LEPU MEDICAL

AIView Series

Patient Monitor

Operator’s Manual

I Preface

Copyright

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Manual Purpose

The instructions for safe operation of the product in keeping with its function and intended use are contained in this manual. In order to operate the product properly, and protect patient and operator from injury, compliance with this manual is first priority.

This manual is based on the maximum configuration and therefore some contents may not apply to your product. Please keep in touch with the manufacturer or your local distributor if you have any questions.

As an indispensable portion of the product, this manual should always be placed near the device so that it can be got easily when needed.

Intended Audience

This manual applies to clinical professionals with knowledge of medical procedures, practices and terminology as required for monitoring of critically ill patients.

Only clinical professionals, anyone who are under their guidance or people who have been trained adequately can use this monitor. The unauthorized or the untrained are forbidden to operate the product.

About this Manual

P/N: 256-100215-D2
Release Date: April 2026
Version: V1.0
Software Version: V1

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II Manual Conventions

Illustrations

Setup or data displayed on your monitor may not be necessarily showed in all illustrations in this manual, because they are used only as examples.

All names mentioned in this manual and illustrations are fictitious. Any similarity is purely coincidental.

General Notes

- *Italic* text is used to indicate prompt information or quote the referenced chapters or sections.
- [XX] is used to indicate the character string in the software.
- → is used to indicate operational procedures.

Special Notes

The warnings, cautions and notes in this manual are used to remind readers of some specific 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.

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Chapter 1 Safety

1.1 Safety Information

1.1.1 Warnings

⚠ Warning

WARNING for PACEMAKER PATIENTS: Although the pacemaker pulse inhibition function is available in this device, the heart rate meter may continue to count the pacemaker rate during occurrences of cardiac arrest or some arrhythmias. Do not rely entirely upon rate meter ALARMS. Keep pacemaker patients under close surveillance. See this manual for disclosure of the pacemaker pulse rejection capability of this device.

⚠ Warning

Each time the monitor is used, check the alarm limits to ensure that they are appropriate for the patient being monitored.

⚠ Warning

Before putting the system into operation, the operator must verify that the device, connecting cables, and accessories are in correct working order and operating condition.

⚠ Warning

The alarm limit shall be within the measuring range, or it may disable the alarm system. Please refer to the related chapter for alarm limit range.

⚠ Warning

A HAZARD can exist if different alarm presets are used for the same or similar device in a single area.

⚠ Warning

Do not silence the audible alarm if patient safety may be compromised.

⚠ Warning

The monitor is prohibited from applying to those who have severe hemorrhagic tendency or who are with sickle cell disease for they may develop partial bleeding when this monitor is used to take the blood pressure measurement.

⚠ Warning

Connect only approved equipments to this device. Equipments connected to the device 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 equipments to the device'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.

⚠ Warning

The device should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the device should be observed to verify that it can run normally in the configuration in which it is used.

⚠ Warning

Do not touch the patient or metal parts in contact with the patient during defibrillation. Otherwise serious injury or death could result.

⚠ Warning

This device is used for a single patient at a time.

⚠ Warning

To avoid explosion hazards, do not use the equipment in the presence of oxygen-rich atmospheres, flammable anesthetics, or other flammable agents.

⚠ Warning

Using the device in the environment of flammable anaesthetic agents may be at risk of explosion.

⚠ Warning

Disconnect the monitor and sensors from the patient before MRI scanning. Using them during MRI could cause burns or adversely affect the MRI image or the monitor's accuracy.

⚠ Warning

If you are in doubt about the accuracy of any measurement, firstly check the patient's vital signs by any alternative means, and then make sure the monitor is functioning properly.

⚠ Warning

The monitor is intended only as an adjunct in patient assessment. It must be used in conjunction with clinical signs and symptoms.

⚠ Warning

The monitor is defibrillation-proof. Verify that the accessories can function safely and normally, and the monitor is grounded correctly before conducting defibrillation. Operate the device on battery power if the integrity of the protective earth conductor or the protective earthing system in the installation is in doubt.

⚠ Warning

Do not place the device or accessories in any position that might cause it to fall on the patient.

⚠ Warning

All the connecting cables and tubes of the applying parts should be kept away from the patient's neck to prevent any possible suffocation of the patient.

⚠ Warning

Do not allow service or maintenance on the device while being used on a patient.

⚠ Warning

Do not open the device housings. All servicing and future upgrades must be carried out by trained and authorized personnel.

⚠ Warning

To prevent the risk of the short circuit and to ensure the ECG signal quality, the device must be properly grounded.

⚠ Warning

Although biocompatibility tests have been performed on all the applied parts, some exceptional allergic patients may still have anaphylaxis. Do NOT apply to those who have anaphylaxis.

⚠ Warning

Please peruse the relative content about the clinical restrictions and contraindication.

⚠ Warning

It is recommended that the clinical operator regularly test the device and accessories. The visual and auditory alarm signal can be checked by disconnecting the accessories or by setting it at Demo mode to simulate alarm event.

1.1.2 Cautions

Caution

All the parts of the monitor should NOT be replaced at will, substitution of a component different from that supplied by the manufacturer might result in measurement error. If necessary, please use the components provided by the manufacturer or those that are of the same model and standards as the accessories along with the monitor which are provided by the same factory, otherwise, negative effects concerning safety and biocompatibility etc. may be caused. No modification of this device is allowed.

Caution

The accessories which can be used repeatedly should be cleaned thoroughly before use on another patient. Please refer to the related chapter for maintenance method.

Caution

Do not immerse the monitor or its accessories in liquid to clean.

Caution

Store and use the device 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.

Caution

If the monitor falls down accidentally or has other functional failures, it cannot be used any more. The safety performance and technical indicators must be tested in detail, and it can be used only after the test results are qualified.

1.1.3 Notes

☞ Note

All combinations of equipment must be in compliance with the standard IEC 60601-1.

☞ Note

The device and accessories must be disposed of in compliance with local regulations at the end of their service lives.

☞ Note

Put the device in a location where it can be easily viewed and operated. Do not locate the device in a place difficult to access the mains plug.

☞ Note

Upon request, the manufacturer may provide necessary circuit diagrams, component part lists, and other technical information to assist qualified service personnel in parts repair.

☞ Note

Any serious incident that has occurred in relation to the device should be reported to the manufacturer and the competent authority of the Member State in which the user and/or patient.

1.2 Device Symbols

Symbol	Description	Symbol	Description
	Device or part of CF type with defibrillation proof		VGA connector
	VGA output		USB connector

Symbol	Description	Symbol	Description
	Nurse call port		Network port
	Synchronous defibrillation analog output port		Equipotential grounding terminal
	Manufacturer		Date of manufacture
	Serial number		Non-ionizing electromagnetic radiation
	Batch code		Unique device identifier
	Caution! Consult accompanying documents		Follow WEEE regulations for disposal
	General warning sign (Background: yellow; Symbol and line: black)		Refer to Operator's Manual (Background: blue; Symbol: white)
	CE marking of conformity		Authorised representative in the European Community
	UKCA marking		UK Responsible Person
IPX2	Degree of protection against ingress of water and particulate matter		Medical device

☞ **Note**

Your device does not necessarily have all of the above symbols.

☞ **Note**

This manual is printed in Black and White.

Chapter 2 Product Introduction

2.1 Product Name and Model

Product Name: Patient Monitor

Product Model: AIView V10, AIView V12, PH10, PH12, LeMonitor V10, LeMonitor V12

2.2 Intended Use

The AIView series patient monitor, hereafter called the monitor, is 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 (optional), arrhythmia detection, ST segment analysis, QT analysis, and heart rate (HR)), respiration (Resp), body temperature (Temp), pulse oxygen saturation (SpO_2), pulse rate (PR), non-invasive blood pressure (NIBP), invasive blood pressure (IBP), pulmonary artery wedge pressure (PAWP) and end-tidal carbon dioxide ($EtCO_2$). The monitor also provides acquisition, display, storage and transmission of 12-lead resting ECG signals, as well as the acquisition, storage and transmission of ambulatory ECG signals, and receive analysis results for clinical diagnosis reference.

The monitor is to be used in medical institutions by qualified clinical professionals or under their guidance. The operators must have received adequate training and be fully competent in the use of the monitor.

☞ **Note**

The monitor can be configured with different parameters. This manual describes all features and options. The monitor you purchase may not cover all functions described below.

2.3 Contraindication

No contraindication.

2.4 Indication for Use

The monitor is indicated for use by health care professionals whenever there is a need for monitoring the physiological parameters of patients.

2.5 Clinical Benefits

For each dangerous situation, the corresponding alarm system is selected as a risk control measure, and the alarm status and its priority should be assigned. The monitoring of each parameter conforms to the requirements of the corresponding special standards.

2.6 Date of Manufacture and Service Life

The service life of the device is 10 years. Please refer to the label on the device for the date of manufacture.

2.7 Function Features

The monitor has the following features:

- Touchscreen and quick keys operation, easy to operate.
- Convenient patient archive management, able to be connected with hospital management system.
- Multiple display views are available, which can be easily shifted for different monitoring purpose.
- The view can be flexibly configured and the display area is adaptive.
- Lead off detection function, and able to send out an alarm.

- Auto detection of lead types: 3 leads, 5 leads, 6 leads and 12 leads.
- Drug calculation, oxygenation calculation, ventilation calculation, renal function calculation, hemodynamic calculation is available.
- Supports the commonly used clinical tool of early warning score (EWS).
- Waveform freezing.
- Automatic arrhythmia detection and analysis.
- ST segment analysis and real-time display of ST segment value.
- QT/QTc measurements.
- Multi-lead synchronous ECG analysis function: simultaneously analyze multiple ECG leads, accurate monitoring can still be achieved even in the presence of interference from individual leads.
- Visual and audible alarm with multiple priorities for physiological and technical alarms.
- Supports multi-language display and multiple input methods.
- Supports large capacity storage.
- Protection against defibrillator discharge, resistance against the interference from electro-surgical unit, and cardiac pacemaker pulse detection and inhibition.
- Be capable of networking with central monitoring system.
- Support 12leads ECG in full screen (optional).
- Supports a variety of operating modes, such as demonstration mode, night mode, standby mode, etc.

- USB data import / export function and application software upgrade are available.

Note

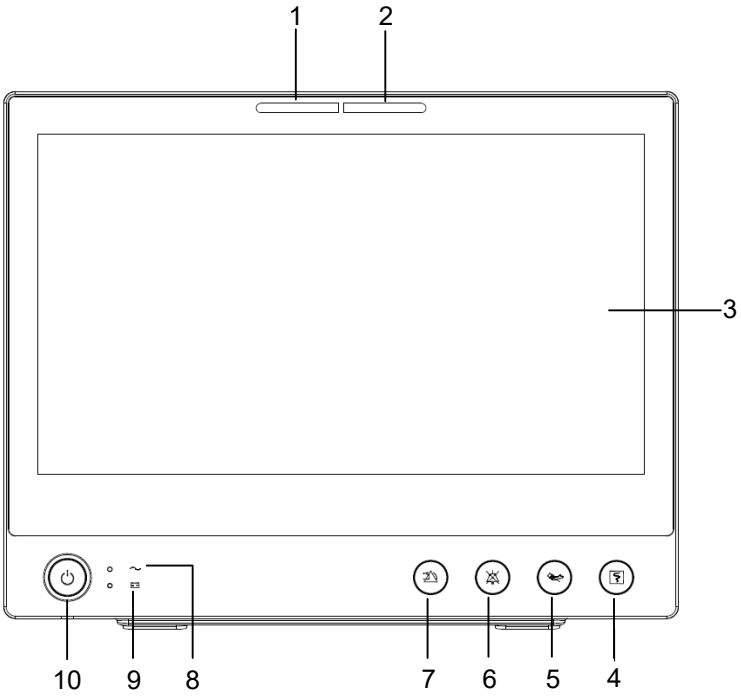
You can customize the module configuration by choosing required modules to meet your own needs. Therefore, your monitor may not have all the monitoring functions and accessories.

2.8 Product View

Note

All illustrations in this manual serve as examples only and may differ from what is actually seen.

2.8.1 Front View



1 Physiological alarm lamp

Physiological alarm lamp is located on the left side of the top of the monitor. When a physiological alarm occurs, this lamp lights and flashes corresponding with the alarm priority:

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

2 Technical alarm lamp

Technical alarm lamp is located on the right side of the top of the monitor. When a technical alarm occurs, this lamp lights and flashes corresponding with the alarm priority:

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

3 Display

4 Record Start/Stop hard key

Press to start a recording or stop the current recording.

5 NIBP Start/Stop hard key

Press to start an NIBP measurement or stops the current NIBP measurement.

6 Alarm Tone Pause hard key

Press to pause the current alarm sound.

7 Alarm Reset hard key

Press to acknowledge the on-going alarm.

8 Power indicator

- Green: AC power is connected.

- Off: AC power is not connected.

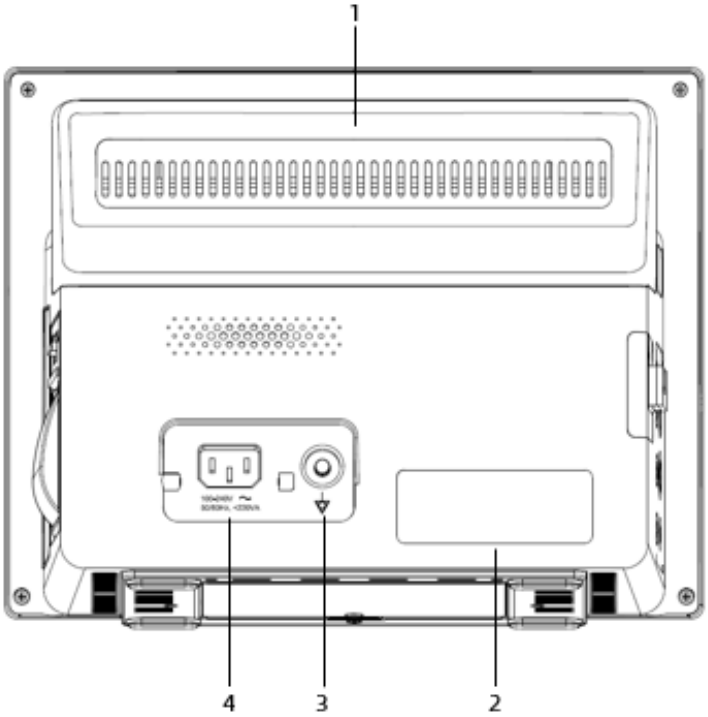
9 Battery indicator

- Yellow: AC power is connected and the battery is being charged.
- Green: AC power is connected and the battery is fully charged.
- Off: AC power is connected and no battery is installed.
- Off: the battery is installed and AC power is not connected.

10 Power switch / Power-on LED

- Press this switch to turn on the monitor, the backlight is always green.
- When the monitor is on, press and hold this switch to turn off the monitor, and the backlight is not lighted.

2.8.2 Rear View



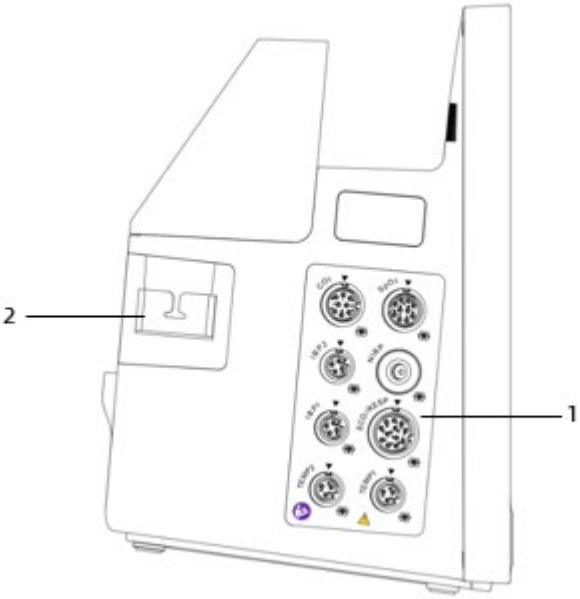
1 Handle

2 Device label

3 Equipotential grounding terminal

4 AC power connector

2.8.3 Left View

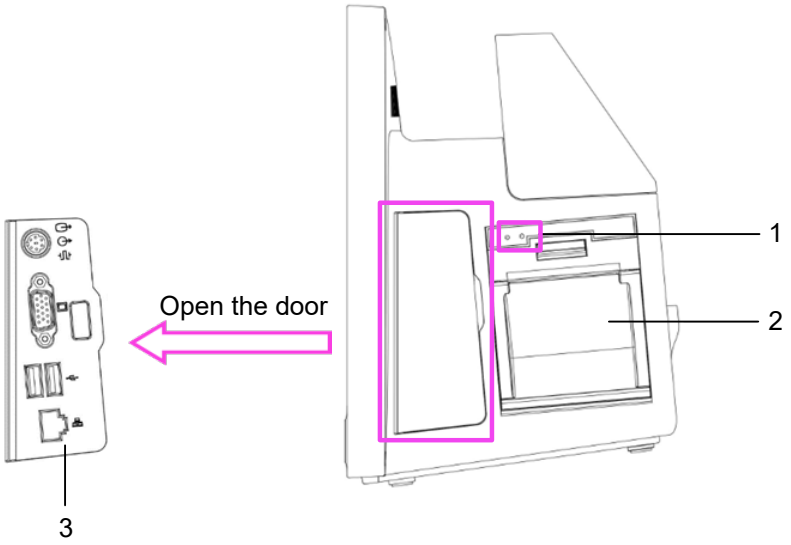


1 Parameter connectors

Connector	Description
TEMP1, TEMP2	Temperature probe connector
NIBP	NIBP cuff connector
SpO_2	SpO_2 sensor connector
ECG/RESP	ECG cable connector
IBP1, IBP2	IBP cable connector
CO_2	CO_2 sensor cable connector

2 CO_2 module (sidestream) holder

2.8.4 Right View



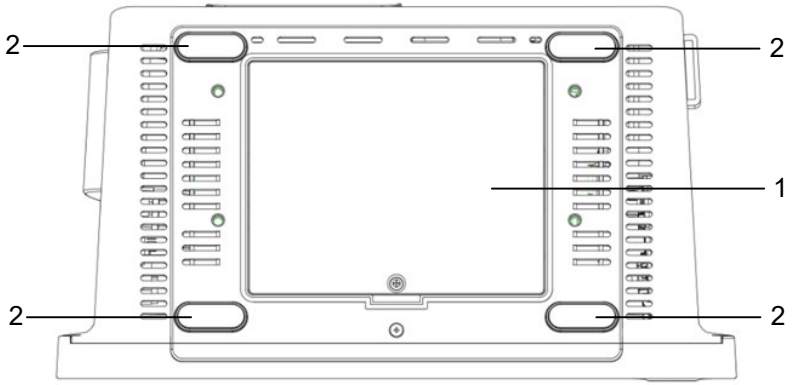
1 Recorder indicators

2 Recorder (optional)

3 Connectors

Connector Icon	Description	Connector Icon	Description
	ECG analog signal output connector		VGA connector
	Nurse call connector		USB connector
	Defibrillator synchronization analog output connector		Network connector

2.8.5 Bottom View



1 Battery compartment

2 Anti-slip foot pad

Chapter 3 Getting Started

3.1 Unpacking and Checking

Before unpacking, examine the packaging carefully for signs of damage. If any damage is found, please contact the carrier immediately.

If the packaging is intact, perform unpacking inspection according to the following steps:

1. Open the package, take out the monitor and its accessories from the box carefully.
2. Check all materials according to the packing list.
3. Check the monitor for any mechanical damages.
4. Check all the accessories for scratches or defects.

Please contact your local distributor or the manufacturer in case of any problems. We will offer the best solution for your satisfaction.

⚠ Warning

When disposing of the packaging materials, be sure to comply with your local waste control regulations or the hospital's waste disposal system.

Caution

Keep the packaging materials out of the reach of children.

Caution

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.

Note

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

3.2 Installation Precautions

Warning

Devices connected to the monitor must meet the requirements of the applicable IEC standards. The system configuration must meet the requirements of the IEC 60601-1-1 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 with IEC 60601-1-1. If you have any question, please contact the manufacturer or your local distributor.

Warning

If it is not evident from the equipment specifications whether a particular combination with other devices is hazardous, for example, due to summation of leakage currents, please consult the manufacturers or an expert in the field, to ensure the necessary safety of patients and all devices concerned will not be impaired by the proposed combination.

Caution

The monitor shall be installed by personnel authorized by manufacturer.

Note

The software copyright of the monitor is solely owned by the manufacturer. 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.

3.3 Environment Requirements

Select a place where the infrastructure and mains supply are well set up. Place the monitor in a safe and stable location where it can easily be viewed and operated.

The operating environment of the device must meet the requirements specified in this manual. Otherwise, unexpected consequences, e.g. damage to the device, could result.

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

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

Caution

Do not locate the device in a place where the power plug is difficult to plug in and out.

3.4 Connecting to Power Source

3.4.1 Using AC Power Source

Before connecting the monitor to the AC mains, check that the voltage and frequency ratings of the power line are the same as those indicated besides the AC power input connector.

To connect the AC power source, follow the steps below:

1. Use the power cable provided with the monitor.

2. Insert one end of it to the AC power connector of the monitor and the other end to the three-pin outlet of the power source with protected-earth.
3. Connect one end of the grounding wire to the equipotential grounding terminal on the rear panel of the monitor, and the other end to the equipotential system.
4. Make sure that the AC power indicator is on to ensure that the AC power supply is connected well.
5. If necessary, connect one end of the provided ground wire to equipotential grounding terminal on the rear of the monitor, and connect the other end to one point of the equipotential grounding system.

3.4.2 Using the Battery

The monitor will be powered by the internal battery when the external power is not available. The battery icon will be displayed in the upper right corner of the screen. 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.

When the battery power is low, the system will alarm for low battery. In this case, the battery can support the monitor to run for about 5 minutes. When the remaining battery power is not enough to support the normal operation of the monitor, the monitor will automatically shut down.

Caution

The provided battery of the monitor must be recharged after transportation or storage. So if the monitor is switched on without

being connected to the AC power supply, it may not work properly due to insufficient battery power.

☞ Note

The monitor can be used normally without any performance degradation when the battery is being charged.

☞ Note

It is better to recharge the battery after it has been used up, and the charging time should be 13~15 hours long.

3.5 Turning on the Monitor

Press the power switch on the front panel of the monitor for about 3 seconds, the monitor automatically performs a self-test, then the alarm tone sounds and the alarm lamps illuminate. This indicates that the visible and audible alarm indicators function correctly. Then the monitor jumps from the startup screen to the main screen. This indicates that the monitor is started successfully.

Check all the applicable functions of the monitor to make sure that the monitor works normally.

⚠ Warning

Before each use, check the device for safe and normal operation. Do not use this device to monitor the patient if there are indications of damage or reminders of error. Please contact your local distributor or the manufacturer.

☞ Note

The monitor runs on battery power without interruption when AC power is unavailable.

3.6 Checking the Recorder/Printer

If your monitor is equipped with a recorder, open the recorder's door to check if paper is properly installed. If there is no paper, refer to *19.5 Loading Paper* for the method of installing the recording paper.

If your monitor is not equipped with a recorder, you can print patient reports through an external network printer. For more information about network printer connection, refer to *20.2 Setting the Network Printer*.

3.7 Operating and Navigating

Everything you need to operate the monitor is contained on its screen. Almost every element on the screen is interactive. Screen elements include measurement data, waveforms, quick keys, information areas, alarms areas and menus. You can access the same element in different ways. For example, you can access a parameter setting menu by selecting the corresponding waveform area, or through the [Parameters] quick key on the main screen.

3.7.1 Using the Touchscreen

You can use the touchscreen to select a screen element by pressing directly on the monitor's screen.

3.7.2 Using the On-Screen Keyboard

You can use the on-screen keyboard to enter information:

- Enter the information by selecting one character after another.
- Select the Backspace key [ ] to delete single characters or select [ ] to delete the entire entry.

- Select the Up key [ ] to switch between uppercase and lowercase letters.
- Select the Enter key [ ] to confirm the entry and close the on-screen keyboard.

If the monitor is connected with a physical keyboard, you can also use this keyboard instead of or in combination with the on-screen keyboard.

3.7.3 Using Keys

The monitor has three different types of keys:

- Quick keys

A quick key is a configurable graphical key, allowing you to quickly access to some functions.

The quick key area is located at the bottom of the main screen. The [Main Menu] key is fixed at the left, and the [More] key is fixed at the right. Selecting the [More] quick key shows more quick keys. The quick keys displayed on the screen are configurable.

The following table shows available quick keys.

Label	Function	Label	Function
Main Menu	Enters the main menu.	ECG Full-Screen	Enters the ECG full screen.
More	Shows more quick keys.	ECG 12-Lead	Enters the ECG 12-Lead acquisition screen, only available when 12-lead function is configured.

Label	Function	Label	Function
Review	Enter the [Review] screen.	Standby	Enters Standby mode.
Freeze	Freezes waveforms.	Night Mode	Enters Night Mode / Exits Night Mode.
Start NIBP	Starts an NIBP measurement or stops the current NIBP measurement.	Private Mode	Enters Private Mode / Exits Private Mode.
Alarm Audio Paused	Pauses alarm tone.	Intubation Mode	Enters Intubation Mode / Exits Intubation Mode.
Alarm Reset	Acknowledges ongoing alarms and reset the alarm system.	Pause Monitoring	Enters the Pause Monitoring mode / Restarts Monitoring.
Stop All	Stops all NIBP measurements.	Venipuncture	Enters the NIBP setup screen and select [Venipuncture] to inflate the NIBP cuff to help venous puncture.
Alarm Setup	Enters the [Alarms] setup screen.	Manual Event	Manually triggers and saves an event.
Patient Info	Enters the [Patient]	Screenshot	Captures the current screen.

Label	Function	Label	Function
	management screen.		
Screens	Enters the [Screens] setup screen.	Holter	Enters the ambulatory ECG setup screen.
Parameters	Enters the [Parameters] setup screen.	Volume	Enters the [System] setup screen to adjust the volume.
Calculations	Enters the [Calculations] screen.	Real-time Print	Starts printing a real-time report.
Minitrends	Enters the [Minitrends] screen.	Record	Starts/Stops a recording.
OxyCRG	Opens the [OxyCRG] screen.	EWS	Enters the [EWS] screen.
Remote View	Opens the [Remote View] screen.	Config	Enters the [Config] screen.

☞ **Note**

The selection of quick keys available on your monitor depends on your monitor configuration and on the options purchased.

- Hard keys

A hard key is a physical key on the monitor, such as the recording key on the front panel.

- Pop-up keys

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

3.8 Screen Views

3.8.1 Screen Types

The monitor provides the following display views:

- Normal screen: meets most monitoring needs.
- Big Numerics screen: displays parameter numerics in big font size for long-distance observation.
- Minitrends screen: displays the recent graphic trends of parameters.
- OxyCRG screen: emphasizes on SpO_2 and Respiration monitoring.
- ECG Half-Screen: ECG half screen displays 7/8 ECG waveforms.
- ECG Full-Screen: ECG full screen displays 7/8 ECG waveforms.
- ECG 12-Lead: ECG full screen 12 lead analysis screen.
- Remote View: displays the real-time waveforms and parameters of other connected monitors.

Caution

For 3-lead ECG monitoring, you cannot select [ECG Half-Screen], [ECG Full-Screen] and [ECG 12-Lead] screen.

Caution

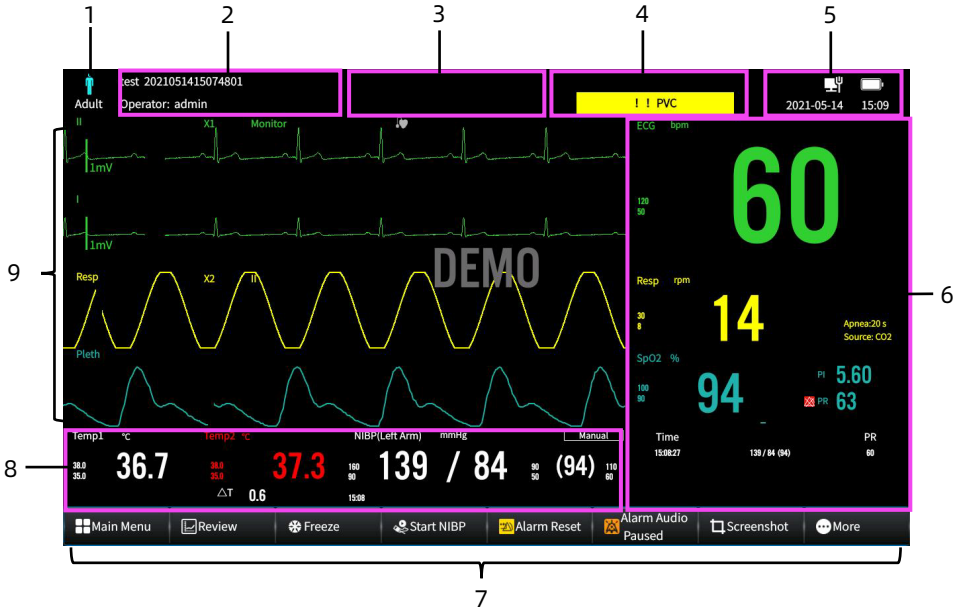
The [ECG 12-Lead] screen is available only when the lead type is set to 12-lead.

Note

In each screen, the display position and display switch of waveforms and parameters can be customized.

3.8.2 Screen Display

The following figure shows the normal screen:



No.	Description
1	Patient type
2	Patient information area (top line): displays patient information, including patient name, medical record number, etc. Clicking this area enters the [Patient Info] menu. Operator information area (bottom line): displays operator name. Clicking this area enters the [Operator] menu. For more information, see *Chapter 6 Managing Patients*.

No.	Description
3	Prompt information area (top line): displays prompt messages. Technical alarm information area (bottom line): displays technical alarm messages.
4	Physiological alarm message area: displays high priority physiological alarm messages on the above; displays medium and low priority physiological alarm messages at the bottom.
5	System status area: displays network status, battery status and system time.
6	Parameter numerics area: displays parameter values, alarm limits, and alarm status. Clicking a parameter numeric block enters the corresponding parameter menu.
7	Quick key area: displays selected quick keys. The quick keys change with the configuration of the monitor.
8	Parameter waveform/numerics area: displays parameter waveforms, or parameter values, alarm limits, and alarm status.
9	Parameter waveform area: displays parameter waveforms.

3.9 Operating Modes

The monitor provides different operating modes.

3.9.1 Monitoring Mode

Monitoring mode is the most frequently used clinical mode for patient monitoring. When the monitor is turned on, it automatically enters Monitoring mode, which shows real time waveform and data.

3.9.2 Demo Mode

Demo mode is only used for demonstration purpose and detection of alarm function. The data and waveform in demo mode are generated by the system, and cannot be used to evaluate the physiological condition of patients.

To change the operating mode into the demo mode, follow the steps below:

1. Click [Main Menu]→[Screens]→[Work Mode].
2. Select [Demo Mode], and then enter the password 123456.

To exit the demo mode, follow the steps below:

1. Click [Main Menu]→[Screens]→[Work Mode].
2. Select [Exit Demo Mode].

⚠ Warning

The demonstration function is mainly used to show the performance of the device and to train personnel. In clinical use, do not set the device to Demo mode, to avoid stimulated data being mistaken for a monitored patient's data, which may cause improper monitoring and delayed treatment.

3.9.3 Night Mode

The night mode is a special clinical monitoring mode. In the night mode, the brightness of the alarm lamp, the alarm volume, QRS volume and key volume of the monitor automatically decrease.

To avoid disturbing the patient, you can use the night mode.

To enter the night mode, follow the steps below:

1. Click [Main Menu]→[Screens]→[Work Mode].
2. Select [Night Mode].

After entering the night mode, the screen displays "Night Mode".

To exit the night mode, follow the steps below:

1. Click [Main Menu]→[Screens]→[Work Mode].
2. Select [Exit Night Mode].

Caution

If your monitor is connected to a central monitoring system (CMS), it automatically exits the Night Mode when it is disconnected from the CMS.

Caution

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

Note

The monitor resumes the previous settings after exiting Night mode.

3.9.4 Intubation Mode

Intubation mode is available for Resp and CO2 monitoring. The intubation mode is a special clinical monitoring mode.

The monitor has the following features after entering Intubation Mode:

- The physiological alarms related to Resp and CO_2 are blocked.
- The intubation mode symbol, intubation mode text and countdown are displayed with a red background in the physiological alarm information area.
- The alarm off symbol is displayed in the parameter area.

To enter the Intubation Mode, follow the steps below:

1. Click [Main Menu]→[Screens]→[Work Mode].

2. Select [Intubation Mode].

The intubation time can be set to 1 min, 2 min, 3 min, 5 min, and the default is 2 min.

After the countdown, the monitor automatically exits the intubation mode. The physiological alarm is activated immediately after exiting the intubation mode.

To exit intubation mode manually, follow the steps below:

1. Click [Main Menu]→[Screens]→[Work Mode].
2. Select [Exit Intubation Mode].

3.9.5 Private Mode

Private mode is a special clinical monitoring mode. Private mode can be used when the patient information should be protected from visitors and other non-clinical personnel. In the private mode, the monitor does not display patient information and monitoring data. This provides controlled access to patient data and ensures confidentiality.

Private mode is only available when the monitor is connected with the CMS and the patient is admitted by the CMS. In the private mode, the monitor still monitors the patient, but the monitoring data is only displayed on the CMS.

To enter the Private Mode, follow the steps below:

1. Click [Main Menu]→[Screens]→[Work Mode].
2. Select [Private Mode].

The monitor has the following features after entering Private Mode:

- No parameters and waveforms are displayed. The screen turns blank.
- Except for the low battery alarm, the monitor inactivates alarm tones and alarm lights for all other alarms.

- All system sounds, including heart beat tone, pulse tone and prompt tone, are muted.
- Monitoring data and alarms are presented only at the CMS.

The monitor automatically exits the private mode in any of the following situations:

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

Warning

In Private mode, all audible alarms are suppressed and the alarm light is deactivated at the monitor. Alarms are presented only at the CMS. Please pay attention to the potential risks.

Caution

You cannot enter the private mode if a low battery alarm occurs.

3.9.6 Suspend Monitoring Mode

If you just want to stop monitoring temporarily, you can set the monitor to suspend monitoring.

To enter the Suspend Monitoring, follow the steps below:

1. Click [Main Menu]→[Screens]→[Work Mode]
2. Select [Pause Montr.].
3. A confirmation dialog box "Are you sure you want to enter Suspend Monitoring mode?" pops up. Click [OK] to enter the suspend monitoring mode, and click [Cancel] to stay in the current screen.

The monitor has the following features after entering Suspend Monitoring mode:

- The screen displays "Suspend Monitoring".
- All alarms are automatically reset, and no new alarms occur.

- Patient information and alarm presets remain unchanged.

Click the [Restart monitoring] button on the screen to exit the suspend monitoring mode.

> ⚠ **Warning**
>
> **In Suspend Monitoring mode, the monitor will pause patient monitoring and suppress all system sounds and alarms except for the battery low alarm. Please pay attention to the potential risks.**

3.9.7 Standby Mode

You can temporarily stop patient monitoring without switching off the monitor by entering the standby mode.

To enter the Standby Mode, follow the steps below:

1. Click [Main Menu]→[Screens]→[Work Mode]
2. Select [Standby Mode].
3. A confirmation dialog box “Are you sure you want to enter Standby mode?” pops up. Click [OK] to enter the standby mode, and click [Cancel] to stay in the current screen.

After entering the standby mode, the screen displays the current date and time, and displays the word "Standby".

The monitor has the following features after entering Standby mode:

- The screen displays the word "Standby" and displays the current date and time.
- Stops all parameter measurements, data storage, recording, printing and network response.
- Disables all the alarms and prompt messages, except for the battery low alarm.
- After entering Standby mode for 30 seconds, the screen brightness will be automatically adjusted to the dimmest.

Click the [Exit] button on the screen to exit the standby mode.

⚠ Warning

In Standby mode, the monitor stops patient monitoring and suppress all system sounds and alarms except for the battery low alarm. Please pay attention to the potential risks.

3.10 Changing Monitor Settings

3.10.1 Selecting the Language

To set the user interface (UI) language, follow the steps below:

1. Press [Main Menu]→[System]→[System].
2. Select [Language] to open the language list.
3. Select the desired language from the list.

☞ Note

To make the language change valid, please restart the monitor.

3.10.2 Setting the Date and Time

To set the system date and time, follow the steps below:

1. Press [Main Menu]→[System]→[System].
2. Set [Date Format]. Options: YYYY-MM-DD, DD-MM-YYYY, MM-DD-YYYY.
3. Set [Time Mode]. Options: 12 hours, 24 hours.
4. Set the current [Date] and [Time].

⚠ Warning

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

☞ Note

If the monitor is connected to a central monitoring system (CMS) or hospital Information system (HIS), the date and time are

automatically taken from the CMS. In this case, you cannot change the date and time on the monitor.

3.10.3 Enabling Daylight Saving Time

The daylight saving time is disabled by default. You need to manually enable the daylight saving time. To do so, follow the steps below:

1. Press[Main Menu]→ [Maintenance] → input password → press [Enter].
2. Select the [Time] tab.
3. Switch on [Summer Time].
4. Adjust daylight saving time settings as necessary.

3.10.4 Adjusting the Screen Brightness

To adjust the screen brightness, follow the steps below:

1. Press [Main Menu]→[System]→[System] to enter the system setup screen.
2. Drag the slider to set the [Brightness].

Its setting range is "1~10", gradually brightened.

3.10.5 Adjusting the Volume

To adjust the keystroke sound and the touch-screen sound, the alarm volume and the beat volume, follow the steps below:

1. Press [Main Menu]→[System]→[System] to enter the system setup screen.
2. Drag the slider to set [Key Volume], [Alarm Volume] and [Beat Volume] respectively.

The volume is gradually increasing.

Caution

When the volume is set to 0, the sound is turned off. It is not recommended to set the alarm volume and beat volume to 0 (Off). Pay attention to potential risks.

3.11 General Operations

3.11.1 Configuring the Displayed Quick Keys

You can set which quick keys need to be displayed on the screen. To do so, please refer to the following steps:

1. Access [Quick Keys] screen in either of the following ways:
   - Press the [Screens] quick key → select the [Quick Keys] tab.
   - Press [Main Menu] → [Screens], select the [Quick Keys] tab.
2. Select a block location to display a certain quick key from the top of this screen, and then select the quick key from the quick key list. For example, to display the [Screens] quick key at the first block, select the first block, and then select [Screens] from the list.
3. Configure all the quick keys that need to be displayed on the screen in the same way.

3.11.2 Switching On or Off a Parameter

You can manually switch on or off a parameter when its module is configured. To do so, please refer to the following steps:

1. Access [Parameters On/Off] screen in either of the following ways:
   - Press the [Screens] quick key → select the [Parameters On/Off] tab.

- Press [Main Menu] → [Screens], select the [Parameters On/Off] tab.

2. Enable or disable desired parameters.

When a parameter is switched off, no measurements and alarms are provided.

3.11.3 Configuring the Normal Screen Layout

You can configure the parameter numerics, waveforms, and their sequence displayed on the normal screen. To do so, please refer to the following steps:

1. Access [Layout] screen in either of the following ways:
   - Press the [Screens] quick key → select the [Layout] tab.
   - Press[Main Menu]→[Screens], select the [Layout] tab.
2. Select a parameter area and select an element to be displayed in this area from the pop-up list. The parameters and waveforms not selected will not be displayed on the screen.

☞ Note

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

☞ Note

Turn off all other parameters except ECG parameter, then the screen can display an ECG signal within a vertical space of 30mm per ECG channel.

3.11.4 Setting Monitoring Parameters

Each parameter has its own setup menu to allow adjusting of the alarm and parameter settings.

Access [Parameters] screen in either of the following ways:

- Select the parameter numeric area of a parameter.
- Press the [Parameters] quick key.
- Press [Main Menu]→[Parameters].

Select the desired parameter. For details of each parameter setting, please refer to the respective parameter setup menu description in corresponding parameter measurement chapters.

3.11.5 Setting the Beat Mode

To set the beat mode, follow the steps below:

1. Press [Main Menu]→[System]→[System] to enter the system setup screen.
2. Set the [Beat] mode. Options: Mode 1, Mode 2.

The frequency of heart beat in the two modes is different, so it is convenient for users to distinguish.

3.11.6 Selecting a Screen

The monitor enters the normal screen after it is powered on. The normal screen is most frequently used for patient monitoring.

To select other screens, please refer to the following steps:

1. Access [Screen Selection] screen in either of the following ways:
   - Press the [Screens] quick key → select the [Screen Selection] tab.
   - Press[Main Menu]→[Screens], select the [Screen Selection] tab.
2. Select the desired screen.

