004728-00	ECG cable, 12-pin, 3/5-lead, defibrillation-proof AHA/IEC	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	ECG cable, 12-pin, 3/5-lead, defibrillation-proof, (DS)	Adult, pediatric
EV6213	009-003652-00	ECG cable, 12-pin, 3/5-lead, ESU-proof, (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	1 to 1.4 m	Adult, pediatric
EL6504A	0010-30-42730	ECG leadwires, 5-lead, IEC, clip, long	1 to 1.4 m	Adult, pediatric
EL6501B	0010-30-42735 009-004729-00	ECG leadwires, 5-lead, AHA, snap	1 to 1.4 m	Adult, pediatric
EL6502B	0010-30-42736 009-004730-00	ECG leadwires, 5-lead, IEC, snap	1 to 1.4 m	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 inches	24 inches	Adult, pediatric
EY6602B	009-004795-00	ECG leadwires, 6-lead, AHA, snap, 36 inches	36 inches	Adult, pediatric
EY6603B	009-004796-00	ECG leadwires, 6-lead, IEC, snap, 24 inches	24 inches	Adult, pediatric
EY6604B	009-004797-00	ECG leadwires, 6-lead, IEC, snap, 36 inches	36 inches	Adult, pediatric
EY6601A	009-004798-00	ECG leadwires, 6-lead, AHA, clip, 24 inches	24 inches	Adult, pediatric
EY6602A	009-004799-00	ECG leadwires, 6-lead, AHA, clip, 36 inches	36 inches	Adult, pediatric
EY6603A	009-004800-00	ECG leadwires, 6-lead, IEC, clip, 24 inches	24 inches	Adult, pediatric
EY6604A	009-004801-00	ECG leadwires, 6-lead, IEC, clip, 36 inches	36 inches	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<sub>2</sub> 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 009-004600-00	7-pin, Mindray	All
572A	0010-20-42712	8-pin, Nellcor	All
582A	040-000332-00	8-pin, Masimo	All

Model	Part No.	Description	Applicable patient
583A	040-005973-00	8-pin, Masimo (RD SET)	All

**Note:** If you need to purchase Masimo sensors, please contact Masimo.

### 26.2.2 Mindray SpO<sub>2</sub> Sensors

Model	PN	Description	Applicable patient	Application site
512F	512F-30-28263	Reusable SpO <sub>2</sub> sensor	Adult	Finger
512H	512H-30-79061	Reusable SpO <sub>2</sub> sensor	Pediatric	Finger
512E	512E-30-90390	Reusable SpO <sub>2</sub> sensor	Adult	Finger
512G	512G-30-90607	Reusable SpO <sub>2</sub> sensor	Pediatric	Finger
518B	518B-30-72107	Reusable SpO <sub>2</sub> sensor	Neonate	Foot
520A	009-005087-00	Disposable SpO <sub>2</sub> sensor	Adult	Finger
520P	009-005088-00	Disposable SpO <sub>2</sub> sensor	Pediatric	Finger
520I	009-005089-00	Disposable SpO <sub>2</sub> sensor	Infant	Toe
520N	009-005090-00	Disposable SpO <sub>2</sub> sensor	Adult, Neonate	Finger, foot
521A	009-005091-00	Disposable SpO <sub>2</sub> sensor	Adult	Finger
521P	009-005092-00	Disposable SpO <sub>2</sub> sensor	Pediatric	Finger
521I	009-005093-00	Disposable SpO <sub>2</sub> sensor	Infant	Toe
521N	009-005094-00	Disposable SpO <sub>2</sub> sensor	Neonate	Foot
518C	040-000330-00	Reusable SpO <sub>2</sub> sensor	Neonate	Foot
518C	115-004895-00	Disposable bandage, for 518C SpO <sub>2</sub> sensor	Neonate	/
513A	115-033848-00	Reusable SpO <sub>2</sub> sensor	Adult, pediatric	Ear
518BLH	115-050154-00	Reusable SpO <sub>2</sub> sensor	Neonate	Foot
512K	115-056388-00	Reusable SpO <sub>2</sub> sensor	Pediatric	Finger, toe

### 26.2.3 Nellcor SpO<sub>2</sub> Sensors

Model	PN	Description	Applicable patient	Application site
DS100A	9000-10-05161	Reusable SpO <sub>2</sub> sensor	Adult	Finger
OXI-P/I	9000-10-07308	Reusable SpO <sub>2</sub> sensor	Pediatric, infant	Finger
OXI-A/N	9000-10-07336	Reusable SpO <sub>2</sub> sensor	Adult, neonate	Finger, foot
MAXAI	0010-10-12202	Disposable SpO <sub>2</sub> sensor	Adult (>30 kg)	Finger
MAXPI	0010-10-12203	Disposable SpO <sub>2</sub> sensor	Pediatric (10 - 50Kg)	Finger
MAXII	0010-10-12204	Disposable SpO <sub>2</sub> sensor	Infant (3 - 20Kg)	Toe
MAXNI	0010-10-12205	Disposable SpO <sub>2</sub> 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	040-003294-00	Disposable temperature probe, esophageal/rectal, general	All
MR412	040-003295-00	Disposable temperature probe, skin	All

### 26.3.3 Compatible Temp Accessories

The follow accessories are compatible with the monitor. To purchase these accessories, contact the manufacturer.

Model/PN	Description	Manufacture
F45160	Disposable silicone Foley catheter with temperature sensor, 14Fr, 10 ml, 12pcs/box	Well Lead Medical Co. Ltd.

## 26.4 NIBP Accessories

### 26.4.1 NIBP Hoses

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

### 26.4.2 NIBP 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	24 - 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

Model	Part No.	Description	Limb Circumference (cm)	Bladder Width (cm)	Applicable patient
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
CM1302	040-000978-00	Reusable cuff, bladderless	18 - 26	9.8	Pediatric
CM1303	040-000983-00	Reusable cuff, bladderless	25 - 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* 125-000051-00	NIBP cuff, single patient use, size 1, 20 pcs/box	3.1 to 5.7	2.2	Neonate
CM1500B	001B-30-70693* 125-000052-00	NIBP cuff, single patient use, size 2, 20 pcs/box	4.3 to 8.0	2.9	Neonate
CM1500C	001B-30-70694* 125-000053-00	NIBP cuff, single patient use, size 3, 20 pcs/box	5.8 to 10.9	3.8	Neonate
CM1500D	001B-30-70695* 125-000054-00	NIBP cuff, single patient use, size 4, 20 pcs/box	7.1 to 13.1	4.8	Neonate
CM1500E	001B-30-70696* 125-000055-00	NIBP cuff, single patient use, size 5, 20 pcs/box	8 to 15	5.4	Neonate

**\*Use with the CM1901 NIBP hose (PN: 6200-30-11560).**

## 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	All
682275	0010-10-12156	Transducer/Manifold Mount, Argon	All
IM2201	001C-30-70759	12 Pin IBP cable, ICU Medical	All
42584	0010-10-42638	IBP transducer, disposable, ICU Medical	All
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	All
IM2206	115-017849-00	12 Pin IBP cable, for Utah, reusable	All
IM2207	0010-21-43082	12 Pin IBP Cable, for Memscap, SP844 82031 transducer, reusable	All
IM2213	0010-30-43055	IBP adapter cable (12-pin to 6-pin), 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<sub>2</sub> Accessories

### 26.7.1 Sidestream CO<sub>2</sub> Accessories

Model	Part No.	Description	Applicable patient
4000	M02A-10-25937	Nasal CO <sub>2</sub> sample cannula, disposable	Adult
4100	M02A-10-25938	Nasal CO <sub>2</sub> sample cannula, disposable	Pediatric
4200	M02B-10-64509	Nasal CO <sub>2</sub> 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 <sub>2</sub> adapter	/

### 26.7.2 Microstream™ CO<sub>2</sub> Accessories

Model	Part No.	Description	Usage	Applicable patient
MVAI	0010-10-42560	Adult-Pediatric Intubated CO <sub>2</sub> FilterLine	Disposable	Adult, pediatric
MVAIH	0010-10-42561	Adult-Pediatric Intubated CO <sub>2</sub> FilterLine	Disposable	Adult, pediatric
MVIIH	0010-10-42562	Neonatal-Infant Intubated CO <sub>2</sub> FilterLine	Disposable	Neonate
MVAIL	0010-10-42563	Adult-Pediatric Intubated CO <sub>2</sub> FilterLine	Disposable	Adult, pediatric
MVAIHL	0010-10-42564	Adult-Pediatric Intubated CO <sub>2</sub> FilterLine	Disposable	Adult, pediatric
MVIIHL	0010-10-42565	Neonatal-Infant Intubated CO <sub>2</sub> FilterLine	Disposable	Neonate
MVA	0010-10-42566	Adt Oral-Nasal CO <sub>2</sub> FilterLine	Disposable	Adult
MVP	0010-10-42567	Ped Oral-Nasal CO <sub>2</sub> FilterLine	Disposable	Pediatric
MVAO	0010-10-42568	Adt Oral-Nasal CO <sub>2</sub> FilterLine w/O <sub>2</sub>	Disposable	Adult
MVPO	0010-10-42569	Ped Oral-Nasal CO <sub>2</sub> FilterLine w/O <sub>2</sub>	Disposable	Pediatric
MVAOL	0010-10-42570	Adt Oral-Nasal CO <sub>2</sub> FilterLine w/O <sub>2</sub> L	Disposable	Adult
MVPOL	0010-10-42571	Ped Oral-Nasal CO <sub>2</sub> FilterLine w/O <sub>2</sub> L	Disposable	Pediatric
MVANH	0010-10-42572	Adult Nasal CO <sub>2</sub> FilterLine	Disposable	Adult
MVINH	0010-10-42574	Neo-Inf Nasal CO <sub>2</sub> FilterLine H	Disposable	Neonate
MVANO	0010-10-42575	Adt Nasal CO <sub>2</sub> FilterLine w/O <sub>2</sub> H	Disposable	Adult
MVPNOH	0010-10-42576	Ped Nasal CO <sub>2</sub> FilterLine w/O <sub>2</sub> H	Disposable	Pediatric
MVAN	0010-10-42577	Adult Nasal CO <sub>2</sub> FilterLine	Disposable	Adult
MVPN	0010-10-42578	Pediatric Nasal CO <sub>2</sub> FilterLine	Disposable	Pediatric

### 26.7.3 Mainstream CO<sub>2</sub> Accessories (Respironics)

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	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	Sensor holding clips	/
1036698	6800-30-50760	CO <sub>2</sub> sensor	/

### 26.7.4 Mainstream CO<sub>2</sub> Accessories (Mindray)

Model	Part No.	Description	Applicable patient
GA3701	125-000278-00	CO <sub>2</sub> sensor	/
GA3201	040-006828-00	Airway adapter, disposable	Adult, pediatric
GA3202	040-006829-00	Airway adapter, disposable	Pediatric, neonate
GA3211	040-006830-00	Airway adapter, reusable	Adult, pediatric
GA3212	040-006831-00	Airway adapter, reusable	Neonate
GA3801	040-006897-00	Cable management straps, 22 mm, 5 pcs/pack	/
GA3802	040-006898-00	Cable management straps, 10 mm, 5 pcs/pack	/

### 26.7.5 Compatible Sidestream CO<sub>2</sub> Accessories

The follow accessories are compatible with the monitor. To purchase these accessories, contact the manufacturer.

