Patient Monitor
WE-9001-VET

User Manual

Whittemore Enterprises, Inc.

Contents

Chapter 1 Safety

1.1 Safety information

WARNING

- **Before using the device, the equipment, patient cable and electrodes etc. should be checked. Replacement should be taken if there is any evident defect or signs of aging which may impair the safety or performance.**
- **The Monitor is intended for clinical monitoring application with operation only granted to appropriate medical staff.**
- **The monitor can be used on only one patient at a time.**
- **EXPLOSION HAZARD-Do not use the device in a flammable atmosphere where concentrations of flammable anesthetics or other materials may occur.**
- **There could be hazard of electrical shock by opening the monitor casing. All servicing and future upgrading to this equipment must be carried out by personnel trained and authorized by our company.**
- **To prevent delayed treatment, sufficient alarm setup should be done according to individual patient situation and make sure that alarm sound can be activated when alarm occurs.**
- **Do not touch the patient, table, or the device during defibrillation.**
- **The device is available to connecting with the patient who using cardiac pacemaker or other electrical stimulation devices, but this may result in risks.**
- **When used with Electro-surgery equipment, the operator (doctor or nurse) must give top priority to the patient safety.**
- **The monitor and devices connected to it shall form an equipotential system (protective earthing).**
- **If the protective earthing system is unstable, the monitor should apply internal power supply.**
- **This device can only be connected to a power socket with protective earthing. If the power socket is not grounded, do not use the socket and the monitor should be power supplied by rechargeable batteries. Do not connect the three-wire cable to a second-wire plug.**
- **The information of physiological waveform, physiological parameters and alarm, etc., shown on the monitor is for medical reference only, it can not be regarded as the basis for clinical treatment directly.**
- **Be careful to place the power cord and various cables of accessories to avoid the patient being wound or suffocated, or the cable entangled together, or subject to electrical interference.**
- **The disposal of packaging materials should obey the local regulations or the hospital waste disposal system. The packaging material must be keep out of the reach of children.**

CAUTION

- **The monitor's service life is 5 years. At the end of its service life, the product described in this manual, as well as its accessories, must be disposed in compliance with related local regulations or hospital regulations. If you have questions concerning disposal of the product, please contact our company or representative institution.**
- **When you have questions about the integrity of the external grounding of the monitor and its arrangement, the internal battery must be used for operation.**
- **Electromagnetic fields can affect the performance of the monitor, so other equipment used near the monitor must meet the appropriate EMC requirements. Mobile phones, X-rays, or MRI devices are possible sources of interference because they could emit high-intensity electromagnetic radiation.**
- **Before turning on the power to the device, make sure that the supply voltage and frequency match the device's label or the requirements specified in this manual.**
- **When the battery is about to exceed its service life, remove the battery immediately from the monitor.**
- **To ensure patient safety, please use the accessories specified in this manual.**

NOTE:

- **Install the equipment in a location that is easy to observe, operate and maintain.**
- **If the monitor gets damp accidentally, or the liquid is dumped on the equipment or accessories, especially if the liquid is likely to enter the monitor, please contact the service personnel in time.**
- **The software is developed in accordance with IEC62304. The possibility of risks caused by program error has been minimized.**
- **The pictures and interfaces in this manual are for reference only, please in kind prevail.**

1.2 Precautionary measures

- In order to avoid the accumulation of electrostatic charge, it is recommended to store, maintain and use the equipment at a relative humidity of 30% or more. The floor should be covered with ESD dissipated carpets or similar materials. In the use of the components, non-synthetic clothing should be wore.
- In order to prevent electrostatic discharging to the ESD-sensitive parts of the device, the personnel should contact the metal frame of the components or the large metal objects near the device. When using the device, especially when it is possible to contact the ESD-sensitive parts of the device, the operator should wear a grounded bracelet designed for ESD-sensitive devices. For more information on proper use, please refer to the instructions provided with the bracelet.

ESD Precautionary procedure training

- All potential users are advised to understand the ESD warning symbols and receive training on ESD precautions.
- The most basic content of the ESD precautionary procedure training should include an introduction to electrostatic charge physics, voltage level in the conventional case, and damage to the electronic components when the operator with electrostatic charge contacts them. In addition, the methods for preventing electrostatic buildup, and the manner and reasons for the release of human body static electricity to the ground or equipment frame or the use of a bracelet to connect the human body to the equipment or the ground before establishing the connection should be described.

1.3 Symbols

Your device may not contain all the following symbols.

	Attention! Please read the accompanying file (the user manual).		
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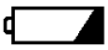
	Alternating current		Manufacturer
	Direct current		Use by
	Standby		This way up
	USB port		Fragile, handle with care
	Equipotential		Keep dry
P/N	Part number		Stacking layers limit
	Batch code		Atmospheric pressure limitation
	Serial number		Temperature limitation
	Date of manufacture		Humidity limitation
	Internet access		Battery
	Waste disposal mark, this symbol indicates that the waste of electrical and electronic equipment can not be disposed as an unclassified municipal waste and must be recovered separately.		
	This symbol indicates that the applied part belongs to type BF, also the unit contains type F isolated (floating) applied part, and it has defibrillation proof function, but does not include direct cardiac application.		
	This symbol indicates that the applied part belongs to type CF, also the unit contains type F isolated (floating) applied part, and it has defibrillation proof function, but does not include direct cardiac application.		

Chapter 2 General

2.1 Introduction

Structure and composing: main unit, accessories (ECG lead cables, SpO_2 sensor, NIBP extension tube, NIBP cuff, TEMP probe, etc.) and power cord.

The monitor is applicable for the clinical monitoring of cat, dog and other animals. Physiological parameters including ECG (including ST-segment measurement and arrhythmia analysis), RESP, SpