MEC-1200 Portable
Multi-parameter Patient Monitor

Operator's Manual

CE 0123

The product bears CE mark indicating its conformity with the provisions of the Council Directive 93/42/EEC concerning medical devices and fulfils the essential requirements of Annex I of this directive.

The product is in radio-interference protection class A in accordance with EN55011.

The product complies with the requirement of standard EN 60601-1-2 “Electromagnetic Compatibility – Medical Electrical Equipment”.

For this Operator’s Manual, the issue date is 2011-07.

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

⚠ WARNING

- **It is important for the hospital or organization that employs this equipment to carry out a reasonable service/maintenance plan. Neglect of this may result in machine breakdown or personal injury.**

NOTE

- **This equipment must be operated by skilled/trained clinical professionals.**

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Preface

Manual Purpose

This manual provides the instructions necessary to operate the Patient Monitor (hereinafter called as this monitor) in accordance with its function and intended use. Observance of this manual is a prerequisite for proper performance and correct operation, and ensures patient and operator safety.

This manual is written based on the maximum configuration. Part of this manual may not apply to your monitor. If you have any question about the configuration of your monitor, please contact our Customer Service.

This manual is an integral part of and should always be kept close to the patient monitor, so that it can be obtained conveniently when necessary.

Intended Audience

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

Illustrations and Names

All illustrations in this manual are provided as examples only. They may not necessarily accord with the graph, settings or data displayed on your patient monitor.

All names appeared in this manual and illustrations are fictive. It is a mere coincidence if the name is the same with yours.

Conventions

- ***Italic*** text is used in this manual to quote the referenced chapters or sections.
- The terms danger, warning, and caution are used throughout this manual to point out hazards and to designate a degree or level or seriousness.

Contents

FOR YOUR NOTES

1 Safety

1.1 Safety Information

The safety statements presented in this chapter refer to the basic safety information that the operator of the patient monitor shall pay attention to and abide by. There are additional safety statements in other chapters or sections, which may be the same as or similar to the followings, or specific to the operations.

⚠DANGER

- **Indicates an imminent hazard situation that, if not avoided, will result in death or serious injury.**

⚠WARNING

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

⚠CAUTION

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

NOTE

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

1.1.1 Dangers

There are no dangers that refer to the product in general. Specific “Danger” statements may be given in the respective sections of this operation manual.

1.1.2 Warnings

⚠WARNING

- **The device is intended for use by qualified clinical physicians or well-trained nurses in the specified places.**
- **To ensure patient safety, verify the device and accessories can function safely and normally before use.**
- **EXPLOSION HAZARD: Do not use this device in the presence of flammable anesthetics, explosive substances, vapors or liquids.**
- **You must customize the alarm settings according to the individual patient situation, and make sure the alarm sound is activated when an alarm occurs.**
- **ELECTRIC SHOCK: Do not open the monitor housing. All servicing and future upgrades to this device must be carried out by personnel trained and authorized by our company only.**
- **DEFIBRILLATION: Do not come into contact with the patient during defibrillation. Otherwise serious injury or death could result.**
- **When used in conjunction with electro-surgery equipment, you must give top priority to the patient safety.**
- **DISPOSE: Dispose of the package material, observing the applicable waste control regulations and keeping it out of children’s reach.**
- **The device must be connected to a properly installed power outlet with protective earth contacts only. If the installation does not provide for a protective earth conductor, disconnect the monitor from the power line and operate it on battery power, if possible.**

1.1.3 Cautions

⚠CAUTION

- **To ensure patient safety, use only parts and accessories specified in this manual.**
- **Remove the battery from the patient monitor if it will not be used or not be connected to the power line for a long period.**
- **Disposable devices are intended for single use only. They should not be reused as performance could degrade or contamination could occur.**
- **At the end of its service life, the product described in this manual, as well as its accessories, must be disposed of in compliance with the guidelines regulating the disposal of such products. If you have any questions concerning disposal of the products, please contact with us.**
- **Magnetic and electrical fields are capable of interfering with the proper performance of the device. For this reason make sure that all external devices operated in the vicinity of the monitor comply with the relevant EMC requirements. Mobile phone, X-ray equipment or MRI devices are a possible source of interference as they may emit higher levels of electromagnetic radiation.**
- **Before connecting the patient monitor to the power line, check that the voltage and frequency ratings of the power line are the same as those indicated on the label or in this manual.**
- **Install or carry the patient monitor properly to avoid damages caused by drop, impact, strong vibration or other mechanical force.**

1.1.4 Notes

NOTE

- **Keep this manual close to the patient monitor so that it can be obtained conveniently when necessary.**
- **This patient monitor complies with the requirements of CISPR11 (EN55011) class A.**
- **The software was developed per IEC601-1-4. The possibility of hazards arising from errors in software program is minimized.**
- **Put the patient monitor in a location where you can easily see the screen and access the operating controls.**
- **The instructions of this manual are based on the maximum configuration. Some of them may not apply to your patient monitor.**

1.2 Equipment Symbols

NOTE

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

	Attention: Consult accompanying documents (this manual).
	Power ON/OFF
	Type CF applied part. The unit displaying this symbol contains an F-type isolated (floating) patient part providing a high degree of protection against shock, and is suitable for use during defibrillation.
	Equipotentiality
	Manufacture date
	Serial number
	European community representative
	CE marking
	The following definition of the WEEE label applies to EU member states only. This symbol indicates that this product should not be treated as household waste. By ensuring that this product is disposed of correctly, you will help prevent bringing potential negative consequences to the environment and human health. For more detailed information with regard to returning and recycling this product, please consult the distributor from whom you purchased it. * For system products, this label may be attached to the main unit only.

FOR YOUR NOTES

2 The Basics

2.1 Monitor Description

This monitor integrates the functions of parameter measurement, waveform monitoring, freezing, and recording, etc. Its color TFT liquid crystal display is able to show patient parameters and waveforms clearly. The monitor also features compact size, lightweight, easy-to-carry handle and built-in battery, which make it portable. The compact control panel and control knob, and the easy-to-use menu system enable you to freeze, record, or perform other operations conveniently. Besides, this monitor can be connected with the central monitoring system whereby a monitoring network will be formed.

2.1.1 Intended Use

The intended use of this monitor is to monitor a fixed set of parameters (see ***2.1.4 Functions***) for single adult, pediatric and neonatal patient, to display patient data and waveforms, to store patient data in a trend database, and to generate alarms and recordings.

This monitor is to be used in but not restricted to medical institutions such as ICU, CCU, cardiopathy ICU, operating room, emergency room and postoperative observation ward etc. This monitor is not intended for helicopter transport or home use.

⚠WARNING

- **This Monitor is to be operated by clinical physicians or appropriate medical staffs under the direction of physicians. The operator of the monitor must be well trained. Any operation by unauthorized or non-trained personnel is forbidden.**
- **The physiological waveforms and parameters and the alarm information displayed by the monitor are only for the reference of physicians, but cannot be used directly to determine the clinical treatment.**

2.1.2 Contraindications

None.

2.1.3 Components

This monitor consists of parameter measuring modules, blood pressure cuff, ECG cables, and SpO_2 sensors. Some of the components are optional and may not apply to your patient monitor.

2.1.4 Functions

This monitor is capable of monitoring the following parameters.

■ ECG	Heart rate (HR) ECG waveform(s) ST segment analysis Arrhythmia analysis
■ RESP	Respiration rate (RR) Respiration waveform
■ SpO2	Oxygen saturation (SpO2) Pulse rate (PR) SpO2 plethysmogram
■ NIBP	Systolic pressure (NS), diastolic pressure (ND), mean pressure (NM)
■ TEMP	Temperature

This monitor has additional functions including visual & audible alarms, freezing, data storage and output, recall, recording and drug calculation etc. Please refer to the following corresponding chapters for details of each specific function.

2.2 External Appearance

2.2.1 Front Panel

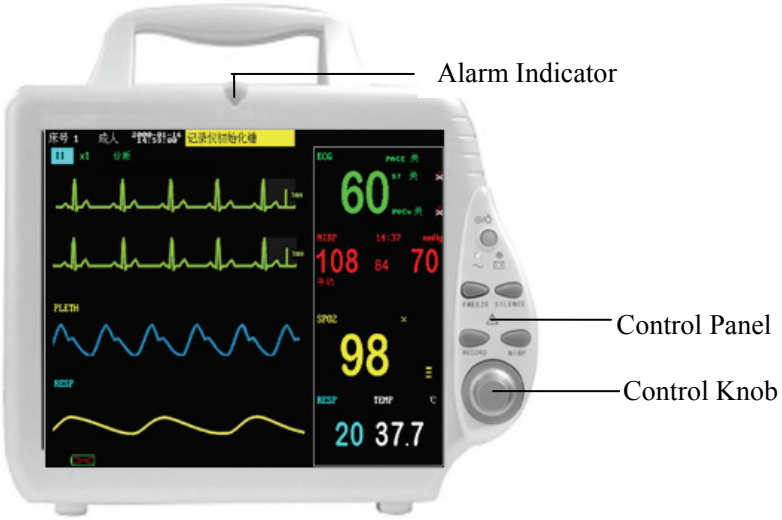


Figure 2-1 Patient Monitor

This monitor is designed to comply with the requirements of relative international safety standards (IEC60601-1, EN60601-2-27 and EN60601-2-30) for medical electrical equipment. This monitor has floating inputs and is protected against the effects of defibrillation and electrosurgery. When proper electrodes are used and applied according to the manufacturer instructions, the screen display will recover within 10 seconds after defibrillation.

The alarm indicator of this monitor complies with the requirement of EN60825-1 A11 Class 1 for LED. The LED indicator varies its flash color and frequency to indicate different alarm levels. For details, please refer to the section of ***6.2.1 Visual Alarms***.

⚠WARNING

- **Move or lift the monitor by the handle only. Do not use the patient cable or the power cord to move or lift the monitor. It might cause the monitor to fall, which might damage the monitor or injure the patient.**

2.2.2 Side Panel

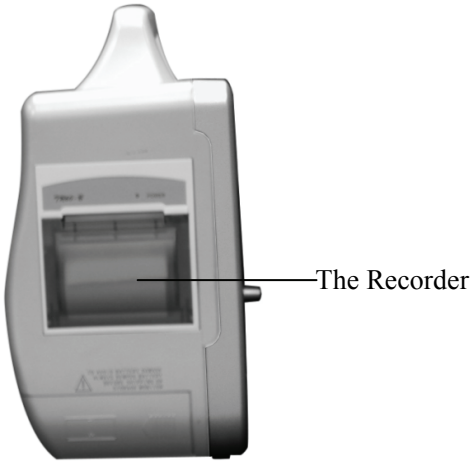


Figure 2-2 Left Panel

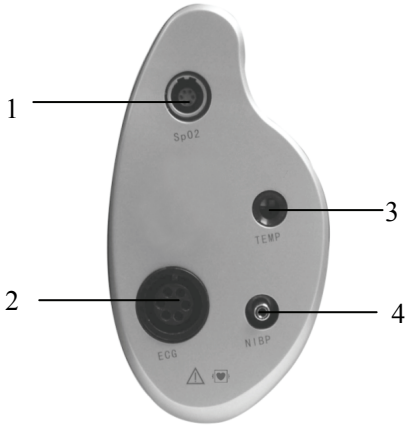


Figure 2-3 Right Panel

1. SpO_2: SpO_2 sensor connector
2. ECG: ECG cable connector
3. TEMP: Temperature probe connector
4. NIBP: NIBP cuff hose connector

2.2.3 Rear Panel

Figure 2-4 Back Side

1. Network Connector: Standard RJ45 connector.
2. Reserved
3. Reserved
4. Mounting holes for support bracket
5. Equipotential grounding connector
6. AC Power Input Connector

⚠WARNING

- **Accessory equipments connected to this patient monitor must be certified according to the respective IEC standards (e.g. IEC 60950 for information technology equipment and IEC 60601-1 for medical electrical equipment). Furthermore all configurations shall comply with the valid version of the system standard IEC 60601-1-1. Any person who connects additional equipment to the signal input or signal output is responsible to ensure the system complies with the requirements of the valid version of the system standard IEC 60601-1-1. If in doubt, contact our company or customer service.**

2.3 Control Panel

The control panel is located at the lower of the front panel, as shown below:

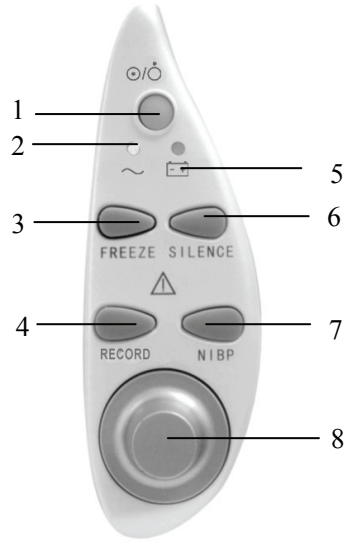


Figure 2-5 Buttons and Knob

1. Power switch

   This key turns the monitor ON and OFF. To turn OFF the monitor, please press this key and hold for more than 2 seconds.

2. AC power indicator

   - ON: AC power is applied to the monitor.
   - OFF: AC power is not applied to the monitor.

3. FREEZE

   This key is pressed to freeze and unfreeze waveforms.

4. RECORD

   Press this key to start or stop recording.

5. Battery indicator

   The battery indicator tells the battery status.

6. SILENCE

   You can press this key to pause alarms, silence the monitor or clear alarms. You can also switch between different alarm statuses through this key.

7. NIBP

   Press this key to start or stop non-invasive blood pressure measurement.

8. Control Knob

   The main operator control is the control knob. The control knob rotates in either direction to highlight parameter labels and menu options. After highlighting the desired selection, press the control knob to execute an operation, make a selection, view a new menu or a small drop-down list. This procedure is referred to as “select” through out the manual. Remember rotate to highlight, and then press to select.

2.4 Display

This monitor has a color TFT LCD display of high resolution. It is able to display patient parameters and waveforms clearly. The following is the standard interface when the monitor is operating normally.

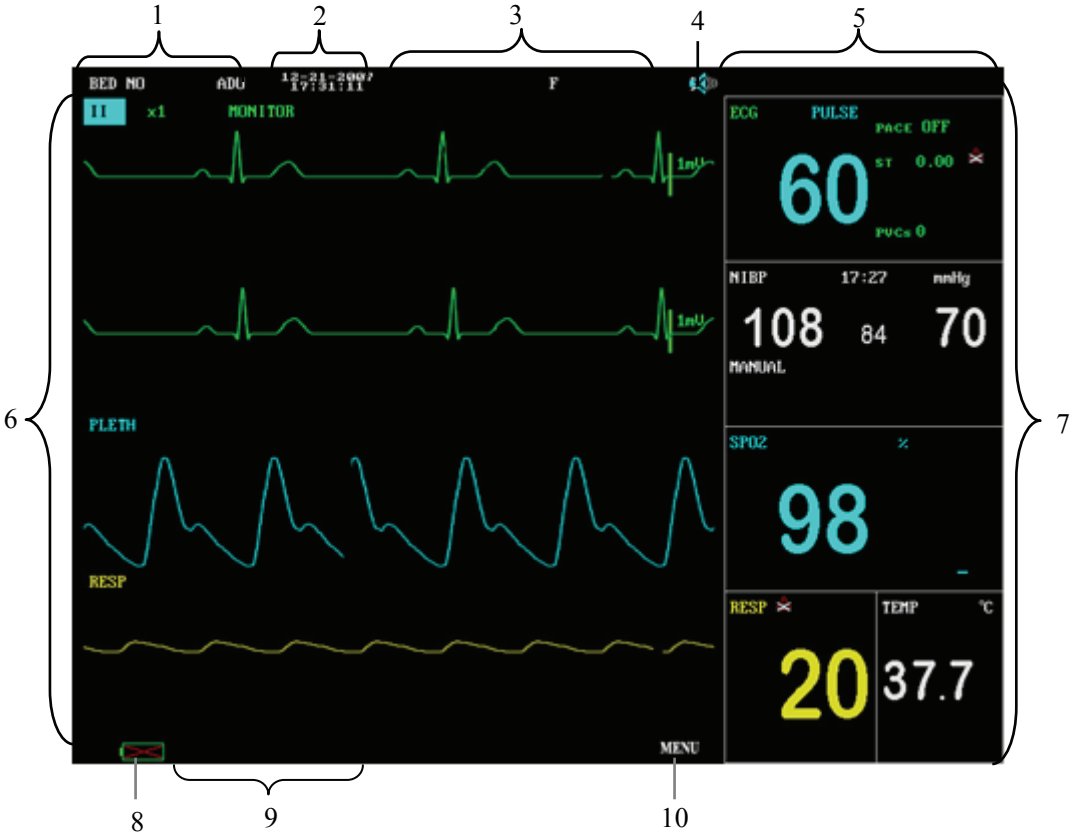


Figure 2-6 Main Screen

1. Patient information area

   It displays patient bed number and patient type.

2. System time

   The system time of the monitor is displayed in two lines. The time format can be set in the TIME SETUP menu.

3. Technical alarms area

   Technical alarm messages or prompt information are displayed in this area. In case of multiple messages, they will be displayed alternately. This area shows the patient name and sex when no message is to be displayed.

4. Sound icon

 Alarms Paused;  System Silenced;  Alarms Silenced. No icon is displayed under normal status.

5. Physiological alarms area

Physiological alarm messages are displayed in this area. In case of multiple messages, they will be displayed alternately.

6. Waveforms area

This area shows the waveforms of physiological parameters. The label of a waveform is displayed on the upper left.

7. Parameter windows

The parameter windows are located on the right of the waveform area, and are divided by white lines. Each window is identified by a parameter label on the upper left. You may select a parameter label to open the setup menu of this parameter. Each of the parameter is described in more detail in the following chapters.

8. Battery symbol

9. Prompt information area

This area shows the prompt messages and network status icons.

10. MENU label

You can select this label to enter SYSTEM MENU.

2.5 Batteries

This monitor is designed to operate on battery power during intra-hospital patient transfer or whenever the power supply is interrupted. The battery is charged automatically when the monitor is connected to AC power, no matter the monitor is powered on or not. Whenever the AC power is interrupted during patient monitoring, the patient monitor will automatically run power from the internal batteries.

The battery symbol displayed on the main screen tells the status of the battery.

-  The battery is installed in the battery slot. The solid part indicates its capacity.
-  No battery is installed in the battery slot.

Besides, the battery indicator also indicates the status of the battery.

- ON: The battery is being charged or the battery is fully charged.
- OFF: No battery is installed. If the battery is installed but the monitor is not. connected to AC power and not turned on, the indicator will also be off.
- Flashes: The monitor is powered by the internal battery.

The capacity of the internal battery is limited. When the battery capacity is too low, a high level alarm is triggered and the “Battery too low” message is given in the technical alarms area. At this moment, the AC power shall be applied to the monitor.

Figure 2-7 Battery Slot Cover

2.5.1 Battery Guidelines

Life expectancy of a battery depends on how frequent and how long it is used. For a properly maintained and stored lead-acid battery, its life expectancy is about 2 years. For more aggressive use models, life expectancy can be less. We recommend replacing lead acid batteries every 2 years.

- To get the most out of the battery, observe the following guidelines:
- The battery performance test must be performed every two years, before monitor repairs, or whenever the battery is suspected as being the source of the problems.
- Condition a battery once when it is used or stored for 3 months, or when its operating time becomes noticeably shorter.
- Take out the battery before the monitor is transported or will not be used for more than 3 months.
- Remove the battery from the monitor if it is not being used regularly. (Leaving the battery in a monitor that is not in regular use will shorten the life of the battery).
- The shelf-life of a fully charged sealed lead acid battery is about 6 months and in 6 months the battery must be fully charged for storage. Then run the monitor on this fully charged battery .When its battery power becomes 50% of the total power, take out the battery from the monitor and store it.

⚠WARNING

- **Keep the battery out of the reach of children.**
- **Use only the battery specified by the manufacturer.**
- **If the battery shows signs of damage or signs of leakage, replace it immediately. Do not use a faulty battery in the monitor.**

2.5.2 Battery Maintenance

Conditioning a Battery

A battery should be conditioned before it is used for the first time. A battery conditioning cycle is one uninterrupted charge of the battery, followed by an uninterrupted discharge of the battery. Batteries should be conditioned regularly to maintain their useful life. Condition a battery once when it is used or stored for two months, or when its run time becomes noticeably shorter.

NOTE

- **Condition a battery once when it is used or stored for 3 months, or when its operating time becomes noticeably shorter.**
- **The actual battery capacity will decrease over time with use of batteries. When a monitor operates on batteries that have been used before, the full capacity battery symbol does not indicate the capacity and operating time of this battery can still fulfill battery specifications in the operator's manual. When conditioning a battery, please replace the battery if its operating time is significantly lower than the specified time.**

To condition a battery, follow this procedure:

1. Disconnect the monitor from the patient and stop all monitoring or measuring.
2. Insert the battery in need of conditioning in the battery slot of the monitor, and leave the other slot empty if your minitor has two slots.
3. Apply AC power to the monitor and allow the battery to charge uninterrupted for 10 hours.
4. Remove AC power and allow the monitor to run from the battery until it shuts off.
5. Apply AC power again to the monitor and allow the battery to charge uninterrupted for 10 hours.
6. This battery is now conditioned and the monitor can be returned to service.

Checking a Battery

The performance of a rechargeable battery may deteriorate over time. To check the performance of a battery, follow this procedure:

1. Disconnect the monitor from the patient and stop all monitoring or measuring.
2. Apply AC power to the monitor and allow the battery to charge uninterrupted for 10 hours.
3. Remove AC power and allow the monitor to run from the battery until it shuts off.
4. The operating time of battery reflects its performance directly.

If your monitor has two battery slots, you can check two batteries at the same time. Please replace the battery or contact with the maintenance personnel if its operating time is significantly lower than the specified time.

NOTE

- **The battery might be damaged or malfunctioned if its operating time is too short after being fully charged. The operating time depends on the configuration and operation. For example, measuring NIBP more frequently will also shorten the operating time.**
- **When a battery has visual signs of damage, or no longer holds a charge, it should be replaced. Remove the old battery from the monitor and recycle it properly.**

2.5.3 Battery Recycling

When a battery has visual signs of damage, or no longer holds a charge, it should be replaced. Remove the old battery from the monitor and recycle it properly. To dispose of the batteries, follow local laws for proper disposal.

⚠WARNING

- **Do not disassemble batteries, or dispose of them in fire, or cause them to short circuit. They may ignite, explode, leak or heat up, causing personal injury.**

FOR YOUR NOTES

3 Installation and Maintenance

3.1 Installation

⚠WARNING

- **The installation of the monitor must be carried out by personnel authorized by our company. The software copyright of the monitor is solely owned by our company. Any action to change, copy or exchange the software copyright by any organization or person is regarded as copyright infringement and is not allowed.**

3.1.1 Unpacking and Checking

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

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

NOTE

- **Please save the packing case and packaging material for future transport and storage.**

⚠WARNING

- **Be sure to keep the packaging materials from children's reach.**
- **Disposal of the packaging materials shall comply with your local requirements.**
- **The equipment might be contaminated in storage, transport or when used. Verify the package and the single use accessories are intact. In case of any damage, do not apply it to patients.**

3.1.2 Environmental Requirements

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

The environment where this monitor is to be used should be free from noise, vibration, dust, and corrosive or explosive and inflammable substances. For a cabinet mounted installation, allow sufficient room at the front and the rear of the cabinet for operation, maintenance and servicing. Besides, allow at least 2 inches clearance around the instrument for proper air circulation.

Condensation can form when the monitor is moved from one location to another, and being exposed to differences in humidity or temperature. Make sure that during operation the instrument is free from condensation.

3.1.3 Power Source Requirements

The power applied to the monitor must meet the requirements specified in this manual.

⚠WARNING

- **Make sure that the operating environment and the power applied to the patient monitor complies the specified requirements. Otherwise its performance might not meet the specifications claimed in A Product Specification, and unexpected results, such as damages to the patient monitor, may be incurred.**
- **The monitor shall be powered according to the requirement for the system power voltage. Otherwise, serious damage might be caused to the system.**

3.1.4 Bracket Mounting

For details, please refer to the corresponding instructions for use of bracket mounting.

3.1.5 Installation Method

⚠WARNING

- **Accessory equipments connected to this patient monitor must be certified according to the respective IEC standards (e.g. IEC 60950 for information technology equipment and IEC 60601-1 for medical electrical equipment). Furthermore all configurations shall comply with the valid version of the system standard IEC 60601-1-1. Any person who connects additional equipment to the signal input or signal output is responsible to ensure the system complies with the requirements of the valid version of the system standard IEC 60601-1-1. If in doubt, contact our company or customer service.**
- **If the monitor is connected to another electrical instrument and the instrument specifications cannot tell whether the instrument combination is hazardous (e.g. due to summation of leakage currents), you should consult Us or experts in the field to ensure the required safety of all instruments concerned.**

NOTE

- **The following operations are not all required. User-customized installation by authorized personnel is provided.**

3.1.5.1 Connecting to AC Power Supply

1. Use the original three-wire AC power cord.
2. Connect the power cord to the receptacle for AC power cord on the rear panel of the monitor.
3. Connect the other end of the power cord to a compatible 3-prong hospital grade AC power outlet.

The 3-prong power outlet must be ground. If it is doubted, contact related personnel of the hospital.

⚠WARNING

- **Do not use three-wire to two-wire adapter with this instrument.**
- **To avoid unexpected power interruption, do no use power outlet with a wall-mounted switch control.**

3.1.5.2 Installing the Battery

If the monitor is to be powered by the internal battery, install the battery following the steps as below:

1. Slide the battery door toward the rear of the monitor to open it.
2. Press the battery catch to the upper using one finger.
3. Insert the battery into the battery slot.
4. Release the battery catch, and it will fix the battery.
5. Close the battery door.

⚠WARNING

- **Make sure the battery door is securely latched. Falling batteries could seriously or fatally injure a patient.**

3.1.5.3 Equipotential Grounding

When other equipments are used together with the monitor, a grounding cable should be used to connect the equipotential grounding connectors of the monitor and of other equipments. This helps to reduce the potential differences between different pieces of equipment, and ensure the safety of the operator and patient.

⚠WARNING

- **If the grounding system is in doubt, the monitor must be supplied from its internal battery.**

3.1.5.4 Connecting Patient Sensors and Probes

Connect the necessary patient sensors or probes to the monitor. For details, see the chapters for specific parameter monitoring in the following pages, or corresponding instructions for sensors and probes.

3.1.5.5 Connecting the Network Cable

The network connector of the monitor is a standard RJ45 connector. It connects the monitor with the central monitoring system, or with a PC for online upgrading. It can also connect with another patient monitor for viewbed monitoring.

1. Connect one end of the network cable with the network connector of the monitor.
2. Connect the other end of the network cable with the hub or switch of the central monitoring system, or with the network connector of a PC, or with the network connector of another patient monitor.