Model	Description	Applicable patient	Manufacture
4707	Nasal CO <sub>2</sub> sample cannula, with O <sub>2</sub> , 25 pcs	Adult	Salter Labs
4703	Nasal CO <sub>2</sub> sample cannula, with O <sub>2</sub> , 25 pcs	Pediatric	Salter Labs
4700	Nasal CO <sub>2</sub> sample cannula, with O <sub>2</sub> , 25 pcs	Neonate	Salter Labs

## 26.8

### 26.9 Mount and Mounting Accessories

Model	Part No.	Description
/	045-000924-00	Rolling stand

Model	Part No.	Description
/	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)
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)
Dock-T	115-066621-00	Transport Dock package (with DC input)
Dock-T	115-066700-00	Transport Dock (with DC input)
/	115-048417-00	N1 Accessories Storage Box
/	042-020780-00	N1 Accessories Storage Box

## 26.10 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



Model	Part No.	Description
/	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)
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)
/	023-002465-00	ELO LCD Display (15.6")
LI12I003A	115-049427-00	Lithium battery kit (2500mAh, 7.2 V)
LI12I003A	022-000338-00	Lithium battery (2500mAh, 7.2 V)

Model	Part No.	Description
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)
/	009-010491-00	Adapting cable connecting the BeneVision N1 and BeneView T1 analog out cable

## 26.11 External Parameter Modules

Model	Part No.	Description
CO2-3	115-037385-00	Sidestream CO <sub>2</sub> module (with packaging)
CO2-3	115-027545-00	Sidestream CO <sub>2</sub> module
CO2-4	115-034095-00	Sidestream CO <sub>2</sub> module (with O <sub>2</sub> sensor, with packaging)
CO2-4	115-027544-00	Sidestream CO <sub>2</sub> module (with O <sub>2</sub> sensor)
CO2-2	115-013200-00	Mainstream CO <sub>2</sub> module (with packaging)
CO2-2	6800-30-50487	Mainstream CO <sub>2</sub> module
CO2-1	115-013201-00	Microstream CO <sub>2</sub> module (with packaging)
CO2-1	6800-30-50558	Microstream CO <sub>2</sub> module
PiCCO	115-013198-00	PiCCO module (with packaging)
PiCCO	115-007270-00	PiCCO module
IBP	6800-30-50850	IBP module (with packaging)
IBP	6800-30-50485	IBP module

# A

## Product Specifications

### A.1 Monitor Safety Specifications

The monitor is classified, according to IEC 60601-1: 2020

Degree of protection against electrical shock	Type CF defibrillation proof for ECG, TEMP, IBP, SpO <sub>2</sub> , PiCCO, and NIBP Type BF defibrillation proof for CO <sub>2</sub>
Type of protection against electrical shock	Class I
Degree of protection against harmful ingress of water	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 <sub>2</sub> module
N1 main unit	1.17	148.5 × 103 × 81	with internal CO <sub>2</sub> module
Modular Rack	1.55	165 × 130 × 168	with N1 not configuring the internal CO <sub>2</sub> module
Modular Rack	1.78	165 × 130 × 168	with N1 configuring the internal CO <sub>2</sub> module
Dock	0.97	190 × 125 × 155	/
Transport Dock (with AC input)	2.51	195.5 × 165 × 253	with cable box
Transport Dock (with AC input)	1.80	195.5 × 165 × 113	without cable box
Transport Dock (with DC input)	1.35	176 × 165 × 113	without cable box
PiCCO module	0.28	136.5 × 40 × 102	/
Mainstream CO <sub>2</sub> module	0.26	136.5 × 40 × 102	/
Microstream™ CO <sub>2</sub> module	0.38	136.5 × 40 × 102	/
Sidestream CO <sub>2</sub> module	0.63	136.5 × 40 × 102	with O <sub>2</sub>
Sidestream CO <sub>2</sub> module	0.54	136.5 × 40 × 102	without O <sub>2</sub>
IBP module	0.26	136.5 × 40 × 102	/

## 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.

### CAUTION

- 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	0 to 40°C	-30 to 70°C
	Relative humidity (noncondensing)	5% to 95%	5% to 95%
	Barometric	427.5 to 805.5 mmHg (57.0 to 107.4 kPa)	375 to 805.5 mmHg (50 to 107.4 kPa) (with CO <sub>2</sub> ) 120 to 805.5 mmHg (16.0 to 107.4 kPa) (without CO <sub>2</sub> )
Modular Rack/ Dock	Temperature	0 to 40°C	-20 to 60°C
	Relative humidity (noncondensing)	15% to 95%	10% to 95%
	Barometric	427.5 to 805.5 mmHg (57.0 to 107.4 kPa)	120 to 805.5 mmHg (16.0 to 107.4 kPa)
Microstream™ CO <sub>2</sub> module	Temperature	0 to 40°C	-20 to 60°C
	Relative humidity (noncondensing)	15% to 95%	10% to 95%
	Barometric	430 to 790 mmHg (57.3 to 105.3 kPa)	430 to 790 mmHg (57.3 to 105.3 kPa)
Sidestream CO <sub>2</sub> module	Temperature	5 to 40°C	-20 to 60°C
	Relative humidity (noncondensing)	15% to 95%	10% to 95%
	Barometric	430 to 790 mmHg (57.3 to 105.3 kPa)	375 to 805.5 mmHg (50 to 107.4 kPa)
Mainstream CO <sub>2</sub> module	Temperature	0 to 40°C	-20 to 60°C
	Relative humidity (noncondensing)	10% to 90%	10% to 90%
	Barometric	427.5 to 805.5 mmHg (57.0 to 107.4 kPa)	400 to 805.5 mmHg (53.3 to 107.4 kPa)

Components	Item	Operating Condition	Storage Condition
PiCCO module	Temperature	10 to 40°C	-20 to 60°C
	Relative humidity (noncondensing)	15% to 75%	10% to 90%
	Barometric	427.5 to 805.5 mmHg (57.0 to 107.4 kPa)	120 to 805.5 mmHg (16.0 to 107.4 kPa)

### Transient operating conditions

The monitor is operated in normal use for a period not less than 20 minutes when moved from room temperature (20°C ± 2°C) to an environment of a temperature range from - 20 °C to 50 °C, 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 °C to 70 °C) to room temperature (20°C ± 2°C), 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 (with AC input)	
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
Transport Dock (with DC input)	
Input	12 VDC (-15%, +25%)/24 VDC (-15%, +25%), 3A
Output	12V(±10%), 2A

### A.4.2 Battery Specifications

Battery type	Rechargeable lithium-Ion battery
Voltage	7.56 VDC, 7.2 VDC (alternative)
Capacity	2500 mAh

Run time	<p>At least 8 hours when the monitor without internal CO<sub>2</sub> 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<sub>2</sub> cable connected, and auto NIBP measurements at an interval of 15 minutes.</p> <p>At least 3 hours when the monitor with internal CO<sub>2</sub> module is powered by one new fully-charged battery at 25°C ± 5°C with factory default screen brightness, Wi-Fi enabled, CO<sub>2</sub> sampling line connected, Temp, IBP, ECG and SpO<sub>2</sub> cable connected, and auto NIBP measurements at an interval of 15 minutes.</p> <p>Shutdown delay: at least 15 minutes after the low battery alarm first occurs.</p>
Charge time	<p>For the monitor without internal CO<sub>2</sub> 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.</p> <p>For the monitor with internal CO<sub>2</sub> 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.</p>

## 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)	15.6"	19"	21.5"
Resolution	1920 x 1080 pixels	1280 x 720 pixels	1920 x 1080 pixels

## A.6 Touchscreen Specifications

Screen type	Capacitive, multi-point touch
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## 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)
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External power supply LED	1 (green)
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### A.7.3 Transport Dock

Power-on LED	1 (green)
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### A.7.4 AC Adapter

Power-on LED	1 (green)
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## 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: 2020.
Frequencies of audio signals	Alarm tone (ISO2 mode/ISO mode): 600 Hz Alarm tone (ISO3 mode): 260 Hz, 440 Hz, 350 Hz Special alarm sound: 900 Hz QRS tone: 500 Hz Screen-tapping tone: 1000 Hz Pulse tone: 687 - 164 Hz (beep-beep-beep. The frequency of pulse tone decreases as the patient's SpO <sub>2</sub> decreases.) NIBP end tone: 520 Hz Timer countdown tone: 620 Hz

## 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 <sub>2</sub>	1
Gas outlet	1
ECG cable connector	1
SpO <sub>2</sub> 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
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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 for standard configuration, 1 optional
USB connector	2
Multi-pin connector	1

## A.10 Signal Outputs Specifications

ECG Analog Output	
Bandwidth (-3dB; reference frequency: 10 Hz)	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 10 Hz)	1V/mV ( $\pm 5\%$ )
Pace enhancement	Signal amplitude: $V_{oh} \geq 2.5V$ Pulse width: $10ms \pm 5\%$ Signal rising and falling time: $\leq 100 \mu s$
IBP Analog Output	
Bandwidth (-3dB; reference frequency: 1Hz)	0 to 40 Hz
Maximum transmission delay	30 ms
Gain (reference frequency 1 Hz)	1 V/100 mmHg, $\pm 5\%$
Defib Sync Pulse	
Output impedance	$\leq 100 \text{ ohm}$
Maximum time delay	35 ms (R-wave peak to leading edge of pulse)
Amplitude	High level: 3.5 to 5 V, $\pm 5\%$ , 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 $\pm 10\%$
maximum rising and falling time	1 ms
Alarm output	
Alarm delay time from the monitor to remote equipment	The alarm delay time from the monitor to remote equipment is $\leq 2$ 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	A maximum of 48 hours of oxyCRG events

## 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 IEC 80601-2-30: 2018 (NIBP), ISO 80601-2-55: 2018 (CO<sub>2</sub>), ISO 80601-2-56: 2018 (TEMP), ISO 80601-2-61: 2017 (SpO<sub>2</sub>).
- **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	BPSK, QPSK, 16QAM, 64QAM
Operating frequency	2.4 GHz to 2.495 GHz. 5.15 GHz to 5.25 GHz, 5.725 GHz to 5.85 GHz
Channel spacing	IEEE 802.11b/g: 5 MHz IEEE 802.11n (at 2.4 GHz): 5 MHz IEEE802.11a: 20 MHz IEEE802.11n (at 5 GHz): 20 MHz
Wireless baud rate	IEEE 802.11b: 1 Mbps to 11 Mbps IEEE 802.11g: 6 Mbps to 54 Mbps IEEE 802.11n: 6.5 Mbps to 72.2 Mbps (MCS0-MCS7) IEEE 802.11a: 6 Mbps to 54 Mbps
Output power	<20dBm (CE requirement, detection mode: RMS) <30dBm (FCC requirement: detection mode: peak power)
Operating mode	As station, access AP for data transmission
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

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#### WARNING

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- **Do perform all network functions of data communication within an enclosed network.**
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#### 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 CMS:  $\leq 2$  seconds.
- The delay for monitor-related settings configured at the CMS to be effective:  $\leq 2$  seconds.
- The total delay of data transmission from one monitor to the other:  $\leq 2$  seconds.
- The delay for the monitor to reset alarms of another to be effective:  $\leq 2$  seconds.