3.11.7 Configuring the Big Numerics Screen

To configure the big numerics screen, please refer to the following steps:

1. Access [Screen Selection] screen in either of the following ways:
   - Press the [Screens] quick key → select the [Screen Selection] tab.
   - Press[Main Menu]→[Screens], select the [Screen Selection] tab.
2. Select the [Big Numerics] option.
3. Select the [Big Numerics] tab.
4. Select a parameter numeric area or waveform area, and then select an element to be displayed in this area from the popup list.

3.11.8 Changing Parameter Colors

To set the color of measurement values and waveforms for each parameter, please refer to the following steps:

1. Access [Parameters On/Off] screen in either of the following ways:
   - Press the [Parameters] quick key.
   - Press[Main Menu]→[Parameters].
2. Select the [Parameter Color] tab and set the colors of measurement values and waveforms for desired parameters.

3.11.9 Setting Password Protection

You can set whether changing alarm-related settings is password protected or not. To do so, follow the steps below:

1. Press [Main Menu] → [Maintenance] → input password → press [Enter].
2. Select the [Alarm] tab.
3. Switch on or off [Alarm Setup Password] as needed.
   - If [Alarm Setup Password] is switched on, changing the alarm switch, alarm high and low limits, alarm priorities and alarm volume settings are password protected. The password is the user maintenance password (i.e., admin password) of the monitor.
   - If [Alarm Setup Password] is switched off, changing the alarm settings is not password protected.

3.12 Turning off the Monitor

To turn off the monitor, follow the steps below:

1. Confirm that patient monitoring has been completed.
2. Disconnect the cables and sensors from the patient.
3. Save or clear the patient data as required.
4. Press and hold the power switch for 3 seconds to turn off the monitor.

Caution

Although not recommended, you can press and hold the power switch for 10 seconds to forcibly shut down the monitor when it cannot be shut down normally. However, this operation may cause loss or corruption of patient data, please proceed with caution.

Note

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

☞ **Note**

If the monitor is equipped with a rechargeable battery, charge the battery after using the monitor every time to ensure that there is sufficient electric power.

Chapter 4 Networked Monitoring

You can connect the monitor to the central monitoring system (CMS), and AI-ECG server through wired or wireless network. If the monitor is networked, a network symbol is displayed on the screen.

4.1 Safety Information

⚠ Warning

Keep network authentication information, for example passwords, safe, to protect the network from being accessed by unauthorized users.

⚠ Warning

Do not connect non-medical devices to the monitor network.

⚠ Warning

Always set the wireless network according to local wireless regulations.

⚠ Warning

If wireless network signal is poor, there may be a risk of data loss in communicating with CMS.

⚠ Warning

RF interference may result in wireless network disconnection.

⚠ Warning

Disconnecting from the network may result in CMS-destined data loss and function failure. Check the patient in case of network disconnection and solve the network problem as soon as possible.

Warning

Ensure that the monitor IP address setting is correct. Changing the network settings may result in network disconnection. Contact your service personnel if there are any problems with the IP address.

4.2 Remote View

In the [Remote View] window, you can view real time waveforms, numeric information of all parameters and alarm information of the selected bed on the same network.

Caution

The IP addresses of the monitors configured with the remote view function should share the same network segment. The IP addresses of the monitors on the same LAN should be unique from each other; you cannot use the remote view function in the monitors in which an IP address conflict exits.

Caution

To have good remote monitoring, make sure the network connection is in good condition.

4.2.1 Opening the Remote View Window

Before opening the Remote View window, make sure the remote view function is configured on your monitor.

Enter the Remote View window in either of the following ways:

- Press the Remote View quick key.
- Press the [Screens] quick key → select [Remote View].
- Press [Main Menu] → [Screens], select [Remote View].

4.2.2 Setting the Remote View Window

Press the [Setup] button in the lower right corner of the Remote View window to open the Remote View Setup menu on which you can:

- Select the waveform to be viewed on the window in the waveform type list.
- Select the parameter to be viewed in the parameter list.
- Select bed No. of the bed to be viewed in the bed No. list.

4.3 Setting the Wired Network

To set the wired network, follow the steps below:

1. Enter the network setup screen in either of the following ways:
   - Press the network status icon in the upper right corner of the screen.
   - Press [Main Menu] → [System], select the [Network] tab.
2. Select the [Wired Network] tab.
3. Select how to get the IP address.

[Auto Acquire IP]: the monitor obtains the IP address automatically.

[Use IP Address below]: you need to input the [IP address], [Subnet Mask] and [Gateway].

4.4 Setting the Wireless Network

To set the wireless network, follow the steps below:

1. Enter the network setup screen in either of the following ways:
   - Press the network status icon in the upper right corner of the screen.
   - Press [Main Menu] → [System], select the [Network] tab.
2. Select the [Wireless Network] tab.

3. Select how to get the IP address.

[Auto Acquire IP]: the monitor obtains the IP address automatically.

[Use IP Address below]: you need to input the [IP address], [Subnet Mask] and [Gateway].

4. Press the [Connect] button to test the network connection.

4.5 Connecting the CMS

To set the central monitoring system (CMS), follow the steps below:

1. Enter the network setup screen in either of the following ways:
   - Press the network status icon in the upper right corner of the screen.
   - Press [Main Menu] → [System], select the [Network] tab.
2. Select the [Central Station] tab.
3. Switch on [Central Station].
4. Set the IP address and port number of the central station server.

> ☞ **Note**
>
> **Make sure that CMS and the monitor are located in the same network segment. Every monitor should have its unique IP address. Otherwise, its network connection will be failed anytime.**

If your monitor is connected to the CMS:

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

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

For more information on the CMS, refer to the Central Monitoring System Operator's Manual.

☞ **Note**

Make sure the network connection between the monitor and the central monitoring system is in good condition.

4.6 Connecting the AI-ECG Server

To connect the AI-ECG server, follow the steps below:

1. Enter the network setup screen in either of the following ways:
   - Press the network status icon in the upper right corner of the screen.
   - Press [Main Menu]→[System], select the [Network] tab.
2. Select the [AI-ECG Server] tab.
3. Set the IP address and port number of the AI-ECG Server.
4. Press the [Test] button to test the connection status of AI-ECG Server.
   - If the connection is successful, the [AI-ECG Server state] displays [Connected].
   - If the connection failed, it displays [Disconnected].

If your monitor is connected to the AI-ECG server of AI-ECG Platform:

- You can send the collected ECG information (including original waveforms, filter settings, etc.) to the AI-ECG server for 12-lead resting ECG analysis and diagnosis.
- Download and print the returned diagnosis reports at the monitor side.

If your monitor is connected to the AI-ECG server of AI-ECG Tracker:

- You can send the collected ECG information (including original waveforms, filter settings, etc.) to the AI-ECG server for single lead / 8-lead / 12-lead ambulatory ECG analysis and diagnosis.
- Download and print the returned diagnosis reports at the monitor side.

Chapter 5 Alarms

Alarms are triggered by physiological parameters that appear abnormal or by technical problems of the monitor. When an alarm occurs, the monitor indicates it through visual and audible alarm indications.

5.1 Safety Information

⚠ Warning

Before monitoring a new patient, always check that the monitor can work properly, the alarm system works properly, and the alarm settings are appropriate for the patient before starting the monitoring.

⚠ Warning

In order to ensure that the operator can accurately identify the alarms, it is recommended that the distance between the operator and the monitor should not exceed 4 meters. If the alarm event needs to be clearly distinguished, it is recommended that the distance between the operator and the monitor should not be more than 1 m (there should be no obstacle within the visual effective distance above).

⚠ Warning

Do not set the alarm limits beyond the measurement ranges, which may cause the alarm system to become ineffective.

⚠ Warning

For the same or similar equipment used in any separate area, there is a potential hazard if different alarm presets are used.

⚠ Warning

For the operator to recognize alarm conditions clearly, the alarm signal sound should be set higher than ambient levels.

⚠ Warning

When monitoring patients that are not continuously attended by a clinical operator, properly configure the alarm system and adjust the alarm settings to the patient's condition.

⚠ Warning

The log is not maintained when the alarm system is powered off and the time of powering off is not captured in the log.

❗ Caution

When the alarm system is powered off, or loses all power, the monitor will save the alarm settings and alarm logs if the power off time is not more than 30s. The stored alarm information does not change with the power off time.

❗ Caution

Up to 1000 alarm events can be stored. When this limit is exceeded, the earliest event is automatically deleted each time when a new event is recorded.

☞ Note

The alarm system function of the monitor can be checked and verified in the demo mode.

5.2 Alarm Categories

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

- **Physiological alarms**: also called patient status alarms, are triggered by parameter measurement exceeding the set alarm limits, or by an abnormal patient condition.

- **Technical alarms**: also called system status alarms, are triggered by a device malfunction or the monitoring result distortion due to improper operation or mechanical problems.

Apart from the physiological and technical alarms, the monitor can also display messages describing the system status or patient status in the prompt message area at the top of the screen.

For alarm events and prompt messages, see *Appendix B Alarm Messages*.

5.3 Alarm Priorities

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

- High priority alarms: indicates a life threatening situation or a severe device malfunction. High priority alarms require an immediate operator response.
- Medium priority alarms: indicates abnormal vital signs or a device malfunction. Medium priority alarms require a timely operator response.
- Low priority alarms: indicate a discomfort condition, a device malfunction, or an improper operation. Low priority alarms require the operator to be aware of this condition.
- Prompt messages: provide additional information of the patient or the monitor.

The monitor has preset alarm priorities for physiological alarm and technical alarm. For more information, see *B.1 Physiological Alarms* and *B.2 Technical Alarms*.

5.4 Alarm Mode

The monitor provides audible and visual alarm indications when an alarm occurs. For more information, see the following table.

Alarm Indication	High Priority Alarm	Medium Priority Alarm	Low Priority Alarm	Prompt Message	Remarks
Alarm lamp	Red flashing Flashing frequency: 2Hz, visual duty cycle: 50%	Yellow flashing Flashing frequency: 0.5Hz, visual duty cycle: 50%	Yellow No flashing visual duty cycle: 100%	None	None
Tone Characteristics	Do-Do-Do--Do-Do-----Do-Do-Do--Do-Do	Do-Do-Do	Do	None	None
Alarm message	Black text inside a red box	Black text inside a yellow box	Black text inside a yellow box	White text	Alarm messages are displayed in the alarm information area at the top

Alarm Indication	High Priority Alarm	Medium Priority Alarm	Low Priority Alarm	Prompt Message	Remarks
					of the screen. You can select the alarm messages to show the alarm list.
Alarm level symbol	! ! !	! !	!	/	The symbols appear before the corresponding alarm message.
Parameter value	Black text inside a red box	Black text inside a yellow box	Black text inside a yellow box	/	None

Caution

When multiple alarms of different priorities occur simultaneously, the monitor selects the highest priority alarm 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, all the alarm messages are displayed cyclically.

Caution

When multiple alarms of the same priority levels occur simultaneously and should be displayed in the same area, all the alarm messages are displayed cyclically.

5.5 Alarm Status Symbols

Apart from the alarm indications as described in *5.4 Alarm Mode*, the monitor uses the following symbols to indicate the alarm status:

Alarm off: indicates that the alarm of a parameter is turned off.

Alarm audio pause: indicates that audible alarm tones are paused.

Alarm audio off: indicates that audible alarm tones are turned off.

Alarm reset: indicates that alarms are acknowledged and the alarm system is reset. At this time, the audible alarm tones are turned off, but the visual alarm still keeps effective.

5.6 Changing Alarm Settings

5.6.1 Setting Parameter Alarm Properties

The system supports centralized setting of alarm properties for all parameters.

To do so, please refer to the following steps:

1. Access [Alarm Limits] screen in either of the following ways:
   - Press the [Alarms] quick key.
   - Press[Main Menu]→[Alarms].

2. Select a parameter tab and set alarm properties as desired.

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

Click the [Defaults] button at the bottom of the screen to restore the default alarm settings.

5.6.2 Changing the Alarm Volume

To change the alarm volume, follow the steps below:

1. Access [System] screen in either of the following ways:
   - Click the volume icon in the upper right corner of the screen.
   - Press [Main Menu]→[System]→[System].
2. Set [Alarm Volume].

The alarm volume can be set from 1 to 10, the volume increases step by step. The alarm can be silenced if the [Alarm Audio Pause Time] is set to [Permanent].

Caution

Do not rely exclusively on the audible alarm system for monitoring. Adjustment of alarm volume to a low level may result in a hazard to the patient. Please pay close attention to the actual clinical condition of patients.

Caution

When adjusting the alarm volume, if it is impossible to ensure that the medical staff are always in the care of the monitor and the patient, it is recommended that the operator should not adjust the volume below the default setting value of the monitor, otherwise, the alarm may not be easily detected and irreversible injury may occur to the patient.

5.6.3 Setting the Alarm Audio Interval

To set the alarm audio interval, follow the steps below:

1. Press[Main Menu]→[Maintenance]→ input password → press [Enter].
2. Select the [Alarm] tab.
3. Set [High Alarm Audio Interval], [Medium Alarm Audio Interval] and [Low Alarm Audio Interval].
   - The setting range of [High Alarm Audio Interval] is 3~15s. Default setting is 10s.
   - The setting range of [Medium Alarm Audio Interval] is 3~30s. Default setting is 10s.
   - The setting range of [Low Alarm Audio Interval] is 16~30s. Default setting is 10s.

5.6.4 Setting the Alarm Audio Pause Time

To set the alarm audio pause time, follow the steps below:

1. Press[Main Menu]→[Maintenance]→ input password → press [Enter].
2. Select the [Alarm] tab.
3. Set the [Alarm Audio Pause Time].

   The alarm audio pause time can be set to [1min], [2min], [3min], [5min], [10min], [30min], [60min] or [Permanent]. Default setting is two minutes.

5.6.5 Setting the Switch of Alarm Audio Off Tone

You can choose whether switching off the alarm audio off prompt sound or not.

To do so, please refer to the following steps:

1. Press[Main Menu]→[Maintenance]→ input password → press [Enter].

2. Select the [Alarm] tab → select the [Other] tab.
3. Set the [Alarm Audio Off Tone].
   - [On] (default setting): when the alarm sound is turned off, the monitor will provide a periodic alarm audio off prompt sound.
   - [Off]: no prompt sound.

⚠ Warning

Switching off alarm audio off prompt sound may result in a hazard to the patient. Please pay attention to the potential risks.

5.6.6 Setting the Switch of the Apnea Alarm Off

You can choose whether switching off the Apnea alarm is permissible or not.

To do so, please refer to the following steps:

1. Press[Main Menu]→[Maintenance]→ input password → press [Enter].
2. Select the [Alarm] tab → select the [Other] tab.
3. Set the [Apnea Alarm Off].
   - [Disabled] (default setting): the Apnea alarm is always on. You cannot switch it off.
   - [Enabled]: you can switch off the Apnea alarm.

⚠ Warning

If you switch off the Apnea (zero respiration rate) alarm, the monitor will not issue the Apnea alarm when that situation occurs. This may result in a hazard to the patient. Keep the patient under close surveillance.

5.7 Pausing Alarm Sound

Press the [Alarm Audio Pause] quick key to pause the current alarm sound.

The monitor has the following features after the alarm sound is paused:

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

After reaching the alarm audio pause time, the monitor will automatically exit the alarm audio pause status. You can also cancel the alarm audio paused status by pressing the [Alarm Audio Pause] quick key.

5.8 Switching Off Alarm Sound

If [Alarm Audio Pause] is set to [Permanent] (see 5.6.4Setting the Alarm Audio Pause Time), press the [Alarm Audio Pause] quick key to switch off all alarm sound.

The monitor has the following features after the alarm sound is switched off:

- The sounds of all physiological alarms and technical alarms are switched off.
- The alarm audio off symbol is displayed in the system status information area.
- The "Alarm Audio Off" message (black text inside a red box) is displayed in rotation with other physiological alarm

messages (if any) in the physiological alarm information area, with a “do-do” tone sounding every 30 minutes.

To exit the alarm audio off status, press the [Alarm Audio Pause] quick key.

⚠ Warning

Pausing or switching off alarm sound may result in a hazard to the patient. Please pay attention to the potential risks.

5.9 Latching Alarms

Physiological alarms can be set to “latch” or “non latch” mode.

- Non latch: if you do not latch physiological alarms, their alarm indications disappear when the alarm condition ends.
- Latch: if you latch physiological alarms, all visual and audible alarm indications remain until the alarms are reset.

To latch physiological alarms, follow the steps below:

1. Press [Main Menu]→[Maintenance]→ input password → press [Enter].
2. Select the [Alarm] tab.
3. Press [Latch].
4. Select how you want to latch the alarms.

The alarms are divided into four priority levels: high risk, high, medium, and low. By default, all latches are turned off.

You can separately latch visual alarm signals and audio alarm signals.

Latching audio alarm signals simultaneously latches the corresponding visual alarm signals.

Selecting alarms of lower priority simultaneously latches higher priority alarms.

Caution

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

5.10 Viewing Alarms

You can view the current alarm in the alarm information area at the top of the screen. If the monitor has more than one physiological (technical) alarm, you can see the physiological (technical) alarm list by selecting the physiological (technical) alarm information area to enter the alarm list window. The alarm information list shows all currently active physiological or technical alarms, with the most recent one at the top of the list.

5.11 Confirming Alarms

To confirm alarms, follow the steps below:

1. Select the technical or physiological alarm information area to enter the technical or physiological alarm information window.
2. Select the check box(s) before one or more alarm messages.
3. Press [Alarm Confirm].

The monitor has the following features after the alarm is confirmed:

- The alarm is silenced.
- A symbol appears before the alarm message.
- Technical alarms are changed to the prompt messages.

Press the [X] button on the right side of the confirmed alarm to cancel the confirmation of the alarm.

After canceling the alarm confirmation, the alarm sound is activated and the alarm confirmation symbol disappears.

5.12 Reviewing Alarms

In the technical or physiological alarm information window, press the [Review] button to enter the alarm event review screen. For more information, see *Chapter 16 Review*.

5.13 Resetting Alarms

Press the alarm reset hard key on the front panel of the monitor, or press the [Alarm Reset] quick key to confirm the ongoing alarms and reset the alarm system. When the alarm system is reset, the alarm reset symbol displays in the system status information area.

Resetting Physiological Alarms

When the alarm system is reset, the sound of the ongoing physiological alarm (including the latch alarm) is silenced.

Resetting Technical Alarms

For technical alarms, when the alarm system is reset, the following occur:

- Technical alarms that can be completely cleared are cleared. For the cleared technical alarm, the monitor gives no alarm indications.
- Technical alarms that can clear sound and light are changed to prompt messages.

Caution

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

☞ **Note**

Alarm reset is not a toggle operation, pressing the alarm reset key again or several times only reset the current alarm event, rather than exit the alarm reset state.

5.14 Testing Alarms

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

For further testing of individual measurement alarms, perform the measurement on yourself or use a simulator. Adjust alarm limits and check that appropriate alarm behavior is observed.

5.15 Processing Alarms

When the monitor gives an alarm, please refer to the following steps and take proper measures:

1. Check the patient's condition.
2. Confirm the parameter of the ongoing alarm 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.

Chapter 6 Managing Patients

6.1 Admitting a Patient

To admit and set a patient as the current monitoring patient, follow the steps below:

1. Access [Patient Info] screen in either of the following ways:
   - Press the patient information area in the upper left corner of the screen.
   - Press the [Patient Info] quick key.
   - Press[Main Menu]→[Patient], select the [Patient Info] tab.
2. Select or enter patient information.
   - [Patient ID]: the patient's medical record number.
   - [Last Name]: the patient's last name (family name).
   - [Middle Name]: the patient's middle name.
   - [First Name]: the patient's first name.
   - [Gender]: the patient's gender, Male, Female and Unspecified.
   - [Age]: the patient's age.
   - [Date of Birth]: the date of birth of the patient, in the format of year month day.
   - [Patient Type]: the patient's type, Adult (age > 12 years old), Pediatric (29 days < age ≤ 12 years old) and Neonate (age ≤ 28 days).
   - [Height]: the patient's height.
   - [Weight]: the patient's weight.
   - [Bed No.]: the patient's bed number.

- [Paced]: Select “Yes” or “No” (For paced patients, select “Yes”.).

3. Press [Yes], the monitor will apply this patient as the current monitoring patient.

⚠ Warning

Discharge the previous patient before starting to monitor a new patient. Failure to do so can lead to data being associated with the wrong patient.

⚠ Warning

The default Patient Type setting is Adult, and Paced setting is Unspecified. Set [Paced] and check if the Patient Type setting is correct for the patient.

⚠ Warning

For paced patients, set [Paced] to [Yes]. If it is incorrectly set to [No], the monitor could mistake a pace pulse for a QRS and fail to give an alarm when the ECG signal is too weak. For non-paced patients, set [Paced] to [No].

6.2 Quickly Admitting a Patient

If you do not have the time or information to fully admit a patient. Complete the rest of the patient information later.

To quickly admit a patient, follow the steps below:

1. Press[Main Menu]→[Patient], select the [Quick Admit] tab.
2. Press [Auto Generated] or use the on-screen keyboard to input the Patient ID.

If the current status is [Patient Not Admitted], press [Yes], the monitor will use this patient as the current monitoring patient; otherwise, in the pop-up confirmation window, press [Yes] to stop monitoring the previous patient and use the patient as the

current monitoring patient. Input patient information as soon as the patient is admitted.

Note

The monitor supports CMS admitting patients remotely.

You can also connect the supported scanner to obtain patient's ID from barcode or QR code and input into the monitor.

6.3 Editing Patient Information

Edit patient information after a patient has been admitted, or when patient information is incomplete, or when it is necessary to change patient information.

To edit patient information, follow the steps below:

1. Access [Patient Info] screen in either of the following ways:
   - Press the patient information area in the upper left corner of the screen.
   - Press the [Patient Info] quick key.
   - Press[Main Menu]→[Patient], select the [Patient Info] tab.
2. Edit patient information as required.

Caution

The monitor will reload the configuration if you changed the patient type.

6.4 Starting Monitoring a Patient

To start monitoring a patient, follow the steps below:

1. Admit the patient.
2. Decide which parameter measurements you want to make.

3. Connect the required patient cables and sensors and make sure they are correctly connected.
4. Check that the patient settings, such as Patient Type, NIBP measuring mode, etc. are appropriate for the patient.
5. Perform desired measurements. For more information, see corresponding parameter measurement chapters.

6.5 Stopping a Parameter Measurement

To stop monitoring a parameter, follow the steps below:

1. Remove corresponding sensor from the patient.
2. Disconnect the sensor from the patient cable.
3. Disconnect the patient cable from the monitor.

6.6 Discharging a Patient

To manually discharge a patient, follow the steps below:

1. Access [Patient Info] screen in either of the following ways:
   - Press the patient information area in the upper left corner of the screen.
   - Press the [Patient Info] quick key.
   - Press[Main Menu]→[Patient], select the [Patient Info] tab.
2. Select [Discharge Patient] to discharge the current patient.

After a patient is discharged, all patient data, including patient information, trend data and physiological alarms, are cleared, the technical alarms are reset, and the monitor settings return to their defaults.

Caution

After a patient is discharged, the monitor enters the "Patient Not Admitted" state, and the data will be saved as historical patient data.

Caution

If the patient is not discharged before the monitor is turned off, the patient will still be the one before shutdown after the monitor is turned on again.

Note

The monitor supports remote manual discharge of patients through the CMS.

6.7 Managing Patient Data

6.7.1 Querying Patient Data

To query patient data, follow the steps below:

1. Access [History] screen in either of the following ways:
   - Press the patient information area in the upper left corner of the screen → select the [History] tab.
   - Press the [Patient Info] quick key → select the [History] tab.
   - Press [Main Menu]→[Patient], select the [History] tab.
2. Input query criteria.
3. Press [Query]. Then a list pops up, including all the patients that meet the query criteria.

6.7.2 Viewing Historical Patient Data

In the [History] screen, select the patient record to view, and press the [Review] button to enter the data review screen to

view the patient's historical data. See *Chapter 16 Review* for details.

6.7.3 Importing / Exporting Patient Data

To import / export the data of the current patient and discharged patients, follow the steps below:

1. Connect the USB drive to the monitor's USB connector.
2. Press[Main Menu]→[Patient], select the [History] tab.
3. Select desired patients from the patient list.
4. Select [Import] or [Export].

6.7.4 Deleting Patient Data

To delete the data of discharged patients, follow the steps below:

1. Press[Main Menu]→[Patient], select the [History] tab.
2. Select desired patients from the patient list.
3. Select [Delete].

Caution

If a patient is deleted, all data related to the patient (such as ECG waveform, alarm events, etc.) will be deleted and cannot be recovered.

Note

The data of the current patient under monitoring cannot be deleted.

6.8 Configuring Patient Information

You can set up patient information to be displayed on the [Patient Info] screen, such as registration number, patient ID, race, etc. To do so, please refer to the following steps:

1. Press[Main Menu]→[Maintenance]→ input password → press [Enter].

2. Select [Patient] tab.
3. Select the patient information to be displayed on the [Patient Info] screen.
4. If necessary, select the custom patient information field and enter the name of the field.

Caution

If the monitor is connected to the central monitoring system (CMS), the patient information and user-defined fields are synchronized with the CMS.

6.9 Managing Operators

Access [Operator] screen in either of the following ways:

- Press the operator information area in the upper left corner of the main screen.
- Press[Main Menu]→[Patient], select the [Operator] tab.

After entering the [Operator] screen, you can switch on the [Operator Information], and the operator's name will be displayed in the operator information area in the upper left corner of the main screen.

The default "admin" or other added operators can be set as the current operator.

On the [Operator] screen, you can also perform the following operations:

- [Add]: add operator information on the current monitor.
- [Edit]: edit the operator information.
- [Delete]: delete the currently selected operator information.
- [Refresh]: refresh the current operator information list.
- [Select as Operator]: set the selected operator as current operator.

Caution

The operator named "admin" preset by the system cannot be deleted from the operator list.

Note

Editing and deleting operations only change the contents of the operator list, and do not change the operator information recorded in historical patients.

Changing the Operator's Password

You can change the admin's password on the monitor.

To change the password, follow the steps below:

1. On the [Operator] screen, select [Modify Password].
2. Enter the original password and new password.
3. Select [Yes].

Chapter 7 Monitoring ECG, Arrhythmia, ST, QT/QTc Analysis

7.1 Introduction

Electrocardiogram (ECG) is the main means to measure the electrical activity of the heart. The ECG signals can be detected through electrodes at the surface of the skin, and displayed on the monitor as waveforms and numerics.

ECG monitoring provides 3/5/6/12-lead ECG monitoring, ST segment analysis, arrhythmia analysis, QT/QTc measurements, and optional 12-lead resting ECG analysis via the AI algorithm.

7.2 Safety Information

⚠ Warning

Only use the patient cable and lead wires provided by the manufacturer. Using those from other suppliers may cause improper performance or poor protection during defibrillation.

⚠ Warning

Make sure that all electrodes are connected to the patient correctly before operation.

⚠ Warning

Check if the patient category setting is correct for the patient.

⚠ Warning

Ensure that the conductive parts of ECG electrodes and associated connectors, including the neutral electrode, do not come into contact with any other conductive parts including earth. Make sure that all electrodes are connected to the patient correctly.

⚠ Warning

For paced patients, set Pacemaker to Yes. Otherwise, it may cause the pacing pulse to be treated as a regular QRS complex, and when the ECG signal is too weak, the system cannot detect it and give alarms. For ventricular paced patients, episodes of ventricular tachycardia may not always be detected.

⚠ Warning

For non-paced patients, set Pacemaker to No.

⚠ Warning

Some pacemakers may cause false low heart rate or arrest alarms, because pacemaker artifacts, such as pacemaker overshoot, may cover the real QRS complex.

⚠ Warning

Pacemaker automatic recognition function is not suitable for pediatric and neonate patients, as well as patients receiving NMT stimulation.

⚠ Warning

For paced patients, the heart rate meter may record the pacing pulse in case of cardiac arrest or arrhythmia. Do not rely entirely on heart rate meter alarms when monitoring patients with pacemakers. Always keep these patients under close surveillance.

⚠ Warning

Do not use dissimilar metal electrodes, otherwise it will cause high polarization voltage. Reusable electrodes will withstand a large bias potential due to polarization, and the recovery time after defibrillation will be particularly long (more than 10 seconds). It is recommended to use disposable electrodes.

⚠ Warning

In surgical mode, the monitor can be used with high frequency surgical equipment. When used with electrosurgical equipment, the operator should pay attention to ensure the safety of the monitored patients and operate in strict accordance with this manual. After the elimination of high frequency signal and high frequency electromagnetic field, it can return to the previous operating mode within 10 seconds without losing any permanent stored data.

⚠ Warning

To minimize the hazard of burns during use of high-frequency electrosurgical units (ESU), the ECG electrodes should not be located between the surgical site and the ESU return electrode.

⚠ Warning

To minimize the hazard of burns during high-frequency surgical procedures, ensure that the monitor's cables and transducers never come into contact with the electrosurgical units (ESU).

❗ Caution

Interference from an ungrounded equipment near the patient or electrosurgery usage can induce noise and artifact into the waveforms.

❗ Caution

When the monitor is inoperable due to overload of ECG signal or saturation of any part of the amplifier, it will prompt "Lead off" to remind the operator.

❗ Caution

Transient caused by cable circuitry blocks while monitoring may cause artifact on ECG signals yielding wrong heart rate reading and even triggering false alarm. If the electrodes and cable are located in proper places according to this manual's instructions for using

electrodes, the chance of this transient occurrence will be decreased.

☞ **Note**

Isoelectric parts (I-wave) after global QRS-onset or before global QRS-offset (K-wave) are excluded from the duration measurement of the respective adjacent waveform.

7.3 ECG Monitoring Preparation

7.3.1 Preparing the Patient Skin

The quality of the ECG waveform displayed on the monitor is the direct reflection of the ECG signal received at the electrode sites. The state of patient's skin directly affects the strength of ECG signal and the accuracy of monitoring information. As the skin is a poor conductor of electricity, therefore preparation of the patient's skin is very important to facilitate good electrode contact to the skin.

To properly prepare the patient skin, please refer to the following steps:

1. Select sites with intact skin, without impairment of any kind. Shave hair from sites, if necessary.
2. Wash sites thoroughly with soap and water. (Never use ether or pure alcohol, because this increases skin impedance).
3. Rub the skin briskly to increase capillary blood flow in the tissues and remove skin scurf and grease.

7.3.2 Connecting ECG Cable and Applying Electrodes

To connect the ECG cable and applying electrodes, follow the steps below:

1. Plug the patient cable into the ECG connector.

2. Attach the snaps to the electrodes prior to placement. Apply some electrode gel on the electrodes if the electrodes are not electrolyte self-supplied.
3. Place the electrodes on the prepared sites. For more information, see *7.3.3 ECG Electrode Placement*.

Caution

To ensure accurate ECG measurement, please select the appropriate electrode type and pay attention to the placement position of the electrodes.

Caution

If any side-effect such as allergic or itchy reaction is found, remove the electrodes from the patients immediately.

Caution

Use only the same type of electrodes recommended by the manufacturer on the same patient to avoid the change of resistance.

7.3.3 ECG Electrode Placement

The electrode identifiers, color codes and electrode placement position of the internationally accepted IEC (European standard) and AHA (American standard) are shown in the table below:

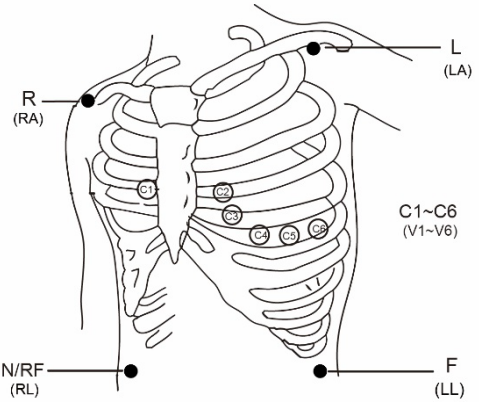
IEC Standard		AHA Standard		Electrode Placement Position
Identifier	**Color Code**	**Identifier**	**Color Code**	
R	Red	RA	White	Directly below the clavicle and near the right shoulder. Right Arm: on the inside of each arm, between the wrist and the elbow.
L	Yellow	LA	Black	Directly below the clavicle and near the left shoulder. Left Arm: on the inside of each arm, between the wrist and the elbow.

IEC Standard		AHA Standard		Electrode Placement Position
Identifier	**Color Code**	**Identifier**	**Color Code**	
F	Green	LL	Red	On the left lower abdomen. Left Leg: on the inside of each calf, between the knee and the ankle.
N or RF	Black	RL	Green	On the right lower abdomen. Right Leg: on the inside of each calf, between the knee and the ankle.
C	White	V	Brown	On the chest in any of the C1-C6 (V1-V6) electrode positions.
C1	White/Red	V1	Brown/Red	On the fourth intercostal space at the right sternal border.

IEC Standard		AHA Standard		Electrode Placement Position
Identifier	**Color Code**	**Identifier**	**Color Code**	
C2	White/Yellow	V2	Brown/Yellow	On the fourth intercostal space at the left sternal border.
C3	White/Green	V3	Brown/Green	Midway between C2 (V2) and C4 (V4) electrode
C4	White/Brown	V4	Brown/Blue	On the fifth intercostal space at the left midclavicular line.
C5	White/Black	V5	Brown/Orange	On the left anterior axillary line, horizontal with the C4 (V4) electrode

IEC Standard		AHA Standard		Electrode Placement Position
Identifier	Color Code	Identifier	Color Code	
C6	White/Violet	V6	Brown/Violet	On the left midaxillary line, horizontal with the C4 (V4) electrode

Electrode Placement



Caution

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

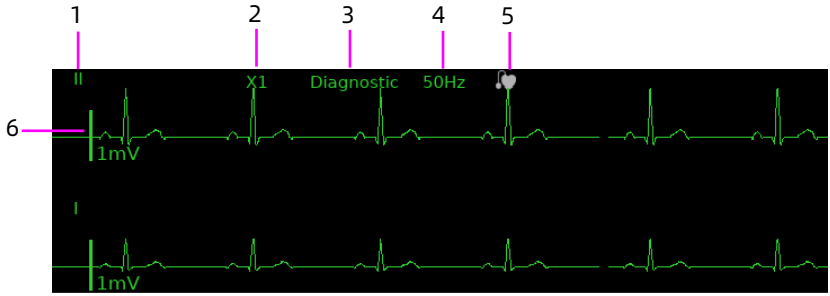
Caution

For actual use, please place the electrodes according to the physician's preference.

7.4 ECG Display

ECG waveform area

The figures below are for reference only. The display may be configured to look slightly different.



1 ECG lead label of the displayed waveform

2 ECG waveform gain

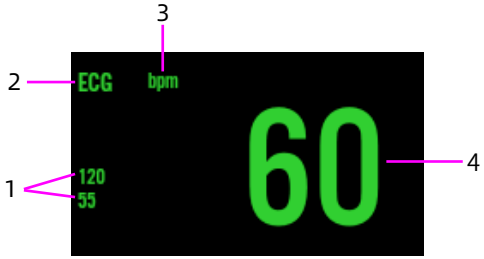
3 ECG filter mode

4 Notch filter status

5 Paced status: If [Paced] is set to [Yes], is displayed. If [Paced] is set to [No], is displayed.

6 1mV scale

ECG parameter area



1 HR alarm limits

2 Parameter label

3 HR unit

4 HR value

Caution

The display of ECG waveform area and parameter area will be different, depending on different lead types and settings.

7.5 Changing ECG Settings

7.5.1 Setting ECG Menu

Access [ECG] setup screen in either of the following ways:

- Select the ECG parameter area.
- Press the [Parameters] quick key.
- Press [Main Menu]→[Parameters].

Depending on the function configuration, the ECG menus are different, please refer to the actual display of the monitor you purchased.

In the ECG Setup screen, you can perform the following operations:

[Lead]: Select the lead type. Options: 3-lead, 5-lead, 6-lead, 12-lead and Auto. The monitor can automatically detect the lead type.

[ECG1], [ECG2]: Set ECG lead label of the displayed waveform. See the following table for details:

Lead Type	ECG1	ECG2
3-lead	Options: I, II, III. The default is II.	––
5-lead	Options: I, II, III, aVR, aVL, aVF, V. The default is II.	Options: I, II, III, aVR, aVL, aVF, V. The default is V.

Lead Type	ECG1	ECG2
6-lead	Options: I, II, III, aVR, aVL, aVF, Va, Vb. The default is II.	Options: I, II, III, aVR, aVL, aVF, Va, Vb. The default is I.
	[Va]: Va, V1, V2, V3, V4, V5, V6. The default is Va. [Vb]: Vb, V1, V2, V3, V4, V5, V6. The default is Vb.	
12-lead	Options: I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6. The default is II.	Options: I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6. The default is V1.

[Speed]: ECG waveform speed. Options: 6.25mm/s, 12.5mm/s, 25mm/s and 50mm/s.

[Filter]: ECG waveform filter mode. Options: Monitor, Diagnostic, Surgery and ST.

- [Monitor]: use under normal monitoring conditions.
- [Diagnostic]: use when diagnostic quality ECG is required.
- [Surgery]: use when the signal is distorted by high frequency or low frequency interference. High frequency interference usually results in large amplitude spikes making the ECG signal look irregular. Low frequency interference usually leads to drifting or rough baseline. The surgery filter reduces artifacts and interference from electro-surgical units. Under normal measurement conditions, selecting this filter mode may suppress certain features or details of the QRS complexes.
- [ST]: recommended for ST monitoring.

[Gain]: ECG gain, to set the size of each ECG waveform.

The base gain is 10mm/mV.

Factor options: x 1/4, x 1/2, x 1, x 2and Auto.

- [x 1/4]: make the height of 1mV ECG signal waveform become 2.5mm.
- [x 1/2]: make the height of 1mV ECG signal waveform become 5mm.
- [x 1]: make the height of 1mV ECG signal waveform become 10mm.
- [x 2]: make the height of 1mV ECG signal waveform become 20mm.
- [Auto]: let the monitor choose the optimal adjustment for all the ECG waves. When "Auto" is selected, the monitor will automatically select one of the above six options and update it timely.

[Notch Filter]: The notch filter removes the line frequency interference. The notch filter can only be switched on or off when the ECG filter mode is set to "Diagnostic". In other filter modes, the notch filter is always off.

Set notch filter frequency according to the power line frequency of your country. To set notch filter frequency, follow the steps below:

1. Press [Main Menu]→[Maintenance]→ input password → press [Enter].
2. Select the [Module] tab.
3. Set [Notch Filter] to [50Hz] or [60Hz] according to the power line frequency.

[Grid]: Switch on or off [Grid] to show or hide grid background on the ECG waveform area.

☞ **Note**

If the amplitude of ECG waveform is too large, the wave peak or the wave valley might not be displayed. In this case, you should change the waveform gain appropriately.

7.5.2 Setting ECG Alarm Properties

To set ECG alarm options, follow the steps below:

1. Access ECG alarm setup screen in either of the following ways:
   - Press the [Alarms] quick key → select the [ECG] tab.
   - Press [Main Menu]→[Alarms], select the [ECG] tab.
   - Select the ECG parameter area → press the [Alarms] button.
2. Set the alarm switch, high and low limit, alarm priority, print output and record output according to your needs.

[Alarm Source]: Options: Auto, HR, PR, HR+PR. The default is Auto.

7.5.3 Setting ECG Lead Off Alarm Priority

To set the priority for ECG lead off alarms, follow the steps below:

1. Press[Main Menu]→[Maintenance]→ input password → press [Enter].
2. Select the [Alarm] tab.
3. Set [ECG Lead Off] from the drop-down menu. Options: High, Med, Low. The default is Prompt.

7.5.4 Setting the ECG Standard

Set the ECG standard according to the leadwires you are using. To set the ECG standard, follow the steps below:

1. Press [Main Menu] → [Maintenance]→ input password → press [Enter].
2. Select the [Module] tab.
3. Set [ECG Standard] from the drop-down menu. Options: AHA, IEC.

7.6 About Arrhythmia Monitoring

Arrhythmia monitoring is intended for adult patients.

7.6.1 Safety Information

⚠ Warning

If you switch off all the arrhythmias alarms, the monitor cannot give any arrhythmias alarm when that situation occurs. This may result in a hazard to the patient. Keep the patient under close surveillance.

⚠ Warning

Heart rate reading may be affected by cardiac arrhythmias. Do not rely entirely on heart rate alarms when monitoring patients with arrhythmias. Always keep these patients under close surveillance.

❗ Caution

The priority of lethal arrhythmia alarms is always high. It cannot be changed.

☞ Note

Because arrhythmia detection needs a template ECG waveform as reference which is a piece of normal ECG waveform with regular rhythm and stable amplitude, it is necessary to re-activate the template learning when the patient is changed, or the arrhythmia detection is incorrect. For stronger arrhythmia detection, it is recommended to wait for a clean and stable ECG waveform before starting ARR detection during the monitoring.