NOTE

- **Different network cable may be used for different connections. Please consult our customer service personnel for details.**
- **The system upgrading through the network connector is to be executed by Our company authorized personnel only.**

3.1.6 Powering on the Monitor

After installing the monitor, please follow the procedure described below to power on the monitor:

1. Before using the monitor, please carry out corresponding safety inspection as given in ***3.2.1 Inspection***.
2. Press the Power Switch on the control panel. A beep will be heard and, at the same time, the alarm indicator will flash once in yellow and then red.
3. The system begins self-testing and the product model will be displayed on the screen.
4. Several seconds later, the system finishes the self-test and displays the main screen.
5. The system will initiate every module, and display “XX alarm disabled!” information in the lower left part of the screen. “XX” represents the name of every module, such as NIBP, RESP etc.
6. At this time, you can operate the monitor using the control panel. “XX alarm disabled!” information will disappear a few seconds later.

When the monitor is plugged into AC power and is turned OFF or not turn ON, the monitor only provides the function of battery charging.

NOTE

- **During initialization process, alarms of every module detected by the system are useless, and thereby are disabled.**

3.1.7 Powering off the Monitor

To power off the monitor, please follow the procedures below:

1. Confirm the patient monitoring is to be finished.
2. Disconnect the cables and sensors between the monitor and the patient.
3. Confirm whether to store or clear the patient monitoring data.
4. Press the Power switch for more than 2 seconds, and the monitor will be powered off.

3.2 Maintenance

⚠WARNING

- **Failure on the part of the responsible hospital or institution employing the use of the monitoring equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazard.**
- **The safety inspection or maintenance, which requires opening the monitor housing, must be performed by trained and authorize personnel only. Otherwise, equipment failure and possible health hazard may be caused.**

3.2.1 Inspection

Make sure the qualified service personnel have implemented a complete inspection before putting the monitor into operation, after monitor servicing or system upgrading, or after the monitor has been used for 6-12 consecutive months. This is to ensure the normal operation of the system.

Follow these guidelines when inspecting the equipment:

- The environment and the power supply meet the specified requirements.
- Inspect the keys, control knob, connectors and accessories for damage.
- Inspect the power cords for fraying or other damage and check the insulation.
- The grounding cables are correctly connected.
- Only specified accessories like electrodes, sensors and probes are applied.
- The monitor clock is correct.
- The audible and visual alarms functions normally.
- Check the performance of the battery.
- The recorder functions normally and the recorder paper meets the requirement.

In case of any damage or exception, do not use the monitor. Contact the technician in your hospital or our Customer Service immediately.

3.2.2 Cleaning

⚠WARNING

- **Be sure to shut down the system and disconnect all power cords from the outlet before cleaning the equipment.**

Your equipment should be cleaned on a regular basis. If there is heavy pollution or lots of dust and sand in your place, the equipment should be cleaned more frequently. Before cleaning the equipment, consult your hospital's regulations for cleaning, disinfecting and sterilizing equipment.

The exterior surfaces of the equipment may be cleaned with a clean and soft cloth, sponge or cotton ball, dampened with a non-erosive cleaning solution. Drying off excess cleaning solution before cleaning the equipment is recommended. Following are examples of cleaning solutions:

- Sodium hypochlorite bleach (diluted)
- Hydrogen peroxide (3%)
- Ethanol (70%)
- Isopropanol (70%)

To avoid damage to the equipment, follow these rules:

- ALWAYS dilute the solutions according to the manufacturer's suggestions.
- ALWAYS wipe off all the cleaning solution with a dry cloth after cleaning.
- NEVER submerge the equipment into water or any cleaning solution, or pour or spray water or any cleaning solution on the equipment.
- NEVER permit fluids run into the casing, switches, connectors, or any ventilation openings in the equipment.
- NEVER use abrasive, erosive cleaners, or cleaners containing acetone.

Failure to follow these rules may erode or fray the casing, or blur lettering on the labels, or cause equipment failures.

For cleaning information of accessories, please refer to the chapters for specific patient parameters and the instructions for use of the accessories.

3.2.3 Disinfection and Sterilization

Sterilization or disinfection may cause damage to the equipment. We recommend the sterilization and disinfection are contained in the hospital's servicing schedule only when necessary. The equipment should be cleaned prior to sterilization and disinfection.

The recommended disinfectants include: ethanol 70%, isopropanol 70%, Perform® classic concentrate OXY ($KHSO_4$ solution).

⚠WARNING

- **Disinfection or sterilization may cause damage to the equipment; therefore, when preparing to disinfect or sterilize the equipment, consult your hospital's infection controllers or professionals.**
- **The cleaning solutions above can only be used for general cleaning. If you use them to control infections, we shall assume no responsible for the effectiveness.**

NOTE

- **ALWAYS dilute the solutions according to the manufacturer's suggestions and adopt lower concentration if possible.**
- **NEVER submerge the equipment into water or any solution, or pour water or any solution on the equipment;**
- **ALWAYS wipe off all the excess liquids on the equipment surface and accessory surface with a dry cloth;**
- **Never use EtO and formaldehyde to disinfect.**
- **Never permit high-pressure and high-temperature disinfection of the equipment and accessories.**

4 System Menu

4.1 Overview

This chapter only gives introduction to the system menu. Other menus will be described in the following chapters.

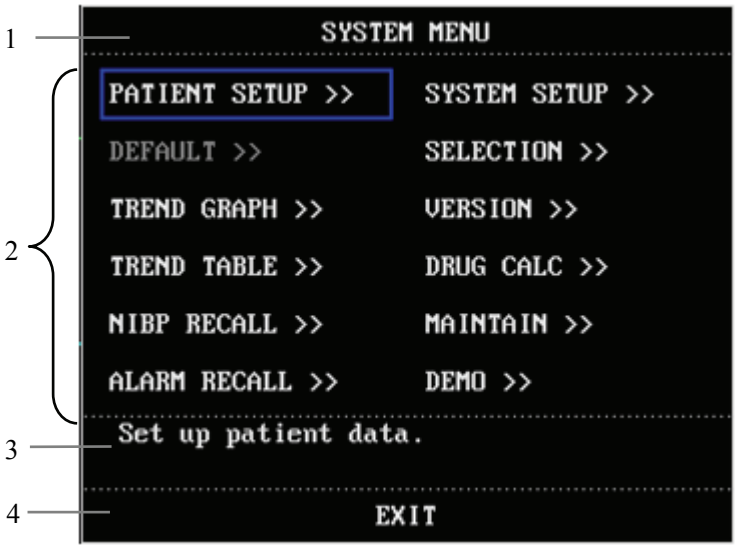


Figure 4-1 SYSTEM MENU

Most menus displayed by the monitor share the same structure. As shown above, a menu is made up of four parts:

1. Menu title: Summarizes the content of the current menu.
2. Main display area: Displays options, keys or prompt information, etc. “>>” means a submenu will pop up if the option is selected.
3. Online help: The help information changes with the highlighted selection.
4. Exit key: Exits from the current menu.

Some menus do not have the EXIT key. Instead, a YES and a NO key or a CONFIRM and a CANCEL key are provided. You can confirm the operations with these keys.

NOTE

- **Your monitor may not include all options described in this chapter.**

4.2 Patient Setup

Select PATIENT SETUP>> in SYSTEM MENU. The following menu appears.

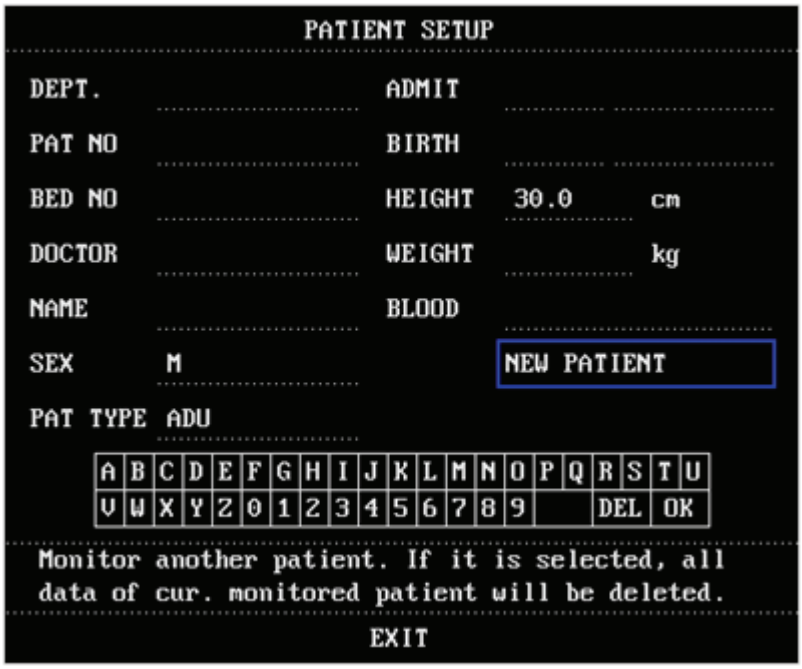


Figure 4-2 PATIENT SETUP

- DEPT — Department in which the patient receives treatment.
- PAT NO — Patient identification number;
- BED NO — Patient bed number (Range: 1~100)
- DOCTOR — Name of the doctor;
- NAME — Patient name;
- SEX — Patient gender: “F” for female; “M” for male;
- PAT TYPE — Patient type:
  ADU, PED and NEO (short for adult, pediatric and neonate);
- ADMIT — The time when the patient is admitted: year-month-day;
- BIRTH — Patient date of birth: year-month-day;
- HEIGHT — Patient height (unit: cm or inch);
- WEIGHT — Patient weight (unit: kg or IB);
- BLOOD — Patient blood type:
  A, B, O, AB or N (N represents unknown)
- NEW PATIENT — Admission of new patient

When you select NEW PATIENT, you access the “CONFIRM TO UPDATE PATIENT” menu as shown below. This allows you to delete previous patient data and begin monitoring a new patient.

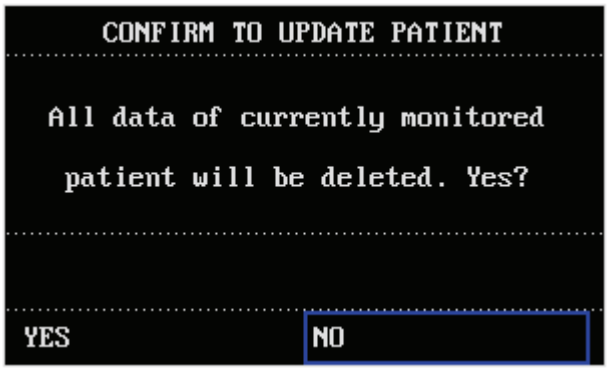


Figure 4-3 Confirm To Update Patient Menu

1. Select [YES] to delete all information of the patient that was being monitored and exit the menu.
2. Select [NO] to exit the menu and the system will keep the information of the patient that was being monitored.

NOTE

- **If you select YES, the system will delete all information of previously monitored patient, or the patient being currently monitored.**

4.3 Default Setup

Select DEFAULT>> in SYSTEM MENU. The following menu appears.

Figure 4-4 DEFAULT Menu

Restoring Factory Default Configuration

1. Rotate the control knob and select the desired configuration.
2. Select EXIT, and a CONFIRM DEFAULT CONFIG dialog box pops up.
3. Select YES to restore the monitor to the selected default configuration, or select NO to cancel the operation.

Saving Current Configuration as User Default Configuration

You can also modify the configuration of the monitor and save the modified configuration as the user-defined default configuration of the corresponding patient type. When the monitor begins monitoring a new patient, you may to choose the user-defined default configuration directly, loosing from performing the settings again. However, the user-defined configuration must be appropriate and correct.

1. Verify the modified configuration is appropriate and correct.
2. Select the SAVE CURRENT AS USER CONFIG option.
3. Select YES in the popup dialog box to save current configuration as the user-defined default configuration.
4. Select NO to cancel the operation.

NOTE

- **In the case that there is a power failure, the configurations before power failure are restored automatically when the patient monitor is restarted.**

4.4 System Setup

Select SYSTEM SETUP>> in SYSTEM MENU. The following menu appears.

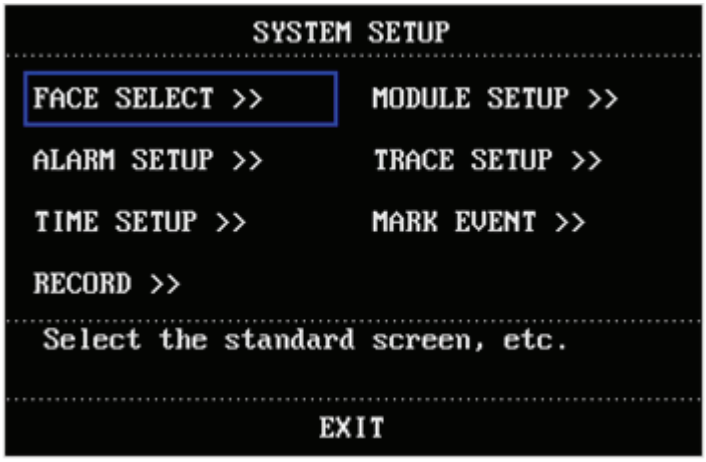


Figure 4-5 System setup

SYSTEM SETUP menu contains the following submenus:

- FACE SELECT>>
- ALARM SETUP>>
- TIME SETUP>>
- RECORD>>
- MODULE SETUP>>
- TRACE SETUP>>
- MARK EVENT>>

4.4.1 Face Select

Select FACE SELECT>> in SYSTEM SETUP menu. The following menu appears.

Figure 4-6 FACE SELECT

In FACE SELECT menu, options are available as shown above. For detailed information, see chapter ***Face Selection***.

4.4.2 Alarm Setup

Select ALARM SETUP>> in SYSTEM SETUP menu. The following menu appears.

Figure 4-7 Alarm Setup

You can perform the following settings in the menu above:

- ALM SEL — Alarm selection
  Options: COMMON ALM SETUP, XX ALM SETUP; (XX refers to HR, ST, PVCs, SPO2, NIBP and TEMP).
- ALARM VOL — Alarm volume
  The volume can be set between 1 and 10. 1 is the minimum and 10 is the maximum volume.
- ALM REC TIME — Alarm recording time
  Options: 8S,16S and 32S.
  When an alarm occurs, the recorder records according to the alarm recording time.
- PARA ALAM TYPE — Options: LATCH and UNLATCH.

4.4.3 Time Setup

Select TIME SETUP>> in SYSTEM SETUP menu. The following menu appears.

Figure 4-8 System Time Setup

With the control knob, you can change the year, month, day, hour, minute and second .

If the monitor is connected with the central monitoring system, the system time of the monitor will be updated in accordance with the central monitoring system, and the TIME SETUP option in SYSTEM SETUP menu will become disabled.

4.4.4 Record Setup

Select RECORD>> in SYSTEM SETUP menu. The following menu appears.

Figure 4-9 Record Setup

- REC WAVE1 — Select the first waveform to be recorded. The setting of this item should be different with those of REC WAVE 2, otherwise, the system will adjust the setting automatically. When OFF is selected, the first waveform will not be recorded.
- REC WAVE2 — Select the second waveform to be recorded. The setting of this item should be different with those of REC WAVE1, otherwise, the system will adjust the setting automatically. When OFF is selected, the second waveform will not be recorded.

NOTE

- **If a parameter is not displayed on the screen, this parameter will be unavailable in the REC WAVE 1 and the REC WAVE 2 options.**

- RT REC TIME — Real-time recording time
  Options: CONTINUAL and 8s.
- TIMING REC TIME — Timing recording time
  The interval between automatic recordings.
  Options: OFF, 10MIN, 20MIN, 30MIN, 40MIN, 50MIN, 1HOUR, 2HOURS, 3HOURS and 4HOURS. The monitor will start recording at the selected interval, record for 8s and shut off automatically.

NOTE

- **TIMING REC TIME cannot be saved after the monitor is turned off. But it can be saved as the user default configuration.**
- **RT REC TIME has priority over TIMING REC TIME.**

- REC RATE — Recording rate
  Options: 25.0 and 50.0; unit: mm/s;
- REC GRID — Recording grid
  ON: You can select ON to print a grid on the recorder paper;
  OFF: You can select OFF to remove the grid from the recorder paper.
- CLEAR REC TASK — Clear recording task
  This key allows you to clear all current recording tasks.

4.4.5 Module Setup

Select MODULE SETUP>> in SYSTEM SETUP menu. The following menu appears.

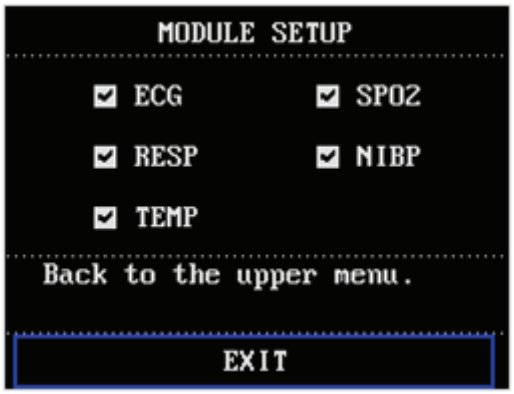


Figure 4-10 Module Setup

This menu allows you to enable or disable a parameter module to determine the information displayed on the main screen. As shown in the figure above, " √ " indicates an enabled module. A module without the " √ " mark is disabled and the related waveform and parameter data disappear from the display.

4.4.6 Trace Setup

Select TRACE SETUP>> in SYSTEM SETUP menu. The following menu appears.

Figure 4-11 Tracing Waveforms Selection

You can choose the waveform to be displayed in the screen. If a parameter in this menu is not selected, its corresponding waveform will not be displayed. However, its corresponding measured parameters will still be displayed.

4.4.7 Mark Event

Select MARK EVENT>> in SYSTEM SETUP menu. The following menu appears.

Figure 4-12 MARK EVENT Menu

This menu allows you to mark four different events, namely event A, B, C and D. The ”@” symbol will appear in the frame of the even being selected. If you attempt to unmark an event, press the control knob again on the marked selection.

The purpose of event marking is to define the records, such as dose taking, injections or therapy, which have influence on patients and parameter monitoring. A mark will be displayed on the trend graph/table indicating the time the mark was initiated in relation to the event it represents.

4.5 Selection Setup

Select SELECTION>> in SYSTEM MENU. The following menu appears.

Figure 4-13 Selection Setup

You can perform the following settings in this menu:

- KEY VOL — Key volume
  The volume can be set between 0 and 10. 0 indicates the volume is off and 10 indicates the maximum volume.
- HELP — Online help
  ON: Indicates the online help is enabled and the help information will be displayed;
  OFF: Indicates the online help function is disabled and the help information will not be displayed.
- ALM LIMIT — Alarm limit
  ON: The alarm limits of parameters are displayed aside the parameter value;
  OFF: The alarm limits of parameters are not displayed aside.

4.6 Monitor Version

You can select VERSION>> in the SYSTEM MENU to check the version information as shown below.

Figure 4-14 Monitor Version

You can see the monitor's configuration by selecting DEVICE CONFIG LIST>> as shown below.

Figure 4-15 Device Configuration List

4.7 Maintenance

Select MAINTAIN>> in SYSTEM MENU. The following menu appears.

Figure 4-16 Enter Maintain Password

Enter USER KEY, then select CONFIRM button. The following menu appears.

Figure 4-17 User Maintain

You can perform the following settings:

- LANGUAGE — Select the required language of the displayed texts.
- LEAD NAMING — Options: AHA and EURO;
- ALM SOUND — You can set the alarm volume to “ON” or “OFF”.
- ALM PAUSE TIME — You can set up the duration of Alarm Pause status. Three options are available, 1 minute, 2 minutes and 3 minutes.
- TEMP SENSOR — You can choose “YSI”.
- NET TYPE — Network type
  Options: CMS and HYPER III.
- LOCAL NET NO — It indicates the bed number of a monitor in the monitoring network. If the NET TYPE is CMS, the LOCAL NET NO can be set between 1 and 64; if the NET TYPE is HYPER III, it can be set between 1 and 8.
- COLOR SELF-DEFINE — This is used to define the color of the waveform displayed on the screen. Five colors can be chosen from: green, cyan, red, yellow and white.

4.7.1 COLOR SELF-DEFINE

Select COLOR SELF-DEFINE >> in USER MAINTAIN menu. The following menu appears.

Figure 4-18 Color Self-define

This menu allows you to choose the color in which the waveform(s) and parameter(s) of a parameter module are to be displayed. OTHER PARA refers to the parameters, NIBP and TEMP, which do not have waveforms.

4.8 DEMO Function

Select DEMO >> in SYSTEM MENU. The following menu appears.

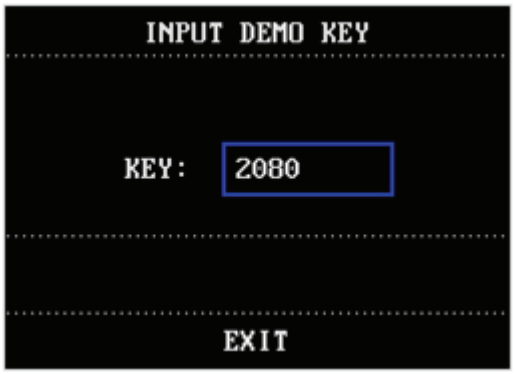


Figure 4-19 Input Demo Key

The monitor enters the demonstration mode when the correct password is input in the menu above. The word DEMO will be displayed on the main screen. The purpose of the demonstration display is to demonstrate the performance of the monitor, and for training purposes.

⚠WARNING

- **In clinical applications, this function is forbidden because the DEMO display can mislead the medical staff to treat the DEMO waveforms and parameters as the actual data of the patient. This may result in serious injury to the patient, or a delay of treatment or improper treatment.**

5 Face Selection

You can open the FACE SELECT menu by selecting FACE SELECT >> in SYSTEM SETUP menu.

Figure 5-1 FACE SELECT

5.1 Standard Screen

The standard screen is the default screen. If the current screen is not the standard screen, you may enter the standard screen by selecting STANDARD SCREEN and then selecting EXIT in FACE SELECT menu. For more information about the standard screen, see ***2.4 Display.***

Figure 5-2 STANDARD SCREEN

5.2 Viewbed Screen

This monitor can view one parameter waveform and measured data from another patient monitor (viewbed monitor) on the same monitoring network. To enter the following screen, open FACE SELECT menu, select VIEWBED SCREEN, and then select EXIT. When connecting by wireless network, viewbed function is disabled.

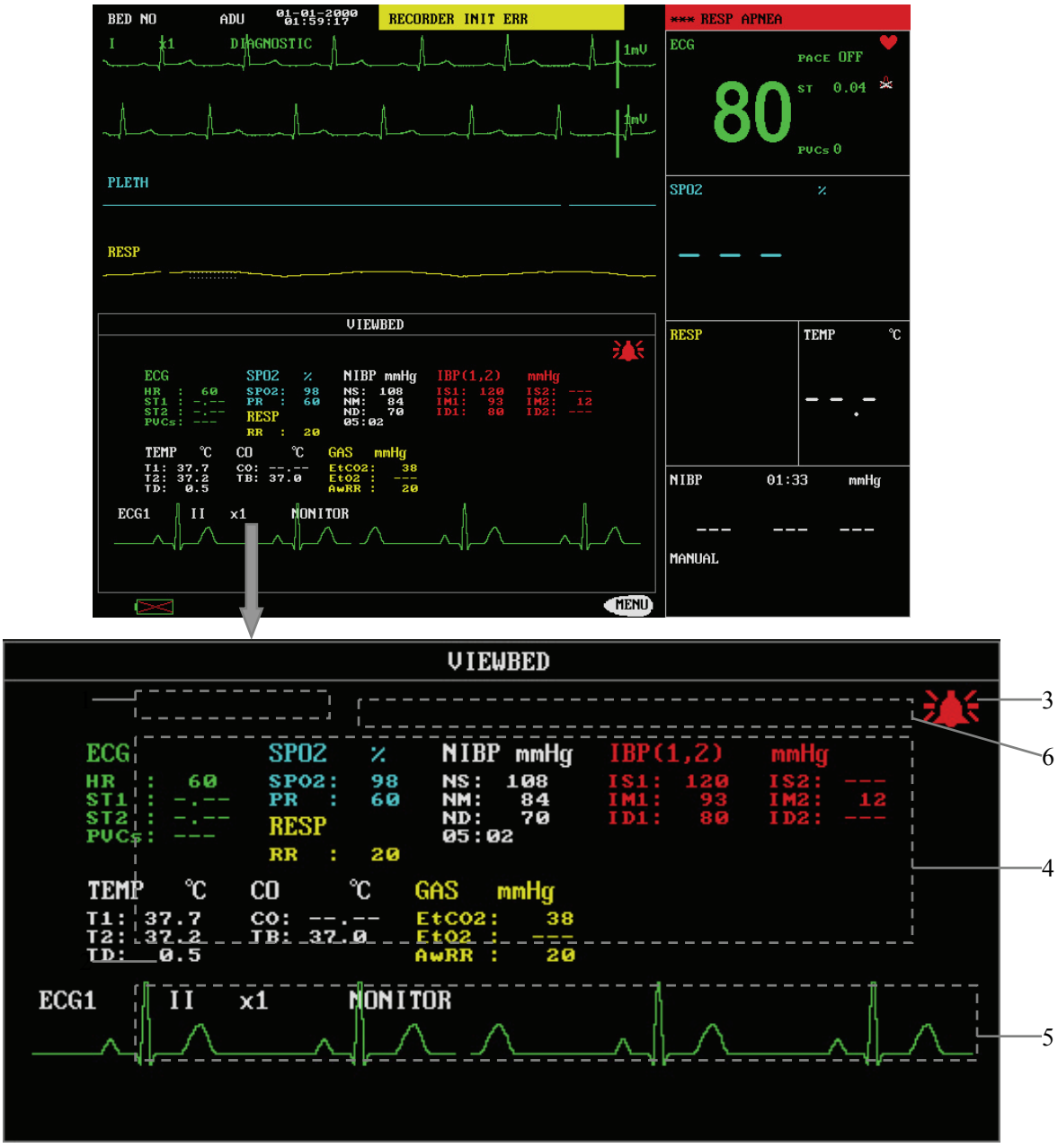


Figure 5-3 VIEWBED SCREEN

The monitor you are viewing from is called “host monitor”. The monitor being viewed is called “viewbed monitor”. The viewbed screen is always displayed at the lower part of the host monitor’s waveform area. As shown in Figure 5-3, it consists of the following parts.

1. Viewbed monitor label

The viewbed monitor lable allows you to select the viewbed monitor you want to view. It displays the bed number and patient name of the viewbed monitor. If they are not entered, the label displays blank. If the host monitor is not connected with any other monitor on the same network, the label displays N/A.

2. Viewbed waveform label

The viewbed waveform label allows you to select a waveform of the viewbed monitor. If the viewbed monitor does not dispaly any waveform, this label displays N/A.

3. Viewbed alarm indicator

The viewbed alarm indicator in the viewbed screen is used to indicate the alarm status of the viewbed monitor. Its color is identical with that of the viewbed monitor.

4. Viewbed parameter area

All parameter data of the viewbed monitor is displayed in this area.

5. Viewbed waveform area

The viewbed waveform area is located beneath the viewbed waveform label. It displays the waveform selected through the viewbed waveform label. The scan type (either refresh or scroll) and the sweep speed of the viewbed waveform follow the host monitor. Besides, information relating to the viewbed waveform is shown above the waveform.