Testing conditions are as follows:

- Number of the monitors supported by a single AP:  $\leq 16$ .
- Each monitor can communicate with the CMS.
- 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 is not 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 GHz 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:  $\leq 16$ .
- Each monitor can communicate with the CMS.
- 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 Bluetooth Technical Specifications

Protocol	Bluetooth 5.0
Modulation mode	GFSK
Operating frequency	2402 to 2480 MHz
Channel spacing	2MHz
Wireless baud rate	2 Mbps, 1 Mbps, 125 kbps
Output power	$\leq 20$ dBm
Data security	AES128

## A.15 Operating Environment

Host CPU	ARM Cortex-A8
Primary programming language	C++
Operating system	Linux 3.2.0

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# B Measurement Specifications

The adjustable range of alarm limits is the same with the measurement range of signals unless otherwise specified.

## B.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 (×0.125), 2.5 mm/mV (×0.25), 5 mm/mV (×0.5), 10 mm/mV (×1), 20 mm/mV (×2), 40 mm/mV (×4), 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: 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 High Freq Cut-off (for 12-lead ECG analysis) 350 Hz (0.05 to 350 Hz), 150 Hz (0.05 to 150 Hz), 35 Hz (0.05 to 35 Hz), or 20 Hz (0.05 to 20 Hz), selectable
Common mode rejection ratio	Diagnostic mode: >90 dB Monitor mode: >105 dB (with notch filter on) Surgical mode: >105 dB (with notch filter on) ST mode: >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 ≤1 μA)
Defibrillation protection	Enduring 5000V (360 J) charge without data loss or corruption Baseline recovery time: <5 s (after defibrillation) Polarization recovery time: <10 s Defibrillation energy absorption: ≤10% (100Ω load)
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
<b>Pace Pulse</b>	
Pace pulse markers	Pace pulses meeting the following conditions are labelled with a PACE marker:  Amplitude: ±2 to ±700 mV Width: 0.1 to 2 ms Rise time: 10 to 100 µs (no greater than 10% of pulse width) No overshoot
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: ±2 to ±700 mV Width: 0.1 to 2 ms Rise time: 10 to 100 µs (no greater than 10% of pulse width) No overshoot

<b>HR</b>	
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-Tach, V-Tach, 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, SVT, SVCs/ min		
ST Segment Analysis			
Measurement range	-2.0 to 2.0 mV RTI		
Accuracy	-0.8 to 0.8 mV: ±0.02 mV or ±10%, whichever is greater. Beyond this range: Not specified.		
Resolution	0.01mV		
QT/QTc Analysis			
Measurement range	QT: 200 to 800 ms QTc: 200 to800 ms QT-HR: 15 to 150 bpm for adult, 15 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 (A/D) 500 samples/s (ECG 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 (high limit - 2 bpm) HR > 40 bpm: 40 bpm to (high limit - 5 bpm)	
ST High	(low limit + 0.2 mV) to 2.0 mV (ST alarm mode: Absolute) 0 mV to 2.0 mV (ST alarm mode: Relative)	0.05 mV
ST Low	-2.0 mV to (high limit - 0.2 mV) (ST alarm mode: Absolute) -2.0 mV to 0 mV (ST alarm mode: Relative)	
QTc High	200 to 800 ms	10 ms
ΔQTc High	30 to 200 ms	

## B.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
<b>Respiration Rate</b>	
Measurement range	0 to 200 rpm
Resolution	1 rpm
Accuracy	0 to 120 rpm: $\pm 1$ rpm 121 to 200 rpm: $\pm 2$ 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 $\leq$ 20: (low limit + 2) to 20 RR $>$ 20: (low limit + 5) to 100 Neonate: RR $\leq$ 20: (low limit + 2) to 20 RR $>$ 20: (low limit + 5) to 150	RR $\leq$ 20: 1 RR $>$ 20: 5
RR Low	RR $\leq$ 20: 0 to (high limit - 2) RR $>$ 20: 20 to (high limit - 5)	

## B.3 SpO<sub>2</sub> Specifications

Alarm limit	Range (%)	Step (%)
SpO <sub>2</sub> High	(low limit + 2) to 100	1
SpO <sub>2</sub> Low	Mindray/Masimo: (Desat+1) to (high limit - 2) Nellcor: (Desat+1) or 20 (whichever is greater) to (high limit - 2)	
SpO <sub>2</sub> Desat Low	0 to (low limit - 1)	

### Mindray SpO<sub>2</sub> Module

Standards	Meet standards of ISO 80601-2-61: 2017		
Measurement range	0 to 100%		
Resolution	1%		
Response time	< 30 s (normal perfusion, no disturbance, SpO <sub>2</sub> value sudden changes from 70% to 100%)		
Accuracy	70 to 100%: ±2%ABS (adult/pediatric) 70 to 100%: ±3%ABS (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 <sub>2</sub> 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 <sub>2</sub> sensors was also validated on adult subjects.			
Refreshing rate	≤1 s		



PI	
Measurement range	0.05 to 20%
Resolution	PI<10.0: 0.01 PI≥10.0: 0.1

#### Nellcor SpO<sub>2</sub> Module

Standard	Meet standards of ISO 80601-2-61: 2017
Measurement range	0 to 100%
Resolution	1%
Refreshing rate	≤1 s
Response time	≤30 s (normal perfusion, no disturbance, SpO <sub>2</sub> value sudden change from 70% to 100%)
Accuracy	70 to 100%: ±2%ABS (adult/pediatric) 70 to 100%: ±3%ABS (neonate) 0% to 69%: Not specified.
When the SpO <sub>2</sub> 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<sub>2</sub> Module

Standards	meets the requirements of ISO 80601-2-61: 2017
Measurement range	1 to 100%
Resolution	1%
Response time	≤20 s (normal perfusion, no disturbance, SpO <sub>2</sub> value sudden changes from 70% to 100%)
Accuracy <sup>1</sup>	70 to 100%: ±2%ABS (measured without motion in adult/pediatric mode) 70 to 100%: ±3%ABS (measured without motion in neonate mode) 70 to 100%: ±3%ABS (measured with motion) 1% to 69%: Not specified.
Refresh rate	≤ 1 s
SpO <sub>2</sub> averaging time	2-4 s, 4-6 s, 8 s, 10 s, 12 s, 14 s, 16 s
Low perfusion conditions	Pulse amplitude: >0.02% Light penetration: >5%
Low perfusion SpO <sub>2</sub> accuracy <sup>2</sup>	±2%
PI measurement range	0.02 to 20%

<sup>1</sup> The Masimo pulse oximeter with sensors have been validated for no motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies in the range of 70% to 100% SpO<sub>2</sub> against a laboratory co-oximeter and ECG monitor. This variation equals plus or minus one standard deviation. Plus or minus one standard deviation encompasses 68% of the population. One percent was added to the accuracies for neonatal sensors to account for accuracy variation due to properties of fetal hemoglobin.

The Masimo pulse oximeter with sensors has been validated for motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies while performing rubbing and tapping motions at 2 to 4 Hz. At an amplitude of 1 to 2 cm and non-repetitive motion between 1 to 5 Hz. At an amplitude of 2 to 3 cm in induced hypoxia studies in the range of 70% to 100% SpO<sub>2</sub> 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.

<sup>2</sup> 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.

## B.4 PR Specifications

Alarm limit	Range	Step
PR High	PR ≤ 40 bpm: (low limit + 2 bpm) to 40 bpm PR > 40 bpm: (low limit + 5 bpm) to 295 bpm	PR ≤ 40: 1 PR > 40: 5
PR Low	PR ≤ 40 bpm: 16 bpm to (high limit - 2 bpm) PR > 40 bpm: 40 bpm to (high limit - 5 bpm)	

### PR from Mindray SpO<sub>2</sub> Module

Measurement range	20 to 300 bpm
Resolution	1 bpm
Response time	<30 s (normal perfusion, no disturbance, PR value sudden changes from 25 to 220bpm)
Accuracy	±3 bpm
Refreshing rate	≤1 s

### PR from Masimo SpO<sub>2</sub>

Measurement range	25 to 240 bpm
Resolution	1 bpm
Response time	≤20 s (with normal perfusion, no disturbance, and a PR value transition from 25 to 220 bpm)
Accuracy	±3 bpm (measured without motion) ±5 bpm (measured with motion)
Refresh rate	≤1 s

### PR from Nellcor SpO<sub>2</sub> 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

## B.5 Temp Specifications

Standard	Meet the standard of ISO 80601-2-56: 2018
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	

## B.6 NIBP Specifications

Standard	Meet standard of IEC 80601-2-30: 2018			
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
Hardware overpressure protection	Adult: ≤330 mmHg Pediatric: ≤330 mmHg Neonate: ≤165 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.

## B.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	≤1 s	
PPV		
Measurement range	0% to 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 <sup>3</sup> /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 ≤ 50: (High limit+ 1) to 360 High limit > 50: (High limit+ 5) to 360	IBP ≤ 50: 1 IBP > 50: 5
Art-M Extreme High		
Art-D Extreme High		
Art-S Extreme Low	low limit ≤ 50: -50 to (low limit- 1) low limit > 50: 50 to (low limit- 5)	
Art-M Extreme Low		
Art-D Extreme Low		

## B.8 CCO Specifications

Standard	Meet the standard of ISO 80601-2-56: 2018	
TB Operating mode	Direct mode	
Minimum time for accurate TB measurement	10 s	
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%
Measured parameters	Measurement range	Measurement Accuracy
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 sensor error)
pCvp	-50 to 300 mmHg	±2% or ±1mmHg, whichever is greater (excluding sensor 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 <sup>2</sup> ) to 15.0 L/min/m <sup>2</sup>	0.1 L/min/m <sup>2</sup>
CCI Low	0.1 L/min/m <sup>2</sup> to (High limit - 0.1 L/min/m <sup>2</sup> )	
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 - 2mmHg) 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: 5 mmHg
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.

## B.9 CO<sub>2</sub> Specifications

Test method described in ISO 80601-2-55 201.12.1.102 is used to determine the rated respiration rate range and the corresponding effects of end-tidal gas reading accuracy as a function of respiratory rate.