☞ **Note**

During arrhythmia detection, incorrect detection might occur if the non-ECG waveforms (e.g., square or triangle waveform) appear.

☞ **Note**

Before starting the 1mV calibration signal, please turn off the arrhythmia detection.

☞ **Note**

During Arrhythmia detection, the template learning is very important. The device requires a group of stable QRS complex waveforms to build up this template. If the system detects Arrhythmia incorrectly, please re-activate the template learning and obtain the correct template.

7.6.2 Changing Arrhythmia Alarm Settings

To set the arrhythmia alarm properties, follow the steps below:

1. Enter the [Alarms] screen in either of the following ways:
   - Press [Main Menu]→[Alarms].
   - Press the [Alarms] quick key.
2. Select the [ARR] tab → [Alarm Name] tab.
3. Set alarm properties as desired.

In the arrhythmias alarm setup screen, you can perform the following operations:

- [Defaults]: press to reset all settings to the defaults.
- [All On]: press to switch on all arrhythmia alarms.
- [Lethals Only]: press to switch on lethal arrhythmia alarms, and switch off other alarms.

7.6.3 Setting the Lethal Arrhythmia Alarms Switch

To allow you to disable the lethal arrhythmia alarms, follow the steps below:

1. Press [Main Menu] → [Maintenance] → input password → press [Enter].
2. Select the [Alarm] tab → select the [ARR] item.
3. Set [V-Fib/V-TachOff] as follows.
   - [V-Fib/V-Tach Off] is set to [Disable] by default. In this case, you cannot switch off [V-Fib/V-Tach] alarm.
   - If you set [V-Fib/V-Tach Off] to [Enable], you can switch off the [V-Fib/V-Tach] alarm.

When the [V-Fib/V-Tach] alarm is switched off, the physiological alarm information area displays a message " V-Fib/V-Tach Alarm Off".

Warning

If you switch off the V-Fib/V-Tach alarm, the monitor will not issue the V-Fib/V-Tach alarm when that situation occurs. This may result in a hazard to the patient. Always keep the patient under close surveillance.

7.6.4 Changing Arrhythmia Alarm Threshold Settings

You can change threshold settings for certain arrhythmia alarms. When an arrhythmia exceeds its threshold, an alarm will be triggered.

To change the arrhythmia alarm threshold settings, follow the steps below:

1. Enter the [Alarms] screen in either of the following ways:
   - Press [Main Menu]→[Alarms].
   - Press the [Alarms] quick key.
2. Select the [ARR] tab → [Threshold] tab.
3. Set the threshold for the desired arrhythmia alarms.

The setting range of arrhythmia threshold is shown in the table below.

Arrhythmia	Threshold Range	Threshold Default Settings
Asystole Delay	3-10s	5 s
Pause Threshold	1.5, 2.0, 2.5, 3.0s	2.0 s
Nonsus V-Tach	3-99 beats	5 beats
Run PVCs	3-99 beats	5 beats
V-Tach Rate	100-200 bpm, step: 5 bpm	130 bpm
V-Brady Rate	15-60 bpm, step: 5 bpm	40 bpm
Extreme Tachy	121-350 bpm	160 bpm
Extreme Brady	0-49 bpm	35 bpm
SV Tachy	60-300 bpm, step: 5 bpm	120 bpm
SV Brady	15-120 bpm, step: 5 bpm	50 bpm
SV Sustained Beats	3-99 beats	5 beats
PVCs/min	1-100	10
A-Fib (HR High)	100-300 bpm, step: 5 bpm	150 bpm
Pauses/min	1-15	8
AF/IrrRhy End Time	0, 1, 2, 3, 4, 5, 10, 15, 30 min	5 min

Arrhythmia	Threshold Range	Threshold Default Settings
Multif PVCs Window	3-31 beats	10 beats

7.6.5 Arrhythmia Analysis Classifications

Arrhythmia Event (Abbreviation)	Arrhythmia Event (In Full or Description)
Lethal Arrhythmia Events:	
Asystole	Asystole
V-Fib/V-Tach	Ventricular-Fibrillation/Ventricular-Tachycardia
Vent Tachy	Ventricular Tachycardia
Vent Brady	Ventricular Bradycardia
Extreme Brady	Extreme Bradycardia
Extreme Tachy	Extreme Tachycardia
Non-lethal Arrhythmia Events:	
Nonsus V-Tach	Nonsustained Ventricular Tachycardia
Vent Rhythm	Ventricular Rhythm
Run PVCs	More than two consecutive Premature Ventricular Contractions
Pair PVCs	A Pair of Premature Ventricular Contractions
R on T	R Waves Interrupting T Waves
Vent Bigeminy	Ventricular Bigeminy
Vent Trigeminy	Ventricular Trigeminy
PVCs/min High	Premature Ventricular Contractions per Minute

Arrhythmia Event (Abbreviation)	Arrhythmia Event (In Full or Description)
Multiform PVC	Multiform Premature Ventricular Contractions
PVC	Premature Ventricular Contractions
Tachy	Tachycardia
Brady	Bradycardia
A-Fib (HR High)	Atrial-Fibrillation (High Heart Rate)
A-Fib	Atrial Fibrillation
A-Fib End	Atrial Fibrillation End
Irr Rhythm	Irregular Rhythm
Irr Rhy End	Irregular Rhythm End
Pause	Heartbeat Pause
Missed Beats	Missed Beats
Pauses/min High	Heartbeat Pauses per Minute
Pacer Not Pacing	Pacer Not Pacing
Pacer Not Capture	Pacer Not Capture

7.7 About ST Monitoring

ST segment of ECG waveform is the period from the end of ventricular depolarization to the beginning of ventricular repolarization, or from the end of QRS complex (J point) to the beginning of T wave. ST segment analysis is often used to monitor the oxygen supply and myocardial activity of patients.

ST segment analysis can only be performed when the [Filter] is set to [Diagnostic] or [ST]. ST segment analysis is intended for adult and pediatric patients.

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

7.7.1 Safety Information

⚠ Warning

This monitor provides information regarding changes in ST deviation levels. The clinical significance of the ST level change information should be determined by a physician.

⚠ Warning

ST segment deviation values may be affected by such factors as certain drugs or metabolic and conduction disturbances.

⚠ Warning

The ST algorithm has been tested for accuracy of the ST segment data. The significance of ST segment changes needs to be determined by a physician.

7.7.2 Enabling ST Analysis/Display ST Parameters

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

1. Enter the ST setup screen in either of the following ways:
   - Select the ST parameter area.
   - Press the [Parameters] quick key, select the [ST] tab.
   - Press [Main Menu] → [Parameters], select the [ST] tab.
2. Switch on [ST Analysis], the ST parameter area appears on the main screen.

The ST parameter display area is configured differently according to the ECG cable used:

- When you are using the 3-lead ECG leadwires, a separate ST parameter area does not appear on the display. The ST deviation value displays in the ECG parameter area.
- When you are using the 5-lead ECG leadwires, the ST parameter area displays 7 ST deviation values for lead I, II, III, aVR, aVL, aVF, V.
- When you are using the 6-lead ECG leadwires, the ST parameter area displays 8 ST deviation values for lead I, II, III, aVR, aVL, aVF, Va, Vb.
- When you are using the 12-lead ECG leadwires, the ST parameter area displays 12 ST deviation values for lead I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6.

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

1 Parameter label

2 ST measurement unit

3 ST alarm off symbol

4 Lead labels

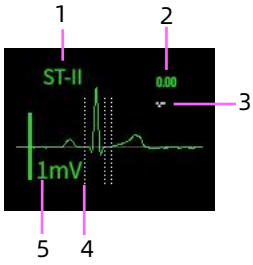
5 ST numerics: a positive value indicates ST segment elevation, and a negative value indicates ST segment depression.

7.7.3 Displaying ST Segments in the Waveform Area

To display ST segments in the waveform area, follow the steps below:

1. Enter the ST setup screen in either of the following ways:
   - Select the ST parameter area.
   - Press the [Parameters] quick key, select the [ST] tab.
   - Press [Main Menu]→[Parameters], select the [ST] tab.
2. Switch on [ST Segment], the ST segments appear in the waveform area.
3. Switch on [Display Markers] and [Display Baseline] when necessary.

The ST segment area displays the current ST segment and baseline ST segment, the current ST value and baseline ST value. The current ST segment is drawn in the same color as the ECG wave, usually green, superimposed over the stored reference segment, drawn in a different color. As shown in the following figure:



1 ST lead
2 Current ST value
3 Baseline ST value
4 Marker
5 1mV scale

7.7.4 Displaying ISO Point, J Point and ST Point Markers

To display the ISO point, J point, and ST point marker on the ST segments in the waveform area, follow the steps below:

To display ST segments in the waveform area, follow the steps below:

1. Enter the ST setup screen in either of the following ways:
   - Select the ST parameter area.
   - Press the [Parameters] quick key, select the [ST] tab.
   - Press [Main Menu] → [Parameters], select the [ST] tab.
2. Switch on [Display Markers].

7.7.5 Displaying Baseline ST Segments

To display the baseline ST segments in the waveform area, follow the steps below:

1. Enter the ST setup screen in either of the following ways:
   - Select the ST parameter area.
   - Press the [Parameters] quick key, select the [ST] tab.
   - Press [Main Menu] → [Parameters], select the [ST] tab.
2. Switch on [Display Baseline], the baseline ST segment (white) appears.

7.7.6 Setting ST Alarm Properties

To set ST alarm options, follow the steps below:

1. Enter the ST alarm setup screen in either of the following ways:
   - Press the [Alarms] quick key, select the [ST] tab.
   - Press [Main Menu] → [Alarms], select the [ST] tab.
   - Select the ECG parameter area → press the [Alarms] button, select the [ST] tab.

2. Set the alarm switch, high and low limit, alarm priority, print output and record output according to your needs.

In the ST alarm setup screen, you can perform the following operations:

- **[All On]**: press to switch on all ST alarms.
- **[All Off]**: press to switch off all ST alarms.
- **[Defaults]**: press to reset all value to the defaults.

7.8 About QT/QTc Interval Monitoring

The QT interval is the time between the beginning of the Q-wave and the end of the T-wave. It represents the total duration of the depolarization (QRS duration) and repolarization (ST-T) phases of the ventricles. QT interval monitoring can assist in the detection of long QT syndrome.

QT interval was negatively correlated with heart rate. The faster the heart rate, the shorter the QT interval, and vice versa. Therefore, several formulas are commonly used to correct the QT interval for heart rate. The heart rate corrected QT interval is abbreviated as QTc.

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

7.8.1 Enabling QT/QTc Monitoring

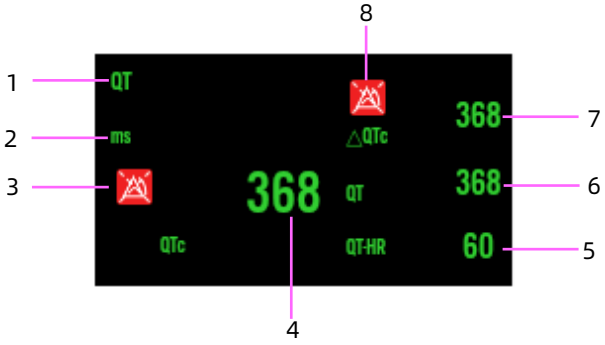
The QT monitoring function is disabled by default. Before you start QT monitoring, enable the QT analysis function.

To do so, follow the steps below:

1. Enter the QT setup screen in either of the following ways:
   - Select the QT parameter area.
   - Press the [Parameters] quick key, select the [QT] tab.
   - Press [Main Menu]→[Parameters], select the [QT] tab.

2. Switch on [QT Analysis], the QT parameter area appears on the main screen.

The following figure shows the QT parameter area. Your monitor screen may look slightly different.



1 Parameter label
2 QT measurement unit
3 QTc alarm limit (if QTc alarm is off, the alarm off symbol is displayed)
4 QTc value
5 QT-HR value
6 QT value
7 ΔQTc value
8 The alarm off symbol is displayed when the ΔQTc alarm is set to off

7.8.2 Selecting Leads for QT Calculation

You can select one lead or all leads for QT calculation. To do so, follow the steps below:

1. Enter the QT setup screen in either of the following ways:
   - Select the QT parameter area.
   - Press the [Parameters] quick key, select the [QT] tab.

- Press [Main Menu] → [Parameters], select the [QT] tab.

2. Set [QT Analysis Lead]. [All] is selected by default, which means all leads are used for QT calculation.

7.8.3 Selecting the QTc Formula

The monitor uses the Hodges correction formula by default to correct the QT interval for heart rate. To select the other QTc formula, follow the steps below:

1. Enter the QT setup screen in either of the following ways:
   - Select the QT parameter area.
   - Press the [Parameters] quick key, select the [QT] tab.
   - Press [Main Menu] → [Parameters], select the [QT] tab.
2. Set [QTc Formula].

   Hodeges: $QTc = QT+1.75 \times (HR-60)$

   Bazett: $QTc = QT \times (HR/60)^{1/2}$

   Fredericia: $QTc = QT \times (HR/60)^{1/3}$

   Framingham: $QTc = QT+154 \times (1-60/HR)$

7.8.4 Entering the QT View Screen

The QT View shows the current and baseline QT parameter values and waveforms. To enter the QT View screen, follow the steps below:

1. Enter the QT setup screen in either of the following ways:
   - Select the QT parameter area.
   - Press the [Parameters] quick key, select the [QT] tab.
   - Press [Main Menu] → [Parameters], select the [QT] tab.
2. Select [QT View].

The current waveform is displayed in the upper left half of the screen, with the same color as the ECG waveform. The baseline waveform is displayed below in white color. The start of the

QRS complex and the end of the T wave are marked with a vertical line.

7.8.5 Setting the QTc Baseline

QT baseline helps quantify changes in QTc and calculate ΔQTc value. The baseline can be from a manual one or provided by the monitor.

After the valid QT value appears, the monitor automatically sets the valid QT value calculated in the first 5 minutes as the QT baseline if no manual baseline is set.

To manually set the baseline, follow the steps below:

1. Select [QT View] → [Set Baseline].
2. From the pop-up dialog box, select [Yes]. The monitor will use the current baseline to calculate ΔQTc.

The baseline remains effective until the new baseline is set.

If no valid QT value, the [Set Baseline] button is not available.

Caution

Changing baseline will affect the QT alarm.

From the [QT View] screen, you can select [Display Baseline] or [Hide Ref.] to display or hide the baseline waveform and QT baseline update time.

7.8.6 Setting QT Alarm Properties

To set QT alarm options, follow the steps below:

1. Enter the QT alarm setup screen in either of the following ways:
   - Press the [Alarms] quick key, select the [QT] tab.
   - Press [Main Menu] → [Alarms], select the [QT] tab.

- Select the ECG parameter area → press the [Alarms] button, select the [QT] tab.

2. Set QTc and ΔQTc alarm properties.

7.9 Factors Affecting ECG Signal

The following factors will affect the quality of acquired ECG signals:

- Interference from electro-surgical units.
- Unreasonable filter mode setting.
- Poor grounding.
- Incorrect placement of electrodes.
- Use expired electrodes or use disposable electrodes repeatedly.
- The skin on which the electrodes are placed is unclean or poor contract caused by scurf and hair.

Chapter 8 Resting 12-Lead ECG Acquisition

The monitor supports automatic acquisition of 12- lead resting ECG waveforms. After acquisition, the data is transmitted to the AI-ECG Platform server through the network for analysis. You can download, view and print the diagnosis report at the monitor side.

☞ **Note**

The resting12-lead ECG analysis function is only available if the monitor you purchased is configured with 12-lead ECG.

☞ **Note**

Please use the resting12-lead ECG data analysis software (AI-ECG Platform, K180432) specified by the manufacturer.

☞ **Note**

According to the function of the AI-ECG Platform, it is only suitable for use in the general adult population.

☞ **Note**

The baseline drift removal (BDR) filter suppresses most baseline drift interference and preserves the fidelity of the ST-segment level. BDR doesn't need to be switched on or off manually as it is configured by default.

8.1 Entering the 12-Lead Screen

To enter the 12-lead screen, follow the steps below:

1. Select the ECG parameter area to enter the ECG Setup screen.
2. From the popup list of the [Lead], select [12-lead].
3. From the bottom of the ECG Setup screen, select [ECG 12-Lead].

You can also enter the 12-lead screen by following the steps below:

- Press the [ECG 12-Lead] quick key.
- Press the [Screens] quick key → select [ECG 12-Lead].
- Press [Main Menu]→[Screens], select [ECG 12-Lead].

There are 12 ECG waveforms and 1 rhythm lead in the waveform area of the 12-lead screen. The rhythm lead is the ECG calculation lead before entering this screen.

8.2 Setting the 12-Lead ECG Acquisition

You can perform the following operations on the 12-lead screen:

- [Start / Stop]: press this button to start / stop ECG acquisition.
- [Freeze]: press this button to freeze the currently displayed waveforms on the screen and enter the freeze screen.
- [Real-time]: set the sampling mode, real-time sampling and pre-sampling can be selected. The default is real-time sampling.
- [10mm/mV]: set the gain of the waveforms.
  Options: 2.5mm/mV, 5mm/mV, 10mm/mV, 20mm/mV.
  The default is 10mm/mV.
- [25mm/s]: set the speed of the waveforms.
  Options: 25mm/s, 50mm/s. The default is 25mm/s.
- [6×2+1R]: set the 12-lead waveform layout.
  Options: 6×2+1R, 3×4+1R. The default is 6×2+1R.
- [10s]: set the acquisition time.
  Options: 10s, 20s, 30s, 60s. The default is 10s.

- [Exit]: press this button to exit the 12-lead screen and return to the main screen.

  If you press this button to exit during the acquisition process, the system will pop up the exit confirmation prompt.

8.3 Connecting to the AI-ECG Server

Before initiating 12-lead ECG acquisition, please set up the network and connect the monitor to the server of AI-ECG Platform. For the specific setting method, please refer to *4.6 Connecting the AI-ECG Server*.

8.4 Initiating 12-Lead ECG Acquisition

After connecting the AI-ECG server, before 12-lead ECG acquisition, please select and install electrodes according to the introduction of *7.3ECG Monitoring Preparation*, check that all electrodes and cables have been properly connected, the patient information is set correctly, and always keep the patient quiet.

To initiate 12-lead ECG acquisition, press the [Start] button in the lower right corner of the [ECG 12-Lead] screen.

- Real-time sampling: acquire the ECG data of the set acquisition time after pressing the [Start] button. During the acquisition process, the remaining acquisition time is displayed. At the completion of acquisition, the system enters the preview screen.
- Pre-sampling: acquire the ECG data of 10 seconds before pressing the [Start] button. At the completion of acquisition, the system enters the preview screen.

In the preview screen, press [Save] to send the saved data to AI-ECG server for analysis. After the report is obtained, you can view it in the [Reports Mgmt] screen.

In addition to the above 12-leadECG analysis, the monitor also supports 12-lead analysis of stored historical waveforms. Follow this procedure:

1. Press [Review] quick key or press [Main Menu] → [Review] to enter the review screen.
2. Select the [Full Disclosure] tab.
3. Select the desired waveform segment.
4. Press the [12-Lead ECG] button to enter the resting ECG acquisition screen.
5. Set the [Period].
6. Press [Start].

The monitor will send the stored data corresponding to the selected time length, or the collected data of the selected time length, to the AI-ECG server (if connected) for analysis.

☞ **Note**

[Start Time] is the time point of the selected waveform segment.

8.5 Reports Management

After ECG acquisition, press [Main Menu]→[Reports] to enter the reports management screen. You can perform the following operations in this screen:

- Press [Delete] to delete one or more selected patient record.
- Press [Preview] to enter the preview screen of ECG waveforms of the selected patient record.

- Press [Upload] to upload one or more selected patient record to the AI-ECG server.
- Press [Download] to download the diagnosis report of the selected patient record from the AI-ECG server.
- Press [View Report] to view the diagnosis report of the selected patient record.
- Press [ ] to print the obtained diagnosis report of the selected patient record via the network printer.

☞ Note

For the processing method of ECG data received by AI-ECG server, please refer to the Operator's Manual of ECG Analysis Software of AI-ECG Platform.

☞ Note

Please configure the network printer before printing 12-lead ECG analysis reports.

Chapter 9 Ambulatory ECG Acquisition

The monitor supports automatic acquisition of single lead / 8-lead / 12-lead ambulatory ECG waveforms. After acquisition, the data is transmitted to the AI-ECG Tracker server through the network for analysis. You can download and print the diagnosis report at the monitor side.

☞ **Note**

Please use the ambulatory ECG data analysis software (AI-ECG Tracker, K200036) specified by the manufacturer.

☞ **Note**

According to the function of the AI-ECG Tracker, it is not suitable for diagnosing patients age 21 and under, and patients with pacemakers.

9.1 Connecting to the AI-ECG Server

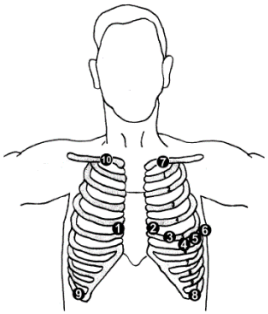
Before initiating ambulatory ECG acquisition, please set up the network and connect the monitor to the server of AI-ECG Tracker. For the specific setting method, please refer to *4.6 Connecting the AI-ECG Server*.

9.2 Electrode Placement

Refer to *7.3.1 Preparing the Patient Skin* for the skin preparation for electrode placement.

Attach the snaps to the electrodes and then place the electrodes on the patient according to the lead type you have chosen. The following figures show the typical position of electrode placement. You can also refer to the position recommended by the analysis system and the physician.

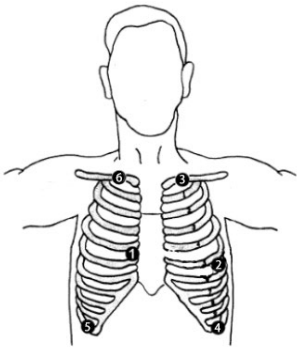
✦ **12-lead (10 Lead Wires) Electrode Placement**



	AHA Color	AHA Label	IEC Color	IEC Label	Position
1	Brown/ Red	V1	White/ Red	C1	The fourth intercostal space at the right edge of sternum
2	Brown/ Yellow	V2	White/ Yellow	C2	The fourth intercostal space at the left edge of sternum
3	Brown/ Green	V3	White/ Green	C3	The position between V2 and V4
4	Brown/ Blue	V4	White/ Dark brown	C4	Midclavicular line at the fifth intercostal space
5	Brown/ Orange	V5	White/ Light blue	C5	Anterior axillary line at the same level as V4
6	Brown/ Purple	V6	White/ Purple	C6	Midaxillary line at the same level as V4 and V5
7	Black	LA	Yellow	L	Left shoulder

	AHA Color	AHA Label	IEC Color	IEC Label	Position
8	Red	LL	Green	F	The lower edge of rib cage, or the level of the navel at the position of middle clavicle line.
9	Green	RL	Black	N	The lower edge of rib cage, or the level of the navel at the position of middle clavicle line.
10	White	RA	Red	R	Right shoulder

✦ **8-lead (6 Lead Wires) Electrode Placement**



	AHA Color	AHA Label	IEC Color	IEC Label	Position
1	Brown/ Red	V1	White/ Red	C1	The fourth intercostal space at the right edge of sternum
2	Brown/ Orange	V5	White/ Light Blue	C5	Anterior axillary line at the same level as V4
3	Black	LA	Yellow	L	The left shoulder
4	Red	LL	Green	F	The lower edge of rib cage, or the level of the

	AHA Color	AHA Label	IEC Color	IEC Label	Position
					navel at the position of middle clavicle line.
5	Green	RL	Black	N	The lower edge of rib cage, or the level of the navel at the position of middle clavicle line.
6	White	RA	Red	R	Right shoulder

Caution

For an accurate ambulatory ECG analysis, it is suggested that Va should be placed in V1 and Vb in V5.

9.3 Initiating Ambulatory ECG Acquisition

Real-time ambulatory ECG acquisition

Press the [Holter] quick key to enter the [Holter] screen. You can perform the following operations in this screen:

- Select [Period] to set the duration of ambulatory ECG acquisition. Options: 24h, 48h, 72h.
- Press [Start] to start the ambulatory ECG acquisition.
- Press [Stop] to stop the ambulatory ECG acquisition after confirmation.
- Press [×] in the upper right corner of the screen to exit the Holter screen.

Note

[Start Time] is displayed automatically. The default is the current time. [Acquire Time] is the current acquisition time.

Historical ECG waveform acquisition

Press [Main Menu]→[Review]→[Full Disclosure], select a waveform segment in the waveform area, and then press the

[Holter] button to enter the Holter screen. You can perform the following operations in this screen:

- Select [Period] to set the duration of ambulatory ECG acquisition. Options: 24h, 48h, 72h.
- Press [Start] to start the ambulatory ECG acquisition.
- Press [Stop] to stop the ambulatory ECG acquisition after confirmation.
- Press [×] in the upper right corner of the screen to exit the Holter screen.

☞ **Note**

[Start Time] is displayed automatically. If a time point is manually selected on the full disclosure waveform, the start time is "the selected time point minus the set time length"; if no time point is selected on the full disclosure waveform, the start time is "the current time minus the set time length".

☞ **Note**

[Acquire Time] is the current acquisition time.

At the completion of acquisition, the monitor automatically sends the data to the AI-ECG server (if connected) for analysis.

9.4 Reports Management

For the preview and print operations of the diagnostic reports, please refer to *8.5 Reports Management*.

☞ **Note**

For the processing method of ECG data received by AI-ECG server, please refer to the Operator's Manual of Ambulatory ECG Analysis Software of AI-ECG Tracker.

Chapter 10 Monitoring Respiration (Resp)

10.1 Introduction

Respiration is monitored by measuring the impedance across the thorax via electrodes places on chest. When the patient is breathing or ventilated, the volume of air changes in the lungs, resulting in impedance changes between the electrodes. Impedance respiration rate (RR) is calculated from the signal representing these impedance changes, and a respiration waveform is displayed on the patient monitor screen.

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

10.2 Safety Information

⚠ Warning

When monitoring the patient's impedance respiration, do not use ESU-proof ECG cables. The monitor cannot measure impedance respiration with ESU-proof ECG cables.

⚠ Warning

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

⚠ Warning

If operating under conditions according to the EMC Standard IEC 60601-1-2 (Radiated Immunity 3V/m), field strengths above 3V/m may cause erroneous measurements at various frequencies. Therefore, it is recommended to avoid the use of electrically radiating equipment in close proximity to the impedance respiration measurement unit.

⚠ Warning

To avoid the hazard of burns during use of high-frequency electrosurgical units (ESU), the electrodes should not be located between the surgical site and the ESU return electrode. Place the ESU return electrode close to the operation area.

Caution

Impedance respiration monitoring is not suitable for patients who are very active, otherwise it may lead to false alarm.

10.3 Resp Monitoring Preparation

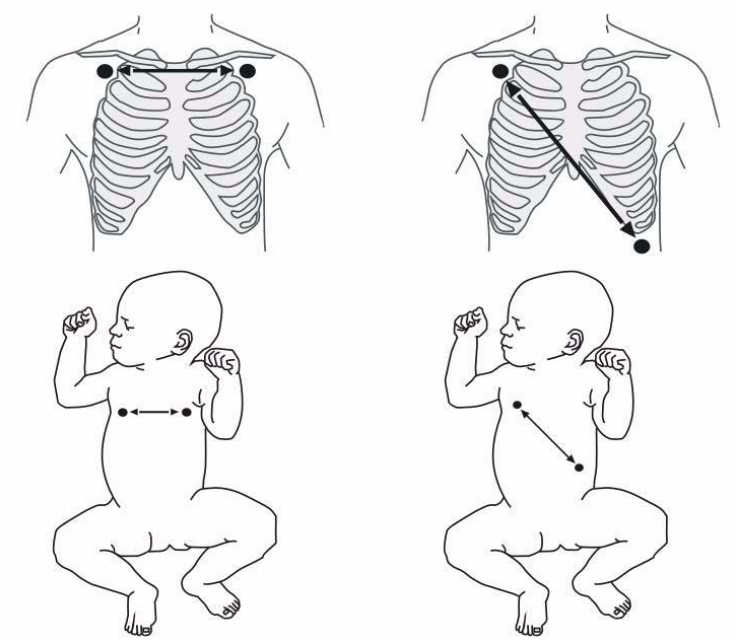
10.3.1 Preparing the Patient Skin

As the skin is a poor conductor of electricity, correct patient skin preparation for electrode placement is important for Resp measurement. You can refer to *7.3.1 Preparing the Patient Skin* for how to prepare the skin.

10.3.2 Placing the Electrodes

Respiration measurement adopts the standard ECG electrode placement with standard ECG electrodes and cables. The respiration signal is always measured between two of the ECG electrodes. There are two standard ECG leads for selection: I lead (R(RA) and L(LA)) and II lead (R(RA) and F(LL)).

For electrode placement, see *7.3.2 Connecting ECG Cable and Applying Electrodes*.



Lead I Lead II

Caution

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.

Caution

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

Caution

Correct electrode placement can help to reduce interference from cardiac related impedance changes: avoid including the liver area and the ventricles of the heart between the respiratory electrodes. This is particularly important for neonates.

Caution

Some patients with restricted movements breathe mainly through the abdomen. In these cases, you may need to place the left leg electrode on the left abdomen at the point of maximum abdominal expansion to optimize the respiratory waveform.

Caution

Periodically inspect electrode application sites to ensure skin integrity. If there are signs of allergy, replace the electrodes or change the application site.

Note

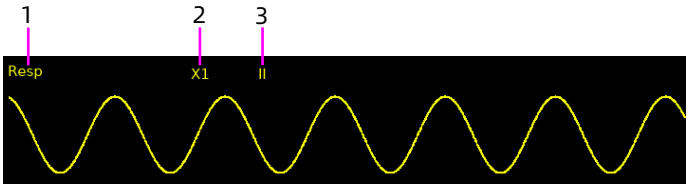
Store the electrodes at room temperature. Open the electrode package immediately prior to use.

Note

Check that the electrode packages are intact and that the electrodes are not past the expiration date. Ensure the electrode gel is moist.

10.4 Resp Display

Resp waveform area

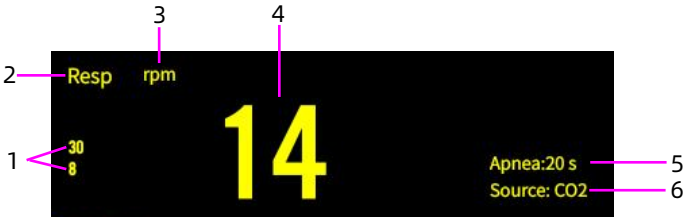


1 Resp lead label

2 Resp waveform gain

3 Resp lead label

Resp parameter area



1 Alarm limits

2 Parameter label

3 Resp unit

4 Respiration rate (RR)

5 Apnea delay time

6 RR source

10.5 Changing Resp Settings

10.5.1 Setting Resp Menu

Access Resp setup screen in either of the following ways:

- Press Resp parameter area.
- Press the [Parameters] quick key → select the [Resp] tab.
- Press [Main Menu] →[Parameters], select the [Resp] tab.

Depending on the function configuration, the Resp menus are different, please refer to the actual display of the monitor you purchased.

In the Resp setup screen, you can perform the following operations:

- **[Speed]**: Respiration waveform sweeping speed. The larger the value, the faster the sweeping speed.

Options: 6.25mm/s, 12.5mm/s, 25mm/s, 50mm/s.

- **[Gain]**: Respiration amplification/gain times, used to adjust the amplitude of respiration waveform, the greater the gain, the higher the amplitude of waveform.

  Options: ×1/8, ×1/4, ×1/2, ×1, ×2, ×4.

  The basic gain is 10mm/mV.

  X1 waveform scale with base gain

  X1/8 one eighth scale size of the base gain

  X1/4 one quarter scale size of the base gain

  X1/2 half scale size of the base gain

  X2 twice scale size of the base gain

  X4 four times scale size of the base gain

- **[Apnea Delay]**: The timeout setting for apnea alarm (in second). Setting range: 10 to 40 seconds, the step is 5 second.

  The Resp parameter area will display "Apnea: XX s (display the set Apnea delay time)"; when an apnea event is detected, an "Apnea" prompt will appear on the alarm information area, and an alarm tone will be issued.

- **[Resp Lead]**: set the respiration lead to get the best respiration waveform.

  Options: I, II.

- **[RR Source]**: select the respiration signal source.

  Options: Auto, CO_2 and ECG.

  When you select [Auto], the monitor automatically selects the RR source according to the priority order: first CO_2, and then ECG. The RR source name is displayed in the lower right corner of Resp parameter area.

When the manually selected RR source is not available, the monitor automatically switches the [RR Source] to [Auto].

10.5.2 Setting Resp Alarms

To set the Resp alarm options, follow the steps below:

1. Access Resp alarm setup screen in either of the following ways:
   - Press [Main Menu] →[Alarms]→ select the [Resp] tab.
   - Press the [Alarms] quick key → select the [Resp] tab.
   - Press the Resp parameter area → press the [Alarms] button.
2. Set alarm properties as desired.

[Apnea Delay]: The timeout setting for apnea alarm (in second).

- When the source of RR is ECG, it can be set within the range of 5s to 120s.
- When the source of RR is CO_2, it can be set within the range of 10s to 60s.

The default is 20s for adult/pediatric patients and 15s for neonatal patients.

The Resp parameter area will display "Apnea: XX s (display the set Apnea delay time)"; when an apnea event is detected, an "Apnea" prompt will appear on the alarm information area, and an alarm tone will be issued.

Caution

You can only switch off the apnea alarm when [Apnea Off] is set to [Enable] in the Maintenance menu.

Chapter 11 Monitoring Pulse Oxygen Saturation (SpO_2)

11.1 Introduction

Pulse oxygen saturation (SpO_2) monitoring is a non-invasive optical technique used to measure the amount of oxygenated hemoglobin (HbO_2) and pulse rate by measuring the absorption of selected wavelengths of light. The light generated in the emitter side of the sensor is partly absorbed when it passes through the monitored tissue. The amount of transmitted light is detected in the detector side of the sensor. When the pulsative part of the light signal is examined, the amount of light absorbed by the hemoglobin is measured and the pulse oxygen saturation can be calculated. The monitor is calibrated to display functional oxygen saturation.

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

11.2 Safety Information

⚠ Warning

Check the SpO_2 sensor and cable before use. DO NOT use the damaged SpO_2 sensor.

⚠ Warning

Verify the compatibility of the monitor, probe, and cable before use to avoid patient injury.

⚠ Warning

DO NOT stare at the light of SpO_2 sensor (infrared light is invisible) when it is switched on, for the infrared light may do harm to the eyes.

⚠ Warning

Inspect SpO_2 sensor application site every one to two hours to ensure skin quality and correct optical alignment, and change the measuring site periodically if necessary. If the skin quality changes, move the sensor to another site.

⚠ Warning

SpO_2 measuring site must be examined more carefully for some special patients. Do NOT place the SpO_2 sensor on the finger with edema or fragile tissue.

⚠ Warning

Avoid placing the SpO_2 sensor on the same extremity with an arterial catheter, blood pressure cuff, or intravascular infusion line, otherwise the blood flow could be interrupted by the cuff or the circulatory condition could make low blood perfusion so that would result in no pulse found or loss of pulse during SpO_2 monitoring and further cause false alarm.

⚠ Warning

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

⚠ Warning

Continuous use of fingertip SpO_2 sensor may result in discomfort or pain, especially for those patients with microcirculatory problem. It is recommended that the sensor should NOT be applied to the same site for over two hours.

⚠ Warning

Excessive ambient light may affect the measuring result, it includes fluorescent lamp, dual ruby light, infrared heater, and direct sunlight etc.

⚠ Warning

Do not apply tape to secure the sensor in place or to tape it shut; venous pulsation may lead to inaccurate oxygen saturation measurements.

⚠ Warning

Vigorous movement of the patient, strong ambient light, or extreme electro-surgical interference may also affect the SpO_2 measuring accuracy.

⚠ Warning

Please do not use the SpO_2 sensor and the monitor when doing the MRI imaging, or burn may be caused by faradism.

❗ Caution

SpO_2 measurements are statistically distributed, only about two-thirds of the measurements can be expected to fall within ±Arms of the value measured by a CO-OXIMETER.

❗ Caution

For a disposal SpO_2 sensor, if the sterile packaging is damaged, do not use it any more.

❗ Caution

DO NOT reuse a disposable SpO_2 sensor that has been used, so as to avoid potential risks.

❗ Caution

When the temperature of SpO_2 sensor is abnormal, do not use it any more.

Caution

Please do not allow the cable to be twisted or bent.

Caution

Please do not use nail polisher or other cosmetic product on the nail.

Caution

The fingernail should be of normal length.

Caution

The SpO_2 sensor cannot be immersed into water, liquor or cleanser completely, because the sensor has no capability to resist the harmful ingress liquid.

Caution

Do not disinfect any SpO_2 sensor by irradiation, steaming, or ethylene oxide.

Note

The clinical study for SpO_2 measurement accuracy was done on human subjects according to Standard ISO 80601-2-61.

Note

A functional tester or SpO_2 simulator cannot be used to assess the accuracy of the oximeter or a SpO_2 sensor. However, it can be used to check how accurately a particular oximeter is reproducing the given calibration curve. Before testing the oximeter by a functional tester, please firstly ask the manufacturer which calibration curve is used, if necessary, request the manufacturer for its dedicated calibration curve and download it into the tester.

Note

The pulse rate is measured via the reference method of a SpO_2 simulator.

☞ **Note**

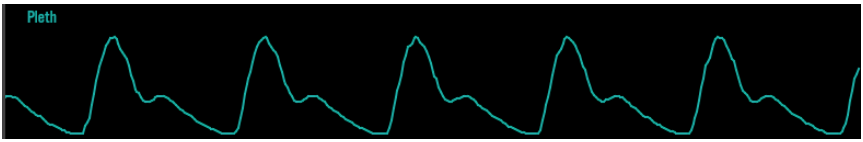
A functional tester or SpO_2 simulator cannot be used to assess the accuracy of pulse rate.

11.3 Measurement Interferences

- The SpO_2 measurement of the monitor may not work effectively for all kinds of patients, for whom with weak pulse due to shock, low ambient / body temperature, major bleeding, or use of vascular contracting drug, the measurement will be more sensitive to interference, if stable readings cannot be obtained at any time, stop to use the SpO_2 monitoring function.
- For those with a substantial amount of staining dilution drug (such as methylene blue, indigo green and acid indigo blue), or carbon monoxide hemoglobin (COHb), or methionine (Me+Hb) or thiosalicylic hemoglobin, and some with icterus problem, the SpO_2measurements may be inaccurate.
- The medicines such as dopamine, procaine, prilocaine, lidocaine and butacaine may also be a major factor blamed for serious error of SpO_2 measurements.
- As the SpO_2 value serves as a reference value for judgment of anemic anoxia and toxic anoxia, the measurement result of some patients with serious anemia may also present as good SpO_2 value.

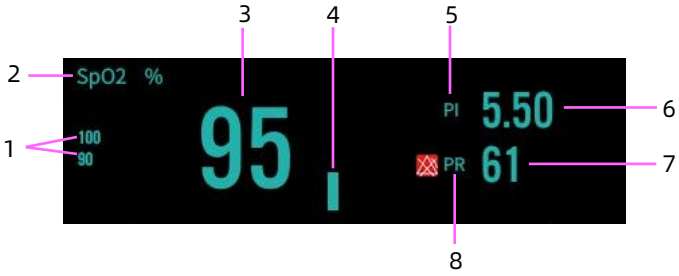
11.4 SpO_2 Display

Plethysmogram



Pleth: abbreviation of plethysmogram. The Pleth waveform is processed by amplitude normalization.

SpO_2 parameter area



1 Alarm limits

2 SpO_2 label

3 SpO_2 value (If the signal is poor, "--" is displayed)

4 Pulse intensity bar graph (When the signal is poor, a hollow bar graph is displayed.)

5 Perfusion index (PI) label

6 Numerical value for the perfusion index (PI)

The PI value indicates the pulsatile strength: Above 1 is optimal, between 0.3 and 1 is acceptable, below 0.3 indicates low perfusion.

7 Pulse rate value

8 Label of pulse rate

11.5 SpO_2 Monitoring Preparation

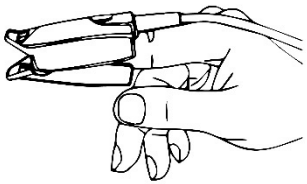
To prepare SpO_2 monitoring, follow the steps below:

1. Select an appropriate sensor according to the patient type and weight.
2. Apply the sensor to the patient according to the instruction for use of the sensor.

We provide several probes for optional, please refer to the following description according to the probe/sensor you've purchased.