6. Technical information area

On the right of the viewbed monitor label is the technical information area. It shows the technical information about viewing of other patient, such as the prompt information indicating failure in viewing other patient due to network problems.

Automatic Selection

When the viewbed screen is opened, the host monitor automatically selects a viewbed monitor on the same network and a waveform of this monitor to view. In case the monitor being viewed is disconnected, the host monitor automatically closes the display of alarms, parameters and the waveform of the viewbed monitor. However, the host monitor will not automatically select to view other monitor. You must make the selection using the viewbed monitor label manually.

If a parameter module of the viewbed patient monitor is turned off or disassembled, the corresponding waveform displayed on the host monitor disappears, and the viewbed waveform area becomes blank. At this time, you can use the viewbed waveform label to view other waveform.

6 Alarms

6.1 Overview

The monitor gives audible or visual alarms to indicate the medical staff, when a vital sign of the patient appears abnormal, or mechanical or electrical problems occur to the monitor.

Upon turning on the monitor, a beep will be heard. At the same time, the alarm indicator will flash once in yellow and red. This is used to verify the audible and visual alarm function of the monitor. If no beep is heard, or the alarm indicator doesn't flash normally, please do not use the monitor, and contact our customer service.

For details about alarm setup of this monitor, please refer to ***4.4.2 Alarm Setup***.

⚠WARNING

- **A potential hazard can exist if different alarm presets are used for the same or similar equipment in any single area, e.g. an intensive care unit or cardiac operating room.**
- **Before patient monitoring or when changing operator, make sure that proper alarm settings are used.**
- **Setting alarm limits to extreme values may render the alarm system useless. For example, high oxygen levels may predispose a premature infant to retrolental fibroplasias. So it may cause hazards to set the high alarm limit of SpO2 to 100%, which is equivalent to switching the alarm off.**

6.1.1 Alarm Categories

The alarms are divided into three categories: physiological alarms, technical alarms and prompt information.

1. Physiological alarms

A physiological alarm either indicates that a monitored physiological parameter is out of specified limits or indicates an abnormal patient condition. For example: HR TOO LOW, ECG LOST or RESP ARTIFACT, etc. Physiological alarm messages are displayed in the physiological alarms area of the main screen.

2. Technical alarms

Technical alarms are also referred to as system error messages. A technical alarm indicates that the monitor or parts of the monitor is not capable of accurately monitoring the patient's condition due to improper operation or system failure. For example: ECG INIT ERR or TEMP SELFTEST ERROR, etc. Technical alarm messages are usually displayed in the technical alarms area of the main screen. But the technical alarms related to NIBP are displayed in the lower part of the NIBP parameter window.

3. Prompt information

Strictly speaking, prompt information cannot be counted in alarms. It is usually information relating to the system, but not concerning vital signs of patients. For example, the monitor prompts "NIBP alarm disabled!" at the time the monitor is powered on. Besides, if a parameter module is turned on but the required leads or sensor are not connected, the monitor will prompt accordingly, such as "ECG LEAD OFF" or "SPO2 SENSOR OFF", etc. Prompt information is usually displayed in the technical alarms area. But the prompt information relating to NIBP is displayed in the lower part of the NIBP paramter window.

NOTE

- **To distinguish from the prompt information, the alarm message is displayed with yellow or red background.**

6.1.2 Alarm Levels

The alarms are divided into three priority levels: high level alarms, medium level alarms and low level alarms.

1. High level alarms

- The patient ‘s life is in danger and requires emergency treatment, or
- Serious technical problem occurs to the monitor, such as error in ECG module initialization.

2. Medium level alarms

- Vital signs of the patient become abnormal, and patient requires immediate treatment, or
- Certain technical problem occurs to the monitor, such as error in temperature calibration.

3. Low level alarms

- Certain technical alarm occurs to the monitor, such as ECG lead off in measurement.

The levels of all technical alarms and some physiological alarms are not user-adjustable, because they have been fixed when the monitor is produced. However, you can change the levels of some physiological alarms in the corresponding parameter setup menus.

All physiological alarms, technical alarms and prompt information are given in ***C Alarm Messages and Prompt Information***.

6.2 Alarm Modes

When an alarm occurs, the monitor raise the user’s attention by the following audible or visual indications.

- Visual alarms
- Audible alarms
- Alarm messages
- Parameter flashes

Besides, the visual alarms, audible alarms and alarm messages are given in different ways to identify different alarm levels.

6.2.1 Visual Alarms

The alarm indicator on the front panel of the monitor varies its flash color and frequency to indicate different alarm levels.

- High level alarm: red and quick flash;
- Medium level alarm: yellow and slow flash;
- Low level alarm: yellow light without flash.

6.2.2 Audible alarms

The monitor uses different alarm tones to indicate different alarm levels.

- High level alarm: “DO-DO-DO--DO-DO---DO-DO-DO--DO-DO”.
- Medium level alarm: “DO-DO-DO”.
- Low level alarm: “DO”.

Different intervals correspond to different alarm levels: High level alarm phonates once every 3 or 8 seconds. Medium level alarm phonates once every 14 or 24 seconds. Low level alarm phonates once every 24 seconds. For details, please refer to ***4.7 Maintenance***.

NOTE

- **When multiple alarms of different levels occur simultaneously, the monitor selects the alarm of the highest level and gives alarm tone accordingly.**

6.2.3 Alarm Messages

Alarm messages are given when alarms occur. The alarm messages are displayed in the physiological alarms area or the technical alarms area in black. For physiological alarms, asterisks are displayed before the alarm messages to identify the alarm level.

- High level alarms: triple asterisks “***”
- Medium level alarms: dual asterisks “**”
- Low level alarms: single asterisk “*”

The monitor varies the background color of the technical and physiological alarm messages to indicate the alarm level.

- High level alarms: red background color
- Medium level alarms: yellow background color
- Low level alarms: yellow background color

NOTE

- **Comparing with an alarm message, the background color of prompt information is the same as that of the position where it appears.**
- **The NIBP technical alarm messages appear in the NIBP parameter window. For high level alarms, the text color is red; for medium and low level alarms, the text color is yellow. The background color is the same as the parameter window.**

6.2.4 Parameter Flashes

An alarm is triggered when a patient parameter exceeds the parameter limit. At the same time, the measured parameter value in the parameter window flashes every second. If the ALM LIMIT in the SELECTION menu is turned ON, the exceeded upper or lower alarm limit also flashes every second.

6.3 Alarm Statuses

When an alarm occurs, normally the monitor gives indications in the modes mentioned above as per the alarm level. If necessary, you can the set the monitor to the following alarm statuses.

- Parameter Alarms Disabled
- Alarms Paused
-  System Silenced
-  Alarms Silenced

6.3.1 Alarms Disabled

If the alarm switch of a parameter is turned off, the monitor does not generate alarms even if the measured parameter value exceeds the alarm limit. This status is called Alarms Disabled.

To disable the alarms of a parameter, you should open the setup menu of the parameter. Take heart rate (HR) as an example.

1. Rotate the control knob and highlight the ECG parameter label.
2. Press the control knob. The ECG SETUP menu pops up.
3. Rotate the control knob and highlight the field on the right of HR ALM.
4. Press the control knob, and then select OFF from the pull-down list.
5. The HR alarms are disabled. The icon will be displayed on the right of the ECG parameter label.

NOTE

- **When a new parameter module is installed or when a parameter module is turned ON, all the parameter alarms and technical alarms related to this module are disabled in the first 30-second operating time. The other module alarms are not influenced.**

6.3.2 Alarms Paused

To pause all alarms of the monitor for 1, 2 or 3 minutes, press the SILENCE key on the control panel once (for less than 2 seconds). In Alarms Paused status,

- Visual alarms and audible alarms are both paused.
- The parameters generating physiological alarms and their upper or lower limits stop flashing.
- Alarm messages are not displayed.
- The physiological alarms area shows the rest time of alarms paused status.
- The icon will be displayed in the sound icon area.

The monitor will not terminate the Alarm Paused status even if a new technical or physiological alarm occurs during the alarms paused time.

6.3.3 System Silenced

To silence the system, press the Silence key for no less than 2 seconds. In the System Silenced status, all system sounds are shielded and the  icon is displayed in the sound icon area. However, other modes of alarms (excluding audible alarms) are given as normal. If a new alarm occurs, the System Silenced status will be terminated.

The system sounds include the audible alarms, key tones, heart beat tones and pulse tones. Among them, key tones refer to the sounds produced when the control knob is rotated and pressed.

6.3.4 Alarms Silenced

In Alarms Silenced status, all audible alarms are suppressed, but other modes of alarms and other sounds are not influenced. The  icon will be displayed in the sound icon area. To silence the audible alarms, first access the USER MAINTAIN menu, and then set the ALARM SOUND to OFF. For details, please refer to ***4.7 Maintenance***.

6.3.5 Status Switchover

1. In the Normal status,

- Press the SILENCE key for less than 2 seconds to switch to the Alarms Paused status, or
- Press the SILENCE key for 2 seconds or more to switch to the System Silenced status.

2. In the Alarms Paused status,

- Press the SILENCE key for less than 2 seconds to switch to the Normal status, or
- Press the SILENCE key for 2 seconds or more to switch to the System Silenced status.

3. In the System Silenced status,

- Press the SILENCE key for less than 2 seconds to switch to the Alarms Paused status, or
- Press the SILENCE key for 2 seconds or more to switch to the Normal status.

4. In the Alarms Silenced status,

- Enter the USER MAINTAIN menu and set ALARM SOUND to OFF.The system restores the default alarm volume.

6.4 Latching Alarms

As described in ***4.4.2 Alarm Setup***, the parameter alarm type can be set to either LATCHED or UNLATCHED.

If the parameter alarm type is set to LATCHED, before or during the occurence of a parameter alarm, the alarm message will be latched even if the initial alarm condition has ceased. The alarm messsage continues to be displayed, but the alarming modes change as follows:

- The measured parameter value and the upper or lower parameter limits stop flashing.
- The generated time of the alarm is displayed behind the alarm message in the physiological alarms area.

If the parameter alarm type is set to UNLATCHED, the monitor stops giving any indication for this alarm when the initial alarm condition has ceased.

6.5 Clearing Alarms

Generally the alarm indications of an alarm will automatically be cleared when the alarm condition that triggers the alarm ceases. However, you can also clear the alarm indications or the latched alarms by the following ways.

1. Clearing audible and visual alarm indications

For some technical alarms, the audible and visual alarm indications will be cleared if the monitor is set to the Alarms Paused status (by pressing the Silence key for less than 2 seconds), and the alarm message will be changed to prompt information during and after the alarms paused time. If the technical alarm is triggered again after the monitor restores to the normal status, the monitor will give alarming indications as normal.

Please refer to ***C Alarm Messages and Prompt Information*** to see for which technical alarms that the audible and visual indications can be cleared.

2. Clearing all alarm indications

For some technical alarms, if the monitor is set to the Alarms Paused status (by pressing the Silence key for less than 2 seconds), all alarm indications will be cleared during and after the alarms paused time. If the technical alarm is triggered again after the monitor restores to the normal status, the monitor gives alarming indications as normal.

Please refer to ***C Alarm Messages and Prompt Information*** to see for which technical alarms that all alarm indications can be cleared.

3. Clearing latched alarms

Clearing latched alarms is also referred to as resetting alarms. It refers to clear the latch alarms by setting the monitor to the Alarms Paused status (by pressing the Silence key for less than 2 seconds).

6.6 When an Alarm Occurs

⚠WARNING

- **When an alarm occurs, always check the patient's condition first.**

When an alarm occurs to the monitor, refer to the following steps and take action properly.

1. Check the patient's condition.
2. Identify the alarming parameter and the alarm category.
3. Identify the cause of the alarm.
4. Take action to remedy the alarm cause.
5. Check if the alarm is cleared.

For details about how to deal with specific alarms, see ***C Alarm Messages and Prompt Information.***

FOR YOUR NOTES

7 Freezing Waveforms

You can freeze the monitored waveforms of a patient as desired and view the waveforms to gain a clear observation. Besides, the monitor can print two frozen waveforms using the recorder.

The freezing function of the monitor has the following features.

- When the monitor enters the frozen mode, it exits all other menus automatically.
- The system freezes all waveforms displayed in the waveforms area.
- The frozen waveforms can be reviewed and recorded.

7.1 Freezing and Unfreezing

Entering the Frozen Mode

1. Press the FREEZE key on the control panel when the monitor is not in frozen mode.
2. The system exits all displayed menus (if displayed), and the FROZEN menu pops up.

Figure 7-1 Frozen Menu

3. All displayed waveforms are frozen. In other words, the waveforms stop being refreshed or scrolling.

Exiting the Frozen Mode

To exit the frozen mode,

- Select EXIT in the FROZEN menu, or
- Press the FREEZE key on the control panel again.

After exiting the frozen mode, all waveforms on the screen are cleared and new real-time waveforms are displayed. If the scan type of the monitor is set to REFRESH, the waveforms are refreshed from the left of the waveforms area to the right; if the scan type is set to SCROLL, the waveforms are displayed from the right of the waveforms area to the left and are scrolling.

7.2 FROZEN Menu

The FROZEN menu is displayed at the lower left corner. You can perform the following settings in this menu.

- WAVE 1 — Waveform 1
  It determines the first frozen waveform to be printed on the recorder paper. The options of waveform 1 include all waveforms displayed on the screen and OFF. The waveform 1 will not be recorded when OFF is selected.
- WAVE 2 — Waveform 2
  It determines the second frozen waveform to be printed on the recorder paper. The options of waveform 2 include all waveforms displayed on the screen and OFF. The waveform 2 will not be recorded when OFF is selected.
- REC — Record
  When selected, the recorder starts printing out the selected waveform 1 and waveform 2.
- EXIT — This option allows you to exit the FROZEN menu and unfreeze the waveforms.

7.3 Recording Frozen Waveforms

1. Select WAVE 1 and WAVE 2.
2. Select the REC option, and the recorder prints out the selected frozen waveforms and the parameters measured at the moment when the waveforms were frozen.
3. If OFF is selected from the WAVE 1 or WAVE 2 options, the recorder will merely print out one waveform and the parameters measured at the moment when the waveforms were frozen.
4. If OFF is selected from both the WAVE 1 and WAVE 2 options, the recorder will not print out any waveform and will merely print out the parameters measured at the moment when the waveforms were frozen.
5. The recording time length is identical to that of the waveforms displayed on the screen. If a waveform is of faster sweep speed, its recording time is shorter.
6. During waveform recording, the monitor is still in frozen mode.
7. When the recording completes, you can select to record other waveforms.
8. If the recorder is not installed, selecting the REC option or pressing the RECORD key triggers the "Recorder does not exit" message, which is displayed in the prompt information area.

8 Recording

8.1 Overview

A thermal recorder can be equipped with the monitor. The performance of the recorder is described as below.

- Records patient information and parameters.
- Records a maximum of two waveforms.
- The optional recording rates: 25mm/s and 50mm/s.
- The recording grid is optional.
- Multiple recording types are supported.

For details about the recorder setup, please refer to ***4.4.4Record Setup***.

8.2 Recording Types

The monitor supports the following types of recordings:

- Real-time recording: continuous real-time recording or 8-second real-time recording.
- Automatic recording.
- Alarm recording: measured parameter alarm, ST segment alarm, or arrhythmia alarm recording.
- Frozen waveform recording.
- Trend graph/table recording: trend graph, trend table, NIBP measurement, alarm event or arrhythmia recording.
- Titration table recording.
- Monitor status information recording.

Real-time recording

Pressing the RECORD key on the control panel, the real-time recording starts and the current parameters and waveforms are recorded. As described in ***4.4.4Record Setup,*** you can set the RT REC TIME to 8S or CONTINUUM in the RECORD menu. You can also select the two waveforms (REC WAVE 1 and REC WAVE 2) to be recorded. If one of the two waveforms is set to OFF, the recorder will merely print out one waveform and all the measured parameters; if both are set to OFF, the recorder will only print out all the measured parameter.

Automatic recording

The monitor starts recording at the selected interval (TIMING REC TIME) and record for 8s waveforms automatically. For details, see ***4.4.4Record Setup***.

Alarm recording

Alarm recording includes measured parameter recording, ST segment alarm recording and arrhythmia alarm recording.

1. Parameter alarm recording

When a parameter alarm occurs, the recorder automatically records two waveforms of 8, 16 or 32 seconds (respectively 4, 8 or 16 seconds before and after the alarm. See ***4.4.2Alarm Setup***) and all measured parameters.

2. ST segment alarm recording

In case of an ST segment alarm, the recorder automatically prints two ECG waveforms of 8, 16 or 32 seconds (respectively 4, 8 or 16 seconds before and after the alarm) and all the measured parameters.

3. Arrhythmia alarm recording

In case of an arrhythmia alarm, the recorder automatically prints an ECG waveform of 8 seconds (respectively 4 seconds before and after the alarm) and all the measured parameters.

NOTE

- **For a parameter alarm recording, you must first set the ALM and ALM REC options to ON.**

Frozen waveform recording

In the frozen mode, the monitor can print the frozen waveforms displayed on the screen and the parameters measured at the moment when the waveforms were frozen. For details, see ***7.3Recording Frozen Waveforms***.

Trend graph/table recording

When the trend graph/trend table or a recall window is opened, you can select the REC option to print out the trend graph, trend table, NIBP measurement, alarm event or arrhythmia event.

Titration table recording

You can select the TITRATION option in the DRUG CALC menu and open the TITRATION window. The REC option in the window allows you to print the calculation result of the titration table.

Monitor status information recording

The REC option in the STATUS menu allows you to print the status information of the monitor.

8.3 Recorder Operations

Continuous real-time recording

1. Press the REC key to start recording.
2. Press the REC key again to stop the recording.

8-second real-time recording

1. Press the REC key to start recording.
2. The recording stops automatically in 8 seconds.

Automatic recording

1. The recorder starts recording automatically at the preset interval (RT REC TIME).
2. The recording stops automatically in 8 seconds.

Alarm recording

1. When an alarm occurs, the recorder starts recording automatically.
2. The recording stops automatically when the preset alarm recording time (ALM REC TIME) is over.

Frozen waveform recording

1. Press the FREEZE key to open the FROZEN menu.
2. Select WAVE 1 and WAVE 2.
3. Select the REC option to record.
4. When the recording completes, the recorder stops automatically.

Trend graph recording

1. Select TREND GRAPH>> in SYSTEM MENU to open the TREND GRAPH window.
2. Select the REC option to start recording.
3. When the recording completes, the recorder stops automatically.

Trend table recording

1. Select TREND TABLE>> in SYSTEM MENU to open the TREND TABLE window.
2. Select the REC option to start recording.
3. When the recording completes, the recorder stops automatically.

NIBP measurement recording

1. Select NIBP RECALL>> in SYSTEM MENU to open the NIBP RECALL window.
2. Select the REC option to start recording.
3. When the recording completes, the recorder stops automatically.

Alarm event recording

1. Select ALARM RECALL>> in SYSTEM MENU to open the ALARM RECALL window.
2. Select the alarm recall time in the START and END fields.
3. Select the ALARM RECALL>> option and open the ALARM RECALL window.
4. Select the REC option to start recording.
5. When the recording completes, the recorder stops automatically.

Arrhythmia alarm recording

1. Select the ECG label in the ECG parameter window to the ECG SETUP menu pops up.
2. Select the ARR ANALYSIS >> option in the ECG SETUP menu, and a popup menu is opened.
3. Select ARR RECALL>> to open the ARR RECALL window.
4. Select the WAVE >> option to open the ARR WAVE RECALL window
5. Select REC to start recording.
6. When the recording completes, the recorder stops automatically.

Titration table recording

1. Select DRUG CALC >> in SYSTEM MENU.
2. Perform the drug calculation, and then select the TITRATION >> option.
3. Select the REC option to start recording.
4. When the recording completes, the recorder stops automatically.

Monitor status information recording

1. Select MAINTAIN >> in SYSTEM MENU, and a popup menu is opened.
2. Select STATUS >> in the popup menu.
3. Select the REC option in the STATUS menu to start recording.
4. When the recording completes, the recorder stops automatically.

8.4 Installing Recorder Paper

Installing Procedure

1. Press the latch at the upper right of the paper compartment door to releases the door.
2. Lift the roller lever located at the upper left of the paper compartment as shown in the following figure.
3. Insert a new roll of recorder paper into the compartment as shown below.
4. The roller of the recorder scrolls automatically, and the paper comes out of the compartment.
5. Push down the roller lever.
6. Close the recorder door.

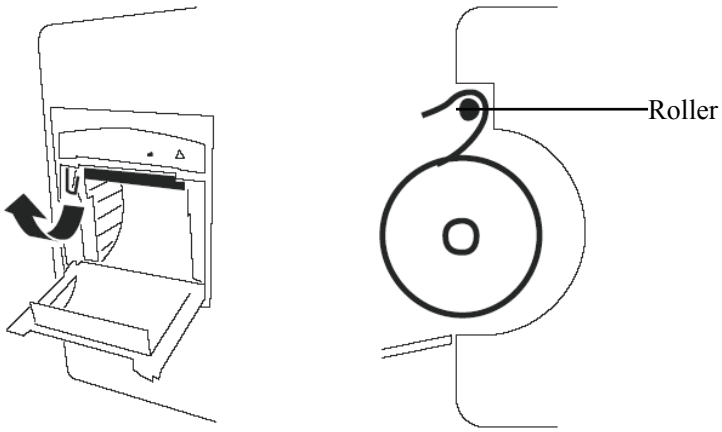


Figure 8-1 Installing Recorder Paper

⚠CAUTION

- **Use the specified recorder paper only. Other recorder paper may cause the recorder to print with poor quality, function improperly or not at all, or bring damage to the thermal print head.**
- **Do not pull the recorder paper with force when the printing is in process. Otherwise, damages to the recorder may be incurred.**
- **Do not leave the recorder door open except you are replacing the recorder paper or removing a fault.**

Removing the Paper Jam

If the recorder does not function properly or produces unusual sound, open the recorder door to check for a paper jam. You can follow the operations below to remove the paper jam.

1. Open the recorder door.
2. Tear the paper off from the leading edge at the paper outlet.
3. Lift the lever on the upper left of the recorder.
4. Pull the paper from the paper inlet.
5. Re-insert the paper.

9 Recall

9.1 Overview

The monitor is able to store important patient data so that the user can review and record the data as desired.

- Trend Graph Recall

You can review the latest 1-hour trend graph of a measured parameter displayed every 1 or 5 seconds, or the latest 72-hour trend graph displayed every 1, 5 or 10 minutes.

- Trend Table Recall

You can review the latest 72-hour trend table data of a measured parameter.

- NIBP Recall

You can review 400 NIBP measurement results, each of which include a systolic pressure, a mean pressure, a diastolic pressure, PR and a measurement time.

- Alarm Event Recall

You can review the latest 60 parameter alarm events, as well as the 8, 16, or 32-second waveforms stored at the time of the alarm.

- Arrhythmia Event Recall

You can review the latest 60 arrhythmia events and the related 8-second waveforms.

This chapter only gives introduction to the first four recalls mentioned above. For details about the arrhythmia event recall, please refer to ***ECG/RESP Monitoring***.

NOTE

- **When your monitor is powered off or the power is interrupted accidentally, all the stored data is lost, if the monitor is not equipped with the function of "Power-off Data Storage".**

9.2 Trend Graph Recall

Select TREND GRAPH >> in SYSTEM MENU. The following window appears.

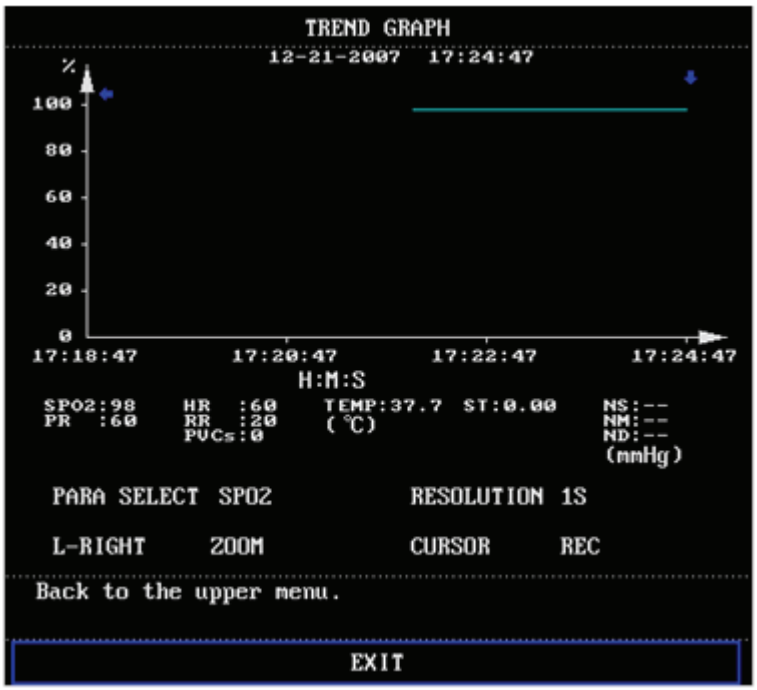


Figure 9-1 TREND GRAPH window

As shown above, PARA SELECT allows you to select a parameter from the options. The trend graph of the selected parameter is displayed. If NIBP is selected, no trend graph is to be displayed. Instead, the ▼ mark indicates the systolic pressure, the ▲ mark indicates the diastolic pressure and the * mark indicates the mean pressure. The x-axis shows the time scale while the y-axis shows the value scale of a parameter. The trend cursor is used to identify a specific time in the whole trend time, and it is displayed below the title "TREND GRAPH". All the parameter values measured at the time of the cursor are displayed in the parameters area.

- PARA SELECT (Parameter Selection)

1. Rotate the control knob and highlight the field at the right PARA SELECT.
2. Press the control knob, and a popup menu with all parameter options is opened.
3. Rotate the control knob and highlight your desired parameter, and then select it. The trend graph of the selected parameter is displayed in the TREND GRAPH window.

- RESOLUTION

1. Rotate the control knob and highlight the field at the right of RESOLUTION.
2. Press the control knob, and a menu pops up.
3. Select 1S or 5S to review a 1-hour trend graph, or
4. Select 1MIN, 5MIN or 10 MIN to review a 72-hour trend graph.

■ L-RIGHT

1. Rotate the control knob to highlight the L-RIGHT option, and then press.
2. If the mark is displayed at the upper left corner of the trend graph, you can rotate the control knob anticlockwise to review the earlier trend graph.
3. If the mark is displayed at the upper right of the trend graph, you can rotate the control knob clockwise to review the later trend graph.

■ ZOOM

1. Rotate the control knob to highlight the ZOOM option, and then press.
2. Rotate the control knob to adjust the vertical value scale.
3. The amplitude of the trend curve changes at the vertical direction accordingly. Any data that is beyond the maximum value of the scale will not be displayed. Instead, it is represented by the maximum scale value.

■ CURSOR

1. Rotate the control knob to highlight the CURSOR option, and then press.
2. Rotate the control knob, and the trend cursor moves as per the preset resolution.
3. The cursor time and the values displayed in the parameters area change accordingly.