End-tidal CO<sub>2</sub> reading is calculated as per the maximum measurement value of expiratory phase.

End-tidal O<sub>2</sub> reading is calculated as per the minimum measurement value of expiratory phase.

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 <sub>2</sub> High	(low limit + 2) to 99 mmHg	1 mmHg
EtCO <sub>2</sub> Low	1 to (high limit - 2)mmHg	
FiCO <sub>2</sub> High	1 to 99 mmHg	

Alarm limit	Range	Step
EtO <sub>2</sub> High	(low limit + 2%) to 100%	1%
EtO <sub>2</sub> Low	0% to (high limit - 2)%	
FiO <sub>2</sub> High	(low limit + 2%) to 100%	
FiO <sub>2</sub> Low	18% to (high limit - 2)%	

### B.9.1 Sidestream CO<sub>2</sub> Module

Standard	Meet the standard of ISO 80601-2-55: 2018
CO <sub>2</sub> Measurement range	0 to 150 mmHg
CO <sub>2</sub> absolute accuracy*	Full accuracy mode: 0 to 40 mmHg: ± 2 mmHg 41 to 76 mmHg: ±5% of reading 77 to 99 mmHg: ±10% of reading 100 to 150 mmHg: ±(3 mmHg + 8% of reading) ISO accuracy mode: add ±2 mmHg to the full accuracy mode
*Inaccuracy specifications are affected by the breath rate and I:E. The EtCO <sub>2</sub> 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 <sub>2</sub> resolution	1 mmHg
O <sub>2</sub> measurement range	0 to 100%
O <sub>2</sub> absolute accuracy	0 ≤ O <sub>2</sub> concentration ≤ 25%: ±1% 25 < O <sub>2</sub> concentration ≤ 80%: ±2% 80 < O <sub>2</sub> concentration ≤ 100%: ±3%
O <sub>2</sub> resolution	1%
Accuracy drift	Meet the requirement for measurement accuracy within 6 hours
Sample flowrate	Using internal CO <sub>2</sub> module: Adult, pediatric, neonatal: 50 ml/min  Using external CO <sub>2</sub> module with O <sub>2</sub> sensor: Adult, pediatric: 120 ml/min Neonatal: 90 ml/min  Using the CO <sub>2</sub> module without O <sub>2</sub> 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	Maximum: 90 s Typically: 20 s

Response time	<p>For CO<sub>2</sub> measurements (using external CO<sub>2</sub> module without O<sub>2</sub> sensor):</p> <p>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</p> <p>≤5.0 s @ 70 ml/min</p> <p>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</p> <p>≤4.5 s @ 90 ml/min</p> <p>Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line:</p> <p>≤5.0 s @ 120 ml/min</p> <p>For CO<sub>2</sub> measurements (using external CO<sub>2</sub> module with O<sub>2</sub> sensor):</p> <p>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</p> <p>≤4.5 s @ 90 ml/min</p> <p>Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line:</p> <p>≤5.0 s @ 120 ml/min</p> <p>For CO<sub>2</sub> measurements (using internal CO<sub>2</sub> module):</p> <p>Measured with a standard Oridion sampling line:</p> <p>≤5.0 s@50 ml/min</p> <p>Measured with a prolonged Oridion sampling line:</p> <p>&lt;6.5 s@50 ml/min</p> <p>For O<sub>2</sub> measurements:</p> <p>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</p> <p>≤4.5 s @ 90 ml/min</p> <p>Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line:</p> <p>≤5.0 s @ 120 ml/min</p>
Rise time	<p>For CO<sub>2</sub> measurements (using external CO<sub>2</sub> module without O<sub>2</sub> sensor):</p> <p>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</p> <p>≤250 ms@70 ml/min.</p> <p>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</p> <p>≤250 ms@90 ml/min.</p> <p>Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line:</p> <p>≤300 ms@120 ml/min</p> <p>For CO<sub>2</sub> measurements (using external CO<sub>2</sub> module with O<sub>2</sub> sensor):</p> <p>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</p> <p>≤250 ms@90 ml/min.</p> <p>Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line:</p> <p>≤300 ms@120 ml/min</p> <p>For CO<sub>2</sub> measurements (using internal CO<sub>2</sub> module):</p> <p>Measured with a standard Oridion sampling line:</p> <p>≤250 ms@50 ml/min</p> <p>Measured with a prolonged Oridion sampling line:</p> <p>≤280 ms@50 ml/min</p> <p>For O<sub>2</sub> measurements:</p> <p>Measured with a DRYLINE II neonatal watertrap and a 2.5-meter neonatal sampling line:</p> <p>≤800 ms@90 ml/min.</p> <p>Measured with a DRYLINE II adult watertrap and a 2.5-meter adult sampling line:</p> <p>≤750 ms@120 ml/min</p>
Data sample rate	100 Hz
awRR measurement range	0 to 150 rpm



awRR measurement precision	<60 rpm: $\pm 1$ rpm 60 to 150 rpm: $\pm 2$ rpm
awRR resolution	1 rpm

Effect of interference gases on CO <sub>2</sub> measurements		
Gas	Concentration (%)	Quantitative effect*
N <sub>2</sub> O	$\leq 60$	$\pm 1$ mmHg
Hal	$\leq 4$	
Sev	$\leq 5$	
Iso	$\leq 5$	
Enf	$\leq 5$	
Des	$\leq 15$	$\pm 2$ mmHg
*: means an extra error should be added in case of gas interference when CO <sub>2</sub> measurements are performed between 0 to 40mmHg.		
Effect of interference gases on O <sub>2</sub> measurements		
Gas	Concentration	
CO <sub>2</sub>	0.2%	
N <sub>2</sub> O	0.2%	
Hal, Des, Sev, Iso, Enf	1.0%	

## B.9.2 Microstream™ CO<sub>2</sub> Module

Standard	Meet the standard of ISO 80601-2-55: 2018
CO <sub>2</sub> Measurement range	0 to 99 mmHg
Accuracy*	0 to 38 mmHg: $\pm 2$ mmHg 39 to 99 mmHg: $\pm 5\%$ of the reading (0.08% increased in error for every 1 mmHg if the reading is more than 38 mmHg)
Accuracy drift	Meets the requirement for measurement accuracy as specified by 80601-2-55
* Accuracy applies for respiration rate up to 80 rpm. For respiration rate above 80 rpm and EtCO <sub>2</sub> exceeding 18 mmHg, the accuracy is 4 mmHg or $\pm 12\%$ of the reading, whichever is greater. For respiration rate above 60 rpm, the above accuracy can be achieved by using the FilterLine 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 ml/min
Sample flowrate tolerance	-7.5/+15 ml/min
Initialization time	180 s (maximum)
Response time	4.3 s (with any 2-meter FilterLine) 5.5 s (with any 4-meter FilterLine)
Rise time	190 msec (with any 2-meter FilterLine) 210 msec (with any 4-meter FilterLine)
Data sample rate	40 Hz
awRR measurement range	0 to 150 rpm

awRR measurement accuracy	0 to 70 rpm: $\pm 1$ rpm 71 to 120 rpm: $\pm 2$ rpm 121 to 150 rpm: $\pm 3$ rpm
awRR resolution	1 rpm

### B.9.3 Mainstream CO<sub>2</sub> Module

Standard	Meet the standard of ISO 80601-2-55: 2018
CO <sub>2</sub> Measurement range	0 to 150 mmHg
Accuracy	0 to 40 mmHg: $\pm 2$ mmHg 41 to 70 mmHg: $\pm 5\%$ of reading 71 to 100 mmHg: $\pm 8\%$ of reading 101 to 150 mmHg: $\pm 10\%$ of reading
Accuracy drift	Meet the requirement for measurement accuracy within 6 hours
Resolution	1 mmHg
Rise time	<60 ms
Effect of interference gases on CO <sub>2</sub> measurements (for module configured with the GA3701 sensor)	Additional worst case error when compensation for O <sub>2</sub> , N <sub>2</sub> O, anesthetic agents, or H <sub>2</sub> is correctly selected: 0 to 40 mmHg: $\pm 1$ mmHg additional error 41 to 70 mmHg: $\pm 2.5\%$ of reading additional error 71 to 100 mmHg: $\pm 4\%$ of reading additional error 101 to 150 mmHg: $\pm 5\%$ of reading additional error Additional error should be added in case of the following gas interference: Xenon ( $\leq 100\%$ ): $\pm 1$ mmHg additional error Ethyl ( $\leq 0.1\%$ ): 0 mmHg additional error Acetone ( $\leq 1\%$ ): $\pm 1$ mmHg additional error
Response time (for module configured with the GA3701 sensor)	<2 s
Data sample rate	100 Hz
awRR measurement range	0 to 150 rpm
awRR measurement accuracy	$\pm 1$ rpm
awRR resolution	1 rpm

# C EMC and Radio Regulatory Compliance

## C.1 EMC

The equipment complies with the EMC standard IEC60601-1-2:2020.

Intended environments: this equipment is intended for use in professional healthcare facility EMC environment and home healthcare EMC environment.

### WARNING


- The use of unapproved accessories may diminish equipment performance.
- The equipment needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided below.
- Use of this equipment adjacent to or stacked with other equipment should be avoided because it could result in improper operation. If such use is necessary, this equipment and the other equipment should be observed to verify that they are operating normally.
- Use of accessories, transducers and cables other than those specified or provided by the manufacturer of this equipment could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation.
- 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 equipment, including cables specified by the manufacturer. Otherwise, degradation of the performance of this equipment could result.
- Other devices may interfere with this equipment even though they meet the requirements of CISPR.
- When the input signal is below the minimum amplitude provided in technical specifications, erroneous measurements could result.
- Use of portable or mobile communications devices can degrade the performance of the equipment.