Type 1: SpO_2 Finger Clip Sensor

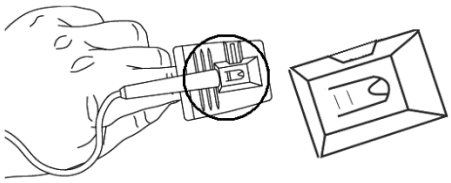
Insert the patient's index finger (middle finger or ring finger with proper nail length can be used as well) into the sensor, as shown in the figure below.



Type 2: SpO_2 Finger Rubber Sensor

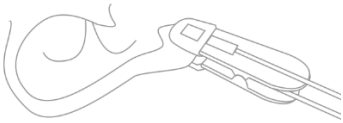
Hold the sensor with its opening towards the patient's finger, the sensor should be oriented in such a way that the sensor side with a finger tip sign is positioned on the top.

Insert the patient's finger into the sensor until the fingernail tip rests against the stop at the end of the sensor. Adjust the finger to be placed evenly on the middle base of the sensor. Direct the cable along the top of the patient's hand. Apply adhesive tape to secure the cable if necessary.



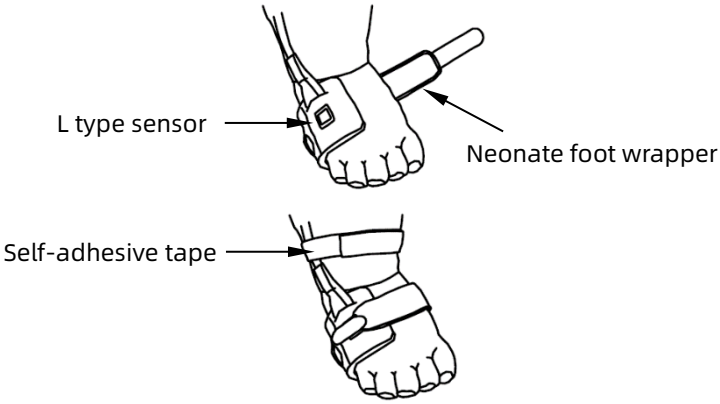
Type 3: SpO_2 Ear Clip Sensor

Clip the sensor on the patient's earlobe, refer to the following figure:



Type 4: SpO_2 Sensor with L-type Wrapper

Refer to the following connection method:



3. Select an appropriate extension cable according to the connector type and plug the cable into the SpO_2 connector.
4. Connect the sensor to the extension cable.

Caution

Do not apply sensor too tightly as this results in venous pulsation which may severely obstruct circulation and lead to inaccurate measurements.

Caution

At elevated ambient temperatures, be careful with measurement sites that are not well perfused, because this can cause burns after prolonged application.

Caution

Avoid placing the sensor on extremities with an arterial catheter, an NIBP cuff or an intravascular venous infusion line.

Caution

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

11.6 Changing SpO_2 Settings

11.6.1 Setting SpO_2 Menu

Enter the SpO_2 setup screen in either of the following ways:

- Select the SpO_2 parameter area.
- Press the [Parameters] quick key → select the [SpO_2] tab.
- Press[Main Menu]→[Parameters], select the [SpO_2] tab.

In the SpO_2 setup screen, you can perform the following operations:

- **[Speed]**: Pleth waveform sweeping speed. The larger the value, the faster the sweeping speed.

  Options: 6.25mm/s, 12.5mm/s, 25mm/s, 50mm/s.
- **[Display PI]**: set whether to display the PI value in the SpO_2 parameter area.
- **[PR Source]**: set the PR source.

  Options: Auto, SPO_2, IBP1, IBP2. The default is Auto. When you select Auto, the system will automatically select the first option in the drop-down menu as the PR source, and

then select backward when the previous one does not exist. If specific PR source is selected, but the source is unavailable, the system will automatically execute Auto obtaining logic, that is, SpO_2> IBP1> IBP2.

- **[NIBP Simul.]**: When monitoring SpO_2 and NIBP on the same limb simultaneously, you can switch on NIBP Simul to lock the SpO_2 alarm status until the NIBP measurement ends. If you switch off NIBP Simul, low perfusion caused by NIBP measurement may lead to inaccurate SpO_2 readings and therefore cause false physiological alarms.

11.6.2 Changing the SpO_2 Alarm Settings

To set SpO_2 alarm options, follow the steps below:

1. Enter the SpO_2 alarms setup screen in either of the following ways:
   - Select the SpO_2 parameter area → press the [Alarms] button.
   - Press the [Alarms] quick key → select the [SpO_2] tab.
   - Press[Main Menu]→[Alarms]→ select the [SpO_2] tab.
2. Set alarm properties as desired.

Caution

The SpO_2 Desat (desaturation) alarm cannot be switched off by default.

11.6.3 Setting the Priority of the SpO_2 Sensor Off Alarm

To set the priority of the SpO_2 sensor off alarm, follow the steps below:

1. Press[Main Menu]→[Maintenance]→ input password → press [Enter].
2. Select the [Alarm] tab.

3. Set [SpO_2 Sensor Off] from the drop-down menu.
   Options: High, Med, Low. The default is Low.

11.7 Changing PR Settings

11.7.1 Changing the PR Alarm Settings

To set PR alarm options, follow the steps below:

1. Enter the PR alarms setup screen in either of the following ways:
   - Press the [Alarms] quick key → select the [SpO_2] tab.
   - Press [Main Menu] →[Alarms]→ select the [PR] tab.
2. Set alarm properties as desired.

[Alarm Source]: options: Auto, HR, PR, HR + PR. The default is Auto.

11.7.2 Setting the PR Source

To set which parameter is used as a PR source, follow the steps below:

1. Enter the SpO_2 setup screen. For the specific operation method, refer to *11.6.1 Setting SpO_2 Menu*.
2. Set [PR Source], select an appropriate PR source from the drop-down list.

Chapter 12 Monitoring Temperature (Temp)

12.1 Introduction

The patient's body temperature can be measured by means of a thermistor probe (a semiconductor whose resistance changes with temperature). Very small amount of constant current is applied to the temperature probe to avoid self-heating. The voltage across the thermistor is measured, and further converted into a temperature reading according to the temperature-resistance characteristic for a specific type of thermistor.

Up to two temperature sites can be monitored simultaneously and the difference (ΔT) between two measured sites is calculated.

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

12.2 Safety Information

Caution

Verify that the probe detecting function works correctly before monitoring. Remove the temperature probe cable from the temperature probe connector, and check that the monitor can display the alarm message [Temp1 sensor off] or [Temp2 sensor off] and give alarm tones correctly.

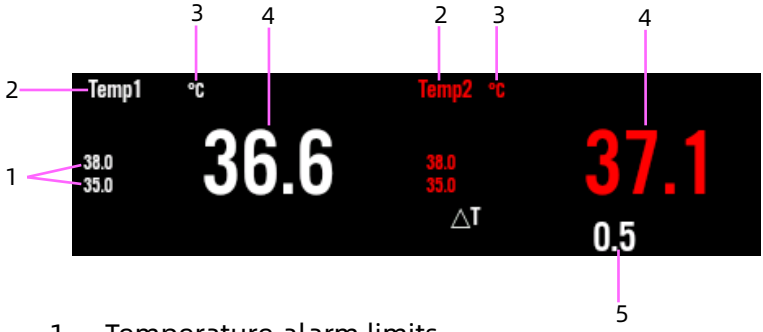
Caution

When unplugging the probe, be sure to hold the head of the connector and pull it out.

Note

There is a range of normal body temperature. At the same time, the temperature of different measurement sites is different. Therefore, the readings of different sites should not be compared directly.

12.3 Temp Display



1 Temperature alarm limits

2 Temperature site

3 Temperature unit

4 Temperature value

5 Temperature difference (ΔT): Difference between two temperature sites.

12.4 Temp Monitoring Preparation

To prepare temperature monitoring, follow the steps below:

1. Select an appropriate probe for your patient according to patient type and measured site.
2. If an extension cable is needed, connect the temperature probe to the extension cable.
3. Plug the probe or temperature cable to the temperature connector marked TEMP1 / TEMP2 on the left panel of the

monitor. If using a disposable probe, connect the probe to the temperature cable.

4. Follow the probe manufacturer's instructions to connect the probe to the patient. Check that the settings are appropriate for the patient.

12.5 Changing Temp Settings

12.5.1 Setting Temp Menu

Enter Temp setup screen in either of the following ways:

- Press Temp parameter area.
- Press the [Parameters] quick key → select the [Temp] tab.
- Press[Main Menu]→[Parameters], select the [Temp] tab.

In Temp setup screen, you can perform the following operations:

- **[Temp1 Label]**: set the label of temperature channel 1 according to the measuring site.
  Options: Temp1, Skin, Axil, Rectum.
- **[Temp2 Label]**: set the label of temperature channel 2 according to the measuring site.
  Options: Temp2, Skin, Axil, Rectum.
- **[Unit]**: select the temperature unit.
  Options: ℃ (Centigrade), ℉ (Fahrenheit).

12.5.2 Setting Temp Alarms

To set the Temp alarm options, follow the steps below:

1. Access Temp alarm setup screen in either of the following ways:
   - Press the Temp parameter area → press the [Alarms] button.

- Press the [Alarms] quick key → select the [Temp] tab.
- Press[Main Menu]→[Alarms]→ select the [Temp] tab.

2. Set alarm properties as desired.

Chapter 13 Monitoring Non-Invasive Blood Pressure (NIBP)

13.1 Introduction

The monitor uses the oscillometric method to measure 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. A cuff is used to occlude the artery by inflating it above the patient's systolic pressure, the oscillometric devices measure the amplitude of pressure changes with pulsation in the cuff as the cuff pressure decreases. The pulsations increase in amplitude, and reach a maximum, then diminish along with the decrement of cuff pressure. The cuff pressure corresponding to the maximal pulse amplitude approximates to the mean artery pressure (MAP), the cuff pressure at the pulse amplitude backward reduced according to proper proportion is defined as systolic pressure (SYS), and the cuff pressure at the pulse amplitude forward reduced according to proper proportion is defined as diastolic pressure (DIA).

NIBP monitoring is intended for adult and pediatric patients.

13.2 Safety Information

⚠ Warning

Be sure to select the correct patient type setting for your patient before NIBP measurement. Do not apply the higher adult settings for pediatric patients. Otherwise, it may present a safety hazard.

⚠ Warning

Before the measurement is carried out, select an appropriate measuring mode depending on the patient type (adult or pediatric).

⚠ Warning

NIBP monitoring is prohibited to those who have severe hemorrhagic tendency or with sickle cell disease, otherwise, partial bleeding will appear.

⚠ Warning

It is recommended to take the blood pressure measurement manually. Medical staff must be present when performing auto or sequential measurement.

⚠ Warning

DO NOT wrap the cuff on limbs with transfusion tube or intubations or skin lesion area, otherwise, injury may be caused to the limbs.

⚠ Warning

If the patient is moving or suffering tremble, hyperkinesia or arrhythmia, it may cause the inflation time of inflatable balloon endures longer, which may not only prolong the measurement time, but also result in the body wrapped by the cuff is troubled by purpura, hypoxemia and neuralgia because of the friction.

⚠ Warning

The air-hose which connects the cuff and monitor should be straightway without any tangle.

❗ Caution

Prior to use of the cuff, empty the cuff until there is no residual air inside it to ensure accurate measurement.

Caution

DO NOT apply or pressurize the CUFF on the arm on the side of a mastectomy or lymph node clearance.

Caution

DO NOT twist the air tube or put heavy things on it.

Caution

When unplugging the air tube, hold the head of the connector and pull it out.

Caution

The NIBP measurement will not be affected when the monitor is connected to the patient on whom the electro-surgical unit and defibrillator is being used.

Caution

The appearance of arrhythmia results in irregular heart beat which may affect the accuracy of NIBP measurement. It is recommended to take the measurement again at this situation.

Caution

The monitor should not be used on pregnant patients.

Caution

The performance of NIBP function can be affected by the extremes of temperature, humidity and altitude, please use it within the appropriate working environment.

Caution

Pressurization of the cuff can temporarily cause loss of function of simultaneously used monitoring ME equipment on the same limb.

☞ **Note**

The NIBP module of the device was clinically investigated according to the requirements of ISO 81060-2:2013.

13.3 Measurement Interferences

- The patient has serious angiospasm, vasoconstriction, or weak pulse.
- Do not take the measurement when the patient uses diuresis or vasodilator.
- Patients with severe bleeding tendency or sickle cells are forbidden to use the NIBP measurement, otherwise local bleeding may be caused.
- Do not apply cuff on the limb where skin damage has occurred or is expected.
- When extremely low or high heart rate or serious arrhythmia of the patient occurs. Especially auricular fibrillation will lead to unreliable or impossible measurement.
- When the patient is suffering from massive hemorrhage, hypovolemia, shock and other conditions with rapid blood pressure change or when the patient has too low body temperature, the reading will not be reliable, for reduced peripheral blood flow will lead to reduced arterial pulsation.
- For patients with severe coagulation disorders, it is necessary to determine whether to carry out automatic blood pressure measurement according to clinical evaluation, because there is a risk of hematoma at the friction between the limb and the cuff.

13.4 Measurement Modes

The following NIBP measurement modes are supported:

- Manual - measurement on demand.
- Auto: repeated measurements at the set interval. Measuring at integral points are available.
- NIBP STAT: continual rapid series of measurements over a five-minute period, then return to the previous mode. The monitor will not stop making measurement until the measuring time is over 5 minutes or the operator stops it manually.
- Sequence: continual automatic measurement at set duration and interval of each stage.

  In this mode, a complete measurement includes up to 7 phases (A, B, C, D, E, F, G). You can set the measurement duration of each cycle and the interval between two NIBP measurements.
- ABPM (ambulatory blood pressure monitoring): conduct NIBP measurements according to the pre-set sequence mode, which automatically measures NIBP according to a specific duration and interval of adaptation period [1], daytime [2] and nighttime [3], supporting multi-point continuous NIBP measurement for 24 hours and above.

  Note [1]: the adaptation period refers to the time it takes for the patient to adapt to the rhythm of interval measurements, the default duration is 1 hour and the default measurement interval for this time period is 10 minutes.

Note [2]: the default is 6:00am-22:00pm in the daytime, and the default measurement interval for this time period is 15 minutes.

Note [3]: the default is 22:00pm-6:00am at night, and the default measurement interval for this time period is 30 minutes.

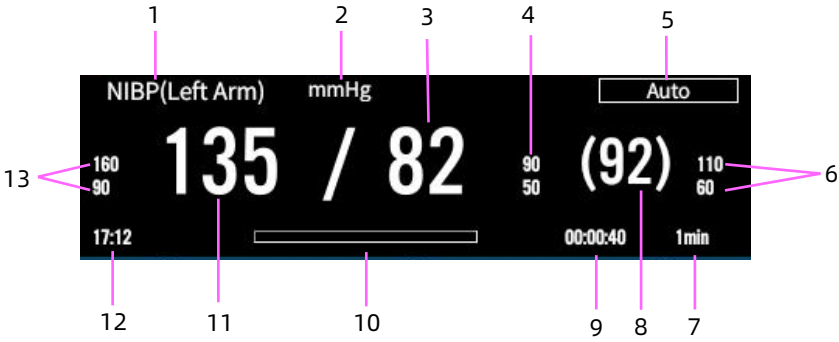
⚠ Warning

"NIBP STAT" mode can only be used for adults.

☞ Note

During the measurement in any mode, you can manually press the NIBP Start/Stop key " **" to terminate the measurement.**

13.5 NIBP Display



1 NIBP label and measurement site

2 NIBP unit: mmHg or kPa

3 Diastolic pressure

4 Diastolic pressure alarm limits. The alarm off icon is displayed when the alarm is set to off.

5 Measurement mode

6 Mean pressure alarm limits. The alarm off icon is displayed when the alarm is set to off.

7 For Auto NIBP, interval is displayed; for Sequence mode, the current phase and interval are displayed.

8 Mean pressure (displayed after measurement completed) or cuff pressure (displayed during the measurement)

9 Time to the next measurement (for Auto mode and Sequence mode)

10 Measurement progress bar

11 Systolic pressure

12 The last NIBP measurement time

13 Systolic pressure alarm limits. The alarm off icon is displayed when the alarm is set to off.

☞ **Note**

NIBP measurement shows no waveform, only numerics are displayed in the parameter area.

☞ **Note**

If NIBP measurement fails, "XX" is displayed; if NIBP measurement is not taken, "--" is displayed.

13.6 NIBP Monitoring Preparation

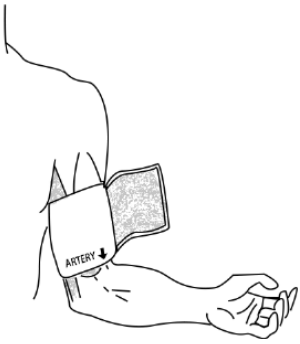
Before starting the NIBP measurement, make sure that the patient remains calm and is relaxed.

To place the NIBP cuff, follow the steps below:

Check to make sure that the patient type setting is correct.

1. Connect the cuff to the air tubing.
2. Connect the air tubing to the NIBP connector on the monitor. Avoid squeezing the pressure tubes. Air must pass unrestricted through the tubing.
3. Select an appropriate cuff according to the patient's age and limb circumference. The width of the cuff should be 40% of the limb circumference, or 2/3 of the length of the upper arm or the thigh. The inflatable part of the cuff should be long enough to encircle to overlap at least 50% to 80% of the limb.
4. Put on the cuff, unfold and wrap it around the patient's upper arm or thigh evenly to appropriate tightness.
5. Locate the cuff in such a way that the "ARTERY" mark "⬇" is at a location where the clearest pulsation of brachial artery is observed. 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). The cuff should be at the same level with the heart, and the lower end of the cuff should be 2cm above the elbow joint. As shown in the figure below:



Caution

The wrong size of cuff may lead to inaccurate measurement results.

Caution

Do not touch or apply external pressure against the cuff and air tubing during NIBP measurement. This may cause inaccurate blood pressure values.

13.7 Starting and Stopping NIBP Measurements

Use NIBP quick key or NIBP menu to start and stop NIBP measurement, as shown in the following table:

Task	By quick Key	From NIBP Menu
Start a manual measurement	Press the [Start NIBP] quick key	Select [Start NIBP] button
Start auto NIBP series	If the current mode is [Auto], press the [Start NIBP] quick key	Select [Auto] for the measurement mode → set the measurement

Task	By quick Key	From NIBP Menu
		[Interval] → select the [Start NIBP] button
Start NIBP sequence measurement	If the current mode is [Sequence], press the [Start NIBP] quick key	Select [Sequence] for the measurement mode → set the sequential mode → set the measurement [Interval] and [Duration] → select the [Start NIBP] button
Start STAT measurement	/	Select the [NIBP STAT] button
Start ABPM measurement	If the current mode is [ABPM], press the [Start NIBP] quick key	Select [ABPM] for the measurement mode → set the measurement adaption period, night time start and end time, daytime/night measurement interval → select [Start NIBP] button
Stop the current NIBP measurements	Press the [Stop All] quick key	Select the [Stop All] button
End auto NIBP series or NIBP Sequence	Press the [Stop All] quick key	Select the [Stop All] button
End STAT measurement	Press the [Stop All] quick key	Select the [Stop All] button

Task	By quick Key	From NIBP Menu
End ABPM measurement	Press the [Stop All] quick key	Select the [Stop All] button

Warning

Too frequent blood pressure measurements may cause purpura, ischemia and neuropathy in the limb with the cuff. Inspect the application site regularly to ensure skin quality and inspect the extremity of the cuffed limb for normal color, warmth and sensitivity. If any abnormality occurs, move the cuff to another place or stop the blood pressure measurement immediately.

Note

Start and stop NIBP measurement by pressing the NIBP Start/Stop key " **"on the front panel of the monitor.**

13.8 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, the measurement should be corrected as follows:

- Add 0.75mmHg (0.10kPa) to the displayed value for each centimetre higher.
- Deduct 0.75mmHg (0.10kPa) to the displayed value for each centimetre lower.

13.9 Changing NIBP Settings

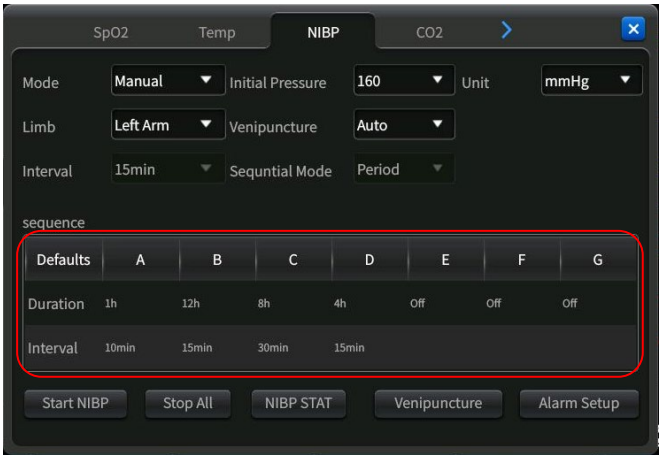
13.9.1 Setting NIBP Menu

Enter NIBP setup screen in either of the following ways:

- Select the NIBP parameter area.
- Press the [Parameters] quick key → select the [NIBP] tab.

- Press[Main Menu]→[Parameters], select the [NIBP] tab.

Sequence or ABPM table



In the NIBP setup screen, you can perform the following operations:

- [Mode]: set the measurement mode.

  Options: Manual, Auto, Sequence, ABPM. Select different mode, the selectable options will vary.

  - [Manual] mode: the selectable options include [Initial pressure], [Unit], [Limb].
  - [Auto] mode: the selectable options include [Initial pressure], [Unit], [Limb] and [Interval].
  - [Sequence] mode: the selectable options include [Initial pressure], [Unit], [Limb], [Sequential Mode] and sequence table containing phases, interval, duration.
  - [ABPM] mode: the selectable options include [Initial pressure], [Unit], [Limb], and ABPM table containing adaption period, night period, interval.

- [Limb]: select NIBP measurement site.

  Options: Left Arm, Right Arm, Left Leg, Right Leg.

- [Interval]: available only in “Auto” mode. Set the time interval between two NIBP measurements. When in “Auto” mode and the [Interval] is set, you must manually start NIBP measurement for the first time. The monitor starts the countdown and automatically starts the next NIBP measurement after reaching the set time interval if the previous NIBP measurement is completed.

  Options: 1min, 2min, 2.5min, 3min, 5mins, 10min, 15min, 20min, 30min, 1h, 1.5h, 2h, 3h, 4h, 8h, Clock 30min, Clock 1h, Clock 2h, Clock 3h.

  Clock: after the first measurement, the monitor automatically synchronizes NIBP automatic measurements with the real time clock. For example, if [Interval] is set to [Clock 30min], and NIBP auto measurement is started at 13:03, the next measurement will be taken at 13:30, and then at 14:00, 14:30, and so on.

  Interval: after the first measurement, the monitor automatically repeats measurements at the set interval. For example, if [Interval] is set to [30min], and NIBP auto measurement is started at 13:03, the next measurement will be taken at 13:33, and then at 14:03, 14:33, and so on.
- [Initial Pressure]: set initial cuff inflation pressure. Its range is different depending on patient type. For the setting range of different patient types, see*A.11NIBP Specifications*.
- [Sequential Mode]: Duration and Period can be selected.

  Select [Period] to set the start and end time of the measurement period.

  Select [Duration] to set the length of lasting time.

  This setting is effective for [Sequence] measurement mode.
- [Unit]: the pressure unit.

Options: mmHg, kPa. 1kPa=7.5mmHg.

13.9.2 Setting NIBP Alarm Properties

To set NIBP alarm options, follow the steps below:

1. Enter the NIBP alarm setup screen in either of the following ways:
   - Select the NIBP parameter area → press the [Alarms] button.
   - Press the [Alarms] quick key → select the [NIBP] tab.
   - Press[Main Menu]→[Alarms], select the [NIBP] tab.
2. Set alarm properties as desired.

13.9.3 Setting NIBP Measurement Timeout

NIBP measurements are displayed as "–" after a preset time. This feature prevents older values being misinterpreted as current measurements.

To adjust the timeout period for NIBP, follow the steps below:

1. Press [Main Menu] → [Maintenance] → input password → press [Enter].
2. Select the [Module] tab.
3. Set the [Valid BP Period] for [NIBP].

Options: 5min, 10min, 15min, 30min, 1h. The default is 10min.

13.9.4 Displaying NIBP List

You can choose to display multi sets of the most recent NIBP measurement results in the parameter area at the bottom area of the screen. To do so, follow the steps below:

1. Enter [Layout] screen in either of the following ways:
   - Press the [Screens] quick key → select the [Layout] tab.
   - Press[Main Menu]→[Screens], select the [Layout] tab.

2. Press the position where the NIBP list needs to be displayed in the parameter area, and select [NIBP] → [NIBP List] from the drop-down list.

In the NIBP list, each NIBP record contains blood pressure data (systolic pressure, diastolic pressure) and pulse rate from NIBP.

13.10 NIBP Statistics

The monitor supports the statistics analysis of collected blood pressure data, and displays the statistical results of NIBP analysis.

13.10.1 Entering the NIBP Statistics Screen

Enter the NIBP Statistics screen in either of the following ways:

- Select the NIBP List in the parameter area on the screen, select [Statistics].
- Press the [Review] quick key → select the [NIBP List] tab, select [Statistics].
- Press [Main Menu] → [Review], select the [NIBP List] tab, select [Statistics].

13.10.2 Setting the NIBP Statistics

Set the following information before starting the NIBP statistics.

- Time interval: set the time interval for statistics, including [Start Time] and [End Time].
- Analysis period: [Full Day], [Daytime] and [Night] are optional.

  Full Day: 00:00:00-24:00:00

  Daytime: 06:00:00-22:00:00

  Night: 22:00:00-06:00:00

13.10.3 Viewing NIBP Statistics Results

Press the [Query] button, the system will automatically extract and analyze the ambulatory blood pressure data, and display the statistical results of ambulatory blood pressure analysis in the selected time period.

The statistical results of blood pressure data analysis are as follows:

Data Label	Description
Min	The minimum values of systolic pressure, diastolic pressure and pulse measurement in the selected time interval.
Average	The average values of systolic pressure, diastolic pressure and pulse measurement in the selected time interval.
Max	The maximum values of systolic pressure, diastolic pressure and pulse measurement in the selected time interval.
SD	The standard deviations of systolic pressure, diastolic pressure and pulse measurement in the selected time interval.
CV	The coefficient of variations of systolic pressure, diastolic pressure, mean arterial pressure and pulse measurement in the selected time interval.
SYS Load	The percentage of SBP measurements greater than the set SBP threshold.
DIA Load	The percentage of DBP measurements greater than the set DBP threshold.
AASI	Ambulatory Arterial Stiffness Index

Data Label	Description
Diurnal Rhythm	Blood pressure changes in a cycle of about 24 hours, the default is Dipper type blood pressure.
SYS Max	The time and date when the maximum systolic pressure value occurs in the selected time interval.
SYS Min	The time and date when the minimum systolic pressure value occurs in the selected time interval.
DIA Max	The time and date when the maximum diastolic pressure value occurs in the selected time interval.
DIA Min	The time and date when the minimum diastolic pressure value occurs in the selected time interval.
Number of Records	The total number of measurements in the selected time interval.
Valid Record Time	The total measurement time in the selected time interval.

13.11 Assisting Venous Puncture

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

To assist venous puncture, follow the steps below:

1. Select the NIBP parameter area.
2. Set [Venipuncture].
3. Press the [Venipuncture] button at the bottom of the window to start inflating the cuff. At the same time, the NIBP parameter area will display the current cuff inflation pressure value and the remaining time of venipuncture.
4. Puncture vein and draw blood sample.

5. Press the [Stop All] button at the bottom of the window, or press the [Stop All] quick key to deflate the cuff. If the cuff is not manually deflated, the cuff automatically deflates after a fixed period of time.

☞ **Note**

During venous puncture, pressing the NIBP Start/Stop key " " cannot perform NIBP measurement.

13.12 Factors Affecting NIBP Measurement

Like common non-invasive blood pressure measurement, improper operation may cause inaccurate or blank result or misunderstanding of the measurement information when the oscillometric method is used to take the blood pressure measurement. These points need particular attention of the operators.

Requirements of the cuff:

- Appropriate cuff should be selected according to the age of the patient.
- Remember to empty the residual air in the cuff before the measurement is commenced.
- Locate the cuff in such a way that the artery mark "⬇" is at a location where the clearest pulsation of brachial artery is observed.
- The cuff should be tightened to a degree where insertion of one finger is allowed.
- The lower end of the cuff should be 2cm above the elbow joint.

Requirements for patient posture, setting and operation:

- The patient should be maintained at supine position with legs uncrossed, so that the cuff and the heart are in a horizontal position and the most accurate measurement is taken. Other postures may lead to inaccurate measurement.
- Do not speak or move before or during the measurement. Care should be taken so that the cuff will not be hit or touched by other objects. The air tube which connects the cuff and monitor should be straight without any tangle.
- It is recommended to take the first reading after the device runs for at least 5 minutes to ensure the stability of the measurement.
- The measurement should be taken at appropriate intervals. Continuous measurement at too short intervals may lead to pressed arm, reduced blood flow and lower blood pressure, and resulting inaccurate measurement of blood pressure. It is recommended the measurement be taken at intervals of more than two minutes.
- Patients should be measured in a relaxed and calm state, otherwise the accuracy of blood pressure measurement data will be affected.
- When taking NIBP measurement on adult patients, the monitor may fail in giving the blood pressure measurement if the pediatric patient type is selected. When taking NIBP measurement on pediatric patients, the operator must NOT operate with the adult patient type setting. The high inflation pressure for adult is not suitable for pediatric patients.
- If the original parts are replaced with parts not provided by the manufacturer, it may cause measurement errors.

Chapter 14 Monitoring Invasive Blood Pressure (IBP)

14.1 Introduction

IBP monitoring can realize real-time monitoring of blood pressure changes during some heart surgeries and other major operations.

The monitor can monitor up to two-channel invasive blood pressures and displays the systolic, diastolic and mean blood pressures and a waveform for each pressure channel. IBP is measured by means of a catheter inserted directly into the circulatory system. A pressure transducer connected to the catheter converts the mechanical force exerted by the blood into an electrical signal, which is displayed graphically and numerically on the monitor screen.

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

14.2 Safety Information

⚠ Warning

All invasive measurements bring risks to patients. Use aseptic technology in the measurement and follow the accessory manufacturer's instructions.

⚠ Warning

Do Not use the damaged or expired pressure tube and transducer.

⚠ Warning

Use only the pressure transducer specified in this manual. Never reuse disposable pressure transducers.

⚠ Warning

The pressure tube which connects the catheter and the pressure transducer should be straightway without any tangle.

⚠ Warning

The transducer should be warmed up before use if the measurement time is greater than 15s.

⚠ Warning

If air bubble appears in pressure tube, please fill the tube with saline solution again. Air bubble may cause inaccurate readings.

⚠ Warning

If measuring intracranial pressure (ICP) for the patient who is sitting, please keep the pressure transducer and the top of patient's ear at the same level. Incorrect leveling may give incorrect values.

⚠ Warning

Use the accessories specified by the manufacturer, when a defibrillator is used.

⚠ Warning

Improper use of a defibrillator may cause injury to the patient. The user should determine whether to perform defibrillation or not according to the patient's condition.

⚠ Warning

Before defibrillation, the user must ensure both defibrillator and monitor have passed the system test and can be safely used jointly.

⚠ Warning

Each time when connecting transducer kit or using a new transducer kit, zero calibration to the IBP transducer must be carried out.

⚠ Warning

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

⚠ Warning

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

⚠ Warning

Mechanical shock to the invasive blood pressure transducer may cause severe shifts in zero balance and calibration, and cause inaccurate readings.

⚠ Warning

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

⚠ Warning

Disposable IBP transducer cannot be reused.

Caution

When unplugging the cable from the monitor, be sure to hold the head of the connector and pull it out.

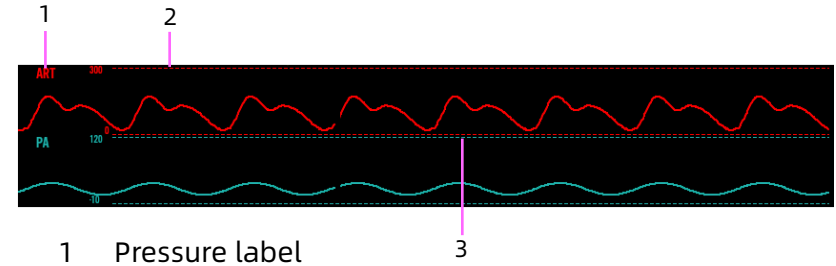
Caution

Before using the tube, cable and/or transducer, make sure that all accessories meet the performance requirements which are not changed by aging or environmental conditions.

14.3 IBP Display

IBP waveform area

The monitor can display 2 channels of IBP pressure waveform.



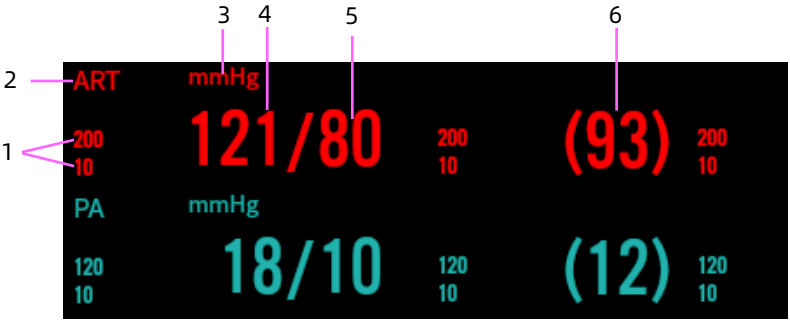
1 Pressure label

2 Top scale

3 Bottom scale

IBP parameter area

The monitor can display 2 pressure measurements.



1 Alarm limits. The alarm off icon is displayed when the alarm is set to off.

2 Pressure label

3 IBP unit: mmHg or kPa

4 Systolic pressure

5 Diastolic pressure

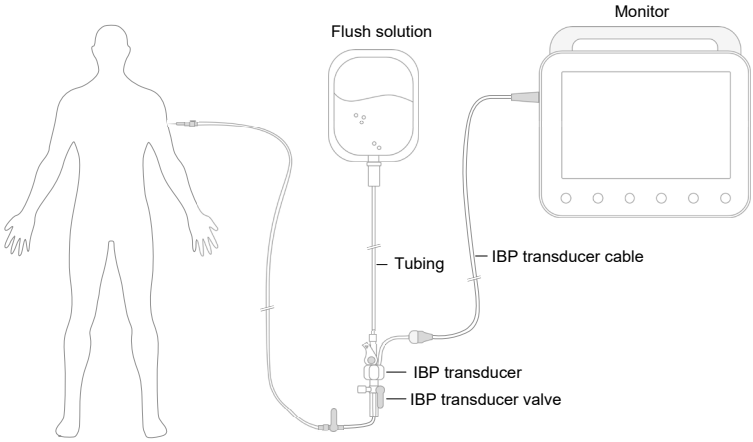
6 Mean pressure

14.4 IBP Monitoring Preparation

To prepare IBP measurement, follow the steps below:

1. Plug one end of the IBP cable into the corresponding IBP connector on the left side of the monitor, and the other end to the IBP transducer.
2. Flush the IBP transducer system to exhaust all air from the catheter 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 with the patient's heart.
4. Select the IBP numeric area, and a window pops up. Select the proper pressure label for currently measured pressure. For more information, see *14.5.1 Setting IBP Menu*.
5. Press the [Zero IBP] button to zero the IBP transducer.

   Press the [Zero IBP] button, a dialog box pops up on the screen, then press [Zero] to start calibration. After the zero calibration is completed, the message "Zero succeeded" will be displayed. If zero calibration fails, corresponding message will also be displayed.
6. After a successful zeroing, turn off the three-way valve to the air and turn on the three-way valve to the patient.



Caution

Make sure that the cables of the transducer are not folded or twisted.

Caution

Make sure that all air bubbles have been flushed from the IBP transducer system before making IBP measurements.

Caution

Make sure that all the transducers are zeroed correctly before making IBP measurements.

14.5 Changing IBP Settings

14.5.1 Setting IBP Menu

Enter IBP setup screen in either of the following ways:

- Select the IBP parameter area.
- Press the [Parameters] quick key → select the [IBP] tab.
- Press [Main Menu]→[Parameters], select the [IBP] tab.

The system enters the IBP1 setting window by default, you can switch to the IBP2 setting window.

In the IBP Setup screen, you can perform the following operations:

- **[IBP Label]**: select the appropriate pressure label.

Label	Description	Label	Description
ART	Arterial blood pressure	PA	Pulmonary artery pressure
CVP	Central venous pressure	RAP	Right atrial pressure
LAP	Left atrial pressure	ICP	Intracranial pressure
P1	Auxiliary pressure 1	P2	Auxiliary pressure 2

P1 / P2 can be chosen if the actual measuring pressure is not in the list of ART, PA, CVP, RAP, LAP, and ICP.

Caution

The same label cannot be selected for different pressures.

- **[Calculation Mode]**: Available only when the [IBP Label] is P1 or P2.

  Options: Dynamic, Static.

  In dynamic calculation, systolic blood pressure, diastolic blood pressure and mean pressure were measured

  In static calculation, only mean pressure was measured.
- **[Average Time]**: the time period for averaging to calculate Mean Pressure. The setting range is 1~12s. The default value is 8s.

- **[Pressure Unit]**: options: mmHg, kPa. After setting the unit, the set unit will be displayed in the IBP parameter area. The units of IBP and NIBP are consistent.
- **[CVP Unit]**: options: mmHg, kPa, cmH2O, defaulting to mmHg.
- **[ICP Unit]**: options: mmHg, kPa, cmH2O, defaulting to mmHg.
- **[Speed]**: IBP waveform sweeping speed. The larger the value, the faster the sweeping speed.

  Options: 6.25mm/s, 12.5mm/s, 25mm/s, 50mm/s.
- **[Filter]**: the pressure waveform filtering.

  Options: 12.5Hz, 40Hz.
- **[Scale]**: Can be set to Auto and Manual. If Auto is selected, the size of the pressure's waveform will be adjusted automatically.
- **[Top Scale]**: Set the top scale of IBP waveform.
- **[Bottom Scale]**: Set the bottom scale of IBP waveform.
- **[Zero IBP]**: perform zero calibration for pressure transducer.

Caution

Before performing zero calibration, please make sure that the transducer is well connected, otherwise the zero calibration cannot be carried out.

14.5.2 Setting IBP Alarm Properties

To set IBP alarm options, follow the steps below:

1. Enter the IBP alarm setup screen in either of the following ways:
   - Press[Main Menu]→[Alarms], select the [IBP] tab.

- Press the [Alarms] quick key → select the [IBP] tab.
- Select the IBP parameter area → press the [Alarms] button.

2. Set alarm properties as desired.

14.5.3 Setting the Priority of the IBP No Transducer Alarm

To set the priority of the IBP no transducer alarm, follow the steps below:

1. Press [Main Menu] → [Maintenance] → input password → press [Enter].
2. Select the [Alarm] tab.
3. Set [IBP No Transducer] to [High], [Med]or [Low]. The default is Low.

14.6 Measuring Pulse Pressure Variation (PPV)

This monitor can calculate PPV from beat-to-beat arterial pressure values. Pulse pressure is the difference between systolic and diastolic blood pressure values for a single beat. Pulse pressure variation is defined as the maximum pulse pressure minus the minimum pulse pressure, and then divided by the average of the two pressures. Within a calculation cycle (32 seconds), obtain the maximum pulse pressure PP_{max} and the minimum pulse pressure PP_{min}, and calculate the PPV measurement value through the following formula:

$$PPV = (PP_{max}-PP_{min}) / [(PP_{max}+PP_{min})/2] \times 100\%$$

To enable the PPV measurement, follow the steps below:

1. Select the IBP parameter area to enter the IBP setup screen.
2. Select the [PPV] tab.
3. Switch on [PPV Measure].
4. Select an arterial pressure as the [PPV Source].

Options: Auto, Art, P1, P2. The default is Auto.

The actual source of Auto is the appropriate label of IBP1 or IBP2.

When the label of IBP1 or IBP2 is P1 or P2, the calculation mode needs to be set as “Dynamic”.

When the PPV measurement is enabled, the IBP parameter area displays the real-time measured value of PPV. Only one PPV can be active at a time.

When the [PPV Measure] is switched off, the PPV measurement function is disabled and the PPV value will no longer be calculated and displayed.

⚠ Warning

The conditions under which PPV is measured, and whether the calculation of a PPV value is clinically meaningful, appropriate and reliable must be determined by a physician.

⚠ Warning

The PPV measurement has been validated only for adult patients.