■ REC (Recording)

The REC option allows you to print the currently displayed parameters and trend graph from the recorder.

■ Mark Event

If an event is marked A, B, C or D, the mark (A, B, C or D)will be displayed at the mark time on the trend graph.

NOTE

- **The chapter uses "earlier" or "later " to indicate the time that an event happened. For example, May 28 is earlier than May 29, and 8 :00 on May 29 is earlier than 9 :00 on May 29.**

9.3 Trend Table Recall

Select TREND TABLE >> in SYSTEM MENU. The following window appears.

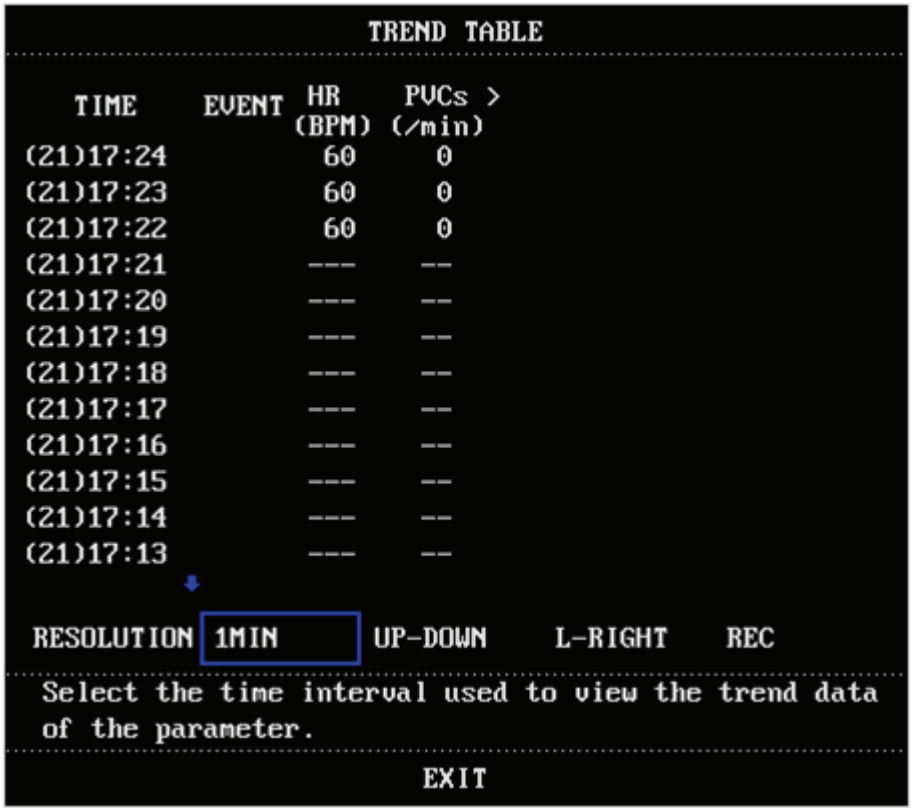


Figure 9-2 TREND TABLE window

The TIME is displayed on the left of the trend table. On the top is the latest time. From the upper to the lower, the interval between two adjacent times depends on the preset resolution. And the date is contained in the brackets. On the right of the TIME is the EVENT. If a marked event happened at a specific time, the mark will be displayed aside that time in the EVENT field. On the right of the trend table are parameter names and the trend data. The symbol "－－" means the parameter is not measured at the corresponding time. Besides, the L-RIGHT option allows change of the parameter name and the trend data.

If you select to review the NIBP trend data, the measurement results as well as the specific measurement time (in the TEST AT filed) are displayed. If more than one measurement results are obtained in a time interval, only one result is to be displayed in the measurement result field.

- RESOLUTION

1. Rotate the control knob to highlight the field at the right of RESOLUTION.
2. Press the control knob, and a popup value with the options, 1MIN, 5 MIN, 10MIN, 30MIN and 60MIN, is opened.
3. The time displayed in the TIME filed changes with the resolution.

- UP-DOWN

1. Rotate the control knob to highlight the UP-DOWN option, and press.
2. If the  mark is displayed at the lower right of the TIME field, you can rotate the control knob anticlockwise to page down and review the trend data of earlier time.
3. If the  mark is displayed at the upper right of the TIME field, you can rotate the control knob clockwise to page up and review the trend data of later time.

- L-RIGHT

1. Rotate the control knob to highlight the L-RIGHT option, and then press.
2. Rotate the control knob to select a parameters set.

   The “>” mark on the right of the parameter names indicates the following page is available, and the “<” mark on the left of the parameter names indicates the previous page is available.
3. The parameter names and the trend data changes with the selected parameter set.

- REC

The REC option allows you to print out the trend data of the currently displayed parameter(s).

- Mark Event

If an event is marked A, B, C or D, the mark (A, B, C or D) will be displayed aside the mark time on the trend table.

9.4 NIBP Recall

Select NIBP RECALL >> in SYSTEM MENU. The following window appears.

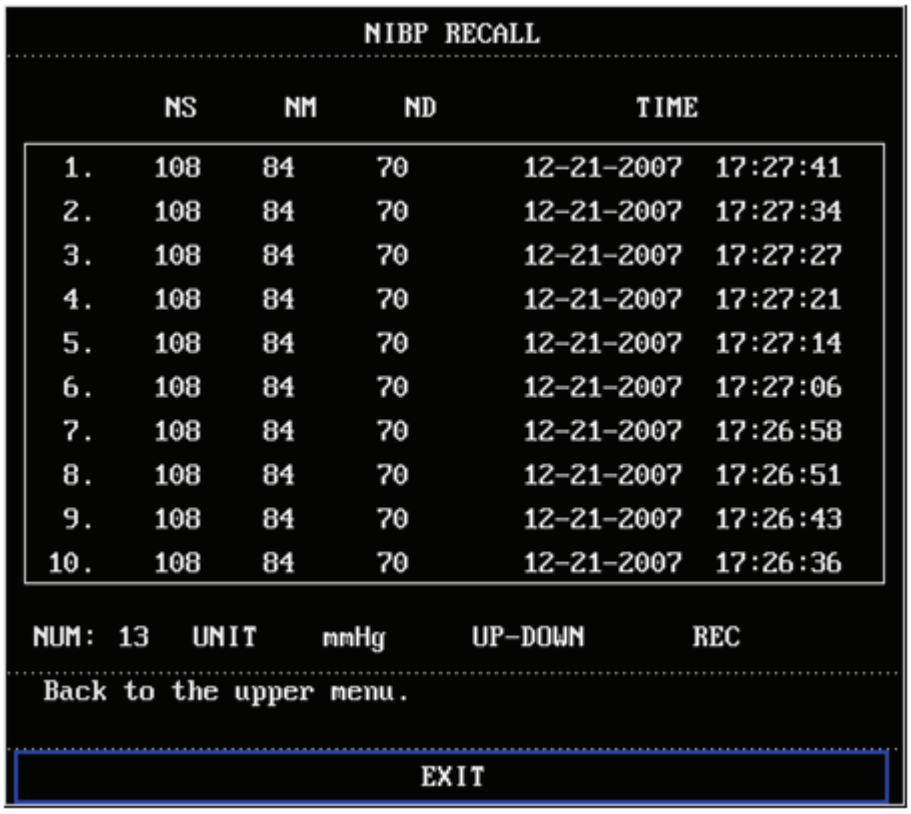


Figure 9-3 NIBP RECALL

The NIBP RECALL window shows the non-invasive systolic pressure (NS), non-invasive mean pressure (NM), non-invasive diastolic pressure (ND) and the measurement time (TIME). The optional pressure units (UNIT) are mmHg and kPa. NUM indicates the current measurement times. A maximum of ten measurements can be displayed on the screen once. If there are more, you may use the UP-DOWN option to review the
data of a later or earlier time. If the measurement times surpass 400, only the latest 400 measurements are to be displayed. The REC option allows you to print out all measurement data of NIBP RECALL.

9.5 Alarm Event Recall

Select ALARM RECALL >> in SYSTEM MENU. The following menu appears.

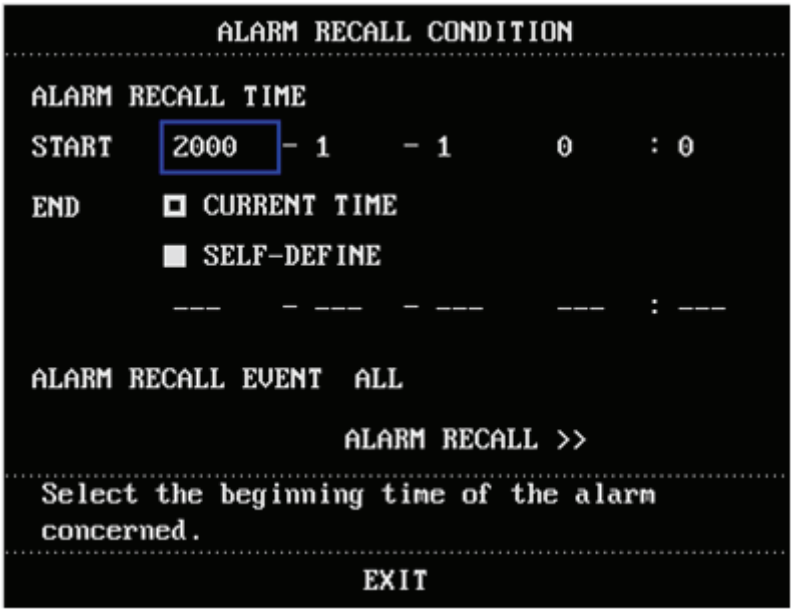


Figure 9-4 ALARM RECALL CONDITION Menu

In this menu, you may select the conditions of alarm review:

- ALARM RECALL TIME

You can select the desired start time and end time for review. The end time can be set to either CURRENT TIME or SELF-DEFINE.

- ALARM RECALL EVENT

The drop-down menu of ALARM RECALL EVENT provides a list of parameter options to be reviewed. Among them, ALL indicates all parameter alarm events are to be reviewed, H refers to the upper parameter limit and L refers to the lower parameter limit.

- ALARM RECALL>>

If the ALARM RECALL TIME and the ALARM RECALL EVENT are both selected, you can select the ALARM RECALL >> option to open the ALARM RECALL window as shown in Figure 9-5.

This window contains the following information:

1. Time span (the start time and end time of alarm recall).
2. Alarm event type.
3. The alarming parameter, parameter value, alarm level and the alarm time.

4. The alarm event number (format: NO: n of N). N indicates the amount of alarm events and n indicates the sequence number of the currently displayed alarm event.
5. Parameter values at the time of the alarm event.
6. Two waveforms at the time of the alarm event. You can set the waveform length by selecting from the ALM REC TIME options in the ALARM SETUP menu. Please refer to ***4.4.2Alarm Setup***.

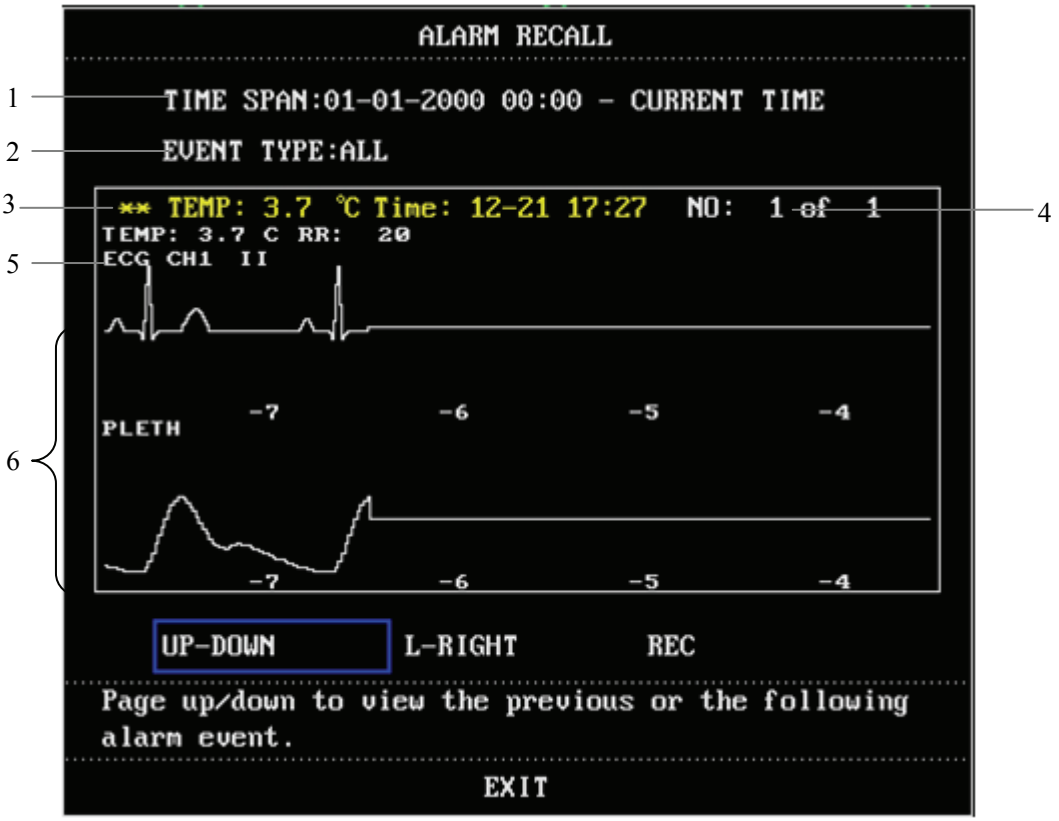


Figure 9-5 ALARM RECALL Menu

- UP-DOWN

The monitor is able to store a maximum of 70 alarm events. But only one alarm event can be displayed in the ALARM RECALL window once. You can select the UP-DOWN option and then rotate the control knob to view an earlier or later alarm event.

- L-RIGHT

You may select the L-RIGHT option and then rotate the control knob to review the 8,16,or 32-second waveforms stored.

- REC

This option allows you to print out all parameter data and waveforms displayed in the current window using the recorder.

10 Drug Calculation

10.1 Drug Calculation

Select DRUG CALC >> in SYSTEM MENU. The following window appears.

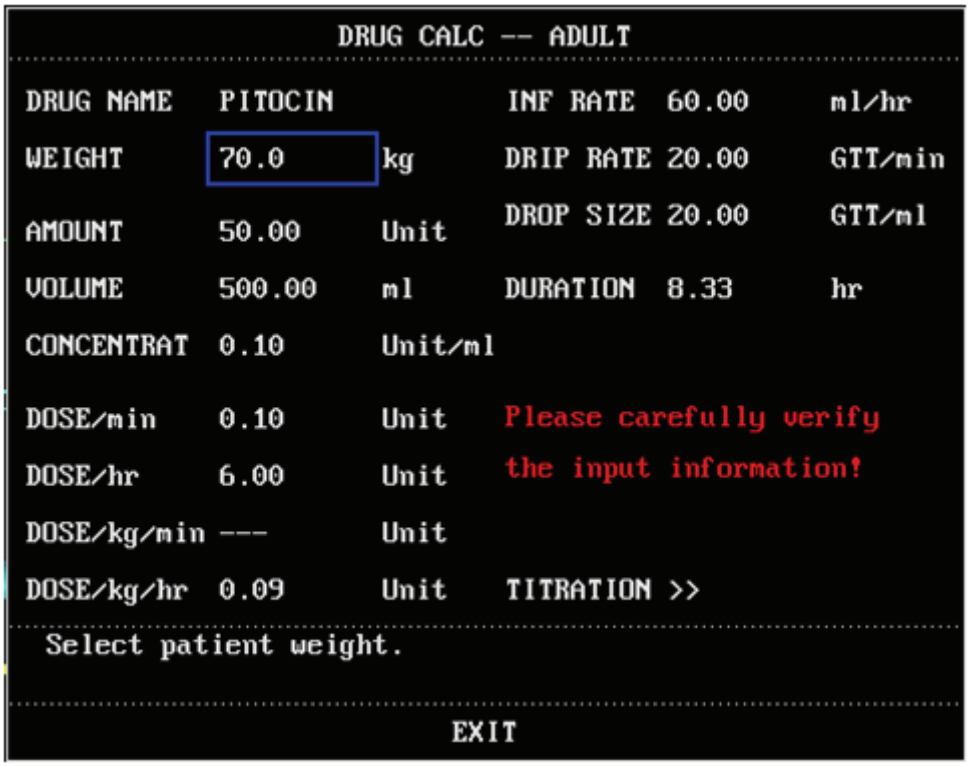


Figure 10-1 Drug calculation

10.1.1.1 Calculation Formula

CONCENTRAT = AMOUNT/VOLUME
INF RATE = DOSE/CONCENTRAT
DURATION = AMOUNT/DOSE
DOSE = INF RATE×CONCENTRAT

10.1.1.2 Operating Method

1. Select the drug name

Open the drop-down menu of DRUG NAME and select one from the following 15 options:

- DRUG A, B, C, D and E
- AMINOPHYLLINE
- DOBUTAMINE
- DOPAMINE
- EPINEPHRINE
- HEPARIN
- ISUPREL
- LIDOCAINE
- NIPRIDE
- NITROGLYCERIN
- PITOCIN

NOTE

- **The DRUG names A, B, C, D and E are user-definable.**

2. Input the patient weight

Select the field on the right of WEIGHT and rotate the control knob to enter the patient weight correctly.

3. Input correct parameter values

The system gives a group of random initial values when the above operations are finisehd. However, these values cannot be used as the calculation reference. The operator shall enter a new group of correct values required in the calculation formula, according to the doctor's instruction.

4. Verify the correctness of the calculation results

After the calculation, the operator shall verify the correctness of the entered parameter values, so as to guarantee correct calculation results.

10.1.1.3 Units

Each drug has its fixed unit or unit series. The operator must select the proper unit according to the doctor's instruction. Among a unit series, one unit may change to another automatically depending on the entered parameter value. If a parameter value exceeds the system-defined range, "——" will be displayed. The units of the self-definable drugs are as follows :

1. DRUG A, B and C uses the unit series: g, mg and mcg.
2. DRUG D uses the unit series: Unit, k Unit and m Unit.
3. DRUG E uses the unit series: mEq.

NOTE

- **In neonate mode, DRIP RATE and DROP SIZE are disabled.**
- **The prerequisite for drug calculation is that the drug name and the patient weight are selected.**
- **The function of drug calculation is independent from other functions of the monitor. The patient information used for drug calculation may not consist with the patient of your monitor. Any change in the DRUG CALC menu will not affect the information of the patient under monitoring.**

⚠WARNING

- **The random values given by monitor cannot be used as the calculation reference.**
- **After the drug calculation, verify the entered parameters are correct and the calculation results are proper. We are not responsible for the consequence caused by wrong entering and operation.**

10.2 Titration Table

After the drug calculation, select TITRATION in DRUG CALC window. The following window pops up.

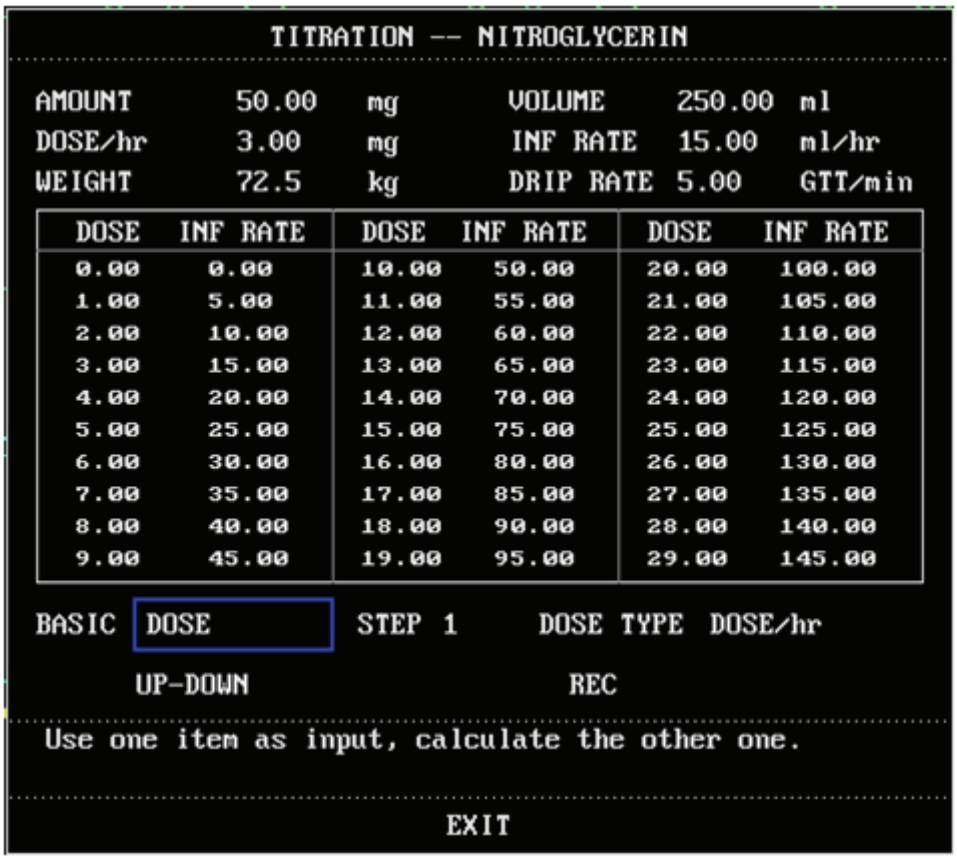


Figure 10-2 TITRATION

■ BASIC

1. Rotate the control knob to highlight the field on the right of BASIC.
2. Press and rotate the control knob to select DOSE, INF RATE or DRIP RATE.
3. The data in the trend table changes accordingly.

■ STEP

1. Rotate the control knob to highlight the field on the right of STEP.
2. Press and rotate the control knob to select a value in the range of 1-10.
3. The data in the trend table changes accordingly.

■ DOSE TYPE

1. Rotate the control knob to highlight the field on the right of DOSE TYPE.
2. Press and rotate the control knob to select either DOSE/min, DOSE /hr, DOSE/kg/min or DOSE/kg/hr in the popup menu.
3. The data in the trend table changes accordingly.

■ UP-DOWN

1. Rotate the control knob to highlight the UP-DOWN option in the window.
2. Rotate the control knob to review more data.

■ REC

The REC option allows you to print the currently displayed data from the recorder.

NOTE

- **The titration table is independent from other functions of the monitor. The patient information used in the titration table may not consist with the patient of your monitor. Any change in the titration table will not affect the information of the patient under monitoring.**

FOR YOUR NOTES

11 ECG/RESP Monitoring

11.1 Overview

11.1.1 ECG Waveform

In the standard screen, one or two ECG waveform(s) is (are) displayed at the top of the display .

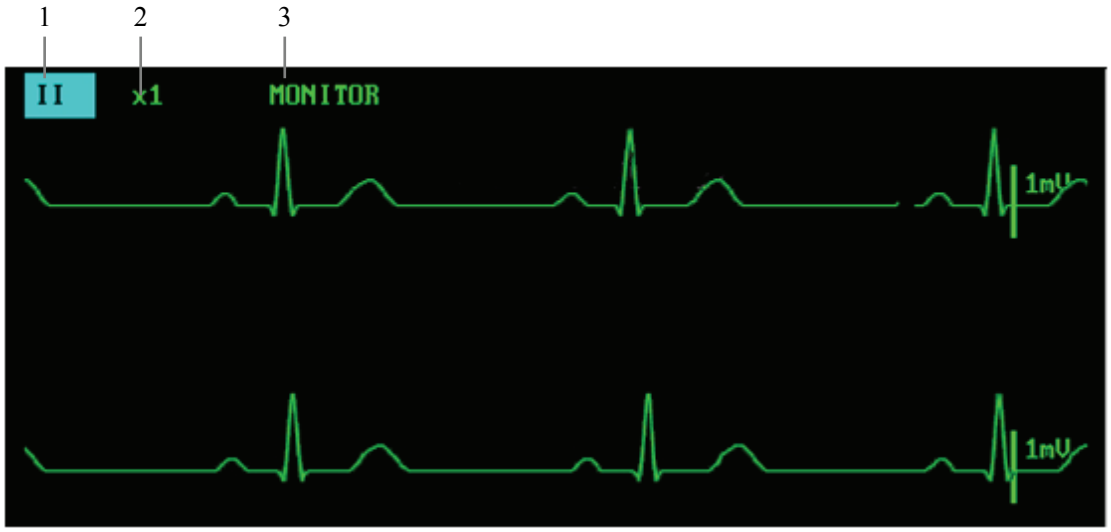


Figure 11-1 ECG Waveforms

1. ECG lead

You can select the lead of channel 1 from the label options. The monitor gives three lead options: I, II and III;

2. Gain of the waveform

You may use this label to adjust the amplitude of the ECG waveform. The gain options include ×0.25, ×0.5, ×1, ×2 and AUTO. When AUTO is selected, the monitor adjusts the gain automatically. Besides, a 1mV scale is displayed at the right side of each ECG waveform. The height of the 1mV bar is directly proportional to the ECG waveform amplitude.

3. Filter Method

The filtering enables clearer and more detailed waveforms. There are three filter methods for selection.

- DIAGNOSTIC: The monitor displays the ECG waveforms without filter;
- MONITOR: It effectively filters the artifacts that might cause false alarms;
- SURGERY: This filter is used to reduce the artifacts and interference from electrosurgery equipment.

The selected filter is applied to both channels, but the filter label is merely displayed above the first ECG waveform.

⚠WARNING

- **Only in the DIAGNOSTIC mode will the monitor provide non-processed real signal waveforms. In the MONITOR or SURGERY mode, the ECG waveforms may have slight distortions and the result of the ST segment analysis may be affected greatly. In the SURGERY mode, the ARR analysis result may be affected to some extent. Hence, the DIAGNOSTIC mode is recommended when monitoring a patient in an environment with slight interference.**

NOTE

- **If the amplitude of an ECG waveform is too large, the peak of the waveform might not be displayed. In this case, you should change the waveform gain properly.**

11.1.2 ECG Parameters

Figure 11-2 ECG Parameters

The parameters related to ECG are displayed to the right of the ECG waveforms as shown above. The heartbeat indicator flashes in the same rate with the patient's heartbeat. On the right of the heart rate value are the ON/OFF status or value of PACE, ST and PVCs.

11.2 ECG Monitoring Procedure

11.2.1 Preparation

1. Skin preparation

The quality of ECG information displayed on the monitor is a direct result of the quality of the electrical signal received at the electrode. Proper skin preparation is necessary for good signal quality at the electrode. A good signal at the electrode provides the monitor with valid information for processing the ECG data. Choose flat, non-muscular areas to place electrodes. Following is a suggested guideline for skin preparation:

- Shave hair from skin at chosen sites.
- Gently rub skin surfaces at sites to remove dead skin cells.
- Thoroughly cleanse the site with a mild soap and water solution (do not use ether or pure alcohol because they will increase skin impedance).
- Dry the skin completely before applying the electrodes.