Guidance and Declaration - Electromagnetic Emissions		
The equipment is intended for use in the electromagnetic environment specified below. The customer or the user of the equipment 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 equipment uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
Conducted and radiated RF EMISSIONS CISPR 11	Class B	The equipment 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 equipment 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 equipment 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	

If the equipment is operated within the electromagnetic environment listed in Table Guidance and Declaration – Electromagnetic Immunity, the equipment 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 equipment is intended for use in the electromagnetic environment specified below. The customer or the user of the equipment 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; ±2 kV, ±4 kV, ±8 kV, ±15 kV air	±8 kV contact; ±2 kV, ±4 kV, ±8 kV, ±15 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines; ±1 kV for input/output lines	±2 kV for power supply lines; ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±0,5 kV, ±1 kV line(s) to line(s); ±0,5 kV, ±1 kV, ±2 kV line(s) to earth	±0,5 kV, ±1 kV line(s) to line(s); ±0,5 kV, ±1 kV, ±2 kV line(s) to earth	
Voltage dips and voltage interruptions IEC 61000-4-11	0 % $U_T$ for 0.5 cycle: at 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°  0 % $U_T$ for 1 cycle and 70 % $U_T$ for 25/30 cycles: at 0°  0 % $U_T$ for 250/300 cycle	0 % $U_T$ for 0.5 cycle: at 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°  0 % $U_T$ for 1 cycle and 70 % $U_T$ for 25/30 cycles: at 0°  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 equipment is intended for use in the specified electromagnetic environment. The customer or the user of the equipment 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 150 kHz to 80 MHz	Portable and mobile RF communications equipment should be used no closer to any part of the equipment, including cables, than the recommended separation distance calculated from the equation appropriate for the frequency of the transmitter. Recommended separation distances: $d = 1.2 \sqrt{P}$
	6 Vrms in ISM bands <sup>a</sup> and amateur radio bands between 0.15 MHz and 80 MHz	6 Vrms in ISM bands <sup>a</sup> and amateur radio bands between 0.15 MHz and 80 MHz	
Radiated RF EM fields IEC61000-4-3	10 V/m 80 MHz to 2.7 GHz	10 V/m 80 MHz to 2.7 GHz	Recommended separation distances: 80 MHz to 800 MHz: $d = 1.2 \sqrt{P}$ 800MHz - 2.7GHz: $d = 2.3 \sqrt{P}$ Where, P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey <sup>b</sup> should be less than the compliance level in each frequency range <sup>c</sup> . Interference may occur in the vicinity of equipment marked with the following symbol: 
	20V/m 80 MHz to 2.5 GHz	20V/m 80 MHz to 2.5 GHz	
<p><b>Note 1:</b> At 80 MHz to 800 MHz, the separation distance for the higher frequency range applies.</p> <p><b>Note 2:</b> These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.</p>			
<p><sup>a</sup>: 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.</p> <p><sup>b</sup>: 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 <b>ME EQUIPMENT or ME SYSTEM</b> is used exceeds the applicable RF compliance level above, the <b>ME EQUIPMENT or ME SYSTEM</b> should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the <b>ME EQUIPMENT or ME SYSTEM</b>.</p> <p><sup>c</sup>: Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3V/m.</p>			

GUIDANCE AND MINDRAY DECLARATION—ELECTROMAGNETIC IMMUNITY			
The equipment is intended for use in the electromagnetic environment specified below. The customer or the user of the equipment should assure that it is used in such an environment.			
IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIROMENT – GUIDANCE
Proximity magnetic fields IEC 61000-4-39	8 A/m 30 kHz CW	8 A/m 30 kHz CW	/
	65 A/m 134,2 kHz Pulse modulation 2,1 kHz	65 A/m 134,2 kHz Pulse modulation 2,1 kHz	
	7,5 A/m 13,56 MHz Pulse modulation 50 kHz	7,5 A/m 13,56 MHz Pulse modulation 50 kHz	

### Test specifications and minimum distances

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 disturbances are controlled. The customer or the user of the equipment can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the equipment as recommended below, according to the maximum output power of the communications equipment. Portable and mobile radio communications equipment (e.g. two-way radio, cellular/ cordless telephones and similar equipment) should be used no closer to any part of this equipment, including cables, than determined according to the following method:						
Test frequency (MHz)	Band(MHz)	Service	Modulation	Maximum power (W)	Distance (m)	Immunity test level (V/m)
385	380 - 390	TETRA 400	Pulse modulation 18Hz	1.8	0.3	27
450	430 -470	GMRS 460 FRS 460	FM $\pm 5$ kHz deviation 1 kHz sine	2	0.3	28
710	704 - 787	LTE Band 13,17	Pulse modulation 217 Hz	0.2	0.3	9
745						
780						
810	800 - 960	GSM 800/900, tetra 800, iDEN 820, CDMA 850, LTE Band 5	Pulse modulation 18 Hz	2	0.3	28
870						
930						
1720	1700 -1990	GSM 1800, CDMA 1900, GSM 1900, DECT, LTE Band 1, 3,4,25,UMTS	Pulse modulation 217 Hz	2	0.3	28
1845						
1970						
2450	2400 -2570	Bluetooth, WLAN, 802.11 b/g/n, RFID 2450, LTE Band 7	Pulse modulation 217 Hz	2	0.3	28
5240	5100 -5800	WLAN, 802.11 a/n	Pulse modulation 217 Hz	0.2	0.3	9

RECOMMENDED SEPARATION DISTANCES BETWEEN PORTABLE AND MOBILE RF COMMUNICATION DEVICE AND THE EQUIPMENT				
The equipment is intended for use in an electromagnetic environment in which radiated RF disturbance are controlled. The customer or the user of equipment can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communication equipment (transmitters) and equipment as recommended below, according to the maximum output power of the communication equipment.				
Rated Maximum Output power of Transmitter (W)	Separation Distance According to Frequency of Transmitter			
	150kHz -80MHz Out ISM and amateur radio bands $d=1.2 \sqrt{P}$	150kHz -80MHz in ISM and amateur radio bands $d=2 \sqrt{P}$	80MHz-800MHz $d=1.2 \sqrt{P}$	800MHz-2.7GHz $d=2.3 \sqrt{P}$
0.01	0.12	0.2	0.12	0.23
0.1	0.38	0.64	0.38	0.73
1	1.2	2	1.2	2.3
10	3.8	6.4	3.8	7.3
100	12	20	12	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.				

## C.2 Radio Regulatory Compliance



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.

- **Changes or modifications not expressly approved by the party responsible compliance could void the user's authority to operate the equipment.**

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# D

## Default Settings

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### D.1 Parameters Default Settings

#### D.1.1 ECG, Arrhythmia, ST and QT Default Settings

##### D.1.1.1 ECG Default Settings

Item		Default Setting
HR/PR	Alarm switch (On/Off)	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/Off)	On
	High limit	Adult: 160 bpm Pediatric: 180 bpm Neonate: 220 bpm
	Priority	High
	Alarm Outputs	Off
Extreme Brady	Alarm switch (On/Off)	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
High Freq Cut-off (for 12-lead only)		35 Hz

Item	Default Setting
Notch Filter	On
Lead Set	Auto
D12L(for 6-lead only)	Off
Smart Lead	On
Baseline Drift Removal (for 12-lead only)	On
Waveform Layout	Standard
Analysis Mode	Multiple Leads
QRS Volume	General, OR: 2 Other department: 0
QRS Threshold	0.16 mV
Paced	Adult: Unspecified Pediatric/neonate: No
Pacer Reject	Off
CrozFusion	On

#### D.1.1.2 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

Item	Alarm Switch	Priority	Alarm Outputs
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
SVT	CCU: On Other departments: Off	Med	Off
SVCs/min	Off	Med	Off

#### D.1.1.3 Arrhythmia Threshold Default Settings

Item	Default Setting		
	Adult	Pediatric	Neonate
Asystole Delay	5 sec	5 sec	3 sec
Tachy	120 bpm	160 bpm	200 bpm
Brady	50 bpm	75 bpm	100 bpm
Extreme Tachy	160 bpm	180 bpm	220 bpm
Extreme Brady	35 bpm	50 bpm	80 bpm
Multif PVCs Window	15 beats	15 beats	15 beats
PVCs/min	10	10	5
Pauses/min	8	8	8
Pause Threshold	2.0 sec	2.0 sec	1.5 sec
AF/Irr Rhy End Time	2 min	2 min	2 min
V-Tach Rate	130 bpm	130 bpm	150 bpm
V-Brady Rate	40 bpm	40 bpm	60 bpm
V-Tach PVCs	6	6	5
V-Brady PVCs	5	5	3
SVT SVCs	5	5	5
SVT HR	180 bpm	200 bpm	210 bpm
SVCs/min	10	10	10

#### D.1.1.4 ST Default Settings

Item	Default Setting
ST Alarm Mode	Absolute

Item		Default Setting
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 <b>Absolute</b> )	Alarm switch (On/Off)	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 <b>Relative</b> )	Alarm switch (On/Off)	Off
	High limit	0.1 mV
	Low limit	-0.1 mV
	Priority	Med
	Alarm Outputs	Off
ST Analysis		Off
ST Segment		Auto
Show Markers		Off
ST Point		J+60 ms
Auto Adjust		On
J		48
ISO		-80

#### D.1.1.5 QT Default Settings

Item		Default Setting
QTc	Alarm switch (On/Off)	Off
	High limit	Adult: 500 Pediatric: 480 Neonate: 460
	Priority	Med
	Alarm Outputs	Off
$\Delta$ QTc	Alarm switch (On/Off)	Off
	High limit	60
	Priority	Med
	Alarm Outputs	Off
QT Analysis		Off
QT Leads		All

#### D.1.1.6 Glasgow 12-lead ECG Algorithm Default Settings

Item	Default Setting
High Freq Cut-off	35 Hz
Baseline Drift Removal	On
Tachy	100

Item	Default Setting
Brady	50
Waveform Layout	Standard
Median Complex	Off
Measurements	On
Interpretation	On
Interpretation Summary	On
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

### D.1.2 Respiration Default Settings

Item		Default Setting
RR	Alarm switch (On/Off)	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/Off)	On
	Priority	Adult: Med, unadjustable Pediatric: Med, unadjustable Neonate: High, unadjustable
	Alarm Outputs	Off
Apnea Delay		20 sec
RR Source		Auto
Resp Lead		Adult: Auto Pediatric: Auto Neonate: II
Gain		×2
Speed		6.25 mm/s
Auto Threshold Detection		On

### D.1.3 SpO<sub>2</sub> Default Settings

Item		Default Setting
SpO <sub>2</sub>	Alarm switch (On/Off)	On
	High limit	Adult: 100% Pediatric: 100% Neonate: 95%
	Low limit	Adult/Pediatric: 90% Neonate: 85%
	Priority	Med
	Alarm Outputs	Off
SpO <sub>2</sub> Desat	Alarm switch (On/Off)	On
	Low limit	80%
	Priority	High
	Alarm Outputs	Off
Sat-Seconds (for Nellcor SpO <sub>2</sub> )		Off
NIBP Simul		Off
Fast SAT(for Masimo SpO <sub>2</sub> )		Off
Display SIQ (for Masimo SpO <sub>2</sub> )		Off
Sensitivity (for Mindray SpO <sub>2</sub> )		Med
Sensitivity (for Masimo SpO <sub>2</sub> )		APOD
Averaging (for Masimo SpO <sub>2</sub> )		8 s
Display PI (for Mindray SpO <sub>2</sub> , Masimo SpO <sub>2</sub> )		On
Speed		25 mm/s
PR	Alarm switch (On/Off)	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
	QRS Volume	General, OR: 2 Other departments: 0
	Display PR	On

## D.1.4 Temperature Default Settings

Item		Default Setting
Txx (xx refers to temperature site)	Alarm switch (On/Off)	On
	High limit	38.0 °C
	Low limit	35.0 °C
	Priority	Med
	Alarm Outputs	Off
ΔT	Alarm switch (On/Off)	On
	High limit	2.0 °C
	Priority	Med
	Alarm Outputs	Off