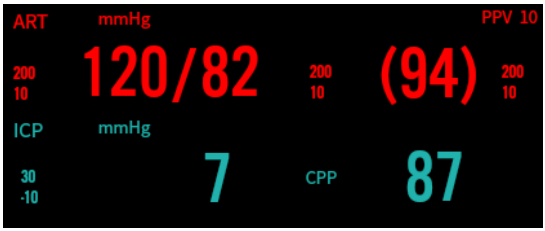
14.7 Measuring Cerebral Perfusion Pressure (CPP)

This monitor can calculate CPP, which is the difference between mean arterial pressure (Art) and intracranial pressure (ICP).

To perform CPP measurement, follow the steps below:

1. Select the IBP parameter area to enter the IBP setup screen.
2. In the [IBP1] and [IBP2] menu, select [ICP] or [Art] for the [IBP Label].

When the Art and ICP pressures are measured simultaneously, the ICP parameter area will display the CPP measured value, as shown in the following figure:



14.8 Measuring Pulmonary Artery Wedge Pressure (PAWP)

PAWP values are used to assess cardiac function. The PAWP is affected by fluid status, myocardial contractility, and valve and pulmonary circulation integrity.

A floating catheter with a balloon at the tip is floated through the blood flow and embedded into the small pulmonary artery, blocking the antegrade blood flow there, the inflated balloon occludes the artery allowing the monitor to record changes in the intrathoracic pressures that occur throughout the respiration cycle. The most accurate PAWP values are obtained at the end of the respiration cycle when the intrathoracic pressure is fairly constant.

⚠ Warning

The PAWP measurement function is not intended for neonatal patients and is only available under adult and pediatric patient types.

14.8.1 PAWP Measurement Preparation

To prepare PAWP measurement, follow the steps below:

1. Connect the IBP transducer, the IBP cable and the monitor's IBP connector.

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.
4. Set the IBP label to PA since the PAWP is measured on PA.

14.8.2 PAWP Measurement Procedure

To measure the PAWP, follow the steps below:

1. Select the PA parameter area on the main screen, and then select [PAWP] to enter the PAWP measurement screen.
2. Wedge the flotation catheter into the pulmonary artery by observing the PA waveform changes on the screen.
3. Select [Start].
4. Inflate the balloon and pay attention to PA waveform changes on the screen when the prompt message "Ready for balloon inflation" appears.
5. The PAWP screen displays the prompt message "Measuring PAWP" for about 5 seconds and then displays the measured PAWP value. When the measurement is complete, the monitor stores the PA waveform and prompts you to deflate the balloon.
6. Deflate the balloon and select [Accept] to store the PAWP value.
7. If you need to start a new measurement, repeat step 3 to step 6.

14.8.3 Setting the Waveforms of the PAWP Screen

On the PAWP screen, select [Setup] to enter the PAWP setup window where you can make the following settings:

- Select [Waveform 1] to set an ECG lead waveform as the first reference waveform.
- Select [Waveform 2] to set Resp or CO_2 waveform as the second reference waveform.
- Select [Speed] to set a sweep speed for the displayed waveforms on the PAWP screen. Options: 6.25mm/s, 12.5mm/s, 25mm/s and 50mm/s. The default is 25mm/s.
- Select [Scale] to set the size of the PA waveform on the PAWP screen. Options: Auto, Manual. The default is Auto. When manual is selected, the top scale and the bottom scale of PA waveform can be set.

14.8.4 Editing the PAWP

When the prompt message "Ready for balloon deflation. Please confirm the result" displays on the PAWP screen, the [Freeze] button changes to [Edit]. To edit the PAWP, follow the steps below:

1. Press the [Edit] button to enter the freeze screen and view the stored waveforms.
2. The monitor displays a cursor in the waveform at the PAWP value. Move the cursor up and down to set it on the correct wedge position.
3. Select [Accept] to store the PAWP value.

14.8.5 Freezing Waveforms

If the measurement fails or if the PAWP value needs to be adjusted, you can adjust the PAWP value according to the following steps:

1. Press the [Freeze] button to lock the waveform.

2. Press the left or right arrow button to view the frozen waveform of 40 seconds.
3. Press the up or down arrow button to adjust the PAWP value.
4. Select [Accept] to store the PAWP value.

14.8.6 Performing Hemodynamic Calculation

On the PAWP screen, select [Hemodynamics] to enter the hemodynamics calculation screen. For more information, see *17.3 Hemodynamic Calculations*.

Chapter 15 Monitoring Carbon Dioxide (CO_2)

15.1 Introduction

CO_2 measuring principle is based on the fact that CO_2 molecules absorb infrared light energy of specific wavelengths, with the amount of energy absorbed being directly related to the CO_2 concentration. When an IR light beam is passed through a gas sample containing CO_2, the electronic signal from a photo detector (which measures the remaining light energy), can be obtained. This signal is then compared to the energy of the IR source, and calibrated to accurately reflect CO_2 concentration in the sample.

CO_2 measurement is used to monitor the patient's respiratory status. The monitor provides the mainstream and sidestream methods for CO_2 monitoring.

- Mainstream measurement: directly insert a mainstream CO_2 sensor attached to an airway adapter into the patient's breathing system, allowing the inspired and expired gas to pass directly across the IR light path. The major advantages of mainstream sensors are fast response time and elimination of water traps. When using mainstream CO_2 sensors, check the window for the patient secretions pooled on periodically. Because that condition may affect the accuracy of the measurement or even make the sensor not work.
- Sidestream measurement: sidestream CO_2 sensors are located away from the airway, requiring a gas sample to be continuously aspirated from the breathing circuit and transported to the sensor by means of a pump. This type of system is needed for non-intubated patients. When using

sidestream CO_2 sensors, there is a water trap or a part of the sampling tube with dehumidifying function. Please periodically check the flow sensor and tubing for excessive moisture or secretion buildup.

CO_2 monitoring is intended for adult, pediatric and neonatal patients.

15.2 Safety Information

⚠ Warning

Use the manufacturer approved accessories only.

⚠ Warning

Explosion Hazard: DO NOT use in the presence of flammable anesthetics or other flammable gases. Use of the CO_2 Sensor in such environment may present an explosion hazard.

⚠ Warning

Electric Shock Hazard: Do not open the sensor cabinet at will, the CO_2 Sensor contains no user serviceable parts.

⚠ Warning

Electrical Shock Hazard: Always disconnect the CO_2 Sensor before cleaning. DO NOT use if it appears to have been damaged. Contact service personnel for help.

⚠ Warning

DO NOT sterilize or immerse the CO_2 sensor in liquids.

⚠ Warning

DO not use the CO_2 sensor when it is wet or has exterior condensation.

⚠ Warning

Do not apply excessive tension to any sensor cable or pneumatic tubing.

⚠ Warning

If the CO_2 sensor fails to respond as described in this manual, do not use it until approved for use by qualified personnel.

⚠ Warning

Reuse, disassembly, cleaning, disinfecting the single patient use CO_2 cannula kits and on-airway adapters may compromise functionality and system performance, leading to a user or patient hazard. Performance is not guaranteed if an item labeled as single patient use is reused.

⚠ Warning

Inspect the sidestream on-airway adapters and sidestream sampling kits for damage prior to use. DO NOT use the sidestream on-airway adapters and sidestream sampling kits if they appear to be damaged or broken.

⚠ Warning

The risk of patient cross-infection will occur if the sampled gas is returned to the breathing system. The risk could be reduced by cleaning and disinfecting the sidestream on-airway adapters and the exhaust vent.

⚠ Warning

The monitor should not be used with gas supplied from oxygen concentrators.

⚠ Warning

If the CO_2 waveform (Capnogram) appears abnormal, inspect the CO_2 airway adapters and replace if needed.

⚠ Warning

Place the exhaust vent of the CO_2 sensor in drafty ambient and do not let anything block the exhaust vent.

⚠ Warning

Periodically check the CO_2/Flow sensor and tubing for excessive moisture or secretion buildup. Do not use them if there is excessive moisture or exterior condensation.

⚠ Warning

Prevent electrostatic discharge (ESD) and electromagnetic interference (EMI) to and from other equipment.

⚠ Warning

DO NOT position the sensor cables or tubing in any manner that may cause entanglement or strangulation.

❗ Caution

When changing sampling tube, it is suggested to choose the default sampling tube with dehumidifying function. The sampling tube without dehumidifying function may be easily blocked by excessive moisture. (Service life: ordinary sampling tube: 6~12 hours; the sampling tube with dehumidifying function: about 120 hours.)

❗ Caution

If the measurement shows an abnormity caused by sampling tube block, please replace it.

❗ Caution

The total length of the sampling tube and extending airway tube shouldn't be longer than 3 meters, too long may cause measurement abnormity. If using T connector sampling cannula kits, please insert the sampling tube with the tubes upward to avoid the effects of excessive moisture.

Caution

Cyclic pressure up to 10kPa (100cmH_2O) can affect the accuracy of measurement.

Caution

The monitor does not have automatic barometric pressure compensation function. Due to the different altitudes in different areas, set the barometric pressure value manually according to the local barometric pressure during CO_2 monitoring. For more information, see *Appendix D Typical Pressures and CO_2 Readings at Altitudes*.

Caution

When CO_2 monitoring is not required, disconnect the sampling line from the monitor.

Caution

Do not block the airway. Do not squeeze or bend the sampling line.

Note

CO_2 sensor is a precision measurement component, please use it correctly and store it properly.

Note

Disposal of the CO_2 Sensor and its accessories should comply with national and/or local requirements.

Note

In the presence of electromagnetic devices (i.e., electrocautery), patient monitoring may be interrupted due to electromagnetic interference. Electromagnetic fields up to 20V/m will not adversely affect system performance.

Note

Nitrous oxide, elevated levels of oxygen, helium and halogenated hydrocarbons can influence the CO_2 measurement.

Note

Excessive moisture in the CO_2 may affect the accuracy of the flow measurement.

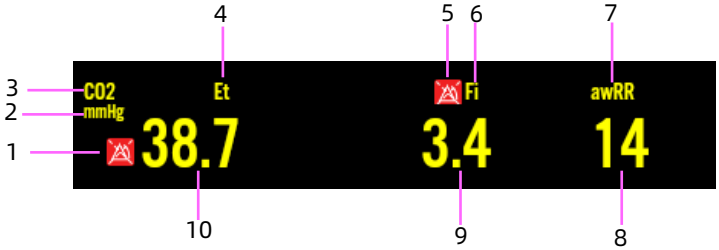
15.3 CO_2 Display

CO_2 waveform area

1 Parameter label

2 CO_2 waveform gain

CO_2 parameter area



1 End tidal CO_2 alarm limits. The alarm off icon is displayed when the alarm is set to off.

2 CO_2 Unit

3 Label of CO_2

4 Label of end tidal CO_2 ($EtCO_2$)

5 The alarm off icon is displayed when the $FiCO_2$ alarm is set to off.

6 Label of fraction of inspired CO_2 ($FiCO_2$)

7 Airway respiration rate (awRR)

8 awRR value

9 $FiCO_2$ value

10 $EtCO_2$ value

15.4 Zeroing the CO_2 Sensor

In the CO_2 setup screen, press the [Zero] button to open a dialogue window for CO_2zero calibration. At this time, place the sampling kit of the CO_2 sensor in a drafty place. Then press the [Zero] button in the dialogue window to perform the zero-resetting. The current zero status will be displayed in the dialogue window. There are three effective zero status: Zeroing, Zero succeeded, Zero failed.

⚠ Warning

When perform a zero calibration during the measurement, disconnect the sensor from the patient's airway first.

⚠ Warning

Please do not rely on the readings during zeroing.

☞ Note

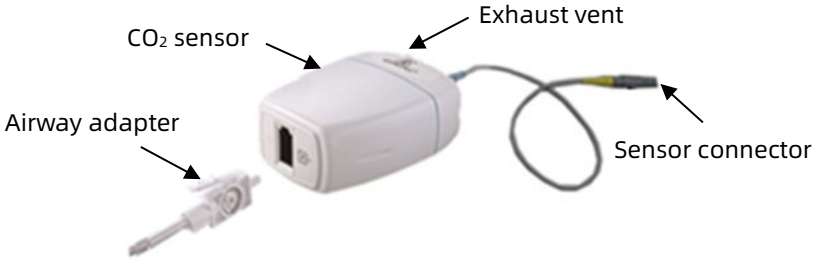
The message of zero status prompts during zero calibration, but there is no audible and visual alarm.

15.5 Connecting CO_2 Sensor

15.5.1 Connecting the Sidestream CO_2 Sensor

To connect the sidestream CO_2 sensor, follow the steps below:

1. Insert one end of the CO_2 sensor cable into the connector marked "CO_2" on the connector panel of the monitor.
2. Insert the sampling tubing with adapter into the CO_2 sensor as shown in the figure below:

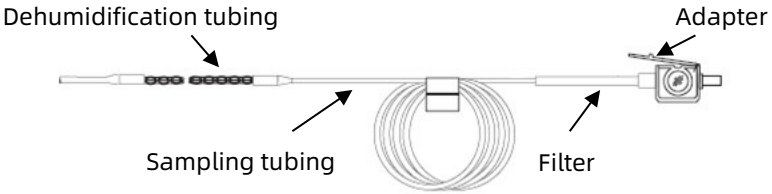


3. After finishing sensor connection, make sure that the air inlet of the sampling tube is exposed to room air and away from all sources of CO_2, including the ventilator, the patient's and operator's breathing.
4. Wait 2 minutes for the sensor to warm up.

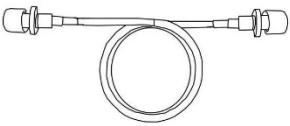
15.5.2 Sidestream Tubing Types

✦ **Default tubing configuration**

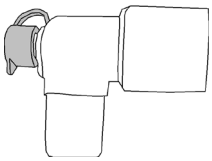
Adapter and sampling tube (single patient use)



Extended airway tube for connecting to sampling tube (Single patient use)

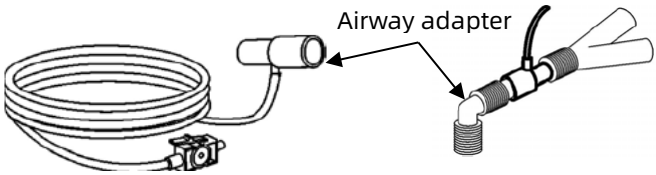


Wye connector

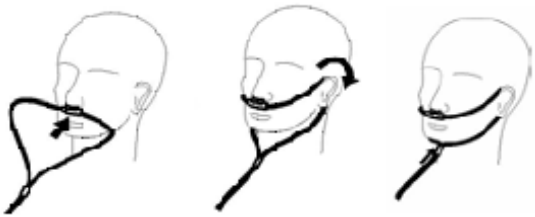


✦ **Optional sampling cannula kits**

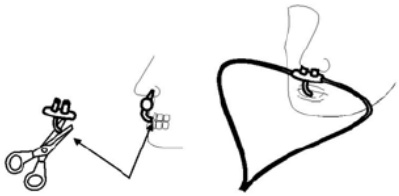
T connector sampling cannula kits



Nasal sidestream cannula kits



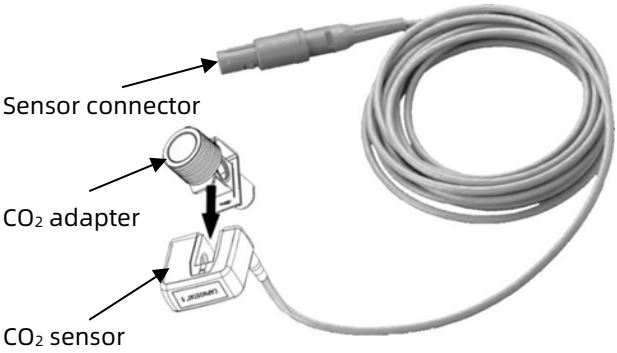
Oral sidestream cannula kits

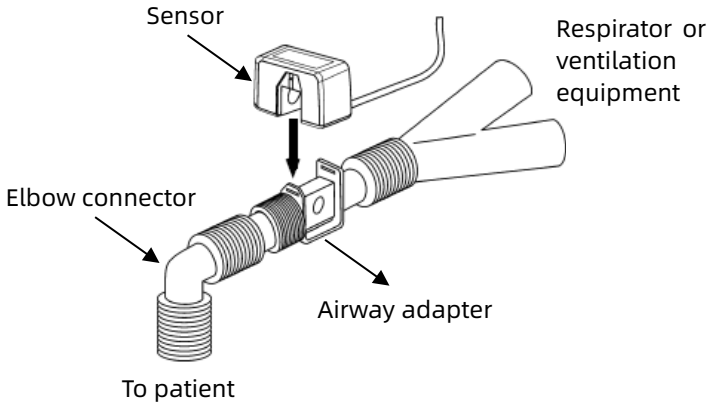


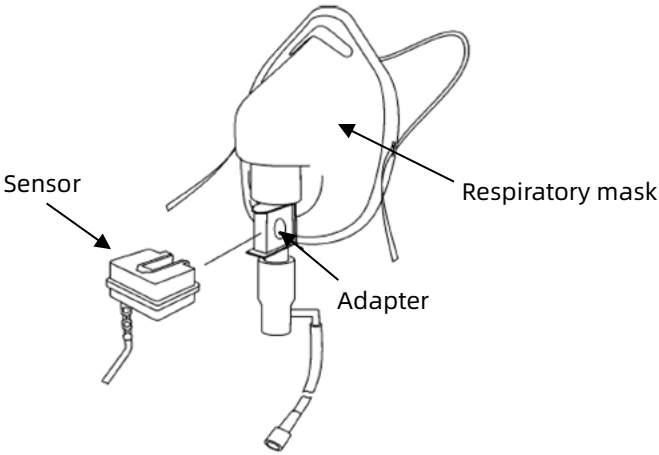
15.5.3 Connecting the Mainstream CO_2 Sensor

To connect the mainstream CO_2 sensor, follow the steps below:

1. Insert on end of the CO_2 sensor cable into the connector marked with "CO_2" on the connector panel of the monitor.
2. Select an appropriate airway connector and connect it with the adapter, then insert the CO_2 adapter into the CO_2 sensor as shown in the figures below:







3. After finishing sensor connection, make sure that the air inlet of the sampling tube is exposed to room air and away from all sources of CO_2, including the ventilator, the patient's and operator's breathing.
4. Wait 2 minutes for the sensor to warm up.

15.6 Changing CO_2 Parameter Settings

15.6.1 Setting CO_2 Menu

Enter CO_2 setup screen in either of the following ways:

- Select the CO_2 parameter area.
- Press the [Parameters] quick key → select the [CO_2] tab.
- Press [Main Menu] →[Parameters], select the [CO_2] tab.

In the CO_2 Setup screen, you can perform the following operations:

- **[Speed]**: CO_2 waveform sweeping speed.
  The larger the value, the faster the sweeping speed.
  Options: 6.25mm/s, 12.5mm/s, 25mm/s, 50mm/s.
- **[Gain]**: gain times, used to adjust the amplitude of CO_2 waveform.

The greater the gain, the higher the amplitude of waveform.

Options: ×1/4, ×1/2, ×1, ×2, ×4.

The basic gain is 10mm/mV.

X1/4: one quarter scale size of the base gain

X1/2: half scale size of the base gain

X1: waveform scale with base gain

X2: twice scale size of the base gain

X4: four times scale size of the base gain

- **[Unit]**: set the CO_2 measurement unit.

  Options: %, kPa and mmHg. If the unit is changed, then the parameter value will change and refresh timely. The unit will be displayed on parameter area.
- **[Temp(℃)]**: set the temperature value of the current measured air flow. Setting range: 0.0~50.0. The default setting is 35.0.
- **[CO2 Flow]**: set the flow rate of the CO_2 sampling. Its value is 50ml/min.
- **[Period]**: set the calculating cycle of the CO_2 value.

  Options: 1b (calculate once every respiration cycle), 10s (calculate once every 10 seconds) and 20s (calculate once every 20 seconds).
- **[Balance Gas]**: set the balance gas in patient's respiration air flow.

  There are three kinds of selectable balance gas: “Air”, “N2O” and “He”, namely: air, nitrous oxide and helium. If no specific balance gas is given, the balance gas can be set as “Air”.

- **[Gas Compensation]**: adjust the concentration of the compensating gas in patient's respiration air flow. Generally, the compensating gas is Oxygen, so it can be called oxygen compensation concentration. Setting range: 1~100; Unit: %; Default value: 16.
- **[AG]**: set whether adding the anesthetic gas to patient's respiration air flow and the concentration of anaesthetic gas.

  Setting range: 0.0~20.0; Unit: %; Default value: 0.

  The default status is not adding anaesthetic gas, that's to say, the concentration is 0.0%.
- **[Atmospheric Pressure]**: set ambient atmospheric pressure.

  Setting range: 400~850; Unit: mmHg.

  It can be determined by barometer or the ambient altitude. Altitude can be used to determine the typical barometric pressure if a barometer is not available, refer to *Appendix D Typical Pressures and CO_2 Readings at Altitudes* for details.

15.6.2 Setting CO_2 Alarm Properties

To set CO_2 alarm options, follow the steps below:

1. Enter CO_2 alarm setup screen in either of the following ways:
   - Select the CO_2 parameter area → press the [Alarms] button.
   - Press the [Alarms] quick key → select the [CO_2] tab.
   - Press [Main Menu] →[Alarms], select the [CO_2] tab.
2. Set alarm properties as desired.

15.7 Measurement Limitations

The following factors may influence the measurement accuracy:

- Leaks or internal venting of sampled gas.
- Mechanical shock.
- Cyclic pressure up to 10kPa (100cmH_2O).
- Other sources of interference, if any.

Chapter 16 Review

16.1 Review Overview

You can review the trend data, events, 12-lead ECG analysis results and waveforms, full disclosure waveforms, and so on, through the Review screen. You can also view the trend data through the Minitrends screen, or the OxyCRG screen, so that you can understand how the patient's condition is developing.

To enter the Review screen:

Select the [Review] quick key, or select [Main Menu]→[Review].

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

16.2 Tabular Trends Review

The tabular trends review screen displays trend data in a tabular form.

In the tabular trends review screen, you can perform the following operations:

- Browse trend data in either of the following ways:
  - Drag the slider on the time line left or right, to locate the trend data at a specific time. At the same time, the data displayed in the current screen will be refreshed accordingly.
  - Press the [<<] or [>>] button on the right side of the time line, to jump to the previous or next tabular trend to observe more data.
  - Slide your finger up and down on the screen to observe the data of other parameters.

- To change the tabular trend group, select the parameter label to be displayed in the pop-up menu of [Group Setup].
- To change the resolution of the tabular trend data, set the [Resolution]. The resolution of tabular trends defines the interval of displaying trend data displayed on the screen.

  A short interval is especially suited for neonatal monitoring, where the clinical situation may change very quickly in a short time. In adult monitoring, where the patient's status typically changes more gradually, a longer interval may be more informative.

  Resolution can be set to: 5s, 30s, 1min, 5min, 10min, 15min, 30min, 1h, 2h, 3h.
- To print a tabular trends report, select [ ] or [ ] icon.

16.3 Graphic Trends Review

The graphic trends review screen displays trend data in a visual format.

In the graphic trends review screen, you can perform the following operations:

- Browse graphic trends in either of the following ways:

➢ Drag the slider on the time line left or right, or move the cursor (blue vertical line) on the trend graph, to locate the trend data at a specific time. At the same time, the data displayed in the current screen will be refreshed accordingly.

➢ Press the [<] or [>] button on the right side of the time line, to move the cursor to the left or right.

➢ Press the [<<] or [>>] button on the right side of the time line, to jump to the previous or next page of graphic trends.

➢ Slide your finger up and down on the screen to observe the graphic trends of other parameters.

- To change the graphic trend group, select the parameter label to be displayed in the pop-up menu of [Group Setup].
- Select [Zoom] to set the length of trend data displayed on the current screen.

  Options: 5min, 10min, 15min, 30min, 1h, 2h, 4h, 8h, 12h, 24h, 48h.
- To print a graphic trends report, select [ ] or [ ] icon.

16.4 NIBP List Review

The monitor can display the latest 2000 groups of NIBP measurement data in the NIBP List review screen. All measurement data can't be displayed on the current screen due to the screen limitation. The current screen can display up to 7 groups of measurement data. You can switch the screen manually to see more measurement data. If the monitor has stored 2000 groups of data, if new data is generated, the earliest data will be discarded.

Enter the NIBP List review screen in either of the following ways:

- Select the NIBP List in the parameter area on the screen.
- Press the [Review] quick key → select the [NIBP List] tab.
- Press [Main Menu] → [Review], select the [NIBP List] tab.

In the NIBP List review screen, you can perform the following operations:

- Press the [<<] or [>>] button in the lower right corner of the screen to turn the page to view the NIBP measurement data.

- Press the page area to select the required page number to view the NIBP measurement data.
- Press [NIBP Statistics] to enter the NIBP statistics screen. For more information, see *13.10 NIBP Statistics*.

16.5 Events Review

The monitor stores events in real time. You can view arrhythmia events, manual events, physiological alarm events, technical alarm events and alarm logs in the Events review screen.

The Events screen displays the event list. Events are displayed in descending chronological order, with the most recent displayed at the top.

To configure the filter, select [Filter Setup] and set the desired filter criterion.

- You can filter events by the alarm priority for arrhythmia events.
- You can filter events by the alarm priority or parameter group for physiological and technical alarm events.

16.6 Full Disclosure Review

You can review up to 140 hours of waveform data on the full disclosure review screen.

You can view the compressed waveforms, full waveforms and numeric values.

In the Full Disclosure screen, you can also perform the following operations:

- Browse full disclosure waveforms in either of the following ways:

➢ Drag the slider on the time line left or right, to locate the waveform at a specific time.

- Press the [<<] or [>>] button on the right side of the time line, to jump to the previous or next full disclosure waveforms.
- Slide your finger up and down on the screen to observe the waveforms at other time points.

- Select [Lead] to set the desired waveforms to be stored and displayed. Up to three channels of waveforms can be displayed.

  Options: ECG(I), ECG(II), ECG(III), ECG(aVR), ECG(aVL), ECG(aVF), ECG(V1), ECG(V2), ECG(V3), ECG(V4), ECG(V5), ECG(V6).
- Select [Duration] to set the length of displayed waveforms.

  Options: 1min, 2min, 5min and 10min.
- Select ECG waveform speed from the speed pop-up list.

  Options: 6.25mm/s, 12.5mm/s, 25mm/s, 50mm/s.
- Select the gain of ECG waveforms in the gain pop-up list.

  Options: x 1/4, x 1/2, x 1, x 2.
- Select [Detail] to view the full waveforms and parameter values.

  You can perform the following operations on this screen:

- Select ECG waveform speed from the [Speed] pop-up list.
  Options: 6.25mm/s, 12.5mm/s, 25mm/s, 50mm/s.
- Select the gain of ECG waveforms in the [Gain] pop-up list.
  Options: x 1/4, x 1/2, x 1, x 2.
- Select [Overview] to switch to the compressed waveform screen.

- [12-Lead ECG]: when 12-lead ECG analysis function is configured, after selecting the start time of the waveform, press this button to conduct 12-lead ECG analysis for the

waveform of the selected time length. For more information, see *8.4 Initiating 12-Lead ECG Acquisition*.

- [Holter]: Press this button to acquire the waveform data of the selected time length, and send it to the AI-ECG server for analysis. For more information, see *9.3 Initiating Ambulatory ECG Acquisition*.
- Select [HRV Analysis] to enter the HRV analysis preview screen.

  In this screen, you can view the statistical results of HRV analysis, including HR trend chart, R-R interval histogram, R-R interval difference histogram, R-R interval scatter plot, R-R interval difference scatter plot, and HRV parameter calculation value list.
- To print a compressed waveform report, select [ ] or [ ] icon.

16.7 ST Review

When ST analysis is enabled, you can view the ST segments and values saved by the monitor in the ST review screen.

In the ST review screen, you can perform the following operations:

- In the pop-up menu of [Trend Group], select ST lead and HR.
- Select [Zoom] to set the length of data displayed on the current screen. Options: 8min, 30min, 1h, 2h, 4h, 8h, 12h, 24h, 48h.
- Select [Detail] to view the ST segment details of the current time.

  In the ST segment details screen, you can perform the following operations:

- View the anterior (V1-V4), inferior (II, III, aVF, aVR) and lateral (I, aVL, V5, V6) ST segments.
- Select [Save Ref.] to save the currently displayed ST segment as the ST reference. The save is temporary and lost after the monitor is switched off or discharging the patient.
- Select [Display Ref.] or [Hide Ref.] to display or hide ST reference. When [Display Ref.] is selected, the current ST segment and ST reference are displayed in the waveform area, and the ST reference time is displayed on the bottom of the waveform area.
- Select [Display Marker] or [Hide Marker] to display or hide markers.
- Select [Trends] to return to the trend chart screen.

- To print ST data, select [ ] or [ ] icon.

16.8 OxyCRG Review

The OxyCRG screen displays the trend curves of HR, SpO_2, Resp, RR and $EtCO_2$. HR and SpO_2 are displayed by default, other parameters are configurable.

16.8.1 Entering the OxyCRG Screen

Enter the [OxyCRG] screen in either of the following ways:

- Press the [OxyCRG] quick key.
- Press the [Screens] quick key → select [OxyCRG].
- Press [Main Menu] → [Screens], select [OxyCRG].

In the OxyCRG screen, you can perform the following operations:

- Select the length of data displayed on the current screen from the Zoom popup list.

- Options: 1min, 2min, 4min, 8min. The default is 2min.
- Select the parameter label in the parameter pop-up list.
- Options: Resp, RR, $EtCO_2$. The default is Resp.
- Press the [Review] button to enter the OxyCRG review screen.

16.8.2 Exiting the OxyCRG Screen

Exit the [OxyCRG] screen in either of the following ways:

- Press the [×] button in the upper right corner of the [OxyCRG] screen. Press the [Screens] quick key, select the screen to be entered.
- Press [Main Menu] → [Screens], select the screen to be entered.

16.8.3 Entering the OxyCRG Review Screen

You can review up to 24 hours of trend curves on the OxyCRG review screen.

Enter the [OxyCRG] review screen in either of the following ways:

- Press the [OxyCRG] quick key → [Review].
- Press the [Review] quick key → select [OxyCRG].
- Press [Main Menu] → [Review], select the [OxyCRG] tab.

In the OxyCRG Review screen, you can perform the following operations:

- On the left side of the screen displays the OxyCRG events list, you can view the parameter trends, compressed waveform, and parameter values of the selected event.
- Select [Zoom] to set the length of data displayed on the current screen. Options: 5min, 10min, 30min, 1h, 2h, 4h, 8h, 12h, 24h. The default is 8h.

- To print an OxyCRG review report, select [ ] or [ ] icon.

16.9 Minitrends Screen

The Minitrends screen shows the recent graphic trends of parameters.

16.9.1 Entering the Minitrends Screen

Enter the [Minitrends] screen in either of the following ways:

- Press the [Minitrends] quick key.
- Press the [Screens] quick key → select [Minitrends].
- Press [Main Menu]→[Screens], select [Minitrends].

On the Minitrends screen, the parameter label is displayed above each trend curve, the scale is on the left side, and the time line is at the bottom of the screen.

16.9.2 Exiting the Minitrends Screen

Exit the [Minitrends] screen in either of the following ways:

- Press the [Screens] quick key, select the screen to be entered.
- Press [Main Menu]→[Screens], select the screen to be entered.

16.10 Screenshot Review

The monitor provides the function of screen capture. Press the [Screenshot] quick key (configurable) to capture and save the current screen display to the monitor.

In the Screenshot review screen, you can perform the following operations:

- On the left side the screen displays the screenshot records list, you can view the details of the captured pictures.

- Select the [Rename] button to modify the name of the selected screenshot.
- To print the selected screenshot, select [ ] icon.

Chapter 17 Calculations

17.1 Introduction

The monitor provides calculation function. The calculated values, which are not directly measured, are computed based on the values you provide.

You can perform the following calculations:

- Drug calculations
- Hemodynamic calculations
- Oxygenation calculations
- Ventilation calculations
- Renal calculations

⚠ Warning

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.

⚠ Warning

The calculation function is independent of other monitoring functions and can therefore be used for patients being monitored by other monitors. Any operation in a calculation window does not affect the patient monitored by the current monitor.

17.2 Drug Calculations

The monitor provides the dosage calculation for 30 kinds of medicine, including: Aminophylline, Dobutamine, Dopamine, Adrenaline, Heparin, Lidocaine, Nitroglycerin, Sodium Nitroprusside, Isoproterenol, Oxytocin, Diltiazem, Esmolol, Fentanyl, Amrinone, Insulin, Labetalol, Lorazepam, Midazolam, Milrinone, Nicardipine, Norepinephrine, Phenylephrine,

Procainamide, Propofol, Vasopressin, Drug A, Drug B, Drug C, Drug D, Drug E. While Drug A through Drug E are user defined.

17.2.1 Calculation Procedure

To perform drug calculation, follow the steps below:

1. Enter the drug calculation screen in either of the following ways:
   - Press the [Calculations] quick key, select the [Drug] tab.
   - Press [Main Menu] → [Calculations], select the [Drug] tab.
2. Set [Drug Name] and [Patient Type]. If the dose of drug is weight dependent, you must switch on [Weight Based] and input the patient's weight.
3. Enter the known values, for example Drug Amount and Solution Volume.
4. Press the [Calculate] button to do the calculation. The calculated values are displayed on the screen automatically.

17.2.2 Checking the Titration Table

When the concentration calculation of a drug is OK in the first tab, the titration table in the second tab ("Titration Table") can be browsed. Use the titration table to see what dose of a drug your patient will receive at different infusion rates.

- [Calculation Based]: to make item as the independent variable, other items will be dependent variables.

  Options: Dose, Infusion Rate

  [Infusion Rate]: by selecting it, the titration table is listed in the sequence of increased infusion rate.

[Dose]: by selecting it, the titration table is listed in the sequence of increased drug dose.

- [Step]: set the interval between two adjacent titration table items.
- [Dose Type]: set the type of dose unit in the titration table.

  Options: Dose/min, Dose/h, Dose/kg/min, Dose/kg/h.

  The changing of unit will cause the re-calculation of [Infusion Rate] according to formulas mentioned in the next section.

17.2.3 Drug Calculation Formula

Description	Unit	Formula
Drug Amount	g series: mcg, mg, g Unit series: Unit, kU, MU mEq series: mEq	Drug Amount = Dose × Infusion Duration
Drug Amount (weight based)	g series: mcg, mg, g Unit series: Unit, kU, MU mEq series: mEq	Drug Amount (weight based) = Dose × Infusion Duration × Weight
Solution Volume	ml	Solution Volume = Infusion Rate × Infusion Duration
Dose	Dose/h, Dose/min	Dose = Infusion Rate × Concentration
Dose (weight based)	Dose/kg/h, Dose/kg/min	Dose (weight based) = Infusion Rate × Concentration / Weight
Concentration	mcg/ml, mg/ml, g/ml, Unit/ml,	Concentration = Drug Amount / Solution Volume

Description	Unit	Formula
	KU/ml, MU/ml, mEq/ml	
Infusion Duration	h	Infusion Duration = Drug Amount / Dose
Infusion Duration (weight based)	h	Infusion Duration (weight based) = Drug Amount / (Dose × Weight)
Infusion Rate	ml/h	Infusion Rate = Dose / Concentration
Infusion Rate (weight based)	ml/h	Infusion Rate = Dose × Weight / Concentration

Remarks:

- Dose/h: refers to the dosage per hour
- Dose/min: refers to the dosage per minute
- (Dose/min) = (Dose/h) / 60
- Dose/kg/h: refers to the dosage per kilogram of body weight per hour
- (Dose/kg/h) = (Dose/h) / patient weight
- Dose/kg/min: refers to the dosage per kilogram of body weight per minute
- (Dose/kg/min) = (Dose/min) / patient weight

17.2.4 Titration Table Calculation Formula

Description	Unit	Formula
Infusion Rate	ml/h	Infusion Rate = Dose / Concentration
Infusion Rate (weight based)	ml/h	Infusion Rate = Dose × Weight / Concentration
Dose	Dose/h, Dose/min	Dose = Infusion Rate × Concentration
Dose (weight based)	Dose/kg/h, Dose/kg/min	Dose (weight based) = Infusion Rate × Concentration / Weight

17.3 Hemodynamic Calculations

17.3.1 Calculation Procedure

To perform hemodynamic calculation, follow the steps below:

1. Enter the hemodynamic calculation screen in either of the following ways:
   - Press the [Calculations] quick key, select the [Hemodynamics] tab.
   - Press [Main Menu] → [Calculations], select the [Hemodynamics] tab.
2. Enter the known values.
3. Press the [Calculate] button, the system will calculate the value of each output parameter according to the calculation formula.

An abnormal calculated value is indicated by a yellow background. An invalid calculated value is indicated by "---". A calculated value greater than the normal upper limit is

indicated by an up arrow " ↑ ". A calculated value lower than the normal lower limit is indicated by a down arrow " ↓ ".

In the [Hemodynamics] screen, you can also perform the following operations:

- Select [Range] to view the normal range of each parameter.
- Select [Unit] to view the unit of each parameter.

17.3.2 Input Parameters for Hemodynamic Calculations

Input Parameter	Full Name / Description	Unit	Adjustable Range
Height	Patient height	cm	20.0-300.0
Weight	Patient weight	kg	0.1-499.0
HR	Heart rate	bpm	0-300
MAP	Mean arterial pressure	mmHg	0-300
CVP	Central venous pressure	mmHg	0-40
C.O.	Cardiac output	L/min	0.1-20.0
PAW	Pulmonary artery wedge pressure	mmHg	0-40
MPAP	Mean pulmonary artery pressure	mmHg	1-120
LVD	Axial diameter of left ventricle	mm	0-120

17.3.3 Output Parameters and Formulas for Hemodynamic Calculations

Output Parameter	Full Name /Description	Unit	Formula	Reference Range
C.I.	Cardiac Index	liters/min /m^2	C.O. / BSA	2.5-4.0
SV	Stroke Volume	ml	C.O. / HR	60-100
SVI	Stroke Volume Index	ml/m^2	SV / BSA	33-47
SVR	Systemic Vascular Resistance	Dynes·sec /cm^{-5}	79.96*(MAP - CVP) / C.O.	800-1200
SVRI	Systemic Vascular Resistance Index	dynes·sec /cm^{-5}/m^2	SVR*BSA	970-2390
PVR	Pulmonary Vascular Resistance	dynes·sec /cm^{-5}	79.96*(paMAP-PAW) / C.O.	150-250
PVRI	Pulmonary Vascular Resistance Index	dynes·sec /cm^{-5}/m^2	PVR*BSA	255-285
LCW	Left Cardiac Work	kg-m	0.0136*MAP*C.O.	5.4-10.0
LCWI	Left Cardiac Work Index	kg-m/m^2	LCW/BSA	3.0-5.5

Output Parameter	Full Name /Description	Unit	Formula	Reference Range
LVSW	Left Ventricle Stroke Work	g·m	0.0136*MAP*SV	8-10
LVSWI	Left Ventricle Stroke Work Index	g·m/m^2	LVSW/BSA	50-62
RCW	Right Cardiac Work	kg-m	0.0136 × paMAP × C.O.	——
RCWI	Right Cardiac Work Index	kg-m/m^2	RCW/BSA	0.54-0.66
RVSW	Right Ventricle Stroke Work	g·m	0.0136*paMAP*SV	51-61
RVSWI	Right Ventricle Stroke Work Index	g·m/m^2	RVSW/BSA	5-10
EF	Ejection Fraction	m^2	(SV/t)*100	40-60

Remarks:

- BSA (Body Surface Area) = Weight $^{0.425}$ * Height $^{0.725}$ * 0.007184
- t = (7.0 / (2.4 + lv_d/10)) * lv_d * lv_d * lv_d / 1000 (lv_d: left ventricle diameter)
- paMAP corresponds to MPAP

17.4 Oxygenation Calculations

17.4.1 Calculation Procedure

To perform oxygenation calculation, follow the steps below:

1. Enter the oxygenation calculation screen in either of the following ways:
   - Press the [Calculations] quick key, select the [OxyCRG] tab.
   - Press [Main Menu] → [Calculations], select the [OxyCRG] tab.
2. Enter the known values.
3. Press the [Calculate] button, the system will calculate the value of each output parameter according to the calculation formula.

An abnormal calculated value is indicated by a yellow background.

An invalid calculated value is indicated by "---".

A calculated value greater than the normal upper limit is indicated by an up arrow " ↑ ".

A calculated value lower than the normal lower limit is indicated by a down arrow " ↓ ".

In the [Oxygenation] screen, you can also perform the following operations:

- Select [Range] to view the normal range of each parameter.
- Select [Unit] to view the unit of each parameter.