2. Attach the ECG leadwire to the electrodes prior to placement.
3. Place the electrodes on the patient. If the conductive ointment is not applied to the electrodes, apply it before the placement.
4. Connect the electrode lead to the patient cable.
5. Make sure the monitor is turned on and is ready for monitoring.

11.2.2 Electrode Placement

⚠WARNING

- **Use only the specified ECG cable for monitoring.**
- **When applying electrodes or connecting cables, make sure they are not connected to any conductive part or the ground. Verify that all ECG electrodes, including neutral electrodes, are securely attached to the patient.**
- **Skin irritation may result from the continuous application of the ECG electrodes. These should be checked each day. If there is an indication of excess skin irritation, replace the electrodes or change the location of the electrodes every 24 hours.**
- **Do not touch the patient, bed or instrument during defibrillation.**
- **When applying the ECG cable with no resistance to our patient monitor or other patient monitor that has no current limit resistance in it, the monitor cannot be applied to defibrillation.**
- **Interference from a non-grounded instrument near the patient and ESU interference can cause inaccuracy of the ECG waveform.**
- **Always dispose of, or recycle electrodes properly to prevent from environment contamination.**
- **Verify the lead fault detection prior to the start of monitoring. Unplug the ECG cable from the ECG connector and the screen should display the error message "ECG LEAD OFF" and an audible alarm should be activated.**

NOTE

- **The conductive ointment coatings should be isolated, and the chest electrodes should have no contact with each other to avoid short-circuit.**
- **Do not use the physiological saline to replace the electrode gel to avoid the electrodes being eroded.**

11.2.2.1 Electrode Placement

Following is the configuration per European standard when using three leadwires:

- R (right arm) electrode: near the right shoulder, directly below the clavicle.
- L (left arm) electrode: near the left shoulder, directly below the clavicle.
- F (left leg) electrode: on the left hypogastrium.

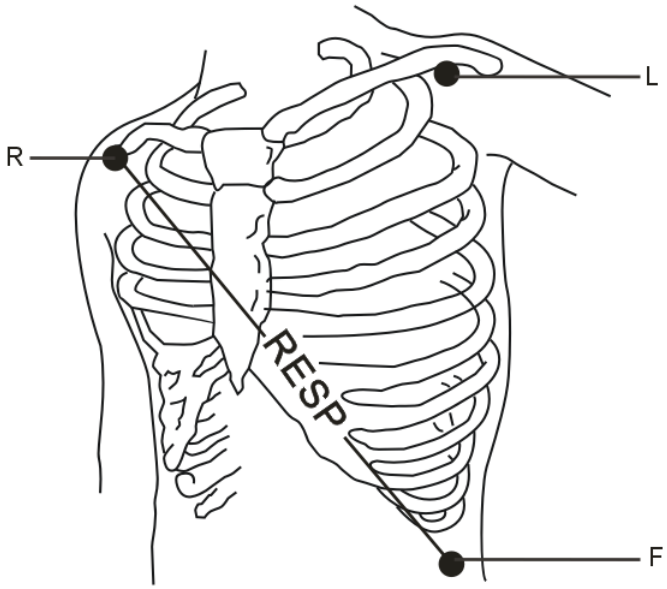


Figure 11-3 Positions of 3-Leadwire Electrode Placement

The chart below shows the label used to identify each leadwire. Included also is its associated color code per American (AHA) and European (IEC) standards.

American Standard		European Standard	
Label	Color	Label	Color
RA	White	R	Red
LA	Black	L	Yellow
LL	Red	F	Green

11.2.2.2 Electrode Placement for Surgical Patients

Electrode placement during surgery is dependent on the type of surgery being performed. For example, with open chest surgery, the electrodes might be placed laterally on the chest or on the back. In the operating room, artifact can sometimes affect the ECG waveform due to the use of electrosurgery equipment. To help reduce this, place the electrodes on the right and left shoulders, the right and left sides near the stomach, and place the chest lead on the left side at mid-chest. Avoid placing the electrodes on the upper arms. This will cause the ECG waveform to be too small.

⚠WARNING

- **When using Electrosurgery equipment, patient leads should be placed in a position that is equal distance from the Electrosurgery electrotome and the grounding plate to avoid burns to the patient. The Electrosurgery equipment wire and the ECG cable must be kept separated and not allowed to tangle.**
- **When using Electrosurgery equipment, never place the ECG electrodes near the grounding plate of the Electrosurgery device. This will cause a great deal of interference with the ECG signal.**

11.2.2.3 Characteristics of Quality ECG Signal

As shown in Figure 11-4, the normal QRS complex should exhibit the following characteristics.

- Tall and narrow with no notches.
- With a tall R-wave completely above or below the baseline.
- With a pacer spike no higher than the height of the R-wave.
- With the T-wave less than one-third of the height of the R-wave.
- With the P-wave much smaller than the T-wave.

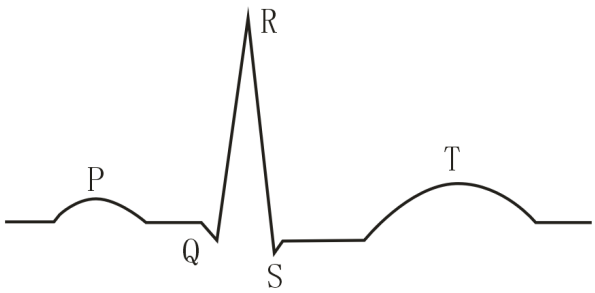


Figure 11-4 Standard ECG Waveform

To display a 1-millivolt calibration pulse on the ECG wave, select the ECG CAL option in the ECG SETUP menu. A message "when CAL, can't monitor! " is displayed on the screen.

NOTE

- **If the ECG waveform is too small, or not accurate, and the electrodes are secure and firmly attached to the patient, change the display to a different lead.**

11.3 ECG Setup Menu

Select the ECG label in the parameter windows. The following menu appears.

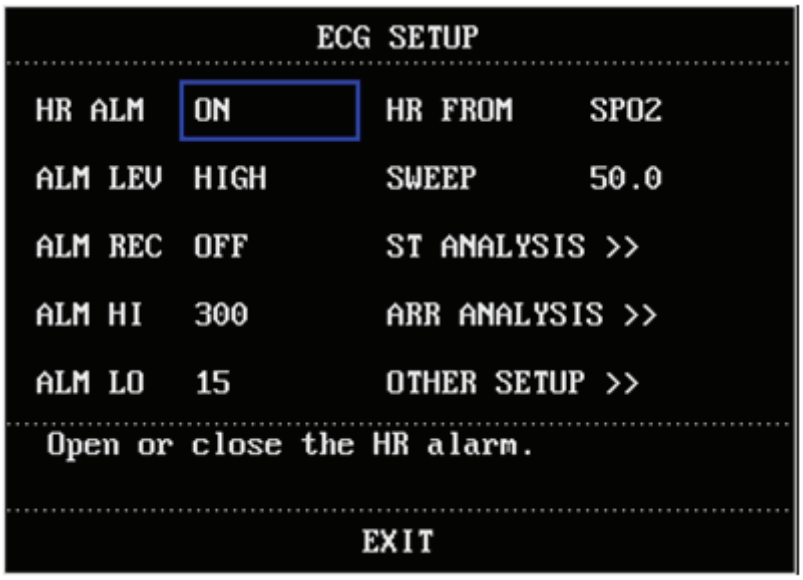


Figure 11-5 ECG SETUP menu

In this menu, you can perform the following settings:

- HR ALM — Heart rate alarm on/off status
  ON: When a heart rate alarm occurs, the monitor gives alarm indications and stores the alarm;
  OFF: When a heart rate alarm occurs, the monitor neither gives alarm indications nor stores the alarm;
  When OFF is selected, the icon is displayed on the right of the ECG label.
- ALM LEV — Alarm level
  Options: HIGH, MED and LOW.
- ALM REC — Alarm recording
  ON: When a heart rate alarm occurs, the monitor enables the recording;

OFF: When a heart rate alarm occurs, the monitor does not enable the recording.

- ALM HI — Upper alarm limit
  Determines the upper ECG alarm limit.
- ALM LO — Lower alarm limit
  Determines the lower ECG alarm limit.

For different patient types, the upper/lower limits of the heart rate alarm may vary in the following range.

Patient type	Max. ALM HI	Min. ALM LO	Increment (beat/min)
Adult	300	15	1
Pediatric	350	15	1
Neonate	350	15	1

NOTE

- **Always set the alarm limits according to the clinical condition of the individual patient.**
- **In many cases, the upper limit of heart rate alarms should not exceed 20 beats per minute higher than the patient's heart rate.**

- HR FROM — Heart rate source
  Options: ECG, SPO_2, AUTO and BOTH

1. ECG: The monitor detects the heart rate through the ECG.
2. SPO_2: The monitor detects the heart rate through the SPO_2. PULSE is displayed to the right of the ECG label while the PR (pulse rate) value is displayed below. The monitor activates pulse beeps instead of heartbeat beeps. Besides, the monitor gives indications to PR alarms but gives no indication to the HR alarms.
3. AUTO: The monitor determines the heart rate source depending on the signal quality. The ECG takes priority of the SPO_2. The SPO_2 is selected as the heart rate source only if the quality of the ECG signal is too poor to be analyzed. Once the ECG signal restores to normal situation, it is selected as the heart rate source again.
4. BOTH: The monitor displays both the HR and the PR values. The later is displayed at the right of the SPO_2 label. The monitor will alarm for both abnormal HR and PR. HR is given priority in determining the source of the beep tone. If HR is not available, the sound will be from the PR.

NOTE

- **If SPO_2 is selected from the HR FROM options, the volume of PITCH TONE will be determined by the PR SOUND setting in the SPO_2 SETUP menu. If other HR FROM option is selected, the volume of PITCH TONE will be determined by the BEAT VOL (beat volume) setting. For details about PITCH TONE, see 12 SpO2 Monitoring.**

- SWEEP Options: 12.5, 25.0 and 50.0 mm/s;
- ST ANALYSIS For details, see 11.4ST Analysis.
- ARR ANALYSIS For details, see 11.5Arrhythmia Analysis.

Other Setup

Select OTHER SETUP >> in ECG SETUP menu. The following menu appears.

Figure 11-6 ECG SETUP menu

In this menu, you can perform the following settings.

- BEAT VOL Beat volume
  Range : 0-10. 0 indicates disabled and 10 indicates the maximum volume.
- PACE ON: When ON is selected, a detected pacemaker signal is indicated by a "|" symbol above the ECG waveform.
  OFF: When OFF is selected, the pacemaker analysis is disabled.

NOTE

- **When monitoring a patient with a pacemaker, PACE must be turned ON. Otherwise, the system will count the pacemaker pulse as QRS complex. Do not completely depend on the alarms of heart rate. The patient with a pacemaker must be nearly monitored.**
- **When PACE is turned ON, the system will neither detect the arrhythmia relating to premature ventricular beats (including PVCs counting) nor perform the ST analysis. When monitoring a patient without a pacemaker, PACE should be turned OFF.**
- **The PACE tag can be printed in the real-time recording when PACE is turned ON.**

■ NOTCH

Determines whether filter or not.

ON: The monitor protects the signals from the noise generated by the power line.

OFF: No filtering.

During the real-time recording, the NOTCH on/off status and the frequency will be recorded.

NOTE

- **If the filter method of the ECG waveform is set to a non-diagnostic mode, only the NOTCH option ON is active and the monitor filters the signals of the power line frequency; if the filter method is set to the diagnostic mode, two NOTCH options, both ON and OFF, are active, and the system sets the NOTCH to OFF automatically.**

■ ECG CAL

Select this option to begin calibrating the ECG. To stop calibration, select this option again, or change the ECG lead selection on the screen.

■ ADJUST WAVE POS

This is used to adjust the position of the ECG waveform on the screen. Select this option to access the ADJUST WAVE POS menu. Open the CH NAME popup menu and select the channel to be adjusted. Afterwards, select the UP-DOWN option and rotate the control knob to adjust the position of the selected channel on the screen. The BACK TO DEFAULT option allows you to restore the waveform to the default position on the screen.

Figure 11-7 ADJUST WAVE POS menu

- DEFAULT — You can use this option to access the ECG DEFAULT CONFIG menu. You may choose the FACTORY DEFAULT CONFIG or the USER DEFAULT CONFIG. After finishing the selection, a dialog pops up asking for confirmation of your selection.

11.4 ST Analysis

11.4.1 Overview

- The function of ST analysis is optional.
- The ST analysis of the monitor is disabled by default.
- When turning ST ANALYSIS on, the monitor selects DIAGNOSTIC mode automatically. You can set the monitor to MONITOR or SURGERY mode as required. However, the ST numerics might be severely distorted in these modes.
- With the ST analysis, the variance of the ST segment at the waveform tracks of the selected lead can be measured. The ST measurement result is displayed numerically in the ST1 and ST2 positions in the parameter window.
- You can review the ST trend graph and trend data in the TREND GRAPH and the TREND TABLE menus.
- Measurement unit of the ST segment: mV (millivolt).
- Measurement symbols of the ST segment: “+” means positive elevation, “-” means negative elevation.
- Measurement range of the ST segment: -2.0 mV to +2.0 mV.

11.4.2 ST Analysis Menu

Select ST ANALYSIS >> in ECG SETUP menu. The following menu appears.

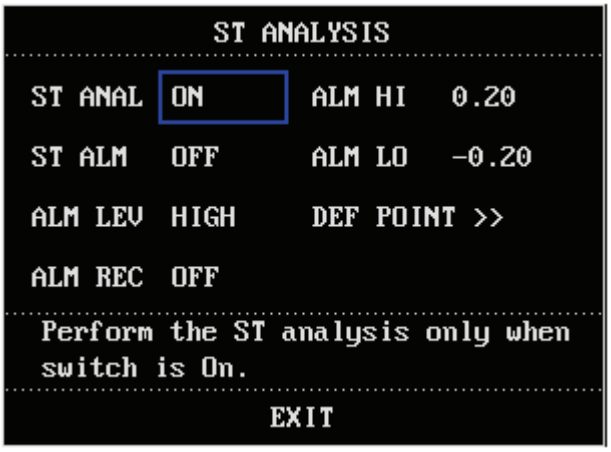


Figure 11-8 ST ANALYSIS menu

In this menu, you can perform the following settings:

- ST ANAL — ST analysis
  ON: Enables the ST analysis;
  OFF: Disables the ST analysis.

NOTE

- **When turning ST ANALYSIS on, the monitor selects DIAGNOSTIC mode automatically. You can set the monitor to MONITOR or SURGERY mode as required. However, the ST numerics might be severely distorted in these modes.**

- ST ALM — ST segment alarm
  ON: If the measured ST numerics exceed the alarm limit, the monitor gives alarm indications and saves the alarm;
  OFF: If the measured ST numerics exceed the alarm limit, the monitor does not give alarm indications or saves the alarm.
  When OFF is selected, the icon is displayed on the right of ST in the parameter window.
- ALM LEV — ST alarm level
  Options: HIGH, MED and LOW;
- ALM REC — ST alarm recording
  ON: The monitor starts recording when an ST alarm occurs;

	OFF: The monitor does not record when an ST alarm occurs.
■ ALM HI	Determines the upper limit of the ST alarm; 2.0mV is the highest.
■ ALM LO	Determines the lower limit of the ST alarm; -2.0 mV is the lowest.

NOTE

- **The alarm limits for two ST segment numerics are identical. You cannot set the alarm limit of one channel separately.**

ST Measurement Point

Selecting DEF POINT >> opens the following window.

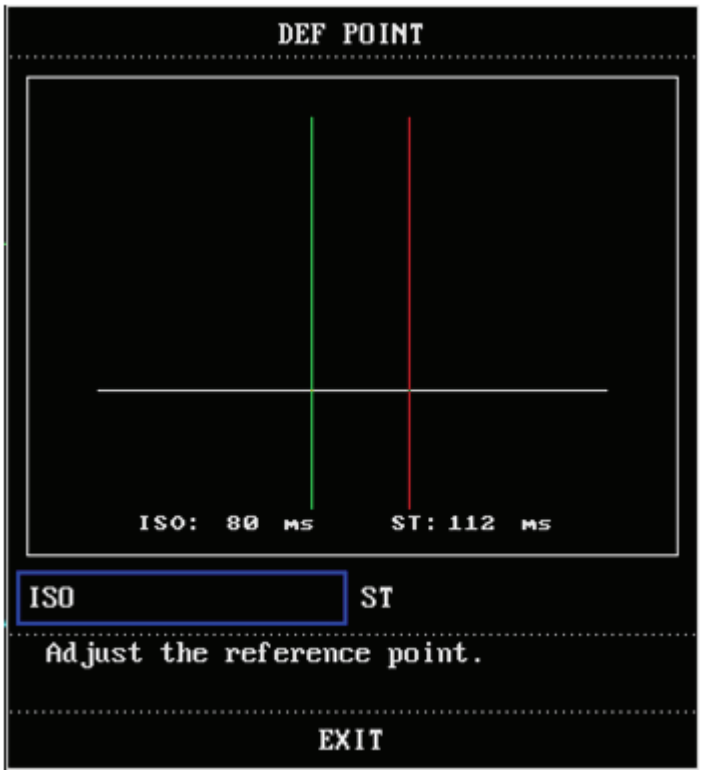


Figure 11-9 DEF POINT window

As shown above, the DEF POINT window shows the QRS complex template. Two vertical lines indicate the positions of the ISO and ST points.

- ISO: It is the base point, used to indicate the baseline point of the ST analysis. The default is 78ms.
- ST: It is the ST measurement point. The default is 109ms.

The two measurement points, ISO and ST, should be adjusted if the patient's HR or ECG morphology changes significantly. You can select the ISO or the ST option in the window and then rotate the control knob to adjust its position.

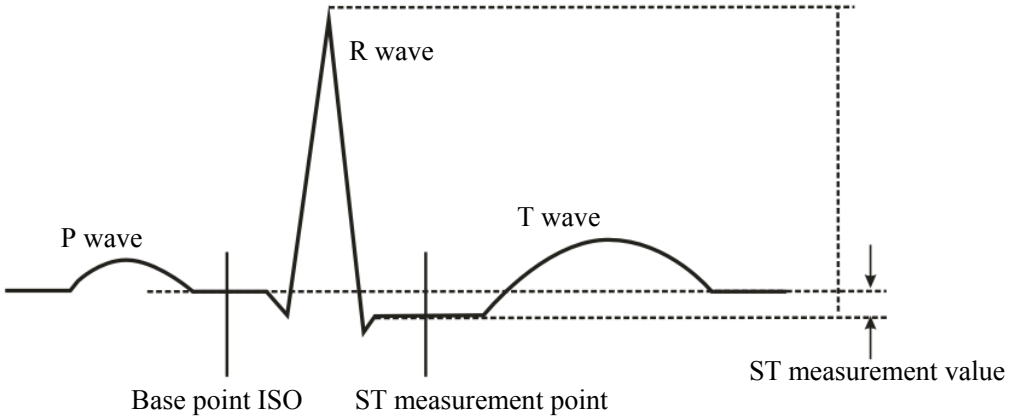


Figure 11-10 ST Measurement Point

As shown above, the peak of the R wave is the reference point for ST measurement. The ST measurement value for a beat complex is equal to the vertical difference between the two measurement points.

NOTE

- **Abnormal QRS complex is not considered in ST analysis.**

11.5 Arrhythmia Analysis

11.5.1 Overview

In clinical application, arrhythmia analysis is used to:

- Monitor the ECG of neonate or adult patients.
- Detect the change of heart rate and premature ventricular beat.
- Store the arrhythmia events and the alarm information generated.

The medical professionals can use the arrhythmia analysis to evaluate patients' condition (such as heart rate, PVCs frequency, rhythm and ectopic beat) and give proper treatment.

The arrhythmia analysis of the monitor has the following characteristics:

- Up to 13 types of arrhythmia analysis.
- Applicable to the monitoring of either a patient with a pacemaker or without.
- Disabled in default situation.
- Capability of raising the doctor's attention to the patient's heart rate, by measuring and classifying the arrhythmia and the abnormal heartbeat and triggering the alarm.
- Capability of storing the latest 80 alarm events (including the ECG waveform respectively 4 seconds before and after the alarm), when performing the arrhythmia analysis. You can review the arrhythmia events through the menu below.

11.5.2 Arrhythmia Analysis Menu

Select ARR ANALYSIS >> in ECG SETUP menu. The following menu appears.

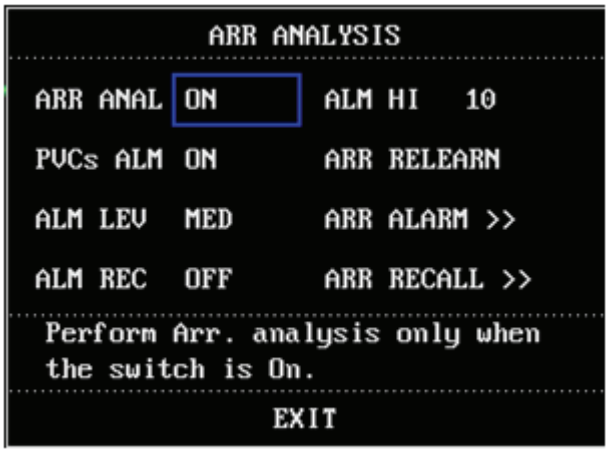


Figure 11-11 ARR ANALYSIS Menu

In this menu, you can perform the following settings:

- ARR ANAL — Arrhythmia analysis
  ON: Enables the arrhythmia analysis;
  OFF: Disables the arrhythmia analysis.
- PVCs ALM — PVCs alarm
  ON: When the PVCs alarm occurs, the monitor gives alarm indications and saves the alarm;
  OFF: When the PVCs alarm occurs, the monitor neither gives alarm indications nor saves the alarm;
  When OFF is selected, the icon is displayed on the right of PVCs in the parameter window.
- ALM LEV — Alarm level
  Options: HIGH, MED and LOW.
- ALM REC — Alarm recording
  ON: The monitor starts recording when the PVCs alarm occurs.
  OFF: The monitor does not record when the PVCs alarm occurs.
- ALM HI — Upper alarm limit
  Determines the upper limit of the PVCs alarm. Range: 1 – 10. An alarm is triggered when the PVCs exceeds the upper limit.
- ARR RELEARN — Arrhythmia relearning
  You can select this option to start a learning procedure. The "ARR LEARNING" message is displayed in the information area of the screen.

11.5.3 Arrhythmia Alarm Setup

Select ARR ALARM >> in ECG SETUP menu. The following menu appears. You can change the settings of the arrhythmia alarm in this menu.

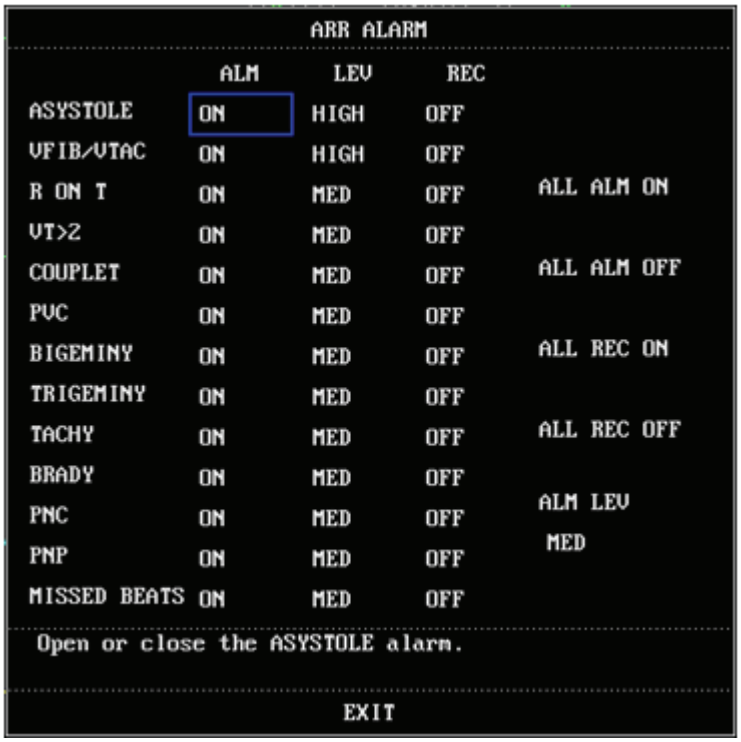


Figure 11-12 ARR ALARM

In the menu, the ALM field indicates the alarm on/off status, REC indicates the alarm recording on/off status and LEV indicates the alarm level. You can change the settings as described below.

- ALL ALM ON — All alarms on
  Enables all arrhythmia alarms;
- ALL ALM OFF — All alarms off
  Disables all arrhythmia alarms;
- ALL REC ON — All recording on
  Enables the recording of all arrhythmia alarms;
- ALL REC OFF — All recording off
  Disables the recording of all arrhythmia alarms;
- ALM LEV — Options: HIGH, MED and LOW.
  Sets the level of all arrhythmia alarms to the same value.

11.5.4 Arrhythmia Recall

Selecte ARR RECALL >> in ARR ANALYSIS menu. The following menu appears. You can review any stored arrhythmia event in this menu.

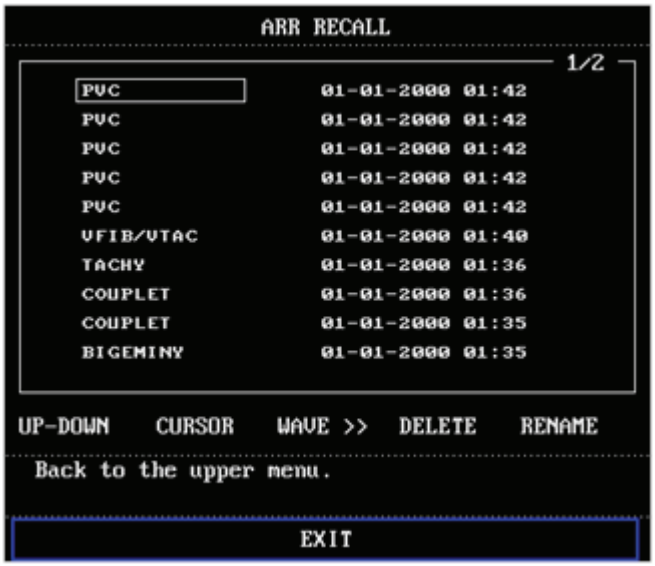


Figure 11-13 ARR RECALL

You can perform the following operations:

- UP-DOWN: A maximum of 10 arrhythmia events can be displayed in the window each time. In case of more than 10 events, you can use the UP-DOWN option to review more. At most 8 pages can be reviewed.
- CURSOR: This option allows you to select an arrhythmia event displayed in the window.
- DELETE: This option allows you to delete a selected arrhythmia event.
- RENAME: This option allows you to change the name of a selected arrhythmia event.
  Select this option, and rotate the control knob till the desired name appears. Then, press the control knob to select the name.
- WAVE >>: Selecting this option opens the following window. In the window, the waveform and the time of a selected arrhythmia event as well as the parameter values at the event time are displayed.