## D.1.5 NIBP Default Settings

Item		Default Setting
NIBP-S	Alarm switch (On/Off)	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
NIBP-D	Alarm switch (On/Off)	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/Off)	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

Item		Default Setting
NIBP-S Extreme	Alarm switch (On/Off)	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 (On/Off)	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 (On/Off)	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
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



## D.1.6 IBP Default Settings

Item		Default Setting
IBP-S	Alarm switch (On/Off)	On
	High limit	<ul style="list-style-type: none"> <li>■ Art/pArt/Ao/UAP/BAP/FAP/LV/P1/P2 arterial pressure Adult: 160 mmHg Pediatric: 120 mmHg Neonate: 90 mmHg</li> <li>■ PA Adult: 35 mmHg Pediatric and neonate: 60 mmHg</li> </ul>
	Low limit	<ul style="list-style-type: none"> <li>■ Art/pArt/Ao/UAP/BAP/FAP/LV/P1/P2 arterial pressure Adult: 90 mmHg Pediatric: 70 mmHg Neonate: 55 mmHg</li> <li>■ PA Adult: 10 mmHg Pediatric and neonate: 24 mmHg</li> </ul>
	Priority	Med
	Alarm Outputs	Off
IBP-D	Alarm switch (On/Off)	On
	High limit	<ul style="list-style-type: none"> <li>■ Art/pArt/Ao/UAP/BAP/FAP/LV/P1/P2 arterial pressure Adult: 90 mmHg Pediatric: 70 mmHg Neonate: 60 mmHg</li> <li>■ PA Adult: 16 mmHg Pediatric and neonate: 4 mmHg</li> </ul>
	Low limit	<ul style="list-style-type: none"> <li>■ Art/pArt/Ao/UAP/BAP/FAP/LV/P1/P2 arterial pressure Adult: 50 mmHg Pediatric: 40 mmHg Neonate: 20 mmHg</li> <li>■ PA Adult: 0 mmHg Pediatric and neonate: -4 mmHg</li> </ul>
	Priority	Med
	Alarm Outputs	Off
IBP-M	Alarm switch (On/Off)	On
IBP-M	High limit	<ul style="list-style-type: none"> <li>■ Art/pArt/Ao/UAP/BAP/FAP/LV/P1/P2 arterial pressure Adult: 110 mmHg Pediatric: 90 mmHg Neonate: 70 mmHg</li> <li>■ PA Adult: 20 mmHg Pediatric and neonate: 26 mmHg</li> <li>■ CVP/pCVP Adult: 14 cmH<sub>2</sub>O Pediatric and neonate: 5 cmH<sub>2</sub>O</li> <li>■ ICP/RAP/LAP/UVF/P3/P4 venous pressure Adult: 10 mmHg Pediatric and neonate: 4 mmHg</li> </ul>

Item		Default Setting
IBP-M	Low limit	<ul style="list-style-type: none"> <li>■ Art/pArt/Ao/UAP/BAP/FAP/LV/P1/P2 arterial pressure Adult: 70 mmHg Pediatric: 50 mmHg Neonate: 35 mmHg</li> <li>■ PA Adult: 0 mmHg Pediatric and neonate: 12 mmHg</li> <li>■ CVP/pCVP Adult: 0 cmH<sub>2</sub>O Pediatric and neonate: 0 cmH<sub>2</sub>O</li> <li>■ ICP/RAP/LAP/UV/P3/P4 venous pressure Adult: 0 mmHg Pediatric and neonate: 0 mmHg</li> </ul>
IBP-M	Priority	Med
	Alarm Outputs	Off
Art-S Extreme	Alarm switch (On/Off)	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 (On/Off)	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 (On/Off)	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

Item		Default Setting
CPP	Alarm switch (On/Off)	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
Auto Scale		Off
Upper Scale	Art, LV, Ao, FAP, BAP, P1, P2	160 mmHg
	CVP, ICP, LAP, RAP, UVP	20 mmHg
	UAP, P3, P4	80 mmHg
	PA	30 mmHg
Lower Scale		-5 mmHg
PPV Measure		Off
PPV Source		Auto
PAWP	Reference Waveform 1	II
	Reference Waveform 2	Resp
	Speed	12.5 mm/sec
	PA Scale (mmHg)	0-30
Overlapping Waveform Setup	Left Scale (mmHg)	0-160
	Right Scale (mmHg)	0-20
	CVP Scale (cmH2O)	0-30
	ICP Scale (mmHg)	0-20
	PA Scale (mmHg)	0-30
	Speed	25 mm/sec
	Gridlines	Off
Display Format		Sys/Dia(Mean)
Display Alarm Limits		Off
Use PA-D as PAWP (only available for independent external display)		Off

### D.1.7 CCO Default Settings (PiCCO)

Item		Default Setting
CCO	Alarm switch (On/Off)	On
	High limit	Adult: 8.5 Pediatric: 3.7
	Low limit	Adult: 4.0 Pediatric: 2.6
	Priority	Med
	Alarm Outputs	Off
CCI	Alarm switch (On/Off)	On
	High limit	4.3
	Low limit	Adult: 2.0 Pediatric: 2.6
	Priority	Med
	Alarm Outputs	Off
Auto pCVP		On
Auto Start		On
Injectate Volume		Adult: 15 ml Pediatric: 10 ml
TD Reminder		8 hr
Select Parameter		CCI, GEDI, ELWI, SVRI, GEF

### D.1.8 CO<sub>2</sub> Default Settings

#### D.1.8.1 General Settings

Item		Default Setting
EtCO <sub>2</sub>	Alarm switch (On/Off)	On
	High limit	Adult and pediatric: 50 mmHg Neonate: 45 mmHg
	Low limit	25mmHg
	Priority	Med
	Alarm Outputs	Off
FiCO <sub>2</sub>	Alarm switch (On/Off)	On
	High limit	4 mmHg
	Priority	Med
	Alarm Outputs	Off
Apnea Delay		20 s
RR Source		Auto
Speed		6.25 mm/s
Scale		50 mmHg
Waveform Type		Draw

### D.1.8.2 Sidestream CO<sub>2</sub> Default Settings

Item		Default Setting
EtO <sub>2</sub>	Alarm switch (On/Off)	On
	High limit	88%
	Low limit	18%
	Priority	Med
	Alarm Outputs	Off
FiO <sub>2</sub>	Alarm switch (On/Off)	On
	High limit	Adult and pediatric: 100% Neonate: 90%
	Low limit	18%
	Priority	Med
	Alarm Outputs	Off
BTPS Compensation		Off
O <sub>2</sub> Compensation		OR: 100% Other departments: 21%
AG Compensation		0%
N <sub>2</sub> O Compensation		0%
Auto Standby		60 min
Operating Mode		Measure

### D.1.8.3 Microstream™ CO<sub>2</sub> Default Settings

Item	Default Setting
BTPS Compensation	Off
Maximum Hold	20 sec
Auto Standby	Off
Operating Mode	Measure

### D.1.8.4 Mainstream CO<sub>2</sub> Default Settings

Item	Default Setting
Maximum Hold	10 sec
O <sub>2</sub> Compensation	Off
Balance Gas	Room Air
AG Compensation	0%
Operating Mode	Measure

## D.2 Routine Default Settings

### D.2.1 Alarm Default Settings

Item	Default Setting
Alarm Volume	Neonatology: 7 CCU: 2 Other departments: 4
High Alarm Volume	Alarm Volume+3
Reminder Volume	2
Apnea Delay	20 sec
Printing Duration On Alarm	20 sec
SpO2 Low Escalation Time	2 min
Alarm Limits Recommendation	Off

### D.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	All
	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

### D.2.3 Minitrends Default Settings (Only Available for the Independent External Display)

Item		Default Setting
Alarm Statistics		OR: Off Other departments: On
Alarm Statistics Duration		OR: 2hrs Other departments: 8 hrs
Minitrend Length		OR: 30 min Other departments: 2 hrs
Baseline (for OR department only)		Off
Routine Vital		Off
Time	(For <b>Routine Vital</b> set to <b>Auto</b> )	08:00
Interval	(For <b>Routine Vital</b> set to <b>Auto</b> )	8 hrs

### D.2.4 OxyCRG Default Settings (Only Available for the Independent External Display)

Section	Item	Default Setting
Parameters Setup	Trend1	btbHR
	Trend2	SpO2
	Compressed	Resp
Apnea Event	Threshold (HR)	100
	Duration (HR)	0 s
	Threshold (SpO2)	80
	Duration (SpO2)	0 s
	Apnea	15 sec
	Event Storage Format	2 min+2 min

### D.2.5 Remote View Default Settings (Only Available for the Independent External Display)

Item	Default Setting
Rollup Alarm Beds	Off
Rollup Interval	Off
Alarm Priority	High Only
Switch Bed Prompt Voice	Off

### D.2.6 Display Default Settings

Item	Default Setting
Choose Screen	Normal Screen

Item		Default Setting
Display	Screen Lock Duration (Only Available for the Independent External Display)	General: Permanent CCU: Permanent Other departments: 10 sec
	Brightness	Auto
	Key Volume	2
Night Mode	Brightness	Auto
	All Mute	Off
	Alarm Volume	2
	QRS Volume	0
	Key Volume	0
	Reminder Volume	1
	NIBP End Tone	Off
	Stop NIBP	Off
	Auto Night Mode	Off
	Night Time Period	22:00 - 6:00

## D.2.7 Report Default Settings

### D.2.7.1 Report Setup

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



## D.2.8 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

## D.2.9 System Time Default Settings

Item	Default Setting
Date Format	yyyy-mm-dd
24-Hour Time	On
Daylight Savings Time	Off

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# E Alarm Messages

## E.1 Physiological Alarm Messages

This section lists physiological alarms, their default priority, and the actions that can be taken when an alarm occurs.

### E.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<sub>2</sub>, PR, and so on.

### E.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 High	Med
Pauses/min High	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
Pacer Not Capture	Prompt

Alarm message	Default priority
Missed Beat	Prompt
A-Fib	Prompt
SVT	Med
SVCs/min High	Med

**Note:** When arrhythmia alarms occur, check the patient's condition and the ECG connections.

### E.1.3 ST Physiological Alarm Messages

ST alarm mode	Alarm messages	Default priority	Cause and solution
Absolute	ST-XX High	Med	The ST value of respective ECG lead 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.
	ST-XX Low	Med	
Relative	ST Single	Med	ST value of any ECG leads 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.
	ST Dual	Med	ST values of two or more ECG leads have 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.

**Note:** XX represents the ECG lead label.

### E.1.4 Resp Physiological Alarm Messages

Alarm message	Default priority	Cause and solution
Resp Artifact	High	The patient's heartbeat has interfered with his respiration. Check the patient's condition and the Resp connections.
Apnea	Adult: Med Pediatric: Med Neonate: High	The respiration signal was so weak that the monitor cannot perform respiration analysis. Check the patient's condition, module and patient connections.