17.4.2 Input Parameters for Oxygenation Calculations

Input Parameter	Full Name / Description	Unit	Adjustable Range
Height	Height	cm	20.0-300.0
Weight	Weight	kg	1.0-250.0
C.O.	Cardiac output	L/min	0.1-20.0
Hb	Hemoglobin	g/L	50-200
RQ	Respiratory quotient	——	0.1-1.5
FiO2	Percentage fraction of inspired oxygen	%	18-100
CaO2	Arterial oxygen content	ml/L	10-400
ATMP	Atmospheric pressure	mmHg	300-1200
PaO2	Partial pressure of oxygen in the arteries	mmHg	10-800
CvO2	Venous oxygen content	ml/L	10-400
PaCO2	Partial pressure of carbon dioxide in the arteries	mmHg	0-200
VO2	Oxygen consumption	ml/min	50-1000

17.4.3 Output Parameters and Formulas for Oxygenation Calculations

Output Parameter	Full Name /Description	Unit	Formula	Reference Range
BSA	Body surface area	m^2	$Wt^{0.425}$*$Ht^{0.725}$*0.007184	––
VO_2 calc	Oxygen consumption	ml/min	(SaO2-SvO_2)*13.4*Hb *C.O.	––
C(a-v)O_2	Arteriovenous oxygen content difference	ml/L	CaO_2 - CvO_2	42-59
O_2ER	Oxygen extraction ratio	%	VO_2/(CaO_2*C.O.) *100	24-28
DO_2	Oxygen delivery	ml/min	CaO_2 * C.O.	950-1150
PAO_2	Partial pressure of oxygen in the alveoli	mmHg	(FiO_2*100)*(ATMP-47)-($PaCO_2$/RQ)	––
$AaDO_2$	Alveolar-arterial oxygen difference	mmHg	(FiO_2*100)*(ATMP-47)-($PaCO_2$/RQ)-PaO_2	10-15
CcO_2	Pulmonary capillary oxygen content	ml/L	(Hb*1.34)+((FiO_2*100)*(ATMP-47)-($PaCO_2$ / RQ))*0.0031)	––

Output Parameter	Full Name /Description	Unit	Formula	Reference Range
Qs /Qt	Pulmonary venous admixture	%	{[(Hb*1.34)+(((FiO$_2$*100)*(ATMP-47)-(PaCO$_2$/RQ))*0.0031)]-CaO$_2$)/{[(Hb*1.34)+(((FiO$_2$*100)*(ATMP-47)-(PaCO$_2$/RQ))*0.0031)]-CvO$_2$}*100	3.0-5.0
C.O.calc	Calculated cardiac output	L/min	VO$_2$ / (CaO$_2$-CvO$_2$)	0.1-20.0
PaO$_2$/FiO$_2$	Oxygenation index	mmHg	PaO$_2$/(FiO$_2$*100)	––
AaO$_2$/PaO$_2$	Ratio of alveolar-arterial oxygen partial pressure difference to oxygen partial pressure	––	[(FiO2*100)*(ATMP-47)-(PaCO$_2$ / RQ) - PaO$_2$] / PaO$_2$	––
DO$_2$I	Oxygen delivery index	ml/min/m^2	(CaO$_2$ * C.O.)/BSA	––

Output Parameter	Full Name /Description	Unit	Formula	Reference Range
VO_2I	Oxygen consumption index	ml/ min/ m^2	(CaO_2- CvO_2)*C.O. /BSA	––

17.5 Ventilation Calculations

17.5.1 Calculation Procedure

To perform ventilation calculation, follow the steps below:

1. Enter the ventilation calculation screen in either of the following ways:
   - Press the [Calculations] quick key, select the [Ventilation] tab.
   - Press [Main Menu] → [Calculations], select the [Ventilation] tab.
2. Enter the known values.
3. Press the [Calculate] button, the system will calculate the value of each output parameter according to the calculation formula.

An abnormal calculated value is indicated by a yellow background.

An invalid calculated value is indicated by "---".

A calculated value greater than the normal upper limit is indicated by an up arrow " ↑ ".

A calculated value lower than the normal lower limit is indicated by a down arrow " ↓ ".

In the [Ventilation] screen, you can also perform the following operations:

- Select [Range] to view the normal range of each parameter.

- Select [Unit] to view the unit of each parameter.

17.5.2 Input Parameters for Ventilation Calculations

Input Parameter	Full Name / Description	Unit	Adjustable Range
FiO_2	Percentage fraction of inspired oxygen	%	18-100
$PeCO_2$	End-tidal CO_2 pressure	mmHg	0-114
PaO_2	Partial pressure of oxygen in the arteries	mmHg	10-800
RQ	Respiratory quotient	––	0.1-1.5
ATMP	Atmospheric pressure	mmHg	300-1200
RR	Respiratory rate	rpm	4-120
$PaCO_2$	Partial pressure of carbon dioxide in the arteries	mmHg	1-200
TV	Tidal volume	ml	15-2000

17.5.3 Output Parameters and Formulas for Ventilation Calculations

Output Parameter	Full Name /Description	Unit	Formula	Reference Range
PAO_2	Partial pressure of oxygen in the alveoli	mmHg	FiO_2*(ATMP-47)-($PaCO_2$ / RQ)	––
$AaDO_2$	Alveolar-arterial	mmHg	FiO_2*(ATMP-47)-	––

Output Parameter	Full Name /Description	Unit	Formula	Reference Range
	oxygen difference		$(PaCO_2/RQ) - PaO_2$	
PaO_2/FiO_2	Oxygenation index	mmHg	PaO_2/FiO_2	––
Pa/AO_2	Arterial to alveolar oxygen ratio	%	$PaO_2/(FiO_2*(ATMP-47)-(PaCO_2/RQ))$	––
$AaDO_2$ $/PaO_2$	Respiratory index	——	$(FiO_2*(ATMP-47)-(PaCO_2/RQ)-PaO_2)/PaO_2$	––
MV	Minute volume	L/min	TV * RR / 1000	––
Vd	Volume of physiological space	ml	$((PaCO_2-PeCO_2)/PaCO_2)$ *TV	145-155
Vd/Vt	Physiologic dead space in percent of tidal volume	%	$((PaCO_2-PeCO_2)/PaCO_2)$ *100%	25-40
VA	Alveolar volume	L/min	$(TV-((PaCO_2-PeCO_2)/PaCO_2)$ *TV) * RR	––

17.6 Renal Function Calculations

17.6.1 Calculation Procedure

To perform renal function calculation, follow the steps below:

1. Enter the renal function calculation screen in either of the following ways:
   - Press the [Calculations] quick key, select the [Renal] tab.
   - Press [Main Menu] → [Calculations], select the [Renal] tab.
2. Enter the known values.
3. Press the [Calculate] button, the system will calculate the value of each output parameter according to the calculation formula.

An abnormal calculated value is indicated by a yellow background.

An invalid calculated value is indicated by "---".

A calculated value greater than the normal upper limit is indicated by an up arrow " ↑ ".

A calculated value lower than the normal lower limit is indicated by a down arrow " ↓ ".

In the [Renal] screen, you can also perform the following operations:

- Select [Range] to view the normal range of each parameter.
- Select [Unit] to view the unit of each parameter.

17.6.2 Input Parameters for Renal Function Calculations

Input Parameter	Full Name / Description	Unit	Adjustable Range
Height	Height	cm	20-300
Weight	Weight	kg	1-250
URK	Urine potassium	mmol/L	1-9999
URNa	Urine sodium	mmol/L	0-9999

Urine	24 hours urine	ml/24h	0-5000
Posm	Plasma osmolality	mOsm/kgH2O	100-500
Uosm	Urine osmolality	mOsm/kgH2O	200-2000
SerNa	Serum sodium	mmol/L	50-300
SCr	Serum creatinine	umol/L	45-90
UCr	Urine creatinine	umol/L	100-5000
BUN	Blood urea nitrogen	mmol/L	0-10

17.6.3 Output Parameters and Formulas for Renal Function Calculations

Output Parameter	Full Name / Description	Unit	Formula	Reference Range
URNaEx	Urine sodium excretion	mmol/24h	URNa*Urine/1000ml	51-102
URKEx	Urine potassium excretion	mmol/24h	URK*Urine/1000ml	––
Na/K	Excretion ratio of urine sodium and potassium	%	URNa/URK*100%	––
CNa	Sodium clearance	ml/24h	(URNa*Urine)/SerNa	––
Clcr	Creatinine clearance rate	ml/min	(Urine * UCr) / (SCr * 1440)	––

Output Parameter	Full Name / Description	Unit	Formula	Reference Range
FENa	Fractional excretion of sodium	%	(URNa*Scr)/(SerNa*UCr) * 100%	––
Cosm	Osmolar clearance	ml/min	(Uosm*Urine/24/60)/Posm	––
CH2O	Free water clearance	ml/h	V*(1-Uosm/Posm)	-120~-25
U/Posm	Urine to plasma osmolality ratio	––	Uosm / Posm	3.0-4.5
BUN/Scr	Blood urea nitrogen-serum creatinine ratio	––	BUN / Scr	––
U/SCr	Urine-serum creatinine ratio	––	Ucr / Scr	––

17.7 Early Warning Score (EWS)

The early warning score (EWS) can help you recognize the early sign of deterioration in patients based on vital signs and clinical observations. Depending on the score calculated, appropriate recommendations are displayed.

The monitor supports the following scoring systems:

- NEWS (National Early Warning Score)
- MEWS (Modified Early Warning Score)

- CART (Cardiac Arrest Risk Triage)

There are two scoring type: total score and single parameter score.

- Total score: add all the subscores of each parameter selected to calculate the total early warning score. When the total score is out of range, actions are recommended.
- Single parameter score: a subscore is given for each parameter based on the entered value. When any subscore is outside of the thresholds, actions are recommended.

⚠ Warning

The EWS system is not applicable to pregnant women and people under 12 years old.

⚠ Warning

NEWS is not applicable to spinal cord injury (SCI) patients.

⚠ Warning

The EWS scores and recommended actions are for reference only and cannot be directly used for diagnostic interpretation.

⚠ Warning

EWS cannot be used as an index of prognosis. It is not a clinical judgement tool. Clinicians must use their clinical judgement in conjunction with the EWS tool at all times.

17.7.1 Scoring Parameters

Scoring parameters of each scoring systems are different, as shown in the table below:

Scoring System	Scoring Parameters

NEWS	Consciousness, Supply O_2 (oxygen supply status), RR, PR, SpO_2, Temp, SBP (systolic pressure)
MEWS	Consciousness, RR, Temp, SBP (systolic pressure), HR
CART	RR, HR, DBP (diastolic pressure), Age

17.7.2 Displaying the EWS Parameter Area

To display the EWS parameter area, follow the steps below:

1. Access [Layout] screen in either of the following ways:
   - Press the [Screens] quick key → select the [Layout] tab.
   - Press [Main Menu] → [Screens], select the [Layout] tab.
2. Select the parameter area where you want to display the EWS score, and then select [Timer] from the popup list.

17.7.3 Entering the EWS Screen

Enter the EWS screen in either of the following ways:

- Press the [EWS] parameter area.
- Press the [EWS] quick key.
- Press the [Calculations] quick key, select the [EWS] tab.
- Press [Main Menu] → [Calculations], select the [EWS] tab.

17.7.4 Performing EWS Scoring

To perform scoring, follow the steps below:

1. Select [Clear] to clear the previous score and update values of currently monitored parameters.
2. Select [Score] system, calculating [Mode] and [Refresh] period as needed.
3. Select [Conscs.] and switch on or off [Supply O2], measure or manually enter the values of other required parameters.
4. Press [Calculate] to obtain the total score.

Caution

Before calculating the score, press [Clear] to clear the previous score.

Caution

You can get the score only when all required parameters have been measured or entered.

17.7.5 Auto Scoring

When [Mode] is set to [Auto], the monitor automatically calculates the total score when the following conditions occur:

- At the completion of the preset refresh period (time interval);
- At the completion of each NIBP measurement;
- When an alarm occurs to the parameter for scoring.

17.7.6 EWS Settings

NEWS Settings				
No.	**Parameter**	**Setting Range**	**Unit**	**Default Setting**
1	Consciousness	Alert, Confusion, Voice, Pain	––	Alert
2	Supply O2	On, Off	––	Off
3	RR	0-150	rpm	Current RR value / empty
4	SpO_2	0-100%	%	Current SpO_2 value / empty
5	Temp	0-50		Current Temp value / empty
6	SBP	0-300	mmHg	Current SBP value / empty

7	PR	0-350	bpm	Current PR value / empty

NEWS Settings				
No.	**Parameter**	**Setting Range**	**Unit**	**Default Setting**
1	Consciousness	Alert, Reacting to Voice, Reacting to Pain, Unresponsive	/	Alert
2	RR	0-150	rpm	Current RR value / empty
3	Temp	0-50		Current Temp value / empty
4	SBP	0-300	mmHg	Current SBP value / empty
5	HR	0-350	bpm	Current HR value / empty

CART Settings				
No.	**Parameter**	**Setting Range**	**Unit**	**Default Setting**
1	RR	0-150	rpm	Current RR value / empty
2	DBP	0-300	mmHg	Current SBP value / empty
3	HR	0-350	bpm	Current HR value / empty
4	Age	0-150	Year	Current patient age

17.7.7 Reviewing EWS Trend Data

Enter the [Review] screen and select [EWS] from [Group Setup] in the [Tabular Trends] and [Graphic Trends] tab to view the EWS trend data.

17.8 Glasgow Coma Scale (GCS)

The Glasgow Coma Scale (GCS) is a widely used clinical assessment system. It evaluates three aspects of behaviors: eye opening, verbal response, and motor response. These three elements are scored, the scores are added together to indicate a patient's level of consciousness.

GCS is intended for adults and pediatric patients.

⚠ Warning

The GCS results are for reference only and cannot be directly used as a diagnostic basis. The diagnostic conclusion is subject to the clinician's judgment.

⚠ Warning

GCS is not applicable to patients who are sedated, paralyzed, intoxicated, or in status epilepticus or have an artificial airway.

⚠ Warning

GCS is not applicable to patients who are non-communicative, deaf, mute, or have mental disorders.

Caution

When using GCS for children under 5 years old or elderly patients with delayed responses, it may result in lower scores.

17.8.1 Displaying the GCS Parameter Area

To display the GCS parameter area, follow the steps below:

1. Access [Layout] screen in either of the following ways:
   - Press the [Screens] quick key → select the [Layout] tab.
   - Press [Main Menu] → [Screens], select the [Layout] tab.

2. Select the parameter area where you want to display GCS score at the bottom of the screen, and then select [GCS] from the pop-up list.

17.8.2 Entering the GCS Screen

Enter the GCS screen in either of the following ways:

- Press the [GCS] parameter area.
- Press the [Calculations] quick key, select the [GCS] tab.
- Press [Main Menu] → [Calculations], select the [GCS] tab.

17.8.3 Performing GCS Scoring

To perform scoring, follow the steps below:

1. Select [Clear] to clear the previous score, if any.
2. Set the [Refresh Period] as needed. The GCS scoring interval can be 30min, 1h, 2h, 4h, 6h, 8h and 12h.
3. Select an option that represents the patient's status from the [Eye Opening] area, [Verbal Response] area, and [Motor Response] area respectively.
4. Press [Calculate] to obtain the total score.

The scoring result and scoring time (the time at which the scoring result is obtained) are displayed on the right side of the GCS screen and in the GCS parameter area. The score range and background color of the scoring result are shown in the following table:

Range	**Color**
12-15	White
5-11	Yellow
3-4	Red

Caution

Before calculating the score, press [Clear] to clear the previous scoring result and scoring time, as well as the selection of eye opening, verbal response, and motor response, and restore to the default settings.

Caution

You can get the score only when all three items involved in the calculation have selected corresponding scores.

Caution

If the set refresh period is reached without re-scoring, the original score becomes invalid and displayed as "-". The scoring time disappears and displays as "--: --".

17.8.4 Reviewing GCS Trend Data

Enter the [Review] screen and select [GCS] from [Group Setup] in the [Tabular Trends] and [Graphic Trends] tab to view the GCS trend data.

17.9 Critical Congenital Heart Disease (CCHD) Screening for Newborns

The monitor has the function of CCHD screening for newborns. By monitoring the SpO_2 of newborns 24 to 48 hours after birth or within 24 hours after birth, the SpO_2 value is calculated in real time, and by observing the trend of SpO_2 difference, the presence of CCHD in newborns is determined according to the CCHD screening guidelines.

17.9.1 Entering CCHD Screen

Enter the CCHD screen in either of the following ways:

- Select the SpO_2 parameter area → select the [CCHD] button (Only available when the patient type is Neonate).
- Press the [Parameters] quick key → select the [SpO_2] tab → select the [CCHD] button.
- Press the [Calculations] quick key, select the [CCHD] tab.
- Press [Main Menu] → [Calculations], select the [CCHD] tab.

17.9.2 Performing CCHD Screening

After entering the CCHD screen, please follow the steps below to perform the screening:

1. Press the [Start Measuring] button below the “SpO2-right hand” when the prompt message "Please take a right hand measurement" appears on the status bar, the 30s SpO_2 line chart of the hand will be displayed at the top of the CCHD screen, and the system will calculate the average value of the 30s measurements.
2. Press the [Start Measuring] button below the “SpO2-foot” when the prompt message "Please take a foot measurement" appears on the status bar, the 30s SpO_2 line chart of the foot will be displayed at the top of the CCHD screen, and the system will calculate the average value of the 30s measurements.
3. Press the [Save] button to save the real-time record to the measurement record.

The SpO_2 parameter area indicates a red "CCHD - 59:00" countdown when no screening result can be determined and 2-3 screenings are required, indicating that the next operation needs to be completed within 1 hour. If the measurement is not carried out before the countdown is over, the red prompt flashes. After continuing the measurement, when the screening

result is negative or after 3 times of measurement, the red prompt disappears.

To screen again, repeat steps 1-3 above. A maximum of 3 consecutive measurements will give a screening result.

On the [CCHD] screen, you can also perform the following operations:

- Press the [Add Report] button to generate a report of the selected measurement record and save it to the report management screen.
- Press the [Print] button to generate a report of the selected measurement record and print it out.
- Check the checkboxes in the list of measurement records or press [Select All], then press the [Delete] button to delete the selected or all measurement records.

The list of measurement records lists up to 3 measurement records for the current patient in chronological order, with the first one displayed at the top. The measurement records (screening reports) of historical patients are saved in the report management screen (if reports have been added).

17.9.3 CCHD Screening Guidelines

The determination of CCHD screening results is as follows:

- When the SpO_2 value of the right hand or foot is < 90%, the screening result is positive, indicating that the screening is not passed.
- When the SpO_2 value of the right hand or foot ≥ 95%, and $\Delta SpO_2 \leq 3\%$, the screening result is negative, indicating that the screening is passed.
- When the SpO_2 value of the right hand and foot are between 90% and 94%, or when $\Delta SpO_2 > 3\%$, "/" is

displayed, indicating that screening needs to be continued. Continuous screening for 3 times, with an interval of less than 60 minutes. If the results of the three consecutive screenings show "/", it means that it is a positive result and the screening is not passed.

17.9.4 CCHD Report Management

Press [Main Menu] → [Reports] to enter the report management screen. You can perform the following operations on the saved CCHD screening reports in this screen:

- Press the [View Report] button to view the selected CCHD report.
- Press the [Print] button to print the selected CCHD report.
- After inserting the USB flash disk into the USB port of the monitor, press the [Export] button to export one or more selected CCHD report(s) to the USB flash disk.
- Press [Delete] to delete one or more selected CCHD report(s).

Chapter 18 Other Functions

18.1 Freezing Waveforms

During patient monitoring, you can freeze the currently displayed waveforms on the screen so that you can have a close examination of the patient's status.

18.1.1 Entering Freeze Screen

In the Non-Freeze status, press the [Freeze] quick key to exit the current operating screen. Freeze status is entered and the pop-up Freeze menu appears on the bottom of the screen.

In Freeze status, all waveforms are frozen and will no longer be refreshed. Nevertheless, the Parameter area refreshes and the data is stored normally.

18.1.2 Exiting Freeze Screen

In the Freeze status, press the [X] button at the upper right corner of the freeze menu to close the freeze menu and exit the freeze screen.

After exiting Freeze status, the system will clear screen waveforms and resume displaying real-time waveforms from left to right in the waveform area.

18.1.3 Reviewing Frozen Waveforms

You can review a waveform of up to 120 seconds before it is frozen by moving the waveform. Press the [<] or [>] button in the Freeze screen to view the frozen waveforms. At the lower right corner of the bottom-most waveform displays the freeze time. The initial frozen time is 0.0s. With the waveforms scrolling, the freeze time changes at an interval of 1 second.

For example, -2.0s means two seconds before the frozen time. This change will be applied for all waveforms on the screen.

18.2 Using the On-Screen Timer

The monitor has a Timer function to notify you when a preset time period is expired.

18.2.1 Displaying the Timer

To display a timer, follow the steps below:

1. Access [Layout] screen in either of the following ways:
   - Press the [Screens] quick key → select the [Layout] tab.
   - Press [Main Menu] → [Screens], select the [Layout] tab.
2. Select the parameter area where you want to display the timer, and then select [Timer] from the popup list.

18.2.2 Setting the Timer

To set the timer, follow the steps below:

1. Access [Timer Setup] screen in either of the following ways:
   - Press the Timer area in the parameter area.
   - Press the [Parameters] quick key → select the [Timer Setup] tab.
2. Set the [Timer Type]:
   [Single]: the timer counts according to the preset [Run Time], stops counting when the run time is reached.
   [Cycle]: the timer counts according to the preset [Run Time], and then restarts counting automatically when the run time is reached. The number of elapsed cycles is displayed below the Timer tile.
3. Set the [Direction]:

[Count Up]: the timer counts up, from zero to Run Time.
[Count Down]: the timer counts down, from Run Time to zero.

4. Set the [Run Time].
5. Set the [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 about to expire.

Note

You cannot set the timer while it is working.

18.2.3 Using the Timer

You can perform the following operations on the timer:

- [Start/Pause]: starts/pauses the timer.
- [Reset]: clears and resets the timer.

Warning

Do not use the timer for critically ill patients.

18.3 Nurse Call

When there is an alarm, the monitor outputs nurse call signal to the hospital's nurse call system to notify the nurse.

The monitor provides nurse call port which is connected to nurse call system through the nurse call cable to perform the nurse call function.

To enable the nurse call function, follow the steps below:

1. Press [Main Menu] → [Maintenance] → input password → press [Enter].

2. Select the [Sig. Out] (Signal Output) tab → switch on [Nurse Call].

Alarms are indicated on the nurse call device only when the following conditions are met:

- The nurse call system is enabled.
- A user-defined alarm occurs.
- Alarms are not paused or reset.

⚠ Warning

Do not rely exclusively on the nurse call system for alarm notification. Remember that the most reliable alarm notification combines audible and visual alarm indications with the patient's clinical condition.

18.4 Managing Configurations

When performing continuous monitoring on a patient, the clinical professional often needs to adjust the monitor's settings according to the patient's condition. The collection of all these settings is called a configuration. The system configuration items can be classified as: parameter configuration items, alarm configuration items, conventional configuration items, and user maintenance items. In order to configure the monitor more effectively and quickly, the monitor provides different sets of configurations to accommodate the varying patient types. You can change some settings from a certain set of configuration and then save the changed configuration as a user configuration.

18.4.1 Restoring Default Configuration

During monitoring, you may change some settings in some cases, but these changes may not be appropriate or correct,

especially when updating patients. Therefore, you should restore the factory default configuration according to your need, so as to ensure that the various configurations of the monitor are suitable for the monitored patients.

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

- A patient is admitted.
- A patient is discharged.
- Patient data is cleared.
- Patient type is changed.

The default configurations include: Factory Defaults (Adult), Factory Defaults (Pediatric), Factory Defaults (Neonate).

The restored configuration is subject to the patient type (adult, pediatric or neonate). This configuration can be either factory configuration or a saved user configuration.

18.4.2 Saving Current Settings

Current settings can be saved as a user configuration. Up to 18 user configurations can be saved. To save current settings, follow the steps below:

1. Press [Main Menu] → [System], select the [Configurations] tab.
2. Select [Save as].
3. In the popup dialog box, enter the configuration name.
4. Select [Enter] to import the configuration as a user configuration.

18.4.3 Deleting a Configuration

To delete a configuration, follow the steps below:

1. Press [Main Menu] → [System], select the [Configurations] tab.
2. Select the configuration you want to delete.
3. Select [Delete].
4. Select [Yes] in the popup dialog box.

18.4.4 Loading a Configuration

You can load a desired configuration to ensure that all the settings are appropriate for your patient. To load a configuration, follow the steps below:

1. Press [Main Menu] → [System], select the [Configurations] tab.
2. Select a desired configuration.
3. Select [Load].
4. Select [Yes] in the popup dialog box.

Caution

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

18.4.5 Exporting a Configuration

To export the current monitor's configuration, follow the steps below:

1. Connect the USB drive to the monitor's USB port.
2. Press [Main Menu] → [System], select the [Configurations] tab.
3. Select the configuration you want to export.
4. Select [Export].
5. Enter the name of the configuration to export.
6. Select [Enter].

7. Select [Yes] in the popup dialog box when a status message reports completion of the transfer.

18.4.6 Importing a Configuration

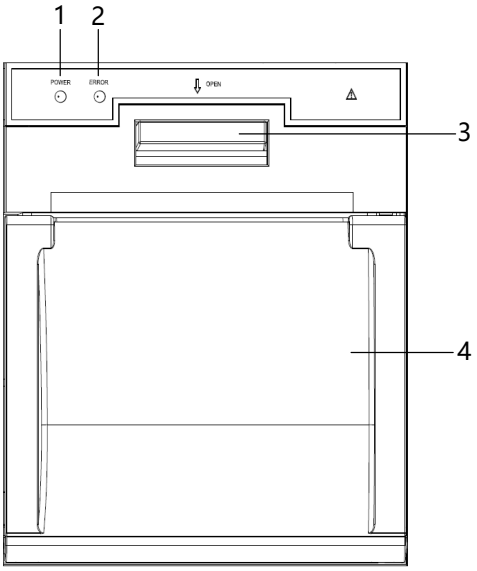
To import the configuration from the USB drive to the monitor, follow the steps below:

1. Connect the USB drive with the saved configuration file to the monitor's USB port.
2. Press [Main Menu] → [System], select the [Configurations] tab.
3. Select [Import].
4. Select the configuration you want to import, and select [Open].
5. Enter the name of the configuration to import.
6. Select [Enter] to import the configuration as a user configuration.

Chapter 19 Recording

19.1 Recorder

A thermal recorder can be used for the monitor and output patient information, measurement data, up to three waveforms, etc. Built-in thermal recorder may be used due to the different configuration.



1 Power indicator:
- On (green light): the recorder works correctly.
- Off: the monitor is switched off.

2 Error indicator:
- On (red light): the recorder is out of paper, or the thermal paper is not loaded properly.
- Off: the paper is loaded correctly.

3 Recorder door open button

4 Paper compartment

19.2 Setting up the Recorder

Press [Main Menu] → [Reports], select the [Recorder Setup] tab to enter the recorder setting screen. You can configure the recorder as follows:

- [Wave 1], [Wave 2], [Wave 3]: select the desired waveform.

  ☞ **Note**

  The recorder can output up to three waveforms at a time.

  ☞ **Note**

  Only ECG waveform can be selected for [Wave 1]. [Wave 1], [Wave 2] and [Wave 3] cannot be set to the same options (for example, [Wave 2] and [Wave 3] cannot be set to Resp at the same time).

  ☞ **Note**

  The recorder can record up to 2 ECG waveforms at a time.

- [Duration]: set the duration of real-time recording.

  Options: Continuous, 8s, 16s, 32s, the default setting is 8s.

  When it is set to [Continuous], [Timed Record Interval] is deactivated, and the recorder will not stop recording the real-time waveform until the recording is manually stopped by pressing the record key.
- [Timed Record Interval]: set the time interval for automatic recording.

  Options: Off, 10min, 20min, 30min, 40min, 50min, 1h, 2h, 3h, 4h. The default setting is switched off.
- [Speed]: set the speed for recording waveforms.

  Options: 25mm/s, 50mm/s, the default setting is 25mm/s.

19.3 Starting Recordings

19.3.1 Manually Starting Recordings

To manually start a recording, you can either:

- Press the hard key on the front panel of the monitor.
- Press the button on the top right corner of the current screen.

19.3.2 Automatic Recordings

In the following conditions, you can set the recorder to automatically start recording:

- Recording at a preset interval

  The recorder starts automatic recording according to the set interval for [Timed Record Interval]. For more information, see *19.2Setting up the Recorder*.
- Recording when a parameter alarm is triggered

To enable automatic recording via recorder when a parameter alarm is triggered, follow the steps below:

1. Select the tab related to parameter alarm in either of the following ways:
   - Press the [Alarm Setup] quick key.
   - Select the parameter numeric area of a parameter → press the [Alarm Setup] button.
   - Press the [Parameters] quick key → select the required parameter → press the [Alarm Setup] button.
2. Switch on the alarm switch [On/Off] and the recording switch [Rec Output] for the parameter.

19.4 Stopping Recordings

Press the hardkey on the front panel of the monitor to stop the current recording.

Recordings stop automatically in the following conditions:

- The recording is completed.
- The recorder runs out of paper.
- Malfunction stops the recorder from running properly.

19.5 Loading Paper

To load the thermal recording paper, follow the steps below:

1. Press and hold down the open button to open the recorder door.
2. Insert a new roll of paper into the paper compartment properly, with printing side facing upwards. Pull about 2cm of the paper out.
3. Close the recorder door.

19.6 Removing Paper Jam

If the recorder works incorrectly or produces unusual sounds, check if there is a paper jam. Remove the paper jam in the following way:

1. Open the recorder door.
2. Take out the paper and tear off the draped part.
3. Reload the paper and close the recorder door.

19.7 Precautions

Observe the following precautions when using the recorder:

- Only standard thermo-sensitive recording paper can be used. Otherwise, it may cause damage to the recorder's thermo-sensitive print head, the recorder may not function, or the recording quality may be poor.
- When the recorder is working, the recording paper goes out steadily. Do not pull the paper outward with force. Otherwise the recorder may be damaged.
- Do not leave the recorder door open unless you reload paper or remove troubles.
- Do not use anything that may destroy the thermal element.
- Do not add unnecessary force to the thermo-sensitive print head.

Chapter 20 Printing

20.1 Supported Printer

The monitor can output patient reports via a connected network printer. The currently supported printer type is HP Laser Jet M203-M206 laser printer.

Caution

For more information about the printer, refer to the document accompanying the printer. With product upgrades, the monitor may support additional printers without prior notice. If you have any doubts about the compatibility of the printer used with this monitor, contact the manufacturer.

20.2 Setting the Network Printer

To set the network printer, follow the steps below:

1. Press [Main Menu] → [Maintenance] → input password → press [Enter].
2. Select the [Print] tab.
3. Set the [Printer IP Address].
4. Press the [Test] button to verify whether the printer is connected normally.

Caution

The IP address of the network printer must be in the same LAN as the monitor.

20.3 Starting a Printing Task

20.3.1 Manual Printing

Print a report manually in one of the following ways:

- Press the button on the top right corner of the current screen.
- Press the [Real-time Print] quick key at the bottom of the main screen.

20.3.2 Automatic Printing

To enable automatic printing reports via a network printer when a parameter alarm is triggered, follow the steps below:

1. Select the tab related to parameter alarm in either of the following ways:
   - Press the [Alarm Setup] quick key.
   - Select the parameter numeric area of a parameter → press the [Alarm Setup] button.
   - Press the [Parameters] quick key → select the required parameter → press the [Alarm Setup] button.
2. Switch on the alarm switch [On/Off] and the printing switch [Print Output] for the parameter.

> ☞ **Note**
>
> **Before sending a print request, make sure that there is enough paper in the printer.**

20.4 Stopping a Printing Task

To stop a printing task, follow the steps below:

1. Press [Main Menu] → [Reports], select the [Print Queen] tab.
2. Select desired printing tasks and then select [Delete].

20.5 Configuring Reports

20.5.1 Configuring Real-time Reports

To configure real-time reports, follow the steps below:

1. Press [Main Menu] → [Reports], select the [Report Setup] tab.
2. Select the [Real-time] tab.
3. Set the desired options.

The menu settings are described below:

- [Speed]: set the waveform speed.
  Options: 12.5mm/s, 25mm/s, 50mm/s, Auto.
- [Print Current Waves]: prints the real-time report for the currently displayed waveforms.
- [Print Specified Wave]: prints the real-time report for the desired waveforms configured.
- [Duration]: set the duration of printing real-time waveform.
  Options: 10s, 20s, 30s, 40s, 50s, 60s, Continuous.
  The default setting is 10s. When it is set to [Continuous], [Timed Record Interval] is deactivated, and the recorder will not stop recording the real-time waveform until the recording is manually stopped.
- [Print Format]: set the print format of ECG waveforms for 12-lead when not connected to AI-ECG Platform.
  Options: 6×2+1, 3×4+1

➢ 6×2+1: displays 12-lead ECG waveforms on one page in two columns, with 6 lines in each column, and one rhythm lead waveform at the bottom.

- 3×4+1: displays 12-lead ECG waveforms on one page in 4 columns, with 3 lines in each column, and one rhythm lead waveform at the bottom.

☞ Note

Under the 12-lead configuration, real-time printing and freeze printing only print ECG waveforms.

20.5.2 Configuring Tabular Trends Reports

To configure tabular trends reports, follow the steps below:

1. Press [Main Menu] → [Reports], select the [Report Setup] tab.
2. Select the [Tabular Trend] tab.
3. Set the desired options.

The menu settings are described below:

- [Start Date]: select the date before which a tabular trends report will be printed.
- [Start Time]: select the time before which a tabular trends report will be printed.
- [Period]: select the period during which a tabular trends report will be printed.

  Options: 30min, 1h, 2h, 4h, 8h, 12h, 24h, 48h, 72h, 96h.

  The default setting is 48h.
- [Resolution]: select the resolution of the tabular trends printed on a report.

  Options: 5s, 30s, 1min, 5min, 10min, 15min, 30min, 1h, 2h, 3h, NIBP, Auto. The default setting is Auto.

  [Auto]: using the [Resolution] setting of the Tabular Trends review screen.

[NIBP]: the tabular trends will be printed at the interval of acquiring the NIBP values.

- [Print Format]: select the printing principle.

  Options: Time Priority, Parameter Priority.

  The default setting is Parameter Priority.

➢ [Time Priority]: print one page span of report with time listed by row and parameter listed by column when [Resolution] is set to [Auto].

➢ [Parameter Priority]: print one page span of report with parameters listed by row and time listed by column when [Resolution] is set to [Auto].

20.5.3 Configuring Graphic Trends Reports

To configure graphic trends reports, follow the steps below:

1. Press [Main Menu] → [Reports], select the [Report Setup] tab.
2. Select the [Graphic Trend] tab.
3. Set the desired options.

The menu settings are described below:

- [Start Date]: select the date before which a graphic trends report will be printed.
- [Start Time]: select the time before which a graphic trends report will be printed.
- [Period]: select the period during which a graphic trends report will be printed.
- [Trend Group]: select the contents of the printed graphic trends report.

20.5.4 Configuring Event Reports

To configure event reports, follow the steps below:

1. Press [Main Menu] → [Reports], select the [Report Setup] tab.
2. Select the [Event] tab.
3. Set the print content of the event report. Options: List, Detail, Select All.

20.6 Viewing Printing Status

To view the status of printing tasks, follow the steps below:

Press [Main Menu] → [Reports], select the [Print Queen] tab.

Each printing task includes the following information:

- Report type
- Print time
- Operator
- Operator ID
- Printing status, for example, printing, failed, retrying, and waiting.

In the [Print Queue] screen, you can view the list of current printing tasks, delete the currently selected print tasks, or delete all printing tasks.

Chapter 21 Battery

21.1 Introduction

The monitor is equipped with a lithium-ion rechargeable battery to support its normal operation when the external power is not available.

21.2 Safety Information

⚠ Warning

Keep the battery out of the reach of children.

⚠ Warning

Use only the battery specified by the manufacturer. Use of unspecified battery may cause a risk of fire or explosion.

⚠ Warning

While replacing the battery, do not use unspecified battery to avoid damage to the device.

⚠ Warning

Keep the battery in their original package until you are ready to use them.

⚠ Warning

Keep the battery away from liquid.

⚠ Warning

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.

⚠ Warning

If the battery shows signs of damage or signs of leakage, replace it immediately. Use caution in removing the battery. Avoid contacting the leakage.

⚠ Warning

The battery can only be charged by this monitor.

⚠ Warning

Do not disassemble the battery, place it in high ambient temperature (above 60℃) environment, burn the battery or short-circuit it. Otherwise, it may cause a risk of fire, explosion, battery leaks or high temperature and even personal injury.

⚠ Warning

The lithium-ion rechargeable battery has a service life of 500 charge / discharge cycles. Replace it when its service life expires. Failure to replace the battery on time may cause serious damage to your equipment from battery overheating.

Caution

Remove the battery before transporting the monitor or the monitor will be laid aside for a long time.

Caution

Do not supply power for other electronic devices via the battery.

21.3 Installing the Battery

The battery must be installed and replaced by service personnel trained and authorized by the manufacturer. The monitor is not equipped with battery when it leaves the factory. Contact the service personnel to install the battery before using it for the first time.

To install the battery, follow the steps below:

1. Turn off the monitor, disconnect the power cord and other cables.
2. Place the monitor face down on the table.
3. Use a Phillips screwdriver to loosen the fixing screws on the battery cover and open the battery cover.
4. Insert the battery into the battery compartment and keep the battery cable outward.
5. Insert the battery cable plug into the corresponding socket.
6. Straighten out the battery cable, fix the battery, close the battery cover, and tighten the fixing screws.

21.4 Battery Indication

The battery status indicator, on-screen battery icons and related alarm messages indicate the battery status.

21.4.1 Battery Status Indicators

The description of battery status indicators are as follows:

Indicator Color	Battery Status
Green	AC power is connected and the battery is fully charged.
Yellow	AC power is connected and the battery is being charged.
Off	AC power is connected and no battery is installed.
	The battery is installed and AC power is not connected.

21.4.2 Battery Icons

The battery icon in the upper right corner of the monitor screen indicates the battery status:

Battery Icon	Description
	The battery is working correctly. The white portion represents the remaining capacity of the battery.
	The battery power is low and needs to be charged. When this icon appears, the battery can power the monitor for up to 30 minutes.
	The battery is almost depleted and needs to be charged immediately. Otherwise, the monitor will automatically shut down after 5 minutes.
	The battery is being charged.
	No battery is installed

21.4.3 Battery-related Alarms

When the battery is low, the “Low battery” alarm will be triggered. When the battery is almost depleted, the “Battery depleted” alarm will be triggered. In this case, immediately connect the AC power supply to the monitor and charge the battery. Otherwise, the monitor will automatically shut down soon.

For more information on battery-related alarms, see *Appendix B Alarms*.

21.5 Charging the Battery

After the monitor is connected to AC power supply, it can automatically charge the battery even though the monitor is turned off.

21.6 Maintaining the Battery

21.6.1 Battery Optimization

The performance of the battery deteriorates over time. It is recommended to optimize the battery every three months. If the battery is not optimized for a long time, the battery capacity display may be inaccurate, causing the incorrect judgment of remaining battery runtime.

To optimize the battery, follow the steps below:

1. Disconnect the monitor from the patient and stop all monitoring and measuring procedures.
2. Allow the battery to be charged uninterruptedly until it is fully charged.
3. Allow the monitor to run on the battery until the battery is completely depleted and the monitor automatically shuts down.
4. Fully charge the battery again for use or charge it to 40%-60% for storage.

Caution

Do not use the monitor to monitor patient during the battery optimization.

Caution

Do not interrupt charging or discharging during battery optimization.

21.6.2 Checking Battery Performance

The performance of the battery deteriorates over time. You should check the battery performance every three months. If you suspect that the battery breaks down, the battery performances should also be inspected.

See steps 1 to 3 of *21.6.1 Battery Optimization* to check the battery performance. The operating time of the battery reflects its performance directly. If the operating time of a battery is noticeably shorter than that stated in the specifications, the battery may have reached its service life or be malfunctioning. If the battery performance meets the requirement, fully charge the battery again for use or charge it to 40%-60% for storage.

Caution

Battery operating time depends on device configuration and operation. For example, too high display brightness or frequent NIBP measurements will shorten the battery operating time.

21.7 Storing the Battery

When the monitor is not used for long-term storage, it needs to be charged regularly to maintain battery performance.

Keep the battery terminals away from metallic objects when storing the battery. If the battery needs to be stored for a long time, place it in a cool environment.

The stored battery should also be optimized regularly. For the optimization method, see *21.6.1 Battery Optimization*.

Caution

Remove the battery from the monitor if the monitor is not used for a long time (for example, several weeks). Otherwise the battery may over discharge, which may damage the battery.