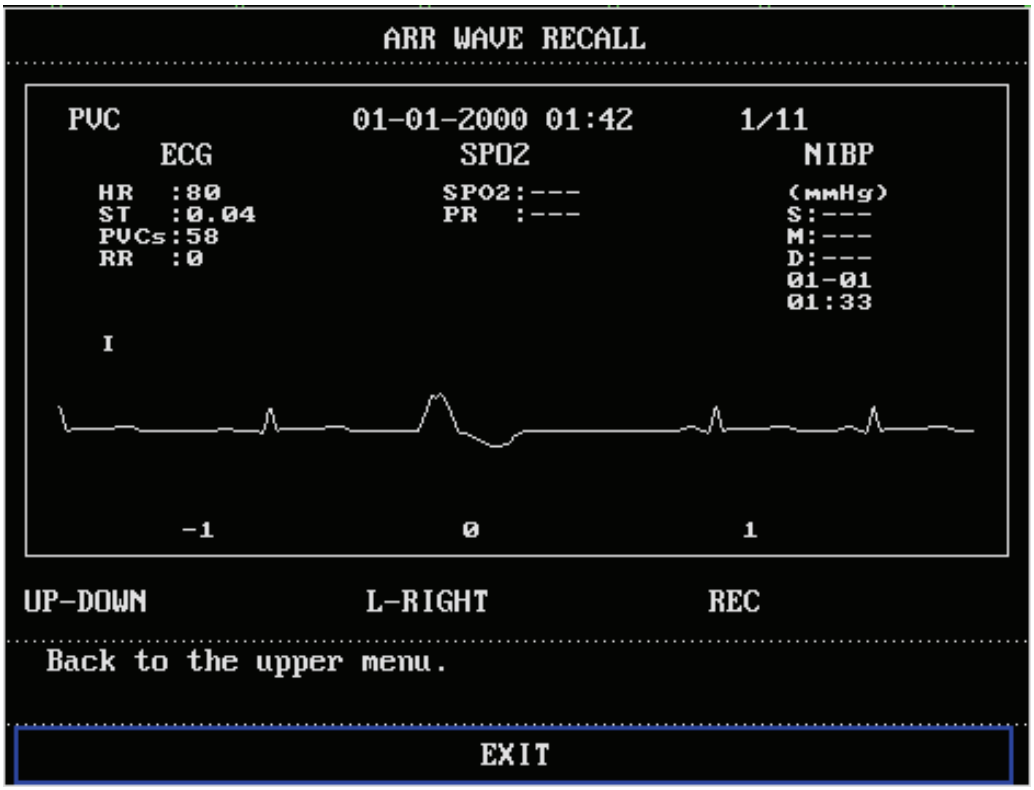


Figure 11-14 ARR WAVE RECALL

You can perform the following operations:

- UP-DOWN: This option allows you to page up and down to review the waveform and the parameters of other arrhythmia events.
- L-RIGHT: This option allows you to review 8-second waveform of the currently displayed arrhythmia event.
- REC: Selecting this option starts the recording of the waveform and the parameters of the currently displayed arrhythmia event.
- EXIT: This option allows you to return to the ARR RECALL window.

11.6 RESP Monitoring

11.6.1 Overview

Respiration is detected by measuring thoracic impedance. The monitor measures the change of the impedanec between the RA and LA electrodes of the ECG lead I, or the RA and LL electrodes of the ECG lead II, and produces a respiration waveform as shown below.

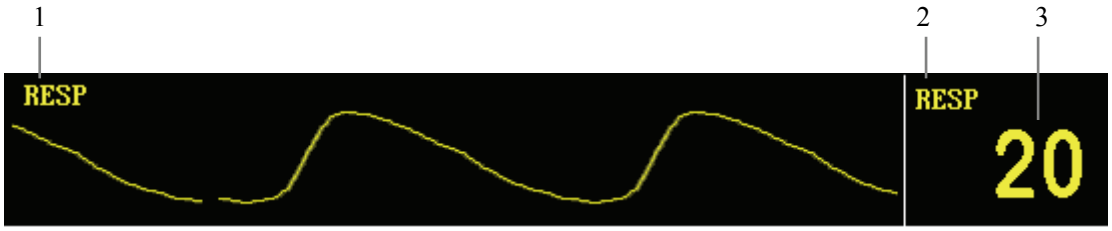


Figure 11-15 Respiration Waveform and Parameter

1. Waveform name.
2. RESP label: Selecting this label, you can open the RESP SETUP menu.
3. RR: Respiration rate numerics.

NOTE

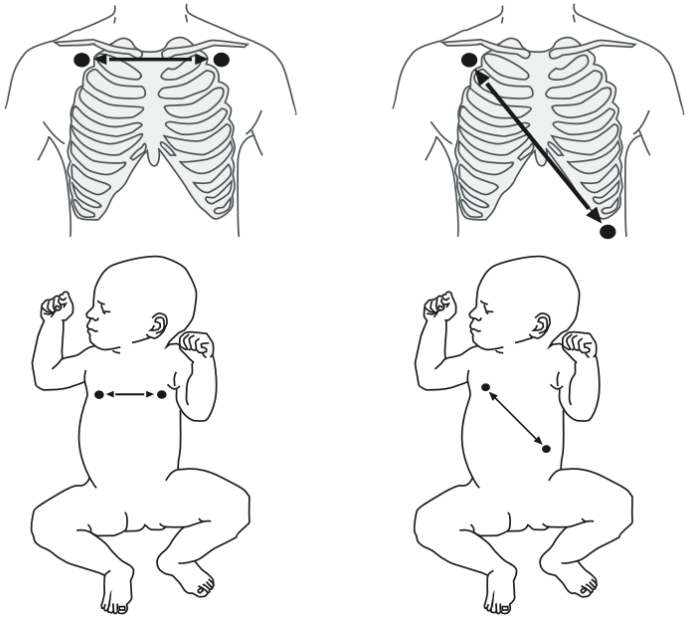
- **Respiration monitoring is not recommended on patients who are very active, as this will cause false alarms.**
- **It is recommended to set Waveform gain to 1 when external electromagnetic interference is great.**

11.6.2 Electrode Placement

Since the same electrodes are used for ECG and respiration monitoring, the electrode placement is very important. Some patients, due to their clinical condition, expand their chest laterally, causing a negative intrathoracic pressure. In these cases it is better to place the two electrodes used for respiration monitoring laterally in the right axillary and left lateral chest areas, at the maximum point of the breathing movement, to optimize the respiratory waveform.

NOTE

- **Please select the ECG cable with no resistance for RESP monitoring.**
- **To optimize the respiration waveform, place the RA and LA electrodes horizontally when the ECG Lead I is selected, and place the RA and LL electrodes diagonally when the ECG lead II is selected.**
- **Try to avoid placing the electrodes so the liver area and the ventricles of the heart are in path between the electrodes used for respiration, to avoid cardiac artifact to overlay on the ECG. This is particularly important when monitoring neonate patients.**



Electrode Placement of ECG Lead I Electrode Placement of ECG Lead II

Figure 11-16 Electrode Placement

11.6.3 Respiration Setup

Selecting the RESP label on the screen opens the following menu.

Figure 11-17 RESP SETUP

In this menu, you can perform the following settings.

- ALM
  Alarm on/off
  ON: When a respiration rate alarm occurs, the monitor gives alarm indications and stores the alarm;
  OFF: When a respiration rate alarm occurs, the monitor neither gives alarm indications nor stores the alarm;
  When OFF is selected, the icon is displayed on the right of the RESP label.
- ALM LEV
  Alarm level
  Options: HIGH, MED and LOW.
- ALM REC
  Alarm recording
  ON: When a respiration rate alarm occurs, the monitor enables the recording;
  OFF: When a respiration rate alarm occurs, the monitor does not enable the recording
- ALM HI
  Upper alarm limit
  Determines the upper limit of respiration rate alarm.
- ALM LO
  Lower alarm limit
  Determines the lower limit of respiration rate alarm.

For different patient types, the upper/lower limits of the respiration rate alarm may vary in the following range.

Patient type	Max. ALM HI	Min. ALM LO	Increment (breath/min)
Adult	120	0	1
Neonate/pediatric	150	0	1

- APNEA ALM — Apnea alarm
  Determines whether the patient's cessation of breath is an apnea event. Range: 10 – 40 seconds.
- SWEEP — Waveform speed
  Options: 6.25, 12.5 and 25.0 mm/s.
- HOLD TYPE — Calculation type
  Options: AUTO and MANUAL

1. AUTO: When AUTO is selected, the monitor automatically determines the detection threshold for respiration and calculates the respiration rate. The HOLD HI and HOLD LO options are inactive.
2. MANUAL: When MANUAL is selected, the user determines the detection threshold for respiration and the monitor calculates the respiration rate depending on the user-selected criteria.

- DEFAULT >> — Select DEFAULT >> to access the RESP DEFAULT CONFIG menu. You can select either FACTORY DEFAULT CONF or USER DEFAULT CONF. After finishing the selection and exiting the menu, a dialog pops up asking for confirmation of your selection.

11.7 Maintenance and Cleaning

⚠WARNING

- **Before cleaning the ECG cable, be sure to disconnect the monitor from the ECG cable, or shut down the system and disconnect all power cords from the outlet.**
- **If the ECG cable is damaged or aged, replace with a new one.**

■ Cleaning

The exterior surfaces of the ECG cable may be cleaned with a soft cloth, dampened with the alcohol, and then be air-dried or dried with a clean dry cloth.

■ Disinfection

Disinfection may cause damage to the equipment. We recommend the disinfection be contained in the hospital's servicing schedule only when necessary. The equipment should be cleaned prior to disinfection.

■ Sterilization

Sterilization may cause damage to the equipment. We recommend the sterilization be contained in the hospital's servicing schedule only when necessary. The equipment should be cleaned prior to sterilization.

12 SpO_2 Monitoring

12.1 Overview

The monitor measures the patients' SpO_2 (oxygen saturation) and displays:

1. Pulse rate (PR) value in the ECG or SpO_2 parameter window.
2. PLETH waveform in the waveforms area.
3. Oxygen saturation (SpO_2%) value in the SpO_2 parameter window.

The PR value is displayed in the ECG parameter window only if:

1. SpO_2 is selected from the HR FROM options in the ECG SETUP menu; or
2. AUTO is selected from the HR FROM options in the ECG SETUP menu and no ECG signal is received.

As the following figure shows, the PLETH waveform is located on the left while the SpO_2 parameter window on the right. The SpO_2 value is displayed by percentage and is followed by a perfusion indicator (pro rata with the pulse intensity). Besides, the SpO_2 label at the upper left corner of the parameter window allows you to access the SpO_2 SETUP menu.

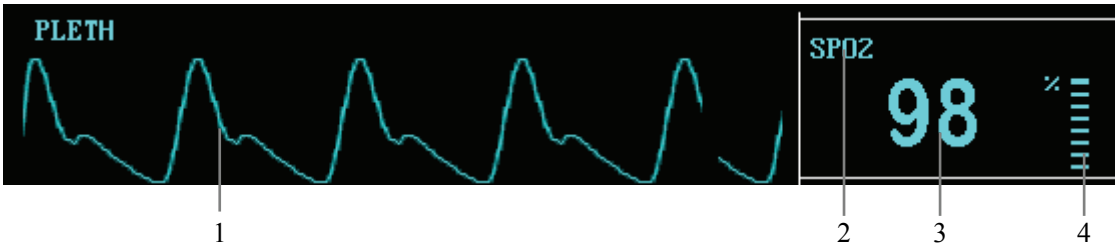


Figure 12-1 SpO2 Waveform and Parameter

1. PLETH waveform
2. SPO2 label
3. SpO_2 value
4. Perfusion indicator

PITCH TONE

The PITCH TONE function refers to the monitor's capability to vary the pitch of the heart rate tone or pulse rate tone with the change of the SpO_2 reading. This monitor provides 22 pitch levels. The pitch rises as the SpO_2 reading increases toward 100% and falls as it decreases. Although the tone pitch cannot be adjusted manually, the tone volume can be adjusted by one of the following two ways, depending on the setting of the HR FROM item in the ECG SETUP menu:

- If the HR FROM is set to SPO2, you can adjust the PITCH TONE volume by changing the setting of the PR SOUND item in the SPO2 SETUP menu;
- In case of other settings, you can adjust the PITCH TONE volume by changing the setting of the BEAT VOL item in the ECG SETUP menu.

If the PR SOUND or BEAT VOL is set to 0, the PITCH TONE function will be muted; if the SpO_2 module is disabled, the PITCH TONE function will be disabled as well.

NOTE

- **SpO_2 and SPO2 are used interchangeably in this chapter.**

12.2 Principles of Operation

SpO_2 monitoring is a non-invasive technique used to measure the amount of oxygenated haemoglobin and pulse rate by measuring the absorption of selected wavelengths of light. The light generated in the probe passes through the tissue and is converted into electrical signals by the photodetector in the probe. The SpO_2 module processes the electrical signal and displays on the screen a waveform and digital values for SpO_2 and pulse rate.

The sensor measurement wavelengths are nominally 660nm for the red LED and 940nm for infrared LED. The maximum optical power output for LED is 4mW.

12.2.1 Precautions

⚠WARNING

- **The SpO_2 value might be overestimated in the presence of Hb-CO, Met-Hb or dye dilution chemicals.**
- **Check if the sensor cable is in normal condition before monitoring. Do not use the SpO_2 sensor once the package or the sensor is found damaged.**
- **Verify sensor cable fault detection before beginning monitoring. Unplug the SpO_2 sensor cable from the connector. The screen will display the prompt information "SPO2 SENSOR OFF" and the audible alarm is activated.**
- **ES (Electrosurgery) equipment wire and SpO_2 cable must not be tangled up.**
- **Do not put the SpO_2 sensor on the limb with arterial catheter or venous syringe.**
- **Do not perform SpO_2 and NIBP measurements on the same limb simultaneously. Obstruction of blood flow during NIBP measurements may adversely affect the reading of the SpO_2 value.**
- **Prolonged and continuous monitoring may increase the risk of burns at the site of the sensor. It is especially important to check the sensor placement, and ensure proper attachment on neonates and patients of poor perfusion or skin sensitive to light. Check the sensor location every 2–3 hours and move to another location if the skin deteriorates. More frequent examinations may be required for different patients.**

12.3 Monitoring Procedure

Sensor selection for SpO_2 measurement depends on the patient type. For an adult patient, you can choose a finger SpO_2 sensor; for an infant patient, you can choose a hand or toe sensor. Refer to the following procedure.

1. Power on the monitor.
2. Attach the sensor to the proper site on the patient.
3. Plug the connector of the sensor extension cable into the SpO_2 connector on monitor.

12.3.1.1 Finger Sensor Placement

You can easily place the finger sensor as shown below.

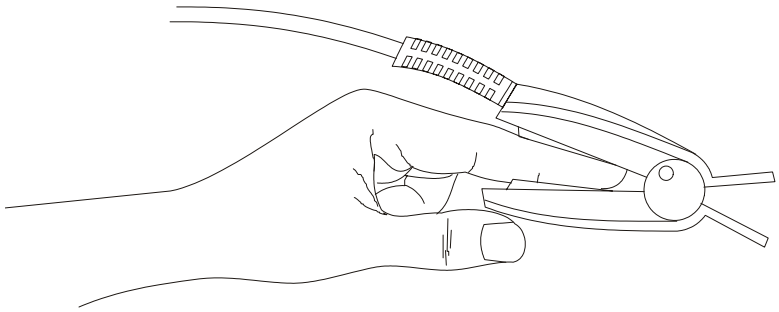


Figure 12-2 Finger Sensor Placement

NOTE

- **Place the SpO_2 sensor cable at the backside of the patient hand. Make sure the fingernail is just opposite to the light emitted from the sensor.**

12.3.1.2 Neonate Sensor Placement

Neonate SpO2 sensor consists of a Y-shape SpO2 sensor and its sheath. Insert t he LED and PD ends of the Y-shape SpO2 sensor respectively into the upper and lower grooves on the sheath (Figure 12-3). The Figure 12-4 shows us the neonate SpO2 sensor after insertion.

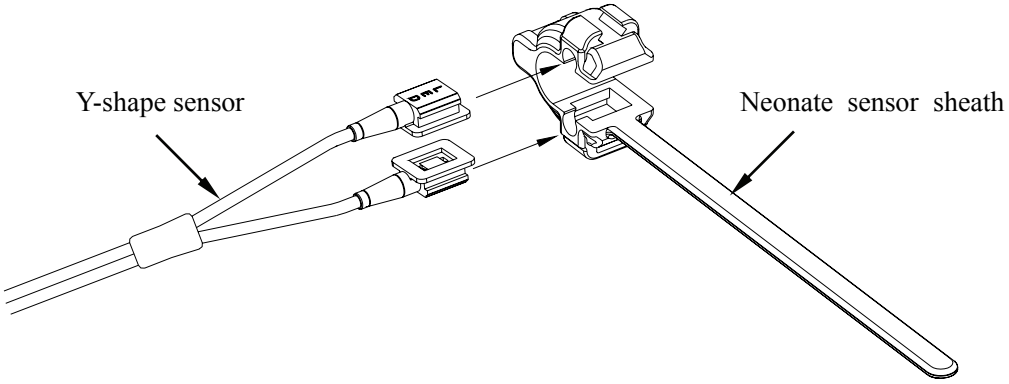


Figure 12-3 Neonate Sensor Placement (1)

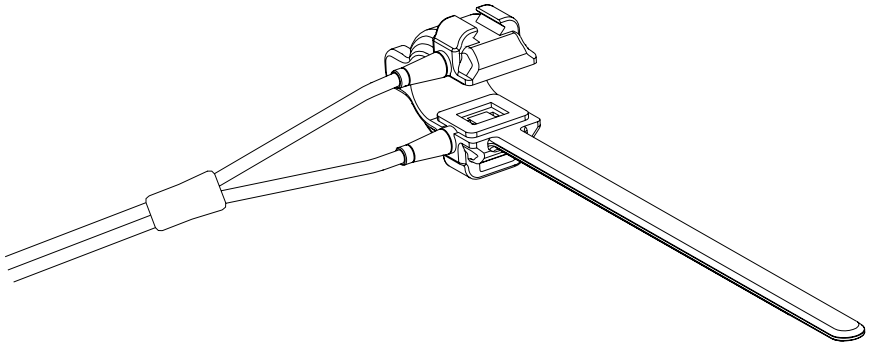


Figure 12-4 Neonate Sensor Placement (2)

Wind the SpO_2 sensor around a hand or foot of a neonate patient. Hold the sensor, pull the belt and fit one of its sides with “V” edge into the “V” groove on the corresponding side of the sheath. Appropriately elongate the belt to about 20mm, and fit the “V” edge of the other side of the belt into the “V” groove of the other side of the sheath. Then, loosen the belt. After the “V” edges of the two sides of the belt fit well into the “V” grooves on the two sides of the sheath, put the belt into the first lock bar to fasten the belt. See Figure 12-5. If the belt is too long, you may put it into the second lock bar. You must position the SpO_2 sensor in this way so as to make the photoelectric component face the correct position. Besides, note not to elongate the belt too much, which may lead to inaccurate measurement and block the blood circulation severely.

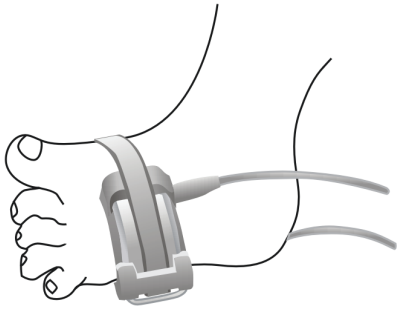


Figure 12-5 Neonate Sensor Placement (3)

NOTE

- **If the sensor cannot be positioned accurately to the part to be measured, it may result in inaccurate SpO_2 reading, or the SpO_2 even cannot be measured because no pulse is detected. In this case, you must position the sensor again.**
- **The excessive patient movement may result in inaccurate reading. In this situation, you must keep the patient quiet or change the measured position to reduce the adverse influence of excessive movement.**

⚠WARNING

- **In the process of extended and continuous monitoring, you should check the peripheral circulation and the skin every 2 hours. If any unfavorable change takes place, you should change the measured position in time.**
- **In the process of extended and continuous monitoring, you should periodically check the position of the sensor. In case that the position of the sensor moves during monitoring, the measurement accuracy may be affected.**

12.4 Measurement Limitations

If the accuracy of any measurement does not seem reasonable, first check the patient's vital signs by an alternate method. Then check the instrument for proper function. Inaccurate measurements may be caused by:

- Improper SpO_2 sensor;
- High-frequency electrical noise, including noise created by the host system, or noise from external sources, such as electrosurgical apparatus connected to the system;
- Oximeters and oximetry sensors used during magnetic resonance imaging (MRI) scanning. Induced current could potentially cause burns;
- Intravascular dye injections;
- Excessive patient motion;
- Excessive ambient light;
- Improper sensor installation or incorrect sensor placement on the patient
- Sensor temperature (optimal temperature is between 28℃ and 42℃);
- The sensor is placed on a limb that is attached to a blood pressure cuff, arterial catheter, or intravascular line;
- Concentration of dysfunctional hemoglobin, such as carboxyhemoglobin and methemoglobin;
- SpO_2 too low;
- Low circular perfusion of the applied part;
- Shock, anemia, low temperature and application of vasomotor all reduce the arterial blood flow and may affect the pulse oximetry measurement.

The absorption of oxyhemoglobin (HbO_2) and deoxyhemoglobin to the light of special wavelength may also affect SpO_2 measurement. If there exist other substances (like carbon hemoglobin, methemoglobin, methylene blue and indigo carmine) absorbing the light of the same wavelength, they may result in false or low SpO_2 reading.

12.5 SpO2 Setup Menu

Selecting the SPO2 label in the parameter window opens the following menu.

Figure 12-6 SPO2 SETUP menu

You can perform the following settings in this menu.

- ALM — SpO_2 alarm on/off status
  ON: When a SpO_2 alarm occurs, the monitor gives alarm indications and stores the alarm;
  OFF: When a SpO_2 alarm occurs, the monitor neither gives alarm indications nor stores the alarm;
  When OFF is selected, the icon is displayed on the right of the SPO2 label.
- ALM LEV — Alarm level
  Options: HIGH and MED.
- ALM REC — Alarm recording
  ON: When a SpO_2 alarm occurs, the monitor enables the recording;
  OFF: When a SpO_2 alarm occurs, the monitor does not enable the recording.
- SPO2 ALM HI — SpO_2 upper alarm limit
- SPO2 ALM LO — SpO_2 lower alarm limit
- PR ALM HI — PR upper alarm limit
- PR ALM LO — PR lower alarm limit

SpO_2 and PR alarm limits:

Parameter	Max. upper limit	Min. lower limit	Step
SpO_2	100	0	1
PR	254	0	1

The default SpO_2 and PR alarm limits:

Parameter	Patient type	Upper limit	Lower limit
SpO_2	Adult	100	90
	Pediatric	100	90
	Neonate	95	90
PR	Adult	120	50
	Pediatric	160	75
	Neonate	200	100

⚠WARNING

- **Setting the SpO_2 upper alarm limit to 100% will disable the upper alarm limit. High oxygen levels may predispose a premature infant to retrolental fibroplasia. Therefore, the upper alarm limit for oxygen saturation must be carefully selected in accordance with the commonly accepted clinical practices.**

- SWEEP — Waveform speed
  Options: 12.5 and 25.0 mm/s.
- PR SOUND — Pulse volume
  Range: 0 – 10. 0 indicates the volume is closed and 10 indicates the maximum volume.
- AVG TIME — 4s, 8s, 16s represent times that SpO_2 average value is counted.
- DEFAULT — You can select this option to access the SPO2 DEFAULT CONFIG menu, in which you may select FACTORY DEFAULT CONFIG or USER DEFAULT CONFIG. After finishing your selection and exiting the menu, the system pops up a dialog box asking for your confirmation.

FOR YOUR NOTES

13 NIBP Monitoring

The Non-invasive Blood Pressure (NIBP) module measures blood pressure using the oscillometric method. This monitor can be applied to adult, pediatric, and neonatal patients. Three modes of measurement are available: manual, automatic and continuous.

- Manual: Pressing the NIBP key on the control panel starts a NIBP measurement.
- Auto: The NIBP measurement is conducted automatically at a preset interval.
- Continuous: The NIBP measurement is performed as many times as possible in five minutes.

The NIBP measurement does not produce any waveform. Instead, it displays the measurement result in the NIBP parameter window as shown below.

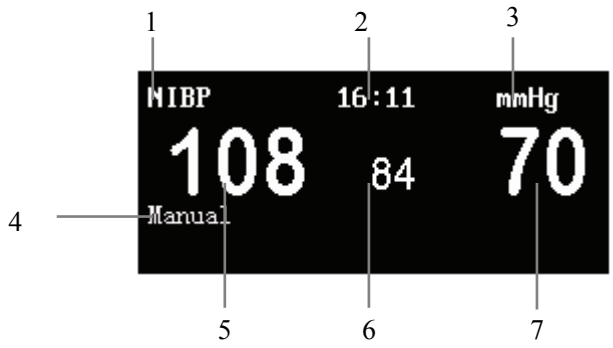


Figure 13-1 NIBP Parameter Window

1. NIBP label: Selecting this label to access the NIBP SETUP menu.
2. Time of last measurement.
3. NIBP unit: mmHg or kPa.
4. Prompt information area: Shows the NIBP measurement mode and other information.
5. Systolic pressure value (NS)
6. Mean pressure value (NM)
7. Diastolic pressure value (ND)

If a set of measured results appears in grey, it indicates this measurement is performed at least 1 hour ago.

13.1 Monitoring Procedure

⚠WARNING

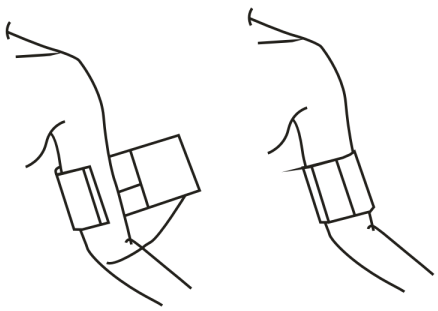
- **You must not perform NIBP measurements on patients with sickle-cell disease or under any condition in which the skin is damaged or expected to be damaged.**
- **For a thrombasthemia patient, it is important to determine whether measurement of the blood pressure shall be done automatically.**
- **Ensure that the setting is correctly made when performing measurements on children. Incorrect patient type setting may cause a danger to the patient because adult blood pressure level is higher than children.**

To perform NIBP measurement on a patient, follow the procedure as below

1. Power on the monitor.
2. Check the patient information area on the screen. If the patient type is incorrect, select a correct patient type in PATIENT SETUP menu.
3. Plug the air hose in the NIBP cuff connector of the monitor.
4. Apply a cuff of proper size to the upper arm or the leg of the patient.
5. Connect the cuff with the air hose.
6. Press the NIBP key on the control panel to start the NIBP measurement.

13.1.1 Cuff Selection and Placement

1. Identify the patient limb circumference.
2. Select appropriate cuff; limb circumference is identified on each cuff.
3. Verify the cuff is completely deflated; place cuff around extremity being used and make sure the marking ϕ matches artery location.
4. Verify the cuff is not wrapped too tightly around the limb. Excessive tightness may cause discoloration or ischemia of the extremities.