### E.1.5 SpO<sub>2</sub> Physiological Alarm Messages

Alarm message	Default priority	Cause and solution
SpO <sub>2</sub> Low (YY hrs YY min YYsec)	High	The SpO <sub>2</sub> value falls below the alarm limit. Check the patient's condition and check if the alarm limit settings are correct.
SpO <sub>2</sub> Desat (YY hrs YY min YYsec)	High	The SpO <sub>2</sub> value falls below the desaturation alarm limit. Check the patient's condition and check if the alarm limit settings are correct.

**Note:** YY hrs YY min YYsec represents the period of time that the SpO<sub>2</sub> alarm has lasted.

### E.1.6 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, SpO <sub>2</sub> sensor and measurement site.

### E.1.7 NIBP Physiological Alarm Messages

Alarm message	Default priority	Cause and solution
NIBP-S Extremely High/ NIBP-D Extremely High/ 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 Extremely High
NIBP-S Extremely Low/NIBP-D Extremely Low/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.

### E.1.8 IBP Physiological Alarm Messages

Alarm message	Default priority	Cause and solution
Art-S Extremely High/Art-D Extremely High/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 Extremely Low/Art-D Extremely Low/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.

### E.1.9 CO<sub>2</sub> Physiological Alarm Messages

Alarm message	Default priority	Cause and solution
FiO <sub>2</sub> Shortage	High	FiO <sub>2</sub> concentration is less than 18%. Check the patient's condition, the ventilated O <sub>2</sub> content and the airway connection.

### E.1.10 EWS Physiological Alarm Messages

Alarm message	Default priority	Cause and solution
EWS Score $\geq N^1$	High/Med	The total score exceeds the configured alarm limit. Check the patient condition.
XX <sup>2</sup> score is 3	Med	The parameter score is 3. Check the patient condition.

**Note1:** 1. N represents the EWS score.

**Note2:** 2. XX represents RR, SpO<sub>2</sub>, Temp, BP-S, BP-D, BP-M, HR, EtCO<sub>2</sub>, or FiO<sub>2</sub>.

### E.1.11 Combined Alarm Messages

Alarm message	Default priority	Cause and solution
HR > XX with IBP-S < XX and RR > XX over YY min	High	This indicates a risk of early stage shock. Check patient status.
qSOFA score $\geq 2$ over YY min	Med	This indicates a risk of early stage sepsis. Check patient status.
ICP-M > XX over YY min	High	This indicates an increased the risk of death. Check patient status.
CPP > XX over YY min	Med	This indicates increased the risk of death and poor prognosis. Check patient status.
CPP < XX over YY min >	Med	

EtCO <sub>2</sub> ≤ XX over YY min	High	This indicates a risk of respiratory depression. Check patient status.
EtCO <sub>2</sub> ≥ XX over YY min		
RR ≤ XX over YY min		
SpO <sub>2</sub> ≤ XX over YY min		
IBP-S ↓ XX within YY min	Prompt	This indicates probable septic shock, gastrointestinal bleeding, or cardiac failure. Check patient status.
IBP-S ↑ XX within YY min		
HR ↓ XX within YY min		
HR ↑ XX within YY min		
PR ↓ XX within YY min		
PR ↑ XX within YY min		
A-Fib with RVR over YY min	High	This indicates critical atrial fibrillation. Check patient status.
A-Fib with Long R-R Interval	High	
R on T with QT Prolonged	Med	The patient has obvious prolonged QT interval with R on T premature ventricular contraction. Check patient status.
Frequent PVCs with QT Prolonged	Med	Premature ventricular contractions with prolonged QT intervals. Check patient status.

**Note:** XX refers to a parameter threshold and YY represents a time threshold. "↓" represents a decrease of parameter measurement. "↑" represents an increase of parameter measurement.

## E.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 check mark ✓ appears before the alarm message.

In the following tables we will use A, B, and C to refer to the indications on alarm reset.

### E.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 HR, RR, SpO<sub>2</sub>, EtCO<sub>2</sub>, and so on.

### E.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.

Alarm message	Default priority	Indication on alarm reset	Cause and solution
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.
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 Lead Off (YY hrs YY min YYsec)	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	/	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:** The alarm priority of ECG XX Lead Off depends on whether HR value is available. If HR value is available, the priority of ECG XX Lead Off is "Low". If HR value is not available, the priority of ECG XX Lead Off is defined by the setting of ECG Lead Off from the Maintenance menu. For more information, see ECG Lead Off in 22.4.7 The Other Tab.

**Note:** XX represents ECG lead label, for example LL, V, Va, Vb, and so on.

**Note:** YY hrs YY min YYsec represents the period of time that the ECG Lead Off alarm lasts.

### E.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.

### E.2.4 SpO<sub>2</sub> Technical Alarm Messages

Alarm message	Default priority	Indication on alarm reset	Cause and solution
SpO <sub>2</sub> Sensor Off	Low	B	The SpO <sub>2</sub> sensor has become detached from the patient or the module. Check the sensor connection. If the alarm persists, replace the sensor.
SpO <sub>2</sub> No Sensor	Low	A	The SpO <sub>2</sub> extension cable is detached from the SpO <sub>2</sub> module, or the SpO <sub>2</sub> sensor is detached from the SpO <sub>2</sub> extension cable. Check the SpO <sub>2</sub> cable and the sensor connection. If the alarm persists, replace the sensor.

Alarm message	Default priority	Indication on alarm reset	Cause and solution
SpO2 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.
SpO2 No Pulse	Low	C	The SpO <sub>2</sub> sensor failed to obtain pulse signal. Check the patient's condition and replace the sensor application site. If the alarm persists, replace the sensor.
SpO2 Sensor Incompatible	Low	C	Incompatible or an unspecified SpO <sub>2</sub> sensor is used. Use specified sensors.
SpO2 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.
SpO2 Interference	Low	C	The SpO <sub>2</sub> signal has been interfered. Check for any possible sources of signal noise and check the patient for excessive motion.
SpO2 Sensor Error	Low	C	Replace the sensor and measure again.
SpO2 Searching Pulse	Prompt	/	SpO <sub>2</sub> is searching for pulse.
SpO2 Low Perfusion	Prompt	/	The SpO <sub>2</sub> 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.

## E.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.

## E.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.



Alarm message	Default priority	Indication on alarm reset	Cause and solution
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.
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.

## E.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	Med	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. Make sure that the valve is open to the patient. If the alarm persists, contact your service personnel.
Host Monitor Version Low	Low	A	The N Series system software version is too low. In order for the N Series monitor to connect to the N1 which connects to the external IBP module and perform IBP monitoring, the system software of N 1 and N series monitor should be V02.25 and above.

**Note:** XX represents an IBP label, for example PA, CVP, FAP, P1, and so on.

## E.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 Sensor Off/TB Sensor Off	Low	A	Check the sensor connections.
TI Sensor Error	Low	C	Replace the sensor.
Abnormal pArt Curve	Low	C	pArt is not detected. Check that pArt is properly measured. For example IBP sensor is properly zeroed and the sensor is properly connected to the patient.

## E.2.9 CO<sub>2</sub> Technical Alarm Messages

Alarm message	Default priority	Indication on alarm reset	Cause and solution
CO2 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 <sub>2</sub> module may fail, contact your service personnel.
CO2 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 <sub>2</sub> module may fail, contact your service personnel.
CO2 Zero Failed	Low	C	For mainstream CO <sub>2</sub> module, check the connections between the adapter and CO <sub>2</sub> transducer. Wait till the sensor's temperature becomes stabilized, and then perform a zero calibration again. For sidestream CO <sub>2</sub> module, replug the module. If the alarm persists, contact your service personnel.
CO2 No Watertrap	Low	B	Check the watertrap connections.
CO2 No Adaptor	Low	B	Check the adaptor connection.
CO2 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.
CO2 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.
High Barometric	Low	C	The ambient pressure exceeds the operating pressure range or CO <sub>2</sub> 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.
Low Barometric	Low	C	The ambient pressure exceeds the operating pressure range or CO <sub>2</sub> 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.
CO2 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.

Alarm message	Default priority	Indication on alarm reset	Cause and solution
CO2 No Filterline	Low	A	Make sure that the filterline is connected.
CO2 Calibration Required	Low	C	Perform a calibration.
CO2 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.
CO2 Adapter Error	Low	A	Check, clean or replace the airway adapter. Perform a zero calibration.
CO2 No Sensor	Low	A	Make sure that the CO <sub>2</sub> transducer is connected.
CO2: Change Watertrap	Low	C	Replace the watertrap.
CO2 Watertrap and Patient Mismatch	Low	C	Check the patient category and use a correct watertrap.

## E.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, SpO<sub>2</sub>, Supp. O<sub>2</sub>, Temp, BP, HR, Consciousness, Blood Sugar, Urine Output, Catheter, Pain Score, Pain, EtCO<sub>2</sub>, FiO<sub>2</sub>, Airway, or Customer defined parameter.**

## E.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 aged, replace the battery.	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.

Alarm message	Default priority	Indication on alarm reset	Cause and solution
XX V Too High	High	C	There is a problem with the system power supply. Restart the monitor.
XX V Too Low	High	C	

**Note:** XX represents 2.5 V, 3.3 V, 5 V, or 12 V.

## E.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.

## E.2.13 Technical Alarm Messages Related to Networked Monitoring

Alarm message	Default priority	Indication on alarm reset	Cause and solution
CMS/eGW Disconnected	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.

## E.2.14 Other System Technical Alarm Messages

Alarm message	Default priority	Indication on alarm reset	Cause and solution
Read dock E2PROM error!	High	C	<p>1. Check if you're using the specified external display.</p> <ul style="list-style-type: none"> <li>If you're using the specified external display, remove the N1 from the Dock, and reconnect the N1 and the Dock.</li> <li>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.</li> </ul> <p>2. If the alarm persists, contact your service personnel.</p>
Storage 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.
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 <i>3.11.1 Switching On or Off a Parameter</i> .
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 <i>3.11.2 Displaying Parameter Numerics and Waveforms</i> .
The patient data storage space is nearly full. Please delete some discharged patients.	Med	B	Delete unnecessary earlier discharged patient.
Patient ID conflicts with XX (XX represents Department-Room number-Bed number)	Med	B	Patient ID of the current patient conflicts with that on another device. Discharge the patient from unused device.
Visit number conflicts with XX (XX represents Department-Room number-Bed number)	Med	B	Visit number of the current patient conflicts with that on another device. Discharge the patient from unused device.

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# F

## Electrical Safety Inspection

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The following electrical safety tests are recommended as part of a comprehensive preventive maintenance program. They are a proven means of detecting abnormalities that, if undetected, could prove dangerous to either the patient or the operator. Additional tests may be required according to local regulations.