Caution

It will greatly shorten the service life of the battery if it is stored in a high temperature environment for a long time.

21.8 Replacing and Recycling the Battery

Replace the battery if it is damaged, aging or cannot store power, and recycle it correctly. Properly dispose of the battery according to your local regulations.

Chapter 22 Cleaning and Disinfection

22.1 Safety Information

⚠ Warning

Do not immerse the device and accessories in liquid.

⚠ Warning

Do not pour liquid on the device or accessories. Do not allow the liquid permeate into the device.

⚠ Warning

Do not use abrasive materials or any strong corrosive solvents for cleaning to avoid scratches or damages to the device.

⚠ Warning

The parts contacted by the infected or suspected patient should be disinfected.

⚠ Warning

The manufacturer is not responsible for the effectiveness of the disinfectant or disinfection method used as a means of infection control. Please consult your hospital's infection control director or epidemiologist for advice.

22.2 Recommended Cleaning Agents

Supported cleaning agents include:

- Sodium hypochlorite (10%, bleaching powder for washing)
- Ethanol (70%~75%)

Supported cleaning tools include:

Cotton ball, soft gauze, soft brush and soft cloth.

22.3 Cleaning

Keep your device and accessories free of dust and dirt. Clean the exterior surface of the monitor monthly or more frequently if any signs of contamination are visible. Consult your hospital's regulations before cleaning the monitor.

After cleaning, check your device carefully. Do not use it if you see any signs of damage or deterioration. Please contact your local distributor or the manufacturer.

To clean the monitor, follow the steps below:

1. Turn off the monitor and disconnect it from the AC power supply cable and accessories.
2. Clean the surface of the monitor with a clean soft gauze moistened with one of the recommended cleaning agents.
3. Wipe off all the cleaning agent residue with a clean dry cloth. Dry your monitor in a ventilated, cool place.

Caution

Keep the cleaning agent away from the connectors of the monitor and accessories while cleaning the device housing.

Caution

Use non-aggressive cleaning agent to clean the surface of the monitor and the display screen.

Caution

Most cleaning agents must be diluted before usage.

22.4 Disinfection

Supported disinfectants include:

- Isopropanol (70%)
- Ethanol (70%-75%)

- Perform® classic concentrate OXY (C/D)

Supported cleaning tools include:

Cotton ball, soft gauze, soft brush and soft cloth.

If your hospital has regulated disinfecting procedures, disinfect the monitor in accordance with the disinfection procedures of your hospital. Clean the monitor before disinfection.

If your hospital does not have regulated disinfecting procedures, follow the steps to disinfect external surfaces of the monitor:

1. Turn off the monitor and disconnect it from the AC power supply cable and accessories.
2. Use a clean soft gauze moistened with one of the recommended disinfectants.
3. Allow disinfecting solution to remain on device per disinfectant instructions or per hospital guidelines.
4. Wipe off the disinfecting solutions with a clean, lightly moistened cloth.
5. Dry your monitor in a ventilated, cool place.

Warning

Ethanol is flammable. Please keep away from fire while using the ethanol disinfectant.

Warning

People allergic to ethanol are forbidden to use the ethanol disinfectant.

Caution

Rubber and plastic products will harden after prolonged contact with alcohol disinfectants, hence the residual disinfectant should be removed in time after disinfection.

Caution

Do not use radiation or steam for disinfection.

Caution

Please avoid contact with the metal parts when user disinfects the device with peroxide or chlorine-containing disinfectants.

22.5 Sterilization

It is not allowed to sterilize the monitor and related accessories unless stated in their operation instructions.

22.6 Cleaning the Print Head

If the thermal printer has been used for a long time, deposits of paper debris may collect on the print head, which may affect the print quality and shorten the lifetime of the roller. Follow this procedure to clean the thermo-sensitive print head:

1. Take measures against the static electricity such as Disposable Wrist Strap for the work.
2. Open the printer door and take out the paper.
3. Gently wipe around the print head using cotton swabs dampened with Ethanol.
4. After the Ethanol has completely been dried, reload the paper and close the printer door.

Caution

The thermal head may be hot after completing the recording task. Do not clean the thermal head of the recorder immediately.

22.7 Cleaning, Disinfection and Sterilization of

Accessories

For the cleaning, disinfection and sterilization methods of reusable accessories, refer to the instructions for use that accompany the accessories.

Chapter 23 Care and Maintenance

In order to ensure the normal operation of the monitor and maintain its service life, please pay attention to the maintenance of the monitor. Refer to the detailed provisions in the sales contract for the warranty period of main unit and accessories of the monitor.

23.1 Safety Information

Warning

No modification of this device is allowed.

Warning

This device contains no user serviceable parts.

Warning

The safety checks or maintenance involving any disassembly of the device should be performed by professional service personnel. Otherwise, undue device failure and possible health hazards could result.

Warning

A comprehensive inspection for the monitor (including functions and safety inspections) should be carried out by qualified personnel every year or after each maintenance.

Caution

If the user does not regularly check or maintain the monitor, it may affect its performance and safety.

Caution

If the user cannot implement a satisfactory maintenance plan, it may disable the monitor functions and endanger human health.

Caution

The SpO_2 calibration of the monitor has been carried out before delivery, and user does not need to calibrate it again during the operation.

Caution

If you find any signs of damage of the monitor or accessories, do not use them.

Caution

The device and accessories shall not be serviced or maintained while in use on a patient.

Caution

If you discover a problem with any of the device, contact your service personnel or our company.

Caution

Use and store the device within the specified temperature, humidity, and altitude ranges.

Caution

When disposing of the packaging material, be sure to observe the applicable waste control regulations and keep it out of the reach of children.

Caution

At the end of its service life, the device, as well as its accessories, must be disposed of in compliance with the local regulations regarding the disposal of such products. If you have any questions concerning disposal of the device, please contact our company.

23.2 Daily Inspection

Before using the monitor, the checks below should be carried out:

- Check the monitor for any mechanical damage;
- Inspect the exposed parts and the inserted parts of all the cables and the accessories;
- Examine all the functions of the monitor that are likely to be used for patient monitoring, and ensure that it is in good working condition;
- Make sure that the monitor is grounded properly.
- Pay close attention to the fluctuation of the local power supply voltage. A power voltage regulator is recommended when necessary.

In case any indication of damage about the function of the monitor is detected and proven, it is not allowed to apply it to the patient for any monitoring. Please contact the local dealer or our company, and we are to offer the best solution as soon as possible for your satisfaction.

23.3 Routine Maintenance

The monitor is designed with a service life of 10 years.

It is strongly recommended to use the product within its life cycle, or it may cause inaccurate measurement. During the long-term use, it is recommended that the user check and calibrate the monitor once a year to ensure the measurement accuracy. Due to the high risk of product aging in the last year of the service life, please pay close attention to the inspection results. Dispose of the monitor and its accessories when their service life is reached.

The inspection items mainly include:

- Check whether the safety signs are damaged.
- Check the main unit and accessories for mechanical and functional damages.
- Carry out the protective grounding impedance, leakage current and insulation resistance test according to the requirements of IEC60601-1.
- Verify the functions of the device according to the operator's manual.

The test and results recording should be carried out by trained and qualified personnel with the safety test knowledge. Please service the monitor if any problem is detected in the above tests.

23.4 Battery Maintenance

Perform battery maintenance regularly to maintain its useful life.

- Check the battery regularly. If it is damaged, contact the manufacturer to purchase a battery of the same model and specification for replacement.
- It is recommended to use the battery once a month to ensure its power capability and long service life, and recharge it after run out of its power capacity.
- Please keep the battery power between 50% to 80% when the monitor is laid aside for a long time. The battery should be charged every 3 months to avoid irreversible capacity loss caused by low battery due to self-discharge during the long time storage.

23.5 ECG Calibration

The ECG signal may be inaccurate due to hardware or software problems. As a result, the ECG wave amplitude becomes greater or smaller.

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

To calibrate the ECG module, follow the steps below:

1. Press[Main Menu]→[Maintenance]→ input password → press [Enter].
2. Select the [Module] tab→[ECG] tab.
3. Switch on [Calibration].
4. Switch off [Calibration] to end the calibration of ECG module.

Caution

During ECG calibration, the patient cannot be monitored.

23.6 NIBP Maintenance

23.6.1 NIBP Leakage Test

The NIBP leakage test checks the integrity of the system and of the valve. In order to avoid significant error of blood pressure measurement or even no measurement result caused by air leakage in the pneumatic system including the cuff during measuring, it is recommended to check if there is leakage in the pneumatic system.

The NIBP leakage test should be performed at least once a year or when you doubt the NIBP measurements. The NIBP leakage test should be performed by the qualified service personnel only.

To perform the NIBP leakage test, follow the steps below:

1. Press[Main Menu]→[Maintenance]→ input password → press [Enter].
2. Select the [Module] tab → [NIBP] tab.
3. Select [Leakage Test].

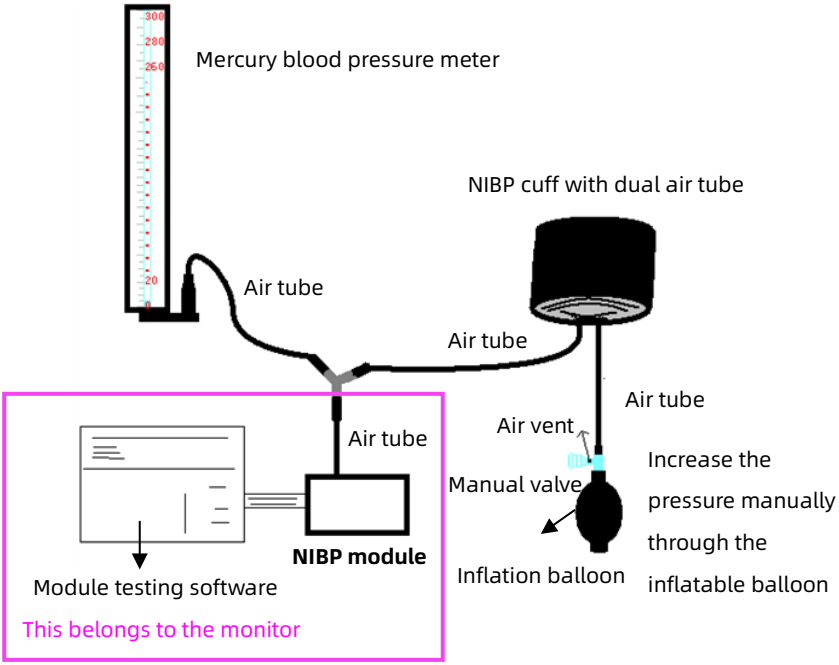
Caution

Please remove the cuff from patient while performing the leakage test.

23.6.2 NIBP Pressure Accuracy Verification

NIBP pressure accuracy verification is a function to inspect the accuracy of pressure measurement by the NIBP module inside the device. Technician or device manager should perform pressure accuracy verification every six months or a year in order to check if the pressure measurement still conforms to the requirement of product performance. If the deviation is beyond the declared specification, it is permitted to return it to factory for repair or calibration.

Before verification, please connect the monitor to a precision pressure meter as the reference equipment like a mercury pressure meter.



✦ **Mode 1: Automatic inflation for the pressure accuracy verification**

At this mode, the monitor can activate the inflation, so the pressure will increase automatically until it exceeds the limit value specified in the table below. This pressure limit value depends on the patient type selection as shown in the table below:

Patient Type	Mode 1 (Maximum pressure value)	Mode 2 (Over-pressure protection pressure value)
Adult	240mmHg	300mmHg
Pediatric	200mmHg	240mmHg

During the inflation, the monitor will close the deflating valve, and the pressure value will be shown during the process. If there is no manual deflation operation, the pressure will persist until deflation by manual operation, so it is necessary to use a

manual valve for doing adequate deflation in several steps to verify the pressure accuracy in the full scale of measurement range.

✦ **Mode 2: Manual inflation for the pressure accuracy verification**

At this mode, the pressure should be increased manually by a pumping balloon, and the verification can be done by applying different pressure value manually. If the increased pressure exceeds the given limit as shown in the table above, the monitor will deflate automatically because of over-pressure protection.

To perform the NIBP pressure accuracy verification, follow the steps below:

1. Press[Main Menu]→[Maintenance]→ input password → press [Enter].
2. Select the [Module] tab → [NIBP] tab.
3. Select [Auto Pressure Test] to perform automatic inflation for the pressure accuracy verification. Or select [Manual Pressure Test] to perform manual inflation for the pressure accuracy verification.

⚠ Warning

Pressure accuracy verification must be operated by technician or device manager. Physicians and nurses are not allowed to do the verification, it is very dangerous especially when the pressure cuff is still on patients.

Caution

After the verification, do press the button again to return to normal working mode, then continue other operation, or the NIBP measurement key will be invalid.

23.7 CO_2 Calibration

For sidestream CO_2 module, a calibration is needed every year or when the measured values have a great deviation.

For maintream CO_2 module, no calibration is needed. If calibration is required, contact your service personnel.

23.8 IBP Calibration

This section is for professional technician only.

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:

- When you use a new transducer or tubing.
- Each time you reconnect the IBP transducer or adapter cable.
- If you think the monitor's pressure readings are not correct.
- When you select another measuring label, the monitor displays the prompt message *Unzeroed*.

There are two methods for calibration: zero calibration and pressure value calibration.

Calibration procedure:

1. Press[Main Menu]→[Maintenance]→ input password → press [Enter].
2. Select the [Module] tab → [IBP] tab.
3. Select [IBP Channel], and input 0mmHg for the pressure.
4. Press the [Calibration] button. After the calibration is completed, the message "Zero succeeded" will be displayed.
5. Then input 100mmHg for the pressure.

6. Press the [Calibration] button. After the calibration is completed, the message "Calibration succeeded" will be displayed. If the calibration fails, corresponding message will also be displayed.

Warning

IBP transducer calibration is prohibited when monitoring a patient.

Caution

Before performing calibration, please make sure that the transducer is well connected, otherwise the calibration cannot be carried out.

23.9 Storage, Packaging and Transportation

If the monitor will not be used for a long time, wipe it clean and keep it in the packaging, which shall be kept in a dry and well ventilated room free from dust and corrosive gases.

The monitor is packed in high quality corrugated cartons with foam inside to protect the monitor against damage during transportation. The outer packaging box is marked with gross weight and dimension.

The monitor should be transported by land (vehicle or railway) or air in accordance with the contractual terms. Do not hit or drop it with force during transportation.

23.10 Viewing Version Information

When performing maintenance for the monitor, you may need to check the system information.

To view the system software version, hardware version, module version, firmware version, and other version information, follow the steps below:

1. Press[Main Menu]→[Maintenance]→ input password → press [Enter].
2. Select the [Version] tab.

You can also press the [Main Menu] → [System], and select [Version] tab to view the software version, monitor name, monitor ID and monitor network information (MAC and IP address).

Chapter 24 Troubleshooting

This chapter lists the problems that are likely to occur. If the problem persists after corrective actions have been taken, contact the manufacturer or your local distributor.

24.1 Prompt Messages

The monitor prompts messages to indicate the current system status. Follow the instructions in the table below to eliminate the problems.

NIBP

Status / Error	Description	Corrective Actions
Self-test failed	NIBP module self-test failed during power on, sensor or other hardware errors.	Module abnormal or faulty, it is recommended to power on again. If this symptom cannot be eliminated, it is recommended to replace the NIBP module or return to the factory for repair.
System error	Abnormal condition of CPU, such as register overflow, divided by zero.	Module abnormal or faulty, it is recommended to power on again. If this symptom cannot be eliminated, it is recommended to replace the NIBP module or return to the factory for repair.
Measurement timeout	Adult exceeds 180s	Normal module operating report, not error or fault.

Status / Error	Description	Corrective Actions
		The module itself has an error return that defines the measurement timeout. Start timing at the beginning of measurement, more than 175s.
Weak signal	Very weak signal because of the cuff, or the patient has very weak pulse.	Normal module operating report, not error or fault.
Cuff error	Cuff is not wrapped correctly, or is not connected.	Normal module operating report, not error or fault.
Air leak	Air moving part, tube or the cuff leak air.	Check the cuff for air leakage. Check the tightness of the module airway. Recondition the module pneumatic components.
Pressure error	Unstable cuff pressure or tangled cuff tubing.	Check the airway, especially the hose, for kinks. Recondition the module.
Over range	Very weak signal because of the cuff, or the patient has very weak pulse.	Normal module operating report, not error or fault.

Status / Error	Description	Corrective Actions
Over motion	The repeated measurement due to moving, excessive noise during the stepping inflation and measuring pressure and pulse, e.g. during patient shaking motion.	Normal module operating report, not error or fault.
Overpressure detected	The blood pressure amplifier is saturated by excessive motion disturbance.	Check whether the airway or air tubing is blocked. Recondition the module.
Exceed measurement range	When any measured value of systolic blood pressure, diastolic blood pressure or mean artery pressure exceeds the nominal measurement range, this technical alarm will be triggered.	Normal application software report, not an error or fault.
Timeout	Indicates that the operation has timed out.	Remeasure

Temp

Status / Error	Description	Corrective Actions
Temperature self-test failed	Power on hardware self-test of temp module failed.	Module abnormal or faulty, it is recommended to power on again. If this symptom cannot be eliminated, it is recommended to replace the Temp module or return to the factory for repair.

ECG

Status / Error	Corrective Actions
Lead(s) off	Normal module operating report, not error or fault.
Unable to detect HR	Normal application software report, not an error or fault.

SpO_2

Status / Error	Corrective Actions
Probe off	Normal module operating report, not error or fault.
SpO_2 module faulty	It is recommended to replace the SpO_2 module or return to the factory for repair.
Unable to detect SpO_2	Normal application software report, not an error or fault.

IBP

Status / Error	Description	Corrective Actions
Transducer error	The transducer signal appears.	The transducer is faulty or the signal line inside the device appears, it is recommended to replace the transducer or return to the factory for repair.
Probe off	IBP cable connector not connected.	Normal prompt message, not an error or fault.
Not zeroed	Each time connecting transducer or selecting another measuring label, perform zero calibration for the module.	Normal prompt message, not an error or fault.
Zeroing OK	Zero calibration result, after successful zero calibration, you can enter the normal measurement process.	Normal prompt message, not an error or fault.
Zeroing failed	Zero calibration failed. The possible reasons are as follows: ● Transducer not connected	Normal prompt message, not an error or fault.

Status / Error	Description	Corrective Actions
	● The measured pressure is pulsating ● Zero pressure out of the measuring range ● Zero calibration time not set	

CO_2

Status / Error	Description	Corrective Actions
Sensor over temp	When the temperature of the sensor is higher than 40℃, the module will send out the information automatically.	Module hardware error or module failure, please return to the factory for repair or replace the sensor.
Sensor faulty	Hardware error, EEPROM checksum error or module failure.	Module hardware error or module failure, please return to the factory for repair or replace the sensor.
No parameter	Barometric pressure and/or gas compensations have not been set since power on.	Wait for the module to complete the setting of barometric pressure and gas compensation. If the information still exists after

Status / Error	Description	Corrective Actions
	For CO_2 to be calculated with the stated accuracy, these values should be set whenever the sensor is plugged in.	more than 20 seconds, consider the following reasons: the module barometric pressure and gas compensation settings are wrong, and the application software fails to issue the setting command.
Module in sleep mode	The sensor is currently in standby state.	Normal module operating report, not error or fault. If this prompt appears during the normal monitoring, it is recommended to start the monitoring operation again for the sensor.
Zero in progress	The module is in the process of zeroing.	Normal report during zero operation, not error or fault.
Sensor warm up	After power on, the module has a preheating process, mainly to detect the temperature of the sensor.	Normal module operating report, not error or fault.
Zero required	When the module's auto zero error occurs.	It is suggested to reset the sensor to zero at this time. If the zero operation fails for more than three times or the request is still reported, it

Status / Error	Description	Corrective Actions
		indicates that the sensor is faulty. Please return to the factory for repair or replace the sensor.
CO_2 out of range	The value being calculated is greater than the upper CO_2 limit (150mmHg). The maximum value output is the upper CO_2 limit.	It is recommended to perform sensor zeroing at this time. If the zeroing operation fails for more than three times or the error is still reported, the sensor is faulty. Please return to the factory for repair or replace the sensor.
Check airway adapter	Usually caused when the airway adapter is removed from the sensor or when there is an optical blockage on the windows of the airway adapter. May also be caused by failure to perform sensor zero when adapter type is changed.	Correctly connect the adapter to eliminate the error. Check if the round transparent window of the adapter is blocked or damaged. It is recommended to replace the adapter.
Check sampling line	When the sampling line is blocked or kinked, the pneumatic pressure is outside	Check for blockage in the sampling line. Check whether the sampling line is tangled.

Status / Error	Description	Corrective Actions
	the expected range.	The error can be eliminated when the airway is unblocked.
Sensor off	When the software system fails to receive any CO_2 data for more than 2 seconds, it is considered that the sensor is off at this time.	Monitoring application software setting status, not reported by the module itself, not an error or fault.
Sensor not ready	When setting the zero operation, the sensor status is not ready. Possible reasons include: Breaths detected The preheating is not completed, and the sensor temperature is not stable The sensor is still in sleep mode Sensor barometric pressure and gas compensation settings are not completed	Normal report during zero operation, not error or fault.

Status / Error	Description	Corrective Actions
Zero in progress	The status information returned by the module during the zero operation.	Normal report during zero operation, not error or fault.
Zero failed and breaths detected	Breathing is detected within 20 seconds of the zero operation.	It is recommended to ensure that there is no breathing gas for at least 20 seconds before the zeroing operation, and perform the zero operation under the condition of clear air to avoid operation failure or zero deviation.

Battery

Status / Error	Corrective Actions
Low battery	Charge the battery in time

24.2 Common Faults

Check the solutions below before requesting service, if you encounter the problems when using the monitor or accessories. If the problem persists, contact your service personnel.

24.2.1 Display Troubleshooting

When there is no display on the screen, follow the steps below:

1. Shut down the device and unplug the power cable.

2. Use a universal meter to check if the outlet has proper voltage.
3. Check the power cable is in good condition, and that it has been properly connected to the monitor and outlet.
4. Remove the fuse from the back cover of this device, and make sure it is in good condition.
5. If all of the above is in good condition, there may be an issue with display screen.

24.2.2 Power Supply Troubleshooting

Symptoms	Possible Causes	Corrective Actions
Battery cannot be recharged and/or fully charged	Battery is defective	Replace the battery
	Main board is defective	Replace the main board

24.2.3 Alarm Troubleshooting

Alarm lamp & alarm sound

Symptoms	Possible Causes	Corrective Actions
The alarm LED does not light	Mainboard is defective	Replace the main board
No alarm sound is issued	Audible alarm is disabled	Check if " " is displayed. If yes, the audible alarm is disabled.
	Speaker is defective	Replace the speaker

	Mainboard is defective	Replace the main board

System alarm

- When the parameter value is higher or lower than the alarm limits, the alarm will issue. Please check whether the alarm limit value is proper or the condition of the patient.
- In case of ECG alarm, check the patient's current condition and check whether the connection of electrode and lead wire is normal.
- Lead(s) off. Please check the connection of the leads.
- Probe off. Please check the connection of the probes.

24.2.4 ECG Troubleshooting

If there are excessive ECG signal interferences or the baseline is too thick, always check the following:

- Check if the plate electrodes are properly located, and if valid plate electrodes are used.
- Check whether the lead wires are properly inserted. If no ECG waveform displayed, check if the ECG lead wires are broken.
- Make sure the mains outlet has standard grounding wire.
- Check if the grounding wire of the apparatus is properly grounded.

24.2.5 SpO_2 and NIBP Troubleshooting

If there are no blood pressure and pulse oxygen measurement results, always check the following:

- Check if the blood pressure cuff is properly wrapped around the arm according to the operating instructions, if

the cuff leaks, and if the inlet is closely connected with the NIBP jack on the side panel.

- Check if the indicator of the pulse oxygen sensor flashes (do not look directly at the lamp in the pulse oximetry sensor) and if the pulse oxygen sensor is properly connected to the SpO_2connector on the side panel.

24.2.6 IBP Troubleshooting

Symptoms	Possible Causes	Corrective Actions
Unable to calibrate	Device malfunction	The pressure hardware may be faulty. Contact the manufacturer or your local distributor.
	Out of range	Confirm that you have selected the value for calibration value that you applying to the transducer, and repeat the calibration.
	No transducer is detected	Check that the transducer is connected and try again.
	Unstable signal is measured	Confirm that there is no disturbance to transducer, and repeat the calibration.
	Perform zero first	No valid zero. Zero the transducer first.
Unable to zero	Device malfunction	The pressure hardware may be faulty. Contact the manufacturer or your local distributor.
	Excessive offset	Confirm that the transducer is vented to air and try again. If this fails, the

Symptoms	Possible Causes	Corrective Actions
	Unstable signal is measured	hardware may be faulty, please change a new adapter cable and try again. If it fails, change a new transducer and try again. If it still fails, please contact the manufacturer or your local distributor.
	No transducer is detected	Check that the transducer is connected and try again. If this fails, exchange the adapter cable and try again. If this fails, exchange the transducer.
	Plusatile pressure	Confirm that the transducer is vented to air, not to the patient, and try again.

24.2.7 CO_2 Troubleshooting

No CO_2 readings

Symptoms	Error Type	Description	Corrective Actions
Sensor temperature is too high	Hardware error	The temperature of the sensor is greater than 40 .	Repair or replace CO_2 sensor
Sensor faulty	Hardware error	Hardware error, EEPROM check error, or module failure	Repair or replace CO_2 sensor

Troubleshooting the sidestream CO_2 sampling

When the sampling system of the sidestream CO_2 module works incorrectly, always check the following:

- Check if the sampling line is kinked.

- If not, remove it from the water trap.
- If the monitor gives a message indicating the airway still works incorrectly, it indicates that the water trap must have been blocked, and you should replace with a new one. Otherwise, you can determine that the sampling line must have been blocked. Replace with a new sampling line.

Chapter 25 Accessories

The accessories listed in this chapter comply with the requirements of IEC 60601-1-2 when in use with the patient monitor. The accessory material that contacts the patients has undertaken the bio-compatibility test and is verified to be in compliance with ISO 10993-1. For details about the accessories, refer to the instructions for use provided with the accessory.

⚠ Warning

Use accessories specified in this chapter. Using other accessories may cause damage to the patient monitor or not meet the claimed specifications in this manual.

⚠ Warning

Check the accessories and their packages for any sign of damage. Do not use them if any damage is detected.

⚠ Warning

Reuse of disposable accessories may cause a risk of contamination and affect the measurement accuracy.

⚠ Warning

Although the accessory material that contacts patients has been evaluated biologically and the biological safety meets the requirements of ISO 10993-1, very few people may have allergic reaction, and those with allergic reaction should stop using it!

❗ 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.

Caution

Use the accessories before the expiration date if an expiration date is indicated.

Caution

Do not use expired accessories.

Caution

Discard disposable accessories according to your local regulations or hospital regulations.

Note

Part No. is subject to change without prior notice, please refer to the label of parts or the supplied package list.

Note

This manual describes all the accessories that are validated for use. Not all accessories are available in every market. Please check availability with your local supplier.

Note

For the replacement cycle and replacement method of the accessories, refer to the instructions for use provided with the accessory.

25.1 ECG Accessories

Accessories	Model	Description	Manufacturer	Applicable Patient
ECG cable and electrode	KE-IGB031	3-lead, snap, defibrillation-proof, reusable	Shenzhen Creative Industry Co., Ltd.	Adult/ Pediatric/ Neonate

Accessories	Model	Description	Manufacturer	Applicable Patient
ECG cable and electrode	KE-IGB051	5-lead, snap, defibrillation-proof	Shenzhen Creative Industry Co., Ltd.	
ECG cable and electrode	KE-IGB061	6-lead, snap, defibrillation-proof	Shenzhen Creative Industry Co., Ltd.	
ECG cable and electrode	KE-IGB101	12-lead, snap, defibrillation-proof	Shenzhen Creative Industry Co., Ltd.	

25.2 Temp Accessories

Accessories	Model	Description	Manufacturer	Applicable Patient
Temp probe	W0001A	10K skin surface	Shenzhen Creative Industry Co., Ltd.	Adult/ Pediatric/ Neonate

25.3 SpO_2 Accessories

Accessories	Model	Description	Manufacturer	Applicable Patient
SpO_2 sensor	KS-AE01	Ear-clip, reusable	Shenzhen Creative Industry Co., Ltd.	Adult/ Pediatric/ Neonate

Accessories	Model	Description	Manufacturer	Applicable Patient
SpO_2 sensor	KS-AC01	Finger-clip, reusable	Shenzhen Creative Industry Co., Ltd.	Adult
SpO_2 sensor	KS-AR01	Large soft finger-cot, reusable	Shenzhen Creative Industry Co., Ltd.	Adult
SpO_2 sensor	KS-AR02	Soft finger-cot, reusable	Shenzhen Creative Industry Co., Ltd.	Pediatric
SpO_2 sensor	KS-ALW02	L-type, with wraps, reusable	Shenzhen Creative Industry Co., Ltd.	Pediatric/ Neonate
SpO_2 sensor	KS-ALW02S	L-type, with wraps, disposable, non-sterile	Shenzhen Creative Industry Co., Ltd.	Neonate
SpO_2 sensor extension cable	KS-AExt01	Reusable	Shenzhen Creative Industry Co., Ltd.	Adult/ Pediatric/ Neonate

25.4 NIBP Accessories

Accessories	Model	Description	Manufacturer	Applicable Patient
Cuff	KN-231	10cm-19cm, reusable	Shenzhen Creative Industry Co., Ltd.	Adult/ Pediatric
Cuff	KN-233	18cm-26cm, reusable	Shenzhen Creative Industry Co., Ltd.	Adult/ Pediatric
Cuff	KN-241	25cm-35cm, reusable	Shenzhen Creative Industry Co., Ltd.	Adult/ Pediatric
Cuff	KN-243	33cm-47cm, reusable	Shenzhen Creative Industry Co., Ltd.	Adult/ Pediatric

25.5 CO_2 Accessories

Accessories	Model	Description	Manufacturer	Applicable Patient
CO_2 module (sidestream)	LoFlo	Sidestream	Respironics California, LLC	Adult/ Pediatric/ Neonate
Sampling cannula	#3475-00	Disposable, non-sterile	Respironics California, LLC	
CO_2 module (mainstream)	CAPONSTAT 5	Mainstream	Respironics California, LLC	
Sampling adapter	#606300	Disposable, non-sterile	Respironics California, LLC	Adult

Accessories	Model	Description	Manufacturer	Applicable Patient
CO_2 module (sidestream)	Capnograph_S	Sidestream	Beijing Kingst Commercial and Trade Co., Ltd.	Adult/ Pediatric/ Neonate
CO_2 sampling line	/	240cm-ϕ2.5*1.6, two male heads	Beijing Kingst Commercial and Trade Co., Ltd.	
Filter	2500-0000218	T4F/T3	Beijing Kingst Commercial and Trade Co., Ltd.	
CO_2 module (mainstream)	Capnograph_M	Mainstream	Beijing Kingst Commercial and Trade Co., Ltd.	
Airway adapter	2301-0000034	V9 / mainstream	Beijing Kingst Commercial and Trade Co., Ltd.	Adult

25.6 IBP Accessories

Accessories	Part No.	Description	Manufacturer	Applicable Patient
IBP transducer	15030120	Disposable	Beijing Target Medical Technologies, Inc.	Adult/ Pediatric/ Neonate
IBP cable	15039057	4 pin, plastic, reusable	Shenzhen Creative Industry Co., Ltd.	

25.7 Other Accessories

Accessories	Specification / Model	Manufacturer
Rechargeable lithium battery	HYLB-2260/10.95V/2750mAh	Shenzhen Hengyu Electric Energy Technology Co., Ltd.
Rechargeable lithium battery	HYLB-2261/10.95V/5500mAh	Shenzhen Hengyu Electric Energy Technology Co., Ltd.

Appendix A Technical Specifications

A.1 Safety Specifications

Standards	Safety standards	IEC 60601-1 IEC 60601-2-27
Classifications	Anti electric-shock type	Class I and internally powered device
	Anti electric-shock degree	Type CF with defibrillation protection
	Electromagnetic compatibility	Group I, Class A
	Operation mode	Continuous
	Degree of protection against harmful ingress of water	Main unit: IPX2 SpO_2 probes: IPX2 (IPX2 means protection from water that hits the product at a 15° angle or less.)
	Disinfection/sterilization method	Refer to *Chapter 22 Cleaning and Disinfection* for details.
	Installation method	Non-permanent installation device
	Degree of safety of application in the presence of flammable anesthetic mixture with air or with oxygen or nitrous oxide	The device is not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide

A.2 Environmental Specifications

Environment	Temperature	Relative Humidity (non-condensing)	Atmospheric Pressure
Operating	5 ～40	15%～95%	57.0kPa～107.4kPa
Storage and Transportation	-20 ～+60	10%～95%	50.0kPa～107.4kPa

A.3 Power Supply Specifications

External Power Supply		
Input Voltage	100 -240 V~	
Input Current	2.0 0.9A	
Frequency	50/60Hz	
Battery		
Configuration	Standard	Optional
Type	Lithium ion rechargeable battery	Lithium ion rechargeable battery
Rated Voltage	10.95 V	10.95 V
Battery Capacity	2750 mAh	5500 mAh
Run Time	After the battery is fully charged, NIBP will perform a measurement every 15 minutes in the standard configuration of the monitor, and the	After the battery is fully charged, NIBP will perform a measurement every 15 minutes under the standard configuration

	continuous working time is not less than 4 hours.	of the monitor, and the continuous working time is not less than 8 hours.
Charging Time	When charged by external AC power supply, after the device is turned off, the charging time is as follows: Time of charging to 90% is less than 3 hours. Time of charging to 100% is less than 4 hours. When charged by external AC power supply, after the device is turned on, the charging time is as follows: Time of charging to 90% is less than 5 hours. Time of charging to 100% is less than 6 hours.	When charged by external AC power supply, after the device is turned off, the charging time is as follows: Time of charging to 90% is less than 5 hours. Time of charging to 100% is less than 6 hours. When charged by external AC power supply, after the device is turned on, the charging time is as follows: Time of charging to 90% is less than 9 hours. Time of charging to 100% is less than 10 hours.
Shutdown Delay	At least 5 minutes (since the first low battery alarm)	

A.4 Physical Specifications

Model	AIView V10, PH10, LeMonitor V10	AIView V12, PH12, LeMonitor V12

Main Unit Size (L×W×H)	≤290mm×170mm×230mm	≤330mm×170mm×25 mm
Net Weight	≤ 3 kg	≤ 4 kg
Display Screen	11.6 inches, color TFT LCD screen Resolution: 1366×768 pixels	13.3 inches, color TFT LCD screen Resolution: 1920×1080 pixels
Indicators	Power button backlight: 1 (Green) AC power indicator: 1 (Green) Battery status indicator: 1 (Yellow and green) Alarm indicator: 1 alarm indicator (Red and yellow) 1 technical alarm indicator (Red and yellow)	
Speaker	Give tones include but not limited to: alarm tones (45db to 85db), button tones, QRS tones and power-on self-check sound. Support PITCH TONE and multi-level tone modulation. The alarm tones comply with IEC 60601-1-8.	
Connector	AC power input connector: 1 Network connector: 1 USB connector: 2 VGA connector: 1 Equipotential grounding terminal: 1 Multi-function connector: 1 (used as ECG analog output connector, synchronous defibrillation analog output connector or nurse call connector)	

	Parameter connector: 1 ECG/RESP connector 1 SpO_2 connector 1 NIBP connector 2 TEMP connectors 2 IBP connectors 1 CO_2 connector
Thermal recorder	Thermal dot matrix recorder Horizontal resolution: 8 dot/mm Vertical resolution: 8 dot/mm Recording paper width: 50 mm ± 1 mm Paper speed: 25 mm/s, 50 mm/s, error ≤ ±5%

A.5 Signal Outputs Specifications

Auxiliary output	
Standard	Meets the requirements of IEC 60601-1 for short-circuit protection and leakage current
ECG analog output	
Bandwidth (-3dB; reference frequency: 10Hz)	0.5 Hz ~ 40 Hz
QRS delay	< 25ms(non-paced)
Output sensitivity	0.4 V/mV5%
Baseline level	2.20 ± 0.2 V
Output impedance	⩽ 100 Ω

Duration of short-circuit	Short circuit to ground for 1 minute, no fault after disconnection.
Defibrillation synchronization signal output	
Output impedance	⩽ 100 Ω
Maximum time delay	30 ms
Amplitude	High level: 3.5 V to 5 V, providing a maximum of 10 mA output current; Low level: < 0.5 V, receiving a maximum of 5 mA input current.
Pulse width	100 ms ± 10%
Rising and falling time	≤ 1 ms
Duration of short-circuit	Short circuit to ground for 1 minute, no fault after disconnection.
Nurse call signal output	
Amplitude	10～15V
Maximum load current	350mA
Duration of short-circuit	Lasting short-circuits is allowable, and it can return to normal automatically.
Alarm Output	
Alarm delay	When the parameter value reaches the alarm condition, the alarm delay time is 4s for low priority alarm, 4s for medium priority alarm, and 3s for high priority alarm.

	The alarm delay time from the monitor to the remote device is 0.5s.
Alarm signal sound pressure level range	45 db(A) to 85 db(A) within a range of one meter

A.6 Data Storage

Patients	100
Trend data	240 hours
Full-disclosure waveforms	140 hours
NIBP measurements	2000 sets
Physiological alarm events	1000 events
Technical alarm events	1000events
Reports	20 sets

A.7 Wi-Fi Specifications

Protocol	IEEE 802.11 a/b/g/n (2.4GHz & 5GHz)
Operating frequency	2412 MHz – 2484 MHz 4.9 GHz – 5.975 GHz
Modulation mode	OFDM with BPSK, QPSK, 16-QAM, and 64-QAM, 802.11b with CCK and DSSS
Wireless security features	WPA/WPA2-Personal WPA/WPA2 Enterprise for Client EAP-TLS EAP-FAST EAP-TTLS PEAP-MSCHAP-v2
Data security	AES128/256, SHA256/384/512, RSA, ECC, ECDH, RNG, CRC

A.8 ECG Specifications

ECG	
Compliant standards	IEC 60601-2-27: 2011 and IEC 60601-2-25: 2011
Lead type	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
Sampling rate	2000Hz
Skew between channels	≤ 100μs
Bandwidth	0.05 Hz ~ 150 Hz
Amplitude quantisation	4.9 μV/LSB
Waveform sweeping speed	6.25mm/s, 12.5mm/s, 25mm/s, 50mm/s error: ≤ ±5%
Frequency response	Diagnostic mode: 0.05 Hz ~ 150 Hz Monitor mode: 0.5 Hz ~ 40 Hz Surgery mode: 1 Hz~ 20 Hz ST mode: 0.05 Hz ~ 40 Hz Use A and D methods based on IEC 60601-2-25 to determine frequency response.
Display sensitivity	2.5mm/mV (×1/4), 5mm/mV (×1/2), 10mm/mV (×1), 20mm/mV (×2), 40mm/mV (×4), Auto. Error: ±5%
Common mode rejection ratio	Surgery mode, monitor mode, ST mode > 105dB Diagnostic mode > 90dB

Input impedance	>10 MΩ
Input signal range	-10.0mV～+10.0mV (peak-to-peak value)
Electrode polarization voltage range	±800 mV
Input offset current	≤0.1μA
Baseline recovery time	<5 s after defibrillation
Patient leakage current	10μA
System noise	≤30 μV (p-v RTI)
Calibration voltage	1mV, error range ±5%
ESU protection	ESU cutting power: 300 W ESU coagulating power: 100 W Recovery time: <10 s Heart rate change under ESU interference: < ±10%
Defibrillation protection	Recovery time of electrode polarization: <10 s
Timing accuracy	Total error within 24 hours: ≤30 s
Pace Pulse	
Pulse marking	It can mark pacing pulses with an amplitude of ±2mV - ±700mV and a pulse width of 0.1 ms-2 ms.