5. Make sure that the cuff edge falls within the range of the <-> mark. If it does not, use a larger or smaller cuff that will fit better.
6. The limb chosen for taking the measurement should be placed at the same level as the patient's heart. If this is not possible, use the following method to correct the measurement result:

- If the cuff is placed higher than the heart level, add 0.75 mmHg (0.10 kPa) for each centimeter of difference.
- If it is placed lower than the heart level, deduct 0.75 mmHg (0.10 kPa) for each centimeter of difference.

⚠WARNING

- **The width of the cuff should be either 40% of the limb circumference (50% for neonates) or 2/3 of the upper arm length. The inflatable part of the cuff should be long enough to circle 50-80% of the limb. The wrong size cuff can cause erroneous readings. If the cuff size is in question, use a larger cuff.**
- **Do not apply the cuff to a limb that has an intravenous infusion or catheter in place. This could cause tissue damage around the catheter when infusion is slowed or blocked during cuff inflation.**
- **Make sure the air tubing connecting the blood pressure monitor is not blocked, twisted, or tangled.**

13.1.2 Operation Guides

1. To start a manual NIBP measurement

- Access the NIBP SETUP menu and select MANUAL from the INTERVAL option; then, press the NIBP key on the control panel to start a manual NIBP measurement; or
- During the interval between two auto NIBP measurements, press the NIBP key on the control panel to start a manual NIBP measurement.

2. To start auto NIBP measurement

Access the NIBP SETUP menu and select a time (e.g. 5MIN) from the INTERVAL options; press the NIBP key on the control panel to start the auto NIBP measurment. When this measurment finishes, the system will perform the NIBP measurment automatically as per the preset interval.

⚠WARNING

- **Auto non-invasive blood pressure measurements performed in long intervals may incur ischemia and neuropathy in the limb wearing the cuff. When monitoring a patient, examine the extremities of the limb frequently for normal color, warmth and sensitivity. If any abnormality is observed, change the position of the cuff on the patient or stop the blood pressure measurements immediately.**

3. To start a continuous NIBP measurement

Selecting CONTINUAL in NIBP SETUP menu starts a continuous NIBP measurement. The monitor continues measuring NIBP for five minutes.

4. To stop a NIBP measurement

During an auto, manual or continuous measurement, pressing the NIBP key on the control panel stops the ongoing measurement.

NOTE

- **If you are in doubt about the accuracy of any reading(s), check the patient's vital signs by an alternative method before checking the function of the monitor.**

13.2 Measurement Limitations

Non-invasive blood pressure measurement uses the oscillometric method of measurement. The monitor detects the regular arterial pressure pulse. In some circumstances when the patient's condition makes it difficult to detect this pulse, the measurement becomes unreliable and the measurement time increases. You should be aware that the following conditions could interfere with the measurement, make the measurement unreliable, prolong the measurement, or even make a measurement impossible.

- Patient Movement

E.g.The patient is moving, shivering, or having convulsions.

- Cardiac Arrhythmia’s

E.g. The patient's cardiac arrhythmia has caused an irregular heartbeat.

- Heart-lung Machine

E.g. Measurements will be impossible if the patient is connected to a heart-lung machine.

- Pressure Changes

E.g.The patient's blood pressure is changing rapidly over the period of time during which the arterial pressure pulses are being analyzed to obtain the measurement.

- Severe Shock

E.g. If the patient is in severe shock or hypothermia, reduced blood flow to the peripheries will cause reduced pulsation of the arteries.

- Heart Rate Extremes

The monitor is unable to perform pressure measurements at a heart rate of less than 40 bpm and greater than 240 bpm.

13.3 NIBP Setup Menu

Selecting the NIBP label in the parameter area opens the following menu.

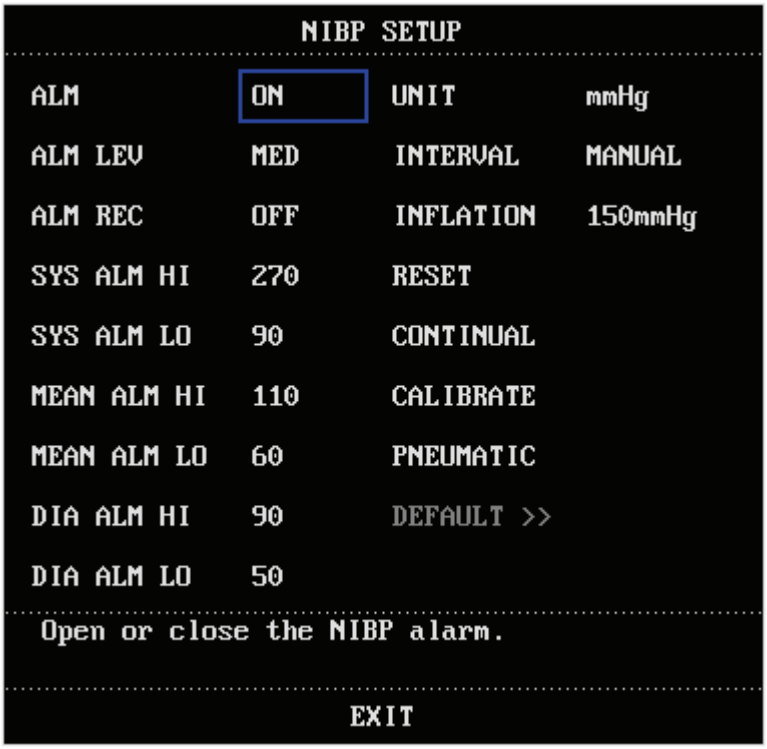


Figure 13-2 NIBP SETUP Menu

You can perform the following settings in this menu.

- ALM
  NIBP alarm on/off status
  ON: When a NIBP alarm occurs, the monitor gives alarm indications and stores the alarm;
  OFF: When a NIBP alarm occurs, the monitor neither gives alarm indications nor stores the alarm;
  When OFF is selected, the icon is displayed on the right of the NIBP label.
- ALM LEV
  Alarm level
  Options: HIGH, MED and LOW.
- ALM REC
  Alarm recording
  ON: When an NIBP alarm occurs, the monitor enables the recording;
  OFF: When a NIBP alarm occurs, the monitor does not enable the recording.
- SYS ALM HI
  Determines the upper limit of the systolic pressure.
- SYS ALM LO
  Determines the lower limit of the systolic pressure.

- MEAN ALM HI — Determines the upper limit of the mean pressure.
- MEAN ALM LO — Determines the lower limit of the mean pressure.
- DIA ALM HI — Determines the upper limit of the diastolic pressure.
- DIA ALM LO — Determines the lower limit of the diastolic pressure.

If a measured pressure crosses a preset upper or lower alarm limit, an alarm will be triggered. The NIBP alarm limits are as follows:

Patient type	**Adult**	**Pediatric**	**Neonate**
Systolic pressure	40–270 mmHg	40–200 mmHg	40–135 mmHg
Mean pressure	20–235 mmHg	20–165 mmHg	20–110 mmHg
Diastolic pressure	10–215 mmHg	10–150 mmHg	10–100 mmHg

- UNIT — Options: mmHg, kPa;
- INTERVAL — Select MANUAL to set the monitor to manual NIBP measurement mode, or select from the time options to determine the interval between automatic measurements. Optional intervals: 1, 2, 3, 4, 5, 10, 15, 30, 60, 90, 120, 180, 240, and 480MIN.
- INFLATION — Select this item to choose the initial pressure when inflate the cuff next time.

There are different selections of the initial pressure

Default	**Default initial value (mmHg/kPa)**	**Options for Initial value in NIBP MANUAL menu (mmHg/kPa)**
FACTORY DEFAULT ADU CONFIG	150	80/100/120/140/150/160/180/200/220/240
FACTORY DEFAULT PED CONFIG	100	80/100/120/140/150/160/180/200
FACTORY DEFAULT NEO CONFIG	70	60/70/80/100/120
USER DEFAULT ADU CONFIG	150	80/100/120/140/150/160/180/200/220/240
USER DEFAULT PED CONFIG	100	80/100/120/140/150/160/180/200
USER DEFAULT NEO CONFIG	70	60/70/80/100/120

■ RESET	Select this option to restore the initial settings of the pressure pump. If the monitor fails to give a visual indication when the pressure pump is working improperly, selecting this option activates a self-test procedure, and restores the monitor to normal performance.
■ CONTINUAL	Select this option to start a continuous measurement for five minutes.
■ CALIBRATE	For details about CALIBRATE, please refer to 13.3.1Calibration.
■ PNEUMATIC	For details about PNEUMATIC, please refer to 13.3.2PNEUMATIC.
■ DEFAULT >>	You can select this option to access the NIBP DEFAULT CONFIG menu, in which you may select FACTORY DEFAULT CONFIG or USER DEFAULT CONFIG. After finishing your selection and exiting the menu, the system pops up a dialog box asking for your confirmation.

13.3.1 Calibration

If you select the CALIBRATE option, the monitor starts the NIBP calibration and the CALIBRATE option changes to STOP CAL. Selecting the option again stops the calibration.

Calibrate the cuff pressure reading with a calibrated reference manometer (or mercury manometer) with accuracy higher than 1mmHg. To perform the calibration, follow the procedure shown below:

1. Remove the blood pressure cuff from the monitor and replace it with a rigid metal container or vessel with a capacity of 500 ml ± 5%.
2. Connect a calibrated reference manometer (with an error less than 1 mmHg) and a ball pump using "T" connectors as shown below.
3. Select the CALIBRATE option.
4. Inflate the metal container using the ball pump until the reference manometer reads 0, then 50, and finally 200 mmHg.
5. The difference between the indicated pressure of the reference manometer and the indicated pressure of the monitor will not exceed 3 mmHg. Contact our Customer Service if these values are not met.

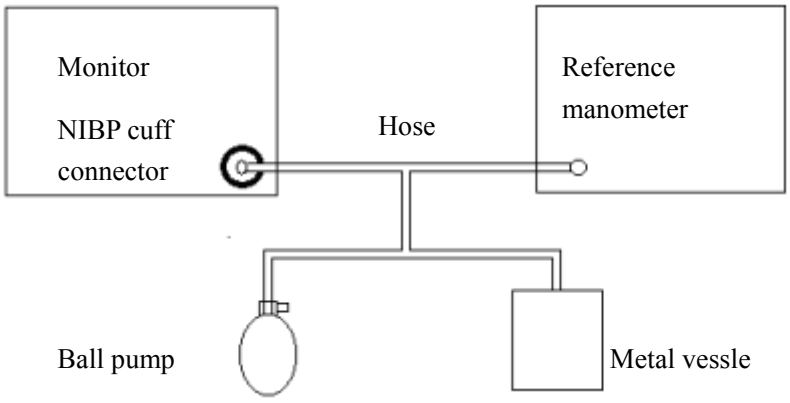


Figure 13-3 NIBP Calibration

NOTE

- **The calibration of the NIBP measurement should be performed every two years or performed according to the Hospital Procedure.**

13.3.2 PNEUMATIC

The PNEUMATIC option is used to test air leakage. When the NIBP cuff is connected, select this option to start the NIBP inflation and test whether the air leakage occurs in the airway. If the test is passed, no prompt information will be displayed; if the test is not passed, corresponding prompt information will be displayed in the NIBP parameter window.

To test air leakage, use the following procedure:

1. Connect the NIBP cuff with the NIBP cuff connector of the monitor.
2. Wrap the cuff around a cylinder of a proper size, as shown below.

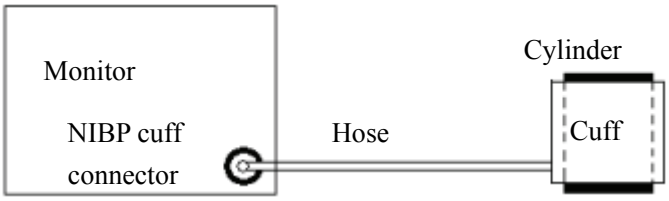


Figure 13-4 NIBP Leakage Test

3. Select the PNEUMATIC option, and the information “Pneum testing…” is displayed at the lower left corner of the NIBP parameter window.
4. After approximately 20 seconds, the monitor will automatically open the deflate valve, ending the test.
5. If no information appears on the bottom of the NIBP parameter area, it indicates the airway is in good condition and an air leak does not exist. However if the information “PNEUMATIC LEAK” appears, it indicates the airway may have an air leak. In this case, check for loose connections. After confirming all connections are secure, perform the test again.

If there is still a failure, contact our Customer Service.

NOTE

- **Set PAT TYPE to ADU in the PATIENT SETUP menu before leakage test.**
- **The pneumatic test, other than being specified in the EN 1060-1 standard, is to be used to simply determine whether there are air leaks in the NIBP airway.**

13.4 Maintenance and Cleaning

⚠WARNING

- **Do not press the rubber tube on the cuff with excessive strength.**
- **When a reusable cuff is not connected to the monitor or is being cleaned, always cover the rubber tube with a lid. Avoid splashing liquid into the rubber tube or the monitor inadvertently.**

Reusable Blood Pressure Cuffs

The cuff is not suitable for dry-cleaned. Instead, it should be machine or hand washed. Machine washing may shorten the service life of the cuff.. Before washing, remove the latex rubber bladder. Allow the cuff to dry thoroughly after washing, and then reinsert the rubber bladder. The cuff can be disinfected by means of conventional autoclaving, gas, or radiation disinfection in hot air ovens, or sterilized by immersion in decontamination solutions. Remember to remove the rubber bladder if you use this method

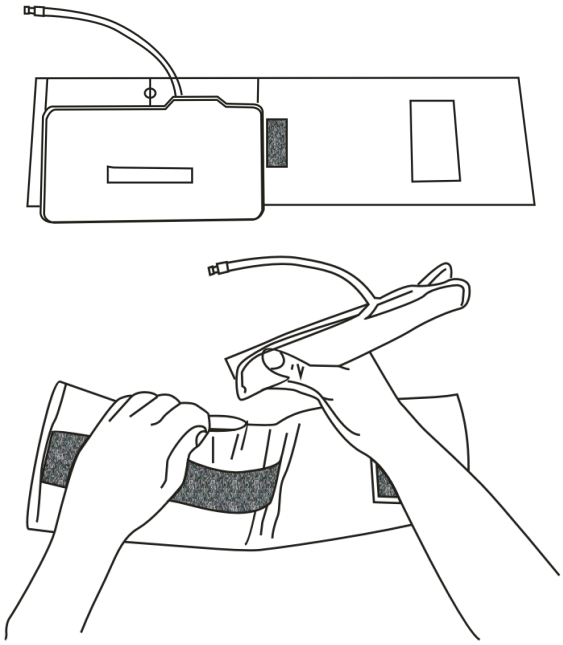


Figure 13-5 Replacing the Rubber Bladder

To replace the rubber bladder in the cuff:

1. Place the bladder on top of the cuff so the rubber tubes line up with the large opening on the long side of the cuff.
2. Roll the bladder lengthwise and insert it into the opening on the long side of the cuff.
3. Hold the tubes and the cuff and shake the complete cuff until the bladder is in position.
4. Thread the rubber tubes from inside the cuff, and out through the small hole under the internal flap.

⚠CAUTION

- **Some disinfectants may cause skin irritation. Please rinse cuff thoroughly with water to remove any residual disinfectants. Using dark colored disinfectants may stain the cuffs. Test a single cuff to ensure that no damage will occur.**

Disposable Blood Pressure Cuffs

Disposable cuffs are intended for single patient use only. Do not sterilize or use autoclave sterilization for disposable cuffs.

NOTE

- **Disposable blood pressure cuffs must be recycled or disposed of properly.**

14 TEMP Monitoring

14.1 Overview

The monitor is able to use one temperature probes,. The measurement values are displayed in the TEMP parameter window as shown below.

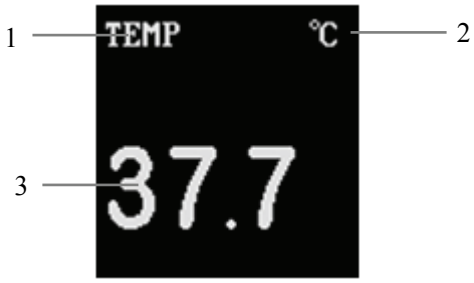


Figure 14-1 TEMP Parameter Window

1. TEMP label: Selecting this label opens the TEMP SETUP menu.
2. Temperature unit: ℃ or ℉.
3. Temperature channel: Displays the temperature measured at temperature channel .

14.2 Measurement Procedure

To measure the temperature of a patient,

1. If a disposable temperature probe is used, plug the temperature probe cable in the temperature probe connector on the side panel of the monitor, and then connect the temperature probe with the cable; if a reusable temperature probe is used, connect the temperature probe with the temperature probe connector directly.
2. Attach the temperature probe to the patient properly.
3. Power on the monitor.

NOTE

- **Disposable temperature probes are for single patient use only.**
- **The self-test of the temperature measurement is performed once per 250 seconds during monitoring. This self-test lasts about 1 seconds and does not affect the normal measurement of temperature.**

⚠WARNING

- **Verify probe cable fault detection before beginning monitoring. Unplug the temperature probe cable from the connector on the monitor. The monitor will display the prompt information "TEMP SENSOR OFF" and an audible alarm is activated. The other channel is the same.**
- **Be careful to avoid damaging the temperature probe and cable. When the temperature probe and cable are not in use, shape them into a loose round. If the cable is tangled too tightly or over-bent, mechanical damage may occur.**
- **The calibration of the temperature measurement function is required every two years (or as dictated by your Hospital Procedures Policy). If you need to calibrate the temperature measurement function, contact our Customer Service.**

14.3 TEMP Setup Menu

Selecting the TEMP label in the parameter window opens the following menu.

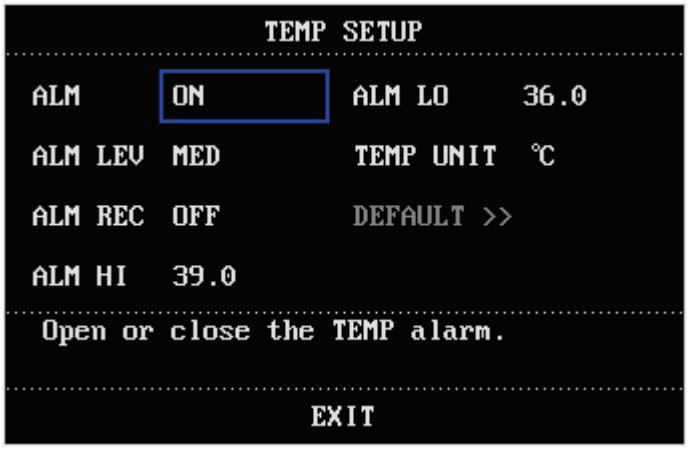


Figure 14-2 TEMP SETUP Menu

You can perform the following settings in this menu.

■ ALM

Temperature alarm on/off status

ON: When a temperature alarm occurs, the monitor gives alarm indications and stores the alarm;

OFF: When a temperature alarm occurs, the monitor neither gives alarm indications nor stores the alarm;

When OFF is selected, the icon is displayed on the right of the TEMP label.

■ ALM LEV

Alarm level

Options: HIGH, MED and LOW.

- ALM REC — Alarm recording
  ON: When a TEMP alarm occurs, the monitor enables the recording;
  OFF: When a TEMP alarm occurs, the monitor does not enable the recording.
- ALM HI — Determines the upper alarm limit.
- ALM LO — Determines the lower alarm limit.
- TEMP UNIT — Options: ℃ and ℉
- DEFAULT >> — You can select this option to access the NIBP DEFAULT CONFIG menu, in which you may select FACTORY DEFAULT CONFIG or USER DEFAULT CONFIG. After finishing your selection and exiting the menu, the system pops up a dialog box asking for your confirmation.

Temperature alarm limits:

Parameter	**Maxi. Upper**	**Mini. Lower**	**Step**
TEMP	50	0	0.1

14.4 Maintenance and Cleaning

⚠WARNING

- **Before cleaning the monitor or the probe, make sure the equipment is turned off and disconnected from AC power.**

Reusable Temperature Probe

- The temperature probe should not be heated to a temperature over 100℃ (212℉). It is only able to bear the temperature between 80 and 100℃ (176 to 212℉) for a short time.
- The probe must not be disinfected in steam.
- Only detergents containing alcohol can be used for disinfection.
- The rectal probes should be used, if possible, in conjunction with a protective rubber cover.
- To clean the probe, hold the tip with one hand and with the other hand rub the probe down in the direction of the connector using a moist lint-free cloth.

NOTE

- **Disposable temperature probes must not be re-sterilized or reused.**
- **Disposable temperature probes must be recycled or disposed of properly.**

15 Accessories

It is recommended to use following accessories on the Monitor.

⚠WARNING

- **Please use the specified accessories listed below with this patient monitor. The device will be possibly damaged or lead some harm if any other accessories are used.**

15.1 ECG Accessories

ECG Electrodes

Model	Quantity	Patient Category	Part No.
210	10 pieces	Adult	0010-10-12304
2249	25 pieces		0509-10-00094
2245	25 pieces	Pediatric	9000-10-07469
2258-3	3 pieces	Neonate	900E-10-04880

One-piece Trunk Cable

Leadwire supported	Compatible with	Model	Type	Patient Category	Part No.
3-leadwire	AHA	\	\	Adult, pediatric	0010-30-12242
	IEC	\	\		0010-30-12243
	AHA	EA 6131B	Defibrillator-proof		0010-30-12246
	IEC	EA 6132B	Defibrillator-proof		0010-30-12247

Note: The cables listed in the table above can be used separately.

Separate Trunk Cable

Leadwire supported	Compatible with	Model	Type	Patient Category	Part No.
3-leadwire	AHA/IEC	EV 6102	Defibrillator-proof	Neonate	0010-30-12377
3-leadwire	AHA/IEC		\		0010-30-12378
3/5-leadwire	AHA/IEC	EV 6101	Defibrillator-proof	Adult, pediatric	0010-30-42782
3/5-leadwire	AHA/IEC	\	\		0010-30-12256

Note: The cables listed in the table above must be used together with leadwires.

Cable Sets

3-Electrode Cable Sets					
Type	**Compatible with**	**Model**	**Patient Category**	**Part No.**	**Remark**
Clip	IEC	EL6302A	Adult, pediatric	0010-30-42725	/
		EL6304A		0010-30-42732	Long
		EL6306A	Neonate	0010-30-42897	/
		EL6308A	Pediatric	0010-30-42899	/
	AHA	EL6301A	Adult, pediatric	0010-30-42726	/
		EL6303A		0010-30-42731	Long
		EL6305A	Neonate	0010-30-42896	/
		EL6307A	Pediatric	0010-30-42898	/
Snap	IEC	EL6302B	Adult, pediatric	0010-30-42733	/
		EL6308B	Pediatric	0010-30-42901	/
	AHA	EL6301B	Adult, pediatric	0010-30-42734	/
		EL6307B	Pediatric	0010-30-42900	/

15.2 SpO2 Accessories

Extension Cable

Extension Cable	Part No.
Extension Cable	0010-20-42594

SpO_2 Sensors

The SpO_2 sensor material that patients or other staff will come into contact with have undertaken the bio-compatibility test and is verified to be in compliance with ISO 10993-1.

Our SpO2 Module			
Type	**Model**	**Patient Category**	**Part No.**
Single patient use	520A	Adult (>30Kg)	520A-30-64101
	520P	Pediatric (10 to 50Kg)	520P-30-64201
	520I	Infant (3 to 20Kg)	520I-30-64301
	520N	Neonate (<3Kg)	520N-30-64401
Reusable	DS-100A	Adult	9000-10-05161
	OXI-P/I	Pediatric, infant	9000-10-07308
	OXI-A/N	Adult, neonate	9000-10-07336
	ES-3212-9	Pediatric(Ear type)	0010-10-12392
	518B	Adult, pediatric, neonate (Multi-sites)	518B-30-72107

Our SpO2 Module			
Type	**Model**	**Patient Category**	**Part No.**
	512D	Adult (Finger type)	512D-30-90200
	512E		512E-30-90390
	512F		512F-30-28263
	512G	Pediatric (Finger type)	512G-30-90607
	512H		512H-30-79061

15.3 NIBP Accessories

Tubing

Type	Patient Category	Part No.
Reusable	Adult, pediatric	509B-30-06259
	Neonate	509B-30-06260

Reusable Cuff

Model	Patient Category	Measurement Site	Limb Circumference (cm)	Part No.
CM1201	Infant	Arm	10 to 19	0010-30-12157
CM1202	Pediatric		18 to 26	0010-30-12158
CM1203	Adult		24 to 35	0010-30-12159
CM1204	Large adult		33 to 47	0010-30-12160
CM1205	Thigh	Thigh	46 to 66	0010-30-12161

Single-Patient Cuff

Model	Patient Category	Measurement Site	Limb Circumference (cm)	Part No.
CM1500A	Neonate	Arm	3.1 to 5.7	001B-30-70692
CM1500B			4.3 to 8.0	001B-30-70693
CM1500C			5.8 to 10.9	001B-30-70694
CM1500D			7.1 to 13.1	001B-30-70695
CM1501	Infant		10 to 19	001B-30-70697
CM1502	Pediatric		18 to 26	001B-30-70698
CM1503	Adult		25 to 35	001B-30-70699
CM1504	Large adult		33 to 47	001B-30-70700
CM1505	Adult	Thigh	46 to 66	001B-30-70701

Disposable Cuff

Model	Patient Category	Measurement Site	Limb Circumference (cm)	Part No.
M1872A	Neonate	Arm	7.1 to 13.1	900E-10-04873
M1870A			5.8 to 10.9	900E-10-04874
M1868A			4.3 to 8.0	900E-10-04875
M1866A			3.1 to 5.7	900E-10-04876

15.4 TEMP Accessories

Extension Cable

Type	Model	Temp probe	Part No.
Reusable	MR420	MR411, MR412	0011-30-90444

Temp Probes

Type	Model	Patient Category	Measurement Site	Part No.
Reusable	YSI 409B	Adult	Skin	900E-10-04881
	YSI 401		Esophageal/Rectal	0509-10-00095
	MR401		Esophageal/Rectal	0011-30-90440
	MR403		Skin	0011-30-90442
	YSI 427	Pediatric, neonate	Skin	0010-10-12124
	YSI 402		Esophageal/Rectal	6000-10-01969
	MR402		Esophageal/Rectal	0011-30-90441
	MR404		Skin	0011-30-90443
Disposable	MR411	\	Esophageal/Rectal	0011-30-90446
	MR411		Skin	0011-30-90447

Note: The disposable Temp probes listed in the table above must be used with the matching extension cables.

FOR YOUR NOTES

A Product Specification

A.1 Safety Classifications

Type of protection against electric shock	Class I with internal electric power supply. Where the integrity of the external protective earth (ground) in the installation or its conductors is in doubt, the equipment shall be operated from its internal electric power supply (batteries), or external DC power supply complying with the requirements of IEC 60601-1
Degree of protection against electric shock	ECG/RESP/TEMP/SpO2/NIBP module: CF (defibrillation proof)
Degree of protection against hazards of ignition of flammable anesthetic mixtures	Not protected (ordinary)
Degree of protection against harmful ingress of water	Not protected (ordinary)
Mode of operation	Continuous
Equipment type	Portable

A.2 Environmental Specifications

Operating conditions	
Temperature	0℃ to 40℃
Relative humidity	15% to 95% (non condensing)
Altitude	-500 to 4600m (-1640 to 15092 feet)
Storage conditions	
Temperature	-20℃ to 60℃
Relative humidity	10% to 95% (non condensing)
Altitude	-500 to 13100m (-1640 to 42979 feet)

A.3 Power Source Specifications

AC Power Supply Specifications	
Line Voltage	100 to 240V～
Current	0.8 to 0.3A
Frequency	50/60 Hz
Fuse	T3.15A, 250V
Internal battery	
Number of batteries	1
Battery type	Sealed lead-acid battery
Time to shutdown	> 5 min (after the first low-power alarm)
Sealed lead-acid battery	
Nominal voltage	12 VDC
Capacity	2.3 Ah
Operating time	100 minutes typical when powered by 2 new fully-charged batteries (25℃, ECG, SpO2, NIBP measurement per 15 minutes).
Charge time	8 hours maximum (in the running status or standby mode)

A.4 Hardware Specifications

Physical	
Size	258 × 118 × 244mm (width×height×depth)
Weight	< 5 kg (With no accessory and battery)
Display	
Type	Color TFT LCD
Size	8.4 inches (diagonal)
Resolution	800×600 pixels
Recorder	
Type	Thermal dot array
Horizontal resolution	160 dots/cm (at 25 mm/s recording rate)
Vertical resolution	80 dots/cm
Width of the recorder paper	48 mm
Length of the recorder paper	30 m
Recording rate	25 mm/s, 50 mm/s
Recorded waveforms	2
LED indicator	
Alarm indicator	1 (yellow and red)
AC/DC power indicator	1 (green)
Battery indicator	1 (green)
Audio indicator	
Speaker	Giving alarm tones (45 to 85dB), keypad tones, and heartbeat/pulse tone. Supporting PITCH TONE and multi-level volume. Audio alarms comply with EN ISO 21647/ISO 21647 and IEC60601-1-8.
Control	
Control knob	1 knob It can be rotated clockwise/counterclockwise or pressed.
Button	7 buttons Power Switch, FREEZE, SILENCE, RECORD, NIBP.

Connectors	
Power supply	1 AC power connector
Parameter	ECG, RESP, TEMP, SpO_2, NIBP
Reserved	\
Reserved	\
Equipotentiality	1 equipotential grounding connector

A.5 Data Storage

Trend data	Long trend: 72 hours, resolution 1min. Short trend: 1 hour, resolution 1 s or 5 s.
Alarm events	60 alarm events and associated waveforms (with user selectable waveform length 8s, 16 or 32).
ARR events	60 ARR events and associated waveforms with 8s wavelength.
NIBP measurements	400 NIBP groups, including systolic pressures, mean pressures, diastolic pressures and measurement time.

A.6 ECG Specifications

Lead type	3-lead (1 channel): I, II, III
Lead naming style	AHA, EURO
Sensitivity selection	2.5mm/mV (×0.25), 5mm/mV (×0.5), 10mm/mV (×1), 20mm/mV (×2) and auto
Sweep speed	12.5mm/s, 25mm/s, 50mm/s
Bandwidth (– 3dB)	Diagnostic mode: 0.05 to100 Hz Monitor mode: 0.5 to 35 Hz Surgery mode: 1 to 15 Hz
Common mode rejection	Diagnostic mode: ≥ 90 dB Monitor mode: ≥ 105 dB Surgery mode: ≥ 105 dB (The notch filter is turned off.)
Differential input impedance	≥ 5 MΩ
Input signal range	±5 mV (peak-to-peak value)
DC offset voltage	±300 mV
Patient leakage current	< 10 uA

Recovery time after defibrillation	< 5s
Calibration signal	1mV (peak-to-peak value), precision: ±5%
HR	
Measurement range	Neonate: 15 to 350 BPM Pediatric: 15 to 350 BPM Adult: 15 to 300 BPM
Resolution	1 BPM
Precision	±1 BPM or ±1%, whichever is greater.
ST segment measurement	
Measurement range	– 2.0 to +2.0 mV
Precision	– 0.8 to +0.8mV: ±0.02 mV or ±10%, whichever is greater. Beyond this range: Undefined.
Update period	10s
Arrhythmia analysis	
Type	ASYSTOLE, VFIB/VTAC, PVC, COUPLET, VT>2, BIGEMINY, TRIGEMINY, R ON T, MISSED BEATS, TACHY, BRADY, PNC and PNP

A.7 RESP Specifications

Measurement technique	Thoracic impedance
Respiration impedance test range	0.3 to 5Ω
Baseline impedance range	200 to 1500 Ω (using an ECG cable with 1kΩ resistance)
Bandwidth	0.2 to 2Hz (-3 dB)
Sweep speed	6.25 mm/s, 12.5 mm/s, 25 mm/s
RR	
Measurement range	Adult: 0 to 120 BrPM Pediatric/neonate: 0 to 150 BrPM
Resolution	1 BrPM
Precision	7 to 150 BrPM: ±2 BrPM or ±2%, whichever is greater. 0 to 6 BrPM: Undefined.
Apnea alarm delay	10 to 40s

A.8 SpO_2 Specifications

SpO2	
Measurement range	0 to 100%
Resolution	1%
Precision	70to100%: ±2% (adult/pediatric, non-motion conditions) 70to100%: ±3% (neonate, non-motion conditions) 0%to69%: Undefined.
Refreshing rate	1s
Alarm delay	10s
PR	
Measurement range	20 to 254bpm
Resolution	1bpm
Precision	±3 bpm (non-motion conditions)
Refreshing rate	1s
Alarm delay	10s

A.9 NIBP Specifications

Measurement technique	Auto oscillation			
Displayed parameters	Systolic pressure, diastolic pressure and mean pressure			
Mode of operation	Manual, auto and continuous			
Measurement interval in auto mode	1/2/3/4/5/10/15/30/60/90/120/180/240/480 minutes			
Measurement time in continuous mode	5 minutes			
Measurement range in normal mode	mmHg	Adult	Pediatric	Neonate
	Systolic pressure	40 to 270	40 to 200	40 to 135
	Diastolic pressure	10 to 210	10 to 150	10 to 100
	Mean pressure	20 to 230	20 to 165	20 to 110
Measurement precision	Maximum average error: ±5mmHg Maximum standard deviation: 8mmHg			
Resolution	1mmHg			

Over-pressure protection	Adult:	297±3 mmHg
	Pediatric:	240±3 mmHg
	Neonate:	147±3 mmHg

A.10 TEMP Specifications

Number of channels	1
Displayed parameters	TEMP
Measurement range	0 to 50℃ (32 to 122℉)
Resolution	0.1℃
Precision	0.1℃
Update period	1s

FOR YOUR NOTES

B EMC

The equipment meets the requirements of IEC 60601-1-2.

NOTE

- **Use of accessories, transducers, and cables other than those specified may result in increased emission and/or decreased immunity of the equipment.**
- **The equipment should not be used adjacent to or stacked with other equipment, and if adjacent or tacked use is necessary, the equipment should be observed to verify normal operation in the configuration in which it will be used.**
- **The equipment needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided below.**
- **The equipment may be interfered with by other equipment, even if that other equipment complies with CISPR emission requirements.**
- **Operation of the device, in the case that the patient physiological signal is lower than the minimum amplitude and/or value specified in the product specifications, may cause inaccurate results.**

TABLE 1

Guidance and MINDRAY declaration — electromagnetic emissions		
The equipment is intended for use in the electromagnetic environment specified below. The customer or the user of the equipment should assure that it is used in such an environment.		
Emissions test	**Compliance**	**Electromagnetic environment — guidance**
RF emissions CISPR 11	Group1	The equipment uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The equipment is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic Emissions IEC61000-3-2	Class A	
Voltage Fluctuations/Flicker Emissions IEC 61000-3-3	Compliance	

TABLE 2

Guidance and MINDRAY declaration — electromagnetic immunity			
The equipment is intended for use in the electromagnetic environment specified below. The customer or the user of the equipment should assure that it is used in such an environment.			
Immunity test	**IEC 60601 Test level**	**Compliance level**	**Electromagnetic environment — guidance**
Electrostatic Discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast Transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines (>3m).	±2 kV for power supply lines ±1 kV for input/output lines (>3m)	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV different mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, Short interruptions and voltage variation on power supply input lines IEC 61000-4-11	<5% U_T (>95% dip in U_T) for 0.5 cycle 40% U_T (60% dip in U_T) for 5 cycle 70% U_T (30% dip in U_T) for 25 cycle <5% U_T (>95% dip in U_T) for 5 sec	<5% U_T (>95% dip in U_T) for 0.5 cycle 40% U_T (60% dip in U_T) for 5 cycle 70% U_T (30% dip in U_T) for 25 cycle <5% U_T (>95% dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of our product requires continued operation during power mains interruptions, it is recommended that our product be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 HZ) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

U_T is the A.C. mains voltage prior to application of the test level.

TABLE 3

<table>
<tr><th colspan="4">Guidance and MINDRAY declaration — electromagnetic immunity</th></tr>
<tr><td colspan="4">The equipment is intended for use in the electromagnetic environment specified below.
The customer or the user of the equipment should assure that it is used in such an environment</td></tr>
<tr><th>Immunity test</th><th>IEC 60601 Test level</th><th>Compliance level</th><th>Electromagnetic environment — guidance</th></tr>
<tr><td>Conduced RF IEC 61000-4-6</td><td>3 Vrms
150kHz to 80MHz</td><td>3 Vrms</td><td rowspan="2">Portable and mobile RF communications equipment should be used no closer to any part of the equipment, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.
Recommended separation distance
$d = 1.2 \times \sqrt{P}$
$d = 1.2 \times \sqrt{P}$ 80 MHz to 800 MHz
$d = 2.3 \times \sqrt{P}$ 800 MHz to 2.5GHz
where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).
Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, [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:  </td></tr>
<tr><td>Radiated RF IEC 61000-4-3</td><td>3 V/m
80MHz to 2.5GHz</td><td>3V/m</td></tr>
<tr><td colspan="4">Note — At 80 MHz and 800 MHz, the higher frequency range applies.
Note — These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.</td></tr>
<tr><td colspan="4">[a] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the equipment is used exceeds the applicable RF compliance level above, the equipment should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the equipment.
[b] Over the frequency ranges 150kHz to 80MHz, field strengths should be less than 3V/m.</td></tr>
</table>

TABLE 4

Recommended separation distances between portable and mobile RF communication and the equipment			
The equipment is intended for use in an electromagnetic environment in which radiated RF disturbance are controlled. The customer or the user of the equipment can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communication equipment (transmitters) and the equipment as recommended below, according to the maximum output power of the communication equipment.			
Rated Maximum Output power of Transmitter W (Watts)	**Separation Distance According to Frequency of Transmitter M (Meters)**		
	150kHz -80MHz $d = 1.2\sqrt{P}$	80MHz -800MHz $d = 1.2\sqrt{P}$	800MHz -2.5GHz $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.37	0.37	0.74
1	1.17	1.17	2.34
10	3.69	3.69	7.38
100	11.67	11.67	23.34
For transmitters at a maximum output power not listed above, the recommended separation distanced in meters (m) can be determined using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer. Note — At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies. Note — These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

FOR YOUR NOTES

C Alarm Messages and Prompt Information

C.1 Physiological Alarm Messages

Note: XX represents the parameters being monitored, such as HR, RR, SpO_2, etc. The "L" field indicates the alarm level, and 1 means high, 2 means medium, 3 mean low, * means the level is user-adjustable.

Alarm messages	**L**	**Cause**	**Measure**
XX TOO HIGH	2*	XX value exceeds the upper alarm limit.	Make sure the alarm limits are appropriate for the patient, and check the patient's condition.
XX TOO LOW	2*	XX value exceeds the lower alarm limit.	
ECG WEAK SIGNAL	1	The ECG signal of the patient is too small so that the system can not perform ECG analysis.	Check the connection of the patient cable and lead wires, and then check the patient's condition.
RESP ARTIFACT	1	The patient's heartbeat interferes with his respiration. The respiration rate cannot be measured correctly.	
NO PULSE	1	The pulse signal of the patient is so weak that the monitor cannot perform pulse analysis.	
CO_2 APNEA	1	The respiration signal of the patient is so weak that the monitor cannot perform respiration analysis.	
RESP APNEA	1		
ASYSTOLE	1*	The asystole arrhythmia event occurs to the patient.	
VFIB/VTAC	1*	The ventricular tachycardia or ventricular fibrillation arrhythmia event occurs to the patient.	
R ON T	2*	The R ON T arrhythmia event occurs to the patient.	
VT > 2	2*	The VT>2 arrhythmia event occurs to the patient.	
COUPLET	2*	The couplet arrhythmia event occurs to the patient.	
PVC	2*	The PVC arrhythmia event occurs to the patient.	

BIGEMINY	2*	The bigeminy arrhythmia event occurs to the patient.	
TRIGEMINY	2*	The trigeminy arrhythmia event occurs to the patient.	
TACHY	2*	The patient is suffering from tachycardia.	
BRADY	2*	The patient is suffering from bradycardia.	
PNC	2*	No pacer signal is captured.	
PNP	2*	The pacemaker is not paced.	
MISSED BEATS	2*	The arrhythmia event of missed beats occurs to the patient.	

C.2 Technical Alarm Messages

Note: XX represents the parameter modules like ECG, NIBP and SpO_2, or the parameters being monitored like HR, PR and SpO_2.

The A field indicates whether an alarm can be completely cleared; the B field indicates whether the visual and audible indications of an alarm can be cleared; the "L" field indicates the alarm level, and 1 means high, 2 means medium, 3 mean low, * means the level is user-adjustable.

C.2.1 General Alarm Messages of Parameter Modules

Alarm message	**A**	**B**	**L**	**Cause**	**Measure**
XX INIT ERR N	Yes	No	1	XX module initialization error N	Restart the monitor. If the error remains, contact our company for repair.
Note: N stands for the error number.					
XX COMM STOP	No	No	1	Failure in communication between XX module and the main board.	
XX COMM ERR	Yes	No	1	Error in communication between XX module and the main board.	
XX ALM LMT ERR	No	No	1	The alarm limit of the XX parameter is changed inadvertently.	If the error remains, contact our company for repair.
XX EXCEED	No	No	1	The measured XX parameter value exceeds the measurement range.	

C.2.2 ECG Module Alarm Messages

Alarm message	A	B	L	Cause	Measure
ECG LEAD OFF	No	Yes	3	The ECG lead is not connected correctly.	Check for correct connection of the leadwires.
ECG X LEAD OFF	No	Yes	3		
Note: X represents the leadwires LL, LA and RA, as per AHA standard, or L and, F, R as per IEC standard.					
ECG NOISE	No	No	3	Large interference signals appear on the ECG signal.	Make sure the leadwires are correctly connected. Check the patient for severe motion.
ECG SELFTEST ERR	Yes	No	1	An error occurs in the ECG initialization.	Restart the monitor. If the error remains, contact our company for repair.

C.2.3 RESP Module Alarm Messages

Alarm message	A	B	L	Cause	Measure
RESP DISTURBED	No	No	3	The module circuit is disturbed.	If the problem occurs continuously, restart the monitor. If it still exits, contact our company for repair.
RR EXCEED	No	No	1	The circuit is disturbed and the measurement is inaccurate.	

C.2.4 TEMP Module Alarm Messages

Alarm message	A	B	L	Cause	Measure
TEMP SENSOR OFF	No	Yes	3	The TEMP sensor is not connected correctly to the patient or the monitor.	Check for correct connection of the TEMP sensor.
TEMP SELFTEST ERROR	No	No	1	Circuit fault of the temperature channel.	Contact our company for repair.
TEMP CALIBRATIO N ERR	No	No	2	Error in temperature channel calibration.	Restart the monitor. If the error remains, contact our company for repair.

C.2.5 NIBP Module Alarm Messages

Alarm message	A	B	L	Cause	Measure
NIBP SELFTEST ERR	Yes	Yes	1	Error in NIBP initialization.	Select RESET from the NIBP SETUP menu. If the error remains, contact our company for repair.
LOOSE CUFF	No	Yes	3	The NIBP cuff is not properly connected.	Check the patient's condition, and check if the patient type is correct. Replace with a proper cuff and connect it correctly. If the problem still exists, contact our company for repair.
AIR LEAK	No	Yes	3	Leak in the airway.	
PNEUMATIC LEAK	No	Yes	3		
CUFF TYPE ERR	No	Yes	2	The cuff applied is not appropriate to the patient type.	
AIR PRESSURE ERROR	No	Yes	3	Failure occurs in the pulse measurement. The monitor cannot perform measurement, analysis, or calculation.	
WEAK SIGNAL	No	Yes	3		
SIGNAL SATUATED	No	Yes	3		
RANGE EXCEEDED	No	Yes	3		Check the patient's condition, and check if the patient type is correct. Replace with a proper cuff and connect it correctly. If the problem still exists, contact our company for repair.
EXCESSIVE MOTION	No	Yes	3	Excessive motion of the patient's arms.	
OVER PRESSURE	No	Yes	2	The airway might be blocked.	
NIBP SYSTEM FAILURE	No	Yes	2	Failure occurs in the pulse measurement. The monitor cannot perform measurement, analysis, or calculation.	
NIBP TIME OUT	No	Yes	2		
MEASURE FAIL	No	Yes	2		
NIBP ILLEGALLY RESET	No	Yes	2	Illegal reset comes out during the NIBP measurement.	Check if the airway is blocked. Deal with the blocking and perform the measurement again. If the problem still exists, contact our company for repair.

C.2.6 SpO_2 Module Alarm Messages

Alarm message	A	B	L	Cause	Measure
SPO2 SENSOR OFF	No	Yes	3	The sensor is disconnected from the patient or the monitor.	Make sure the sensor is placed on the patient's finger or other parts, and the monitor is connected to cables correctly.
SPO2 NO SENSOR	Yes	Yes	3	The sensor is disconnected from the patient or the monitor, or it is not properly connected.	Disconnect and reconnect the sensor as directed by the instructions. If the alarm remains, the sensor or the cable might have been damaged.
				The SpO_2 is connected upside down.	Disconnect and reconnect the sensor as directed by the instructions. Pay attention to the mark on the probe.
SPO2 LOW PERFUSION	No	No	3	The pulse signal is too weak.	Move the sensor to a site with better perfusion.

C.2.7 Recorder Module Alarm Messages

Alarm message	A	B	L	Cause	Measure
RECORDER INIT ERR N	Yes	No	2	An error occurs during the recorder initialization.	Contact the hospital's engineers or our customer Service.
Note: N represents the error number.					
RECORDER SELFTEST ERR	Yes	No	2	An error might occur to the RAM, ROM and CPU watchdog.	Open the RECORD menu and select the CLEAR REC TASK option. If the problem remains, contact our company for repair.
RECORDER VLT HIGH	No	No	1	A problem occurs to the system power.	If this alarm message is given for many times, contact our company for repair.
RECORDER VLT LOW	No	No	1		

Alarm message	A	B	L	Cause	Measure
RECORDER HEAD HOT	No	No	1	The thermal head of the recorder is too hot.	Resume the recording till the recorder cools down completely. If the problem still exists, contact our company for repair.
REC HEAD IN WRONG POS.	Yes	Yes	3	The thermal head of the recorder is in wrong position.	Restore the control lever of the recorder to its previous position.
RECORDER OUT OF PAPER	Yes	Yes	3	The recorder paper is used up.	Replace with a new paper roll.
RECORDER PAPER JAM	No	No	2	The recording continues for more than 30 minutes.	Place the recorder correctly and try again.
RECORDER COMM ERR	Yes	No	2	Error in recorder communication.	Open the RECORD menu and select the CLEAR REC TASK option. If the problem remains, contact our company for repair.
TOO MANY REC TASKS	No	No	2	Quite a few alarm events occur at the same time.	Check the patient's condition and the alarms. Open the RECORD menu and select the CLEAR REC TASK option. If the problem remains, contact our company for repair.
RECORDER PAPER W.P.	Yes	Yes	2	The paper roll of the recorder is not placed in the correct position.	Place the paper roll correctly.
RECORDER S. COMM ERR	Yes	No	2	Error in recorder communication.	Open the RECORD menu and select the CLEAR REC TASK option. If the problem remains, contact our company for repair.
REC NOT AVAILABLE	No	No	2	Error in the recorder work mode.	

C.2.8 System Alarm Messages

Alarm message	A	B	L	Cause	Measure
REAL CLOCK NEED SET	No	No	1	The system time is incorrect.	Reset the system time and then restart the monitor.
REAL CLOCK NOT EXIST	No	No	1	No button battery, or the battery power is depleted.	Add, or replace with a new button battery.
KEYBOARD INIT ERR N	No	No	1	Keyboard error. The keyboard cannot be used.	Contact our company for repair.
Note: N represents the error number.					
KEYBOARD ERROR	No	No	2		
NET INIT ERR (G.)	No	No	2	The system cannot be connected to the network due to problems in the monitor's network part.	
NET INIT ERR (Ram)	No	No	2		
NET INIT ERR (Reg)	No	No	2		
NET ERR (Run 1)	No	No	2		
NET ERR (Run 2)	No	No	2		
12V TOO HIGH	No	No	1	A problem occurs to the system power.	If this alarm message is given for many times, contact our company for repair.
12V TOO LOW	No	No	1		
BATTERY TOO LOW	No	No	1	The battery voltage is too low.	Connect the monitor with AC power to recharge the battery.

C.3 Prompt Messages

Prompt messages	Cause	Measure
ECG1 SIGNAL SATURATION	Signals of abrupt change interfere with the ECG signal.	Check whether the electrodes and leads are well connected.
ECG2 SIGNAL SATURATION		
SEARCH PULSE	The SpO_2 module is searching the pulse.	Wait till the end of the searching.
Recorder		

Prompt messages	Cause	Measure
RECORDER INITIALIZING	The recorder is in the initializing status.	Wait for the recorder to finish the initialization.
RECORDER BUSY	The recorder is recording.	Wait for the recorder to finish the recording.
NIBP module		
Manual measure...	The NIBP module is performing the manual measurement.	Wait for the NIBP module to finish the measurement.
CONTINUAL...	The NIBP module is performing the continuous measurement.	
Auto measuring...	The NIBP module is performing the auto measurement.	
Resetting...	The NIBP module is being reset.	Wait the NIBP module to finish the resetting.
Resetting...		
Please start	This message appears after the auto measurement interval is selected.	Press the NIBP button to start the measurement.
CALIBRATE...	The NIBP module is performing the calibration.	Wait for the NIBP module to finish the calibration.
Calibration over	The calibration is finished.	None
PNEUMATIC...	The NIBP module is checking the pneumatic system for leakage.	Wait for the NIBP module to finish checking the pneumatic system.
Pneum test over	The NIBP finishes checking the pneumatic system for leakage.	None
Measurement over	The NIBP button is pressed during the measurement.	None
Reset failed	The reset fails.	None
ST LEARNING	The QRS complex template for the ARR analysis is forming.	Wait till the end of the ARR learning.
ARR LEARNING		

D Symbols and Abbreviations

Symbols and abbreviations that you may encounter while reading this manual or using the monitor are listed below with their meanings.

D.1 Symbols

A	ampere
Ah	ampere hour
bpm	beats per minute
BrPM	breaths per minute
℃	centigrade
cc	cubic centimeter
cm	centimeter
dB	decibel
℉	fahrenheit
g	gram
GTT	gutta
hr	hour
hPa	hundred pascal
Hz	hertz
inch	inch
kg	kilogram
kPa	kilopascal
l	litre
lb	pound
m	meter
mcg	micrograms
mEq	milli-equivalents
mg	milligrams
min	minute
ml	milliliter
mm	millimeters
mmHg	millimeters of mercury

ms	millisecond
mV	millivolt
mW	milliwatt
nm	nanometer
ppm	part per million
s	second
V	volt
VA	volt ampere
Ω	ohm
µA	microampere
µm	micron
µV	microvolt
W	watt
-	minus
%	percent
/	per; divide; or
^	power
+	plus
=	equal to
<	less than
>	greater than
≤	less than or equal to
≥	greater than or equal to
±	plus or minus
×	multiply
©	copyright

D.2 Abbreviations

AAMI	Association for Advancement of Medical Instrumentation
AC	altenating current
ADT	adult
AHA	American Heart Association
ANSI	American National Standard Institue
AP	access point
ARR	arrhythmia

ART	arterial
AUX	Auxiliary output
AwRR	Air way respiratory rate
BTPS	body temperature and pressure, saturated
CCU	critical care unit
CH	channel
CISPR	International Special Commmittee on Radio Interferennce
CMS	central monitoring system
cmos	Complementary Metal Oxide Semiconductor
CPU	central processing unit
CVP	central venous pressure
D	diastolic
DC	direct current
DIA	diastolic
e.g.	for example
ECG	electrocardiograph
EEC	European Economic Community
EMC	electromagnetic compatibility
ERR	error
ES	electrosuigical
ESU	electrosuigical unit
Et	end-tidal
EURO	European
Fi	fraction of inspired
$FiCO_2$	fraction of inspired carbon oxygen
FiN_2O	fraction of inspired nitrous oxide
FiO_2	fraction of inspired oxygen
fpga	Field Programmable Gate Array
Hb-CO	Carbonmono-xide hemoglobin
HR	heart rate
HT	height
IEC	International Electrotechnical Commission
ID	invasive diastolic brood pressure
IM	invasive mean brood pressure
IS	invasive systolic brood pressure
Ins, INS	Inspired Minimum
$InsCO_2$	Inspired Minimum carbon dioxide

ISO	International organization for standardization
LA (L)	left arm
LAP	left artria pressure
LCD	liquid crystal display
LED	light emitting diode
LL (F)	left leg
Loop	loop read-write test fail
M	mean
MAC	minimal alveolar concentration
MAP	mean arterial pressure
MDD	Medical Device Directive
MEAN	mean pressure
MetHb	methemoglobin
Mii	initialize MII registers fail
MRI	magnetic resonance imaging
N/A	not applied
NEO	neonate, neonatal
NIBP	noninvasive blood pressure
ND	non-invasive diastolic brood pressure
NM	non-invasive mean brood pressure
NS	non-invasive systolic brood pressure
O_2	oxygen
oxyCRG	Oxygen Cardio-respirogram
P	power
PA	pulmonary artery
PD	photodetector
PED	pediatric
PLETH	plethysmogram
PM	Patient Monitor
PR	pulse rate
PVC	premature ventricular complex
QRS	interval of ventricular depolarization
RA (R)	right arm
RAM	random access memory
RAP	right atrial pressure
Reg	test NE2000 registers fail
RESP	respiration

RL (N)	right leg
ROM	read-only memory
RR	respiration rate
S	systolic
SpO_2	arterial oxygen saturation from pulse oximetry
SYNC	synchronization
SYS	systolic
TEMP	temperature
TFT	Thin-Film Technology
V (C)	precordial lead (chest)
VGA	Video Graphice Array

FOR YOUR NOTES