All tests can be performed using commercially available safety analyzer test equipment. These procedures assume the use of a 601PROXL International Safety Analyzer or equivalent safety analyzer. Other popular testers complying with IEC 60601-1 used in Europe, such as Fluke, Metron, or Gerb, may require modifications to the procedure. Please follow the instructions of the analyzer manufacturer.

The 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.

### F.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.

### F.2 Device Enclosure and Accessories

#### F.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.).

## F.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.

## F.3 Device Labeling

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

- Main unit label
- Integrated warning labels

## F.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,  $R = 0.2 \Omega$  Maximum

## F.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  $\mu$ A in Normal Condition
- ◆ 1000  $\mu$ A in Single Fault Condition

For IEC60601-1,

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



## F.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  $\mu$ A in Normal Condition
- ◆ 50  $\mu$ A in Single Fault Condition

For BF  applied parts

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

## F.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  $\mu$ A
- ◆ For BF  applied parts: 5000  $\mu$ A

## F.8 Patient Auxiliary Current

Patient Auxiliary currents are measured between any selected Applied Part connector and the remaining Applied Part connectors. 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  $\mu$ A in Normal Condition
- ◆ 50  $\mu$ A in Single Fault Condition

For BF  applied parts,

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

### NOTE

- 
- **Make sure the safety analyzer is authorized comply with requirement of IEC60601-1.**
  - **Follow the instructions of the analyzer manufacturer.**
-

# **G** ECG Wave Recognition Method for Mindray Resting 12-lead ECG Analysis Algorithm

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## **G.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.

## **G.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.

## **G.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.

## **G.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.

## **G.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.

## **G.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  $\mu$ V. The global QRS duration is from global QRS onset to the global QRS termination.

## **G.7 ST segment**

The ST segment measurements are made at J point, and at equal intervals throughout the ST segment.

## G.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.

## G.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	$\pm 10$	2.256	SD $\leq 8$
QRS DURATION	-0.143	$\pm 6$	2.413	SD $\leq 5$
PR INTERVAL	-8.286	$\pm 10$	1.729	SD $\leq 8$
QT INTERVAL	1.385	$\pm 12$	6.501	SD $\leq 10$
Q DURATION	-0.108	$\pm 6$	4.241	SD $\leq 5$
R DURATION	3.020	$\pm 6$	2.710	SD $\leq 5$
S DURATION	-3.282	$\pm 6$	3.396	SD $\leq 5$

## G.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	$\pm 10$	10.194	SD $\leq 15$
QRS Duration	-9.750	$\pm 10$	6.676	SD $\leq 10$
PQ Interval	2.458	$\pm 10$	7.182	SD $\leq 10$
QT Interval	-4.500	$\pm 25$	14.483	SD $\leq 30$

## G.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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# H

## Abbreviations

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Abbreviation	In Full
°C	centigrade
°F	Fahrenheit
μA	microampere
μV	microvolt
μs	microsecond
Ω	ohm
A	ampere
Ah	ampere hour
AaDO <sub>2</sub>	alveolar-arterial oxygen gradient
AC	alternating current
Adu	adult
AG	anaesthesia gas
AHA	American Heart Association
Ao	aortic pressure
Art	arterial
ATMP	barometric pressure
aVF	left foot augmented lead
aVL	left arm augmented lead
aVR	right arm augmented lead
awRR	airway respiratory rate
BAP	brachial arterial pressure
BoA	Balance of Anesthesia
bpm	beat per minute
bps	bit per second
BSA	body surface area
BT	blood temperature
BTPS Compensation	body temperature and pressure, saturated
CAA	Clinical Assistive Application
CaO <sub>2</sub>	arterial oxygen content
cc	cubic centimeter
CCI	continuous cardiac index
CCO	continuous cardiac output
CCU	cardiac (coronary) care unit
CE	Conformité Européenne

Abbreviation	In Full
CFI	cardiac function index
C.I.	cardiac index
CIS	clinical information system
CISPR	International Special Committee on Radio Interference
cm	centimeter
cmH <sub>2</sub> O	centimeters of water
CMOS	complementary metal oxide semiconductor
CMS	central monitoring system
C.O.	cardiac output
CO <sub>2</sub>	carbon dioxide
COHb	carboxyhemoglobin
Compl	compliance
CPI	cardiac power index
CQI	CPR quality index
CPO	cardiac power output
CVP	central venous pressure
dB	decibel
DC	direct current
Des	desflurane
Dia	diastolic
dpi	dot per inch
dPmx	left ventricular contractility
DS	dyne second
DVI	digital video interface
DO <sub>2</sub>	oxygen delivery
DO <sub>2</sub> I	oxygen delivery index
ECG	electrocardiograph
EDV	end-diastolic volume
EE	Energy Expenditure
EEC	European Economic Community
EMC	electromagnetic compatibility
EMG	electromyograph
EMI	electromagnetic interference
Enf	enflurane
ESU	electrosurgical unit
Et	end-tidal
EtAA	end-tidal anesthetic agent



Abbreviation	In Full
EtDes	end-tidal anesthetic agent
EtEnf	
EtHal	
EtIso	
EtSev	
EtCO <sub>2</sub>	end-tidal carbon dioxide
EtN <sub>2</sub> O	end-tidal nitrous oxide
EtO	ethylene oxide
EtO <sub>2</sub>	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 <sub>2</sub>	Mixed Expired CO <sub>2</sub> Concentration
Fi	fraction of inspired
FiAA	inspired anesthetic agent
FiDes	inspired anesthetic agent
FiEnf	
FiHal	
FiIso	
FiSev	
FiCO <sub>2</sub>	fraction of inspired carbon oxygen
FiN <sub>2</sub> O	fraction of inspired nitrous oxide
FiO <sub>2</sub>	fraction of inspired oxygen
FPGA	field programmable gate array
FV	flow-volume
g	gram
GCS	Glasgow Coma Scale
GEDV	global end diastolic volume
GEDI	global end diastolic volume index
GEF	global ejection fraction
GHz	gigahertz
GTT	gutta
h	hour
Hal	halothane
Hb	hemoglobin
Hct	haematocrit

Abbreviation	In Full
HIS	hospital information system
HR	heart rate
Hz	hertz
in	inch
IABP	intra-aortic balloon pump
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
k	kilo
kg	kilogram
kPa	kilopascal
LA	left arm
LAP	left atrial pressure
LCD	liquid crystal display
LCW	left cardiac work
LCWI	left cardiac work index
LDAP	Lightweight Directory Access Protocol
LED	light emitting diode
LL	left leg
LVET	left ventricular ejection time
LVSW	left ventricular stroke work
LVSWI	left ventricular stroke work index
L	litre
lb	pound
m	meter
MAC	minimum alveolar concentration
mAh	milliampere hour
MAP	mean arterial pressure

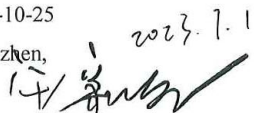
Abbreviation	In Full
Mb	mega byte
Mb	Myoglobin
mcg	microgram
mEq	milli-equivalents
MetHb	methemoglobin
MEWS	Modified Early Warning Score
mg	milligram
min	minute
ml	milliliter
MLDAP	Mindray LDAP, Mindray Lightweight Directory Access Protocol
mm	millimeter
mmHg	millimeters of mercury
MRI	magnetic resonance imaging
ms	millisecond
mV	millivolt
mW	milliwatt
MΩ	megaohm
MV	minute volume
MValv	Alveolar Minute Volume
MVCO <sub>2</sub>	CO <sub>2</sub> minute production
MVe	expiratory minute volume
MVi	inspiratory minute volume
MVO <sub>2</sub>	O <sub>2</sub> minute consumption
N/A	not applied
N <sub>2</sub>	nitrogen
N <sub>2</sub> O	nitrous oxide
Neo	neonate
NEWS	National Early Warning Score
NIBP	noninvasive blood pressure
NIF	negative inspiratory force
nm	nanometer
O <sub>2</sub>	oxygen
O <sub>2</sub> %	oxygen concentration
OR	operating room
oxyCRG	oxygen cardio-respirogram
PA	pulmonary artery
pArt	artery pressure from the PiCCO module
pArt-D	diastolic artery pressure from the PiCCO module
pArt-M	mean artery pressure from the PiCCO module

Abbreviation	In Full
pArt-S	systolic artery pressure from the PiCCO module
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
PIF	peak inspiratory flow
PI	perfusion index
PIP	peak inspiratory pressure
Pleth	plethysmogram
Pmean	mean pressure
PO <sub>2</sub>	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
rpm	breaths per minute
RQ	respiratory quotient
RR	respiration rate
RSBI	rapid shallow breathing index
s	second
Sev	sevoflurane
SI	stroke index
SlopeCO <sub>2</sub>	Slope of the alveolar plateau
SMR	satellite module rack
SOFA	Sepsis-Related Organ Failure Assessment

Abbreviation	In Full
SpO <sub>2</sub>	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
SVR	systemic vascular resistance
SVRI	systemic vascular resistance index
SVV	stroke volume variation
SvO <sub>2</sub>	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
V	volt
VA	volt ampere
VAC	volts alternating current
VEPT	volume of electrically participating tissue
VPB	ventricular premature beat per minute
W	watt

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# Declaration of Conformity

Declaration of Conformity V3.0		
<b>Declaration of Conformity</b>		
<b>Manufacturer:</b>	Shenzhen Mindray Bio-Medical Electronics Co., Ltd. Mindray Building, Keji 12th Road South, High-tech Industrial Park, Nanshan, Shenzhen, 518057, P. R. China	
<b>EC-Representative:</b>	Shanghai International Holding Corp. GmbH (Europe) Eiffestraße 80 20537 Hamburg, Germany	
<b>Product:</b>	<b>Patient Monitor (Including Accessories)</b>	
<b>Model:</b>	BeneVision N1 / BeneVision M1	
<p>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.</p>		
<b>Standards Applied:</b>		
<input checked="" type="checkbox"/> EN 60601-1:2006+A1:2013+A2:2021	<input checked="" type="checkbox"/> EN 60601-1-2:2015/A1:2021	
<input checked="" type="checkbox"/> EN IEC 62311:2020	<input checked="" type="checkbox"/> EN 50566:2013	
<input checked="" type="checkbox"/> EN 62209-2:2010	<input checked="" type="checkbox"/> ETSI EN 301 489-1 V2.2.2	
<input checked="" type="checkbox"/> ETSI EN 301 489-17 V3.2.4	<input checked="" type="checkbox"/> EN 300 328 V2.2.2	
<input checked="" type="checkbox"/> ETSI EN 301 893 V2.1.1		
<b>Start of CE-Marking:</b>	2017-10-25	
<b>Place, Date of Issue:</b>	Shenzhen, 2023.7.11	
<b>Signature:</b>		
<b>Name of Authorized Signatory:</b>	Mr. Wang Xinbing	
<b>Position Held in Company:</b>	Deputy Director, Technical Regulation	

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