Pulse rejection	When tested in accordance with the IEC 60601-2-27: 201.12.1.101.13, the heart rate meter rejects all pulses meeting the following conditions. Amplitude: ±2mV to ±700mV Width: 0.1ms to 2ms No overshoot Minimum input slew rate: 5.5V/s RTI
HR	
Measurement range	Adult: 15bpm-300bpm Pediatric: 15bpm-350bpm Neonate: 15bpm-350bpm
Resolution	1 bpm
Measurement accuracy	±1% or ±1 bpm, whichever is greater
Alarm limit setting range	High limit: 16bpm～350bpm Low limit: 15bpm～349bpm
Alarm limit setting resolution	1 bpm
Alarm limit accuracy	±1 bpm
Tall T-wave rejection capability	For T wave with QRS wave of 100ms, QT interval of 350ms, duration of 180ms and amplitude lower than 1.2mV, the heart rate calculation is not affected.
Minute heart rate averaging algorithm	The lastest 8 RR intervals are all in a certain range of average heart beats. Display refresh rate: 1 beat/s

Response time to heart rate changes	Meets the requirements of IEC 60601-2-27: Clause 201.7.9.2.9.101 b) 5). From 80 bpm to 120 bpm: less than 8 s From 80 bpm to 40 bpm: less than 8 s
Accuracy of heart rate meter and its response to irregular rhythm	In compliance with the requirements in Clause 201.7.9.2.9.101 b) 4) of IEC 60601-2-27, the heart rate after 20 seconds of stabilization is displayed as follows: Ventricular bigeminy (waveform A1): 80 bpm Slow alternating ventricular bigeminy (waveform A2): 60 bpm Rapid alternating ventricular bigeminy (waveform A3): 120 bpm Bidirectional systoles (waveform A4): 90 bpm
Time to alarm for tachycardia	<11s (applicable to all clauses of IEC 60601-2-27)
ST Segment Analysis	
Measurement range	-2.0 mV~+2.0 mV
Measurement accuracy	-0.8 mV~0.8 mV: ±0.02 mV or ±10%, whichever is greater. Beyond this range: not defined.
Resolution	0.01 mV
ST alarm high limit	(low limit + 0.2 mV)～2.0 mV
ST alarm low limit	-2.0 mV～(high limit - 0.2 mV)
QT/QTc Analysis	

Measurement range	QT: 200 ms～800ms QTc: 200 ms～800ms
Measurement accuracy	QT: 30 ms QTc: not defined
QTc alarm high limit	200 ms～800ms
ΔQTc alarm high limit	30 ms～200ms

A.9 Resp Specifications

Respiration excitation waveform	<300 μA RMS, 52 kHz (±10%)	
Respiration rate measurement range	Adult: 0 rpm～120 rpm Pediatric and neonate: 0 rpm～150 rpm	
Respiration rate measurement accuracy	Adult: 7-120 rpm: ±2 rpm or ±2%, whichever is greater Pediatric/neonate: 7-150 rpm: ±2 rpm or ±2%, whichever is greater 0～6 rpm: not defined	
Alarm limit setting range	Adult	Pediatric and neonate
	High limit: 1rpm～120rpm	High limit: 1rpm～150rpm
	Low limit: 0 rpm～119 rpm	Low limit: 0 rpm～149 rpm
Alarm accuracy	±1 rpm	

Apnea alarm delay setting range	5 s～120 s

A.10 Temp Specifications

Compliant standards	ISO 80601-2-56: 2017
Measurement range	0℃～50℃ (32°F～122°F)
Measurement mode	Direct mode
Measurement accuracy	within the range of 0℃～50℃, the maximum allowable error is ±0.1℃ (without probe) within the range of 25℃～45.0℃, the maximum allowable error is ±0.2℃ (with probe) within other measurement ranges, the maximum allowable error is ±0.4℃ (with probe)
Minimum time for accurate measurement	Body surface: <100 s Body cavity: <80 s
System response time	<150 s
Alarm limit setting range	High limit: 0.1 ℃～50.0 ℃ Low limit: 0.0 ℃～49.9 ℃
Alarm accuracy	±0.1℃

A.11 NIBP Specifications

Compliant standards	IEC 80601-2-30: 2018
Measurement method	Manual, Auto, Sequence, ABPM
Automatic measurement mode repetition intervals	1min, 2min, 2.5min, 3min, 5mins, 10min, 15min, 20min, 30min, 1h, 1.5h, 2h, 3h, 4h, 8h, Clock 30min, Clock 1h, Clock 2h, Clock 3h
Continuous measurement mode time	5 min
Maximum single measurement time	Adult and pediatric: no more than 180s
Venipuncture measurement time	Adult and pediatric: no more than 180s
Static pressure measurement range	0 mmHg～300 mmHg (0.0 kPa～40.0 kPa)
Static pressure measurement accuracy	±3 mmHg (±0.4 kPa)
Initial inflating pressure setting range	Adult: 80 mmHg～280 mmHg (10.6 kPa～37.2 kPa) Pediatric: 80 mmHg～210 mmHg (10.6 kPa～27.9 kPa)

<table>
<tr><td>Default value of initial inflating pressure</td><td colspan="4">Adult: 160 mmHg (21.3 kPa)
Pediatric: 140 mmHg (18.6 kPa)</td></tr>
<tr><td>Overvoltage protection</td><td colspan="4">Adult: ≤297 mmHg (39.5kPa) ±3 mmHg (±0.4kPa)
Pediatric: ≤247 mmHg (32.9kPa) ±3 mmHg (±0.4kPa)</td></tr>
<tr><td rowspan="7">Monitoring range</td><td colspan="2">Blood pressure (unit)</td><td>Adult</td><td>Pediatric</td></tr>
<tr><td rowspan="2">SYS</td><td>mmHg</td><td>25～290</td><td>25～240</td></tr>
<tr><td>kPa</td><td>3.3～38.6</td><td>3.3～31.9</td></tr>
<tr><td rowspan="2">MAP</td><td>mmHg</td><td>15～260</td><td>15～215</td></tr>
<tr><td>kPa</td><td>2.0～34.6</td><td>2.0～28.6</td></tr>
<tr><td rowspan="2">DIA</td><td>mmHg</td><td>10～250</td><td>10～200</td></tr>
<tr><td>kPa</td><td>1.3～33.3</td><td>1.3～26.6</td></tr>
<tr><td>Monitoring accuracy</td><td colspan="4">Average deviation ≤±5mmHg (±0.67 kPa)
Standard deviation ≤8mmHg (1.067 kPa)</td></tr>
<tr><td rowspan="4">Alarm limit setting range</td><td colspan="2">Blood pressure (mmHg/kPa)</td><td>Adult</td><td>Pediatric</td></tr>
<tr><td rowspan="2">SYS</td><td>High limit</td><td>(26～290)/
(3.5～38.6)</td><td>(26～240)/
(3.5～30.0)</td></tr>
<tr><td>Low limit</td><td>(25～289)/
(3.3～38.5)</td><td>(25～239)/
(3.3～31.8)</td></tr>
<tr><td>MAP</td><td>High limit</td><td>(16～260)/
(2.1～34.6)</td><td>(16～215)/
(2.1～28.6)</td></tr>
</table>

		Low limit	(15～259)/ (2.0～34.5)	(15～214)/ (2.6～28.5)
	DIA	High limit	(11～250)/ (1.5～33.3)	(11～200)/ (1.5～26.6)
		Low limit	(10～249)/ (1.3～33.1)	(10～199)/ (1.3～26.5)
Venipuncture				
Pressure setting range	Adult: 20 mmHg-120 mmHg (2.7 kPa-16.0 kPa), step 10 mmHg Pediatric: 20 mmHg-80 mmHg (2.7 kPa-10.6 kPa), step 10 mmHg			
Allowable error of cuff inflating pressure	±5 mmHg (±0.67kPa)			

A.12 SpO_2 Specifications

Compliant standards	ISO 80601-2-61: 2011
Measurement range	0%～100%
Measurement accuracy	70%~100%: ±2%
SpO_2 accuracy test	The SpO_2 measurements are statistically distributed, only about 2/3 of SpO_2 measurements can be expected to fall within ±Arms of the value measured by a CO-Oximeter.

Sensor	Wavelength: Red light: 660nm, Infrared light: 905nm Maximum optical output power: ≤2mW
Data update cycle	≤8s
Perfusion index (PI) measurement range	0.1%～20%, the measurement accuracy is not defined
Alarm limit setting range	High limit: 1%～100% Low limit: 0%～99%
Alarm accuracy	70%~100%: ±1%

SpO_2 accuracy study and results

According to the requirements of the standard and the needs of clinical data statistics, 20 adult volunteers were selected (including 8 males, 12 females; 4 light-skinned people, 6 dark-skinned people; age distribution: 20-30 years old: 10; 31-40 years old: 10) as the subjects.

Sensor	Item	Results
KS-AC01	Group count	347
	Mean deviation	-0.91
	Arms(%)	1.71
KS-AR01	Group count	347
	Mean deviation	-0.95
	Arms(%)	1.54
KS-AR02	Group count	347
	Mean deviation	-1.24

	Arms(%)	2.01
KS-ALW02	Group count	461
	Mean deviation	-1.23
	Arms(%)	2.2
KS-AE01	Group count	347
	Mean deviation	0.38
	Arms(%)	1.6

SpO_2 accuracy for Fitzpatrick style I-IV

Sensor	Item	SpO_2 Range (%)			
		70-100 (Overall)	70-80	80-90	90-100
KS-AC01	# of data pairs	231	65	79	87
	Bias	-0.8	-0.37	-1.02	-0.93
	Arms	1.67	2	1.71	1.34
KS-AR01	# of data pairs	231	65	79	87
	Bias	-0.92	-0.83	-1.18	-0.74
	Arms	1.55	1.73	1.79	1.12
KS-AR02	# of data pairs	231	65	79	87
	Bias	-1.32	-1.72	-1.5	-0.86
	Arms	2.08	2.6	2.2	1.43
KS-ALW02	# of data pairs	321	82	111	128
	Bias	-1.16	-0.9	-1.56	-0.99

	Arms	2.07	2.21	2.39	1.63
KS-AE01	# of data pairs	231	65	79	87
	Bias	0.19	0.55	-0.07	0.15
	Arms	1.59	1.9	1.7	1.18

SpO_2 accuracy for Fitzpatrick style V-VI

Sensor	Item	SpO_2 Range (%)			
		70-100 (Overall)	70-80	80-90	90-100
KS-AC01	# of data pairs	116	37	45	34
	Bias	-1.13	-1.49	-1.18	-0.67
	Arms	1.77	2.12	1.87	1.1
KS-AR01	# of data pairs	116	37	45	34
	Bias	-1.02	-1.38	-1.22	-0.35
	Arms	1.53	1.82	1.67	0.79
KS-AR02	# of data pairs	116	37	45	34
	Bias	-1.07	-1.46	-1.42	-0.17
	Arms	1.88	2.33	1.96	1.02
KS-ALW02	# of data pairs	140	42	54	44
	Bias	-1.39	-1.12	-1.88	-1.05
	Arms	2.46	2.38	2.9	1.89

KS-AE01	# of data pairs	116	37	45	34
	Bias	0.78	1.4	0.6	0.33
	Arms	1.63	2.18	1.44	1.06

SpO_2 accuracy for female

Sensor	Item	SpO_2 Range (%)			
		70-100 (Overall)	70-80	80-90	90-100
KS-AC01	# of data pairs	166	51	63	52
	Bias	-0.7	-0.78	-0.8	-0.51
	Arms	1.69	2.21	1.63	1.04
KS-AR01	# of data pairs	166	51	63	52
	Bias	-0.92	-1.29	-0.96	-0.52
	Arms	1.56	1.93	1.62	0.98
KS-AR02	# of data pairs	166	51	63	52
	Bias	-1.07	-1.62	-1.23	-0.33
	Arms	1.95	2.42	2.06	1.14
KS-ALW02	# of data pairs	280	73	104	103
	Bias	-1.32	-1.41	-1.74	-0.84
	Arms	2.17	2.31	2.54	1.57
KS-AE01	# of data pairs	166	51	63	52

	Bias	0.21	0.54	0.22	-0.12
	Arms	1.63	1.94	1.66	1.19

SpO_2 accuracy for male

Sensor	Item	SpO_2 Range (%)			
		70-100 (Overall)	70-80	80-90	90-100
KS-AC01	# of data pairs	181	51	61	69
	Bias	-1.11	-0.78	-1.36	-1.13
	Arms	1.72	1.85	1.9	1.43
KS-AR01	# of data pairs	181	51	61	69
	Bias	-0.97	-0.78	-1.44	-0.71
	Arms	1.53	1.58	1.87	1.07
KS-AR02	# of data pairs	181	51	61	69
	Bias	-1.39	-1.64	-1.72	-0.92
	Arms	2.07	2.59	2.17	1.45
KS-ALW02	# of data pairs	181	51	61	69
	Bias	-1.09	-0.35	-1.54	-1.24
	Arms	2.24	2.21	2.62	1.87
KS-AE01	# of data pairs	181	51	61	69
	Bias	0.54	1.18	0.13	0.44
	Arms	1.58	2.06	1.56	1.11

SpO_2 accuracy for pediatric

Sensor	Item	SpO_2 Range (%)			
		70-100 (Overall)	70-80	80-90	90-100
KS-ALW02	# of data pairs	280	73	104	103
	Bias	-1.32	-1.41	-1.74	-0.84
	Arms	2.17	2.31	2.54	1.57

A.13 PR Specifications

Alarm limit setting range	High limit: 1 bpm～250 bpm Low limit: 0 bpm～249 bpm
Alarm accuracy	±1% or ±1bpm, whichever is greater
PR from NIBP module	
Measurement range	30bpm～250bpm
Measurement accuracy	±3bpm or ±3%, whichever is greater
PR from SpO_2 module	
Measurement range	30bpm～250bpm
Measurement accuracy	±2bpm or ±2%, whichever is greater
PR from IBP module	
Measurement range	20bpm～250bpm
Measurement accuracy	±1 bpm or ±1%, whichever is greater

A.14 CO_2 Specifications

Compliant standards	ISO 80601-2-55: 2018

Measurement mode	Sidestream and mainstream
Measurement range	0 mmHg～150 mmHg (0 kPa～20.0 kPa)
Measurement accuracy	Accuracy in mmHg ±2 mmHg for CO_2 range 0-40 mmHg ±5% for CO_2 range from 41-70 mmHg ±8% for CO_2 range from 71-100 mmHg ±10% for CO_2 range from 101-150 mmHg
	Accuracy in kPa ±0.27 kPa for CO_2 range (0 kPa~5.3 kPa ±5% of gas level for CO_2 range (5.5 kPa~9.3 kPa) ±8% of gas level for CO_2 range (9.5 kPa~13.3 kPa) ±10% of gas level for CO_2 range (13.5 kPa~20 kPa)
	Accuracy in vol% ±0.26% for CO2 range (0%~5.3%) ±5% of gas level for CO2 range (5.4%~9.2%) ±8% of gas level for CO2 range (9.3%~13.2%) ±10% of gas level for CO2 range (13.3%~19.7%)
	Note 1: 1 kPa≈7.5 mmHg, 1 vol%≈7.6 mmHg Note 2: 5%, 8% and 10% are all relative errors Note 3: The CO_2 accuracy ranges are defined based on the original unit of mmHg. When converted to kPa or vol%, the values are rounded to one decimal place, which may

<table>
<tr><td></td><td colspan="3">result in discontinuities at certain boundary points (e.g. 5.4 kPa). In such cases, the accuracy requirements shall be interpreted according to the original mmHg-based intervals to ensure complete coverage.</td></tr>
<tr><td>Alarm limit setting range</td><td colspan="3">High limit: 1mmHg-150mmHg (0.13 kPa-20kPa)
Low limit: 0 mmHg-149mmHg (0 kPa-19.8kPa)</td></tr>
<tr><td>Alarm accuracy</td><td colspan="3">±1mmHg (±0.13kPa)</td></tr>
<tr><td>Sampling rate (sidestream)</td><td colspan="3">50 ml/min fixed flow rate</td></tr>
<tr><td>Response time and rise time</td><td colspan="3">Sidestream: response time < 9 s
rise time (t 10-90%) is about 70 ms
Mainstream: response time
rise time < 60 ms</td></tr>
<tr><td>RR test method</td><td colspan="3">Measure RR with respiratory simulator and I/E ratio as 1:1 according to EN ISO 80601-2-55 fig 201.101</td></tr>
<tr><td rowspan="5">$EtCO_2$ inaccuracy factor</td><td colspan="3">The $EtCO_2$ measurement accuracy is affected by the respiration rate. High RR causes a slight decrease in $EtCO_2$ measurement accuracy.</td></tr>
<tr><td>$EtCO_2$ (mmHg)</td><td>Respiration Rate (rpm)</td><td>Accuracy</td></tr>
<tr><td rowspan="2">0-40</td><td>0-79</td><td>±2 mmHg</td></tr>
<tr><td>>80</td><td>±12%</td></tr>
<tr><td>41-70</td><td>0-79</td><td>±5%</td></tr>
</table>

<table>
<tr><td rowspan="6"></td><td></td><td>>80</td><td>±12%</td></tr>
<tr><td rowspan="2">70-100</td><td>0-79</td><td>±8%</td></tr>
<tr><td>>80</td><td>±12%</td></tr>
<tr><td rowspan="2">>100</td><td>0-79</td><td>±10%</td></tr>
<tr><td>>80</td><td>±12%</td></tr>
<tr><td>Drift of measurement accuracy</td><td colspan="3">Short-term: The module works for more than 4 hours, and the maximum drift does not exceed 0.8mmHg.
Long-term: The module works for more than 120 hours and still meets the specified performance standards.</td></tr>
<tr><td>Warm-up time</td><td colspan="3">The time of reaching the specified working performance after the CO_2 module is switched on:
Mainstream: Parameters can be displayed within 15 s, and the ambient temperature is 25°C, and it takes 2 minutes to reach the specified working performance standard.
Sidestream: Parameters can be displayed within 20 s, and the ambient temperature is 25°C, and it takes 2 minutes to reach the specified working performance standard.</td></tr>
<tr><td>Maximum time interval of intervention</td><td colspan="3">When the sampling gas temperature is 37 degrees, the indoor temperature is 23 degrees, and the sampling relative humidity is 100%, the maximum time interval for the operator to intervene in the water and gas treatment system is 120 hours.</td></tr>
<tr><td colspan="4">Apnea</td></tr>
</table>

Measurement range	Sidestream: 2 rpm~150 rpm Mainstream: 0 rpm~150 rpm
Measurement accuracy	±2 rpm
Apnea alarm delay	0~60 s

A.15 IBP Specifications

Compliant standards	IEC 60601-2-34: 2011
Measurement range	-50mmHg-300mmHg (-6.7kPa-40.0kPa)
Measurement accuracy	±1mmHg (±0.1kPa) or ±2%, whichever is greater (main unit)
Resolution	1mmHg (0.1kPa)
Alarm limit setting range (adult)	**ART (SYS, DIA, MAP):** High limit: 1mmHg-300mmHg (0.1kPa-40.0kPa) Low limit: 0mmHg-299mmHg (0kPa-36.7kPa) **PA (SYS, DIA, MAP):** High limit: 1mmHg-120mmHg (0.1kPa-16.0kPa) Low limit: 0mmHg-119mmHg (0kPa-15.8kPa) **CVP, RAP, LAP, ICP (SYS, DIA, MAP):** High limit: -9mmHg-40mmHg (-1.2kPa-5.3kPa) Low limit: -10mmHg-39mmHg (-1.3kPa-5.2kPa) **P1, P2 (SYS, DIA, MAP):**

	High limit: -49mmHg-300mmHg (-6.5kPa-40.0kPa) Low limit: -50mmHg-299mmHg (-6.7kPa-39.8kPa) **CPP (SYS, DIA, MAP):** High limit: -49mmHg-300mmHg (-6.5kPa-40.0kPa) Low limit: -50mmHg-299mmHg (-6.7kPa-39.8kPa)
Alarm accuracy	±1mmHg (±0.1kPa)
Pressure transducer	
Sensitivity	5V/Volt/mmHg
Impedance range	300 to 3000Ω
Volume output	<0.02mm³/100mmHg
Warm-up time	15 s
Measurement accuracy	±4 mmHg (±0.5 kPa) at a frequency of 1 Hz
PPV	
Measurement range	0%-50%
Resolution	1%
CPP	
Measurement range	-50mmHg-300mmHg
PAWP	
Measurement range	-50mmHg-300mmHg

A.16 Arrhythmic Events

No.	ECG arrhythmic event

1	Asystole
2	Ventricular tachycardia/ventricular fibrillation
3	Ventricular tachycardia
4	Ventricular bradycardia
5	Extreme tachycardia
6	Extreme bradycardia
7	R on T
8	Run of premature ventricular contractions
9	Paired premature ventricular contractions
10	Premature ventricular contractions
11	Multiform premature ventricular contractions
12	Ventricular premature beat bigeminy
13	Ventricular premature beat trigeminy
14	Tachycardia
15	Bradycardia
16	Pacemaker not capturing
17	Pacemaker not pacing
18	Missed beat
19	Nonsustained ventricular tachycardia
20	Ventricular rhythm
21	Heartbeat pause
22	Irregular rhythm
23	Atrial fibrillation
24	PVCs/min high
25	Pauses/min high

26	Irregular rhythm end
27	Atrial fibrillation end
28	High heart rate atrial fibrillation

Appendix B Alarms

This chapter lists only the most important physiological and technical alarm messages. Some messages appearing on your monitor may not be included.

B.1 Physiological Alarms

Alarm Category	Alarm Messages	Configurable Priorities	Default Priority
General	XX High	Med, High	Med
	XX Low		
Arrhythmia	Asystole	High	High
	V-Fib/V-Tach	High	High
	Vent Tachy	High	High
	Vent Brady	High	High
	Extreme Tachy	High	High
	Extreme Brady	High	High
	Nonsus V-Tach	Prompt, Low, Med, High	Med
	Vent Rhythm	Prompt, Low, Med, High	Med
	Run PVCs	Prompt, Low, Med, High	Med
	Pair PVCs	Prompt, Low, Med, High	Med
	R on T	Prompt, Low, Med, High	Med
	Vent Bigeminy	Prompt, Low, Med, High	Med
	Vent Trigeminy	Prompt, Low, Med, High	Med
	PVCs/min	Prompt, Low, Med, High	Med
	Multiform PVC	Prompt, Low, Med, High	Med

Alarm Category	Alarm Messages	Configurable Priorities	Default Priority
	PVC	Prompt, Low, Med, High	Med
	SV Tachy	Prompt, Low, Med, High	Med
	SV Brady	Prompt, Low, Med, High	Med
	A-Fib (HR High)	Prompt, Low, Med, High	Med
	A-Fib	Prompt, Low, Med, High	Prompt
	A-Fib End	Prompt, Low, Med, High	Med
	Irr Rhythm	Prompt, Low, Med, High	Med
	Irr Rhy End	Prompt, Low, Med, High	Med
	Pause	Prompt, Low, Med, High	Med
	Pauses/min	Prompt, Low, Med, High	Med
	Missed Beats	Prompt, Low, Med, High	Med
	Pacer Not Pacing	Prompt, Low, Med, High	Med
	Pacer Not Capture	Prompt, Low, Med, High	Med
ST	ST-XX (lead) High/Low	Low, Med, High	Med
QT	QTc High	Low, Med, High	Med
	ΔQTc High	Low, Med, High	Med
ECG	Extreme Tachy	High	High
	Extreme Brady	High	High
Resp	Apnea	High	High
	Resp Artifact	High	High
SpO_2	SpO_2 Desat	High	High
	SpO_2 Event	Low, Med	Low

Alarm Category	Alarm Messages	Configurable Priorities	Default Priority
CO_2	Apnea	High	High
IBP	Rapid BP Drop	High	High

Note: “XX” represents a measurement or parameter label, such as HR, ST, RR, SpO_2 or PR, etc.

B.2 Technical Alarms

Default Priority	Alarm Source	Alarm Messages
High	System	Battery low, unknown error
	CO_2	CO_2 sensor failure, CO_2 sensor temperature too high
	PR	Pulse not found
Medium	ECG / SpO_2	Lead(s) off, Probe off
	CO_2	CO_2 sensor off, Zero required, CO_2 out of range, check airway adapter, check sampling line, zero failed (in zero operation
Low	NIBP	Self test failed, system error, measurement timeout, signal weak, cuff error, air leakage, pressure error, out of range, arm motion, overpressure detected, signal saturation, test air leakage
	Temp	Self test failed

Appendix C Default Settings

This chapter lists only the most important default settings of your monitor as it is delivered from the factory.

☞ **Note**

If your monitor has been ordered preconfigured to your requirements, the settings at delivery will be different from those listed here.

C.1 Alarm Default Settings

Item / Parameter		Adult	Pediatric	Neonate
HR/PR	Switch	On	On	On
	High	120 bpm	160 bpm	200 bpm
	Low	50 bpm	75 bpm	100 bpm
	Priority	Med	Med	Med
	Alarm Outputs	Off	Off	Off
	Alarm Source	Auto	Auto	Auto
ST-I, ST-II, ST-III, ST-aVR, ST-aVL, ST-aVF,	Switch	Off	Off	Off
	High	0.2mV	0.2mV	0.2mV

Item / Parameter		Adult	Pediatric	Neonate
ST-V1, ST-V2, ST-V3, ST-V4, ST-V5, ST-V6, ST-V, ST-Va, ST-Vb	Low	-0.2mV	-0.2mV	-0.2mV
	Priority	Med	Med	Med
	Alarm Outputs	Off	Off	Off
QTc	Switch	Off	Off	Off
	High	500	480	460
	Priority	Med	Med	Med
	Alarm Outputs	Off	Off	Off
ΔQTc	Switch	Off	Off	Off
	High	60	60	60
	Priority	Med	Med	Med
	Alarm Outputs	Off	Off	Off
RR	High	30 rpm	30 rpm	100 rpm
	Low	8 rpm	8 rpm	30 rpm
	Switch	On	On	On
	Priority	Med	Med	Med

Item / Parameter		Adult	Pediatric	Neonate
	Alarm Outputs	Off	Off	Off
Apnea	Switch	On	On	On
	Priority	High	High	High
	Apnea Delay	20s	20s	15s
	Alarm Outputs	Off	Off	Off
Temp1, Temp2	High	38.0 ℃	38.0 ℃	38.0 ℃
	Low	35.0 ℃	35.0 ℃	35.0 ℃
	Switch	On	On	On
	Priority	Med	Med	Med
	Alarm Outputs	Off	Off	Off
ΔT	ΔT	2.0 ℃	2.0 ℃	2.0 ℃
	Switch	On	On	On
	Priority	Med	Med	Med
	Alarm Outputs	Off	Off	Off
SpO_2	Switch	On	On	On
	High	100 %	100 %	95 %
	Low	90 %	90 %	90 %
	Priority	Med	Med	Med

Item / Parameter		Adult	Pediatric	Neonate
	Alarm Outputs	Off	Off	Off
SpO_2 Desat	Switch	On	On	On
	Low	80 %	80 %	80 %
	Priority	High	High	High
	Alarm Outputs	Off	Off	Off
SpO_2 Event	Switch	Off	Off	Off
	High	2 %	2%	2%
	Priority	Low	Low	Low
	Alarm Outputs	Off	Off	Off
PR	Switch	On	On	On
	High	120 bpm	160 bpm	200 bpm
	Low	50 bpm	75 bpm	100 bpm
	Priority	Med	Med	Med
	Alarm Outputs	Off	Off	Off
	Alarm Source	Auto	Auto	Auto
NIBP-S	Switch	On	On	/
	High	160 mmHg	120 mmHg	/
	Low	90 mmHg	70 mmHg	/

Item / Parameter		Adult	Pediatric	Neonate
	Priority	Med	Med	/
	Alarm Outputs	Off	Off	/
NIBP-D	Switch	On	On	/
	High	90 mmHg	70 mmHg	/
	Low	50 mmHg	40 mmHg	/
	Priority	Med	Med	/
	Alarm Outputs	Off	Off	/
NIBP-M	Switch	On	On	/
	High	110 mmHg	90 mmHg	/
	Low	60 mmHg	50 mmHg	/
	Priority	Med	Med	/
	Alarm Outputs	Off	Off	/
$EtCO_2$	Switch	On	On	On
	High	50mmHg	50mmHg	45mmHg
	Low	25mmHg	25mmHg	30mmHg
	Priority	Med	Med	Med
	Alarm Outputs	Off	Off	Off
$FiCO_2$	Switch	On	On	On
	High	4mmHg	4mmHg	4mmHg

Item / Parameter		Adult	Pediatric	Neonate
	Low	0	0	0
	Priority	Med	Med	Med
	Alarm Outputs	Off	Off	Off
ART-S/ ART-D/ ART-M	Switch	On	On	On
	High	200 mmHg	160 mmHg	140 mmHg
	Low	10 mmHg	10 mmHg	10mmHg
	Priority	Med	Med	Med
	Alarm Outputs	Off	Off	Off
PA-S/ PA-D/ PA-M	Switch	On	On	On
	High	120 mmHg	100 mmHg	90 mmHg
	Low	10 mmHg	10 mmHg	10mmHg
	Priority	Med	Med	Med
	Alarm Outputs	Off	Off	Off

C.2 System Default Settings

Screen	Item	Default Setting
ECG Setup	Lead	Auto
	ECG1	II
	ECG2	I
	Speed	25mm/s
	Gain	×1

Screen	Item	Default Setting
	Filter	Monitor
	Notch Filter	On
	Grid	Off
ST Setup	ST Analysis	Off
	ST Segment	Off
	Display Markers	Off
QT Setup	QT Analysis	Off
	QT Analysis Lead	All
	QTc Formula	Hodges
Resp Setup	Speed	6.25mm/s
	Gain	×2
	Resp Lead	II
	RR Source	Auto
SpO_2 Setup	Speed	25mm/s
	Display PI	Off
	PR Source	Auto
	NIBP Simul.	Off
	Sat-Seconds	Off
Temp Setup	Temp1 Label	Temp1
	Temp2 Label	Temp2
	Unit	
NIBP Setup	Mode	Manual
	Limb	Left Arm

Screen	Item	Default Setting		
	Interval	15min		
	Unit	mmHg		
	Initial Pressure	Adult: 160 mmHg Pediatric: 140 mmHg		
	Sequential Mode	Period		
	Venipuncture	Auto		
	Sequence (Period)	Phase	Duration	Interval
		A	1h	10min
		B	12h	15min
		C	8h	30min
		D	4h	15min
		E	Off	––
		F	Off	––
		G	Off	––
	Sequence (Duration)	Phase	Duration	Interval
		A	Current time - Current time + 1 hour	10min
		B	Current time +1 hour - 22:00 on that day	15min

Screen	Item	Default Setting		
		C	22:00 on that day - 6:00 the next day	30min
		D	6:00 on the second day - 24 hours on the second day	15min
		E	Off	––
		F	Off	––
		G	Off	––
CO_2 Setup	Speed	12.5mm/s		
	Gain	X1/2		
	Unit	mmHg		
	Temp(℃)	35		
	CO2 Flow	50ml/min		
	Period	10s		
	Balance Gas	Air		
	Gas Compensation	16		
	AG	0		

Screen	Item	Default Setting
	Atmospheric Pressure	760mmHg
IBP Setup	IBP Label	IBP1: ART IBP2: PA
	Calculation Mode	Dynamic
	Average Time	8s
	Pressure Unit	mmHg
	CVP Unit	cmH2O
	ICP Unit	mmHg
	Speed	25mm/s
	Filter	12.5Hz
	Scale	Auto
	Top Scale	IBP1: 300 IBP2: 120
	Bottom Scale	0
Normal Screen Setup	Waveform 1	ECG II
	Waveform 2	ECG I
	Waveform 3	Resp
	Waveform 4	SpO_2
	Parameter 1	ECG
	Parameter 2	Resp
	Parameter 3	SpO_2
	Parameter 4	NIBP
	Parameter 5	Temp1

Screen	Item	Default Setting
Observation bed layout	Waveform 1	II
	Waveform 2	ECG2
	Parameter 1	ECG
	Parameter 2	SpO_2
	Parameter 3	NIBP
	Parameter 4	Resp
	Parameter 5	Temp
	Parameter 6	CO_2
System Setup	Key Volume	3
	Beat Volume	2
	Alarm Volume	6
	Screen Brightness	6
	Beat	Mode 2
	Date Format	YYYY-MM-DD
	Time Mode	12 hours
Patient Info	Type	Adult
	Gender	Unspecified
	Height	cm
	Weight	kg
	Paced	No
Maintenance - Alarm	Physio. Alarm Latch	Off

Screen	Item	Default Setting
	Alarm Audio Paused Time	2min
	High Alarm Audio Interval(s)	10
	Med Alarm Audio Interval(s)	15
	Low Alarm Audio Interval(s)	25
	ARR - V-Fib/V-Tach Off	Enable
	ECG lead off	Low
	IBP No Transducer	Low
	SPO_2 Sensor Off	Low
	Apnea Off	Disable
	Alarm Audio Off Tone	On
	Alarm Setup Password	Off

Appendix D Typical Pressures and CO_2 Readings at Altitudes

Altitude	Atmospheric Pressure (mmHg)	$EtCO_2$ Reading	
		(%)	(mmHg)
0m	760	5	38.0
70m	754	5	37.7
100m	751	5	37.5
200m	743	5	37.1
1500m	641	5	32.0
3000m	537	5	26.8
5000m	420	5	21.0

Appendix E EMC Compliance

Table 1

Guidance and manufacturer's declaration-electromagnetic emission for all EQUIPMENT and SYSTEMS

The Patient Monitor is intended for use in the electromagnetic environment specified below. The customer or the user of the equipment or system should assure that it is used in such an environment.		
Emissions test	**Compliance**	**Electromagnetic environment-guidance**
RF emissions CISPR 11	Group 1	Patient Monitor uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	Patient Monitor is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/flicker emissions IEC 61000-3-3	Complies	

Table 2

Guidance and manufacturer's declaration-electromagnetic immunity for all EQUIPMENT and SYSTEMS

The Patient Monitor is intended for use in the electromagnetic environment specified below. The customer or the user of the equipment or system should assure that it is used in such an environment.			
Immunity test	**IEC60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Electrostatic discharge (ESD) IEC61000-4-2	±8kV contact ±2kV, ±4kV, ±8kV, ±15kV air	±8kV contact ±2kV, ±4kV, ±8kV, ±15kV air	Floors should be wood, concrete or ceramic tile. if floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC61000-4-4	±2kV for power supply lines ±1 kV for input/output lines	±2kV 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	±1kV differential mode ±2kV common mode	±1kV differential mode ±2kV common mode	Mains power quality should be that of a typical commercial or hospital environment.

Voltage dips, short interruptions and voltage variations on power supply input lines IEC61000-4-11	0 % U_T; 0.5 cycle g) At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° 0 % U_T; 1 cycle and 70 % U_T; 25/30 cycles Single phase: at 0° 0 % U_T; 250/300 cycle	0 % U_T; 0.5 cycle g) At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° 0 % U_T; 1 cycle and 70 % U_T; 25/30 cycles Single phase: at 0° 0 % U_T; 250/300 cycle	Mains power quality should be that of a typical commercial or hospital environment. If the user of the equipment or system requires continued operation during power mains interruptions, it is recommended that the equipment or system be powered from an uninterruptible power supply or a battery.
Power frequency (50Hz/60Hz) magnetic field IEC61000-4-8	30A/m	30A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: U_T is the a.c. mains voltage prior to application of the test level.			

Table 3

Guidance and manufacturer's declaration – electromagnetic immunity for EQUIPMENT and SYSTEM that are not LIFE-SUPPORTING

Patient Monitor is intended for use in the electromagnetic environment specified below. The customer or the user of Patient Monitor should assure that it is used in such an electromagnetic environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz 6 V in ISM and amateur radio bands between 0,15 MHz and 80 MHz	3 V 150 kHz to 80 MHz 6 V in ISM and amateur radio bands between 0,15 MHz and 80 MHz	Portable and mobile RF communications equipment should be used no closer to any part of Patient Monitor, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance**
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.7 GHz 385 MHz-5785 MHz Test	3 V/m 80 MHz to 2.7 GHz 385 MHz-5785 MHz Test	

	specifications for ENCLOSURE PORT IMMUNITY to RF wireless communication equipment (Refer to table 9 of IEC 60601-1-2: 2014)	specifications for ENCLOSURE PORT IMMUNITY to RF wireless communication equipment (Refer to table 9 of IEC 60601-1-2: 2014)	$d = [\frac{3.5}{V_1}]\sqrt{P}$ $d = [\frac{12}{V_2}]\sqrt{P}$ $d = [\frac{3.5}{E_1}]\sqrt{P}$ 80MHz to 800MHz $d = [\frac{7}{E_1}]\sqrt{P}$ 800MHz to 2.7GHz 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 metres (m).[b] Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[a] should be less than the compliance level in each frequency range.[b]

			Interference may occur in the vicinity of equipment marked with the following symbol.

NOTE 1: At 80 MHz 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.

a: The ISM (industrial, scientific and medical) bands between 150 kHz and 80 MHz are 6,765 MHz to 6,795 MHz; 13,553 MHz to 13,567 MHz; 26,957 MHz to 27,283 MHz; and 40,66 MHz to 40,70 MHz. The amateur radio bands between 0,15 MHz and 80 MHz are 1,8 MHz to 2,0 MHz, 3,5 MHz to 4,0 MHz, 5,3 MHz to 5,4 MHz, 7 MHz to 7,3 MHz, 10,1 MHz to 10,15 MHz, 14 MHz to 14,2 MHz, 18,07 MHz to 18,17 MHz, 21,0 MHz to 21,4 MHz, 24,89 MHz to 24,99 MHz, 28,0 MHz to 29,7 MHz and 50,0 MHz to 54,0 MHz.

b: Field strengths from fixed transmitters, such as base stations for radio (cellular / cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, and electromagnetic site survey should be considered. If the measured field strength in the location in which Patient Monitor is used exceeds the applicable RF compliance level above, the Patient Monitor should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the Patient Monitor.

c: Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3V/m.

Table 4

Recommended separation distances between portable and mobile RF communications equipment and the equipment or system for EQUIPMENT and SYSTEM that are not LIFE-SUPPORTING

The Patient Monitor is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the equipment or system can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the equipment or system as recommended below, according to the maximum output power of the communications equipment.				
Rated maximum output power of transmitter (W)	**Separation distance according to frequency of transmitter (m)**			
	150kHz to 80MHz outside ISM and amateur radio bands $d=[\frac{3.5}{V_1}]\sqrt{P}$	150kHz to 80MHz in ISM and amateur radio bands $d=[\frac{12}{V_2}]\sqrt{P}$	80 MHz to 800 MHz $d=[\frac{3.5}{E_1}]\sqrt{P}$	800 MHz to 2.7 GHz $d=[\frac{7}{E_1}]\sqrt{P}$
0.01	0.12	0.20	0.035	0.07
0.1	0.38	0.63	0.11	0.22
1	1.2	2.00	0.35	0.70
10	3.8	6.32	1.10	2.21
100	12	20.00	35	70

For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in metres (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 separation distance for the higher frequency range applies.

NOTE 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Appendix F Cybersecurity Measures

Personal Information Safety

Protecting personal health information is a major component of security strategy. To protect the personal information and ensure the proper device performance, the user should take necessary precautions in accordance with local laws and regulations and institution's policies. Recommends health care organizations or medical institutions to implement a comprehensive and multifaceted strategy to protect the information and systems from internal and external security threats.

To ensure the patients' safety and protect their personal health information, the user should implement security practices or measures that include:

- Physical safeguards - physical safety measures to ensure that unauthorized personnel do not have access to the device.
- Operational safeguards - safety measures during operation.
- Administrative safeguards - safety measures in management.
- Technical safeguards - safety measures in technical field.

Caution

The access/operation of the device is restricted to authorized personnel only. Assign only staff with a specific role the right to use the device.

Caution

Ensure that all device components maintaining personal information (other than removable media) are physically secure (i.e. cannot remove without tools).

Caution

Ensure that the data are deleted after the patient is discharged (Refer to Section 6.7.4 Deleting Patient Data).

Caution

Ensure that the device is connected only to the authorized/approved device. Users should operate all deployed and supported devices within authorized specifications, including approved software, software configuration, security configuration, etc.

Caution

Protect all the passwords to prevent unauthorized changes. Only the manufacturer's service personnel are allowed to modify the Factory Maintain settings and Software updates.

Caution

Anti-virus measures such as USB device virus scanning should be carried out prior to using USB flash drive.

Caution

Firewalls and/or other security devices should be in place between the medical system and any externally accessible systems. It's recommended to use Windows defender firewall or any other firewall that can defend against DoS and DDoS attacks, and keep it up to date.

Caution

DoS and DDoS protection of the router or switch must be turned on for defensing against attacks.

Caution

When the device is returned for maintenance, disposed of, or removed from the medical institution for other reasons, it is necessary to ensure that all patient data are removed from the device. (Refer to Section *6.7.4 Deleting Patient Data*).

Caution

When building the networking environment: 1) If a wireless router is used, please turn on the MAC address filtering function of the wireless router and add the MAC address of the monitor to the rule list. The wireless router only allows devices in the rule list to access the wireless network. 2) It is suggested to build a VLAN, assign the LAN ports where the approved switch port, device and Central Monitoring System are into the same VLAN, and isolate it from other VLANs.

Caution

Please protect the privacy for the information and the data displayed on the screen, and for the information and the data stored in the device.

Note

Log files generated by the device are used for system troubleshooting and do not contain protected medical data.

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P/N: 256-100215-D2 Version: V1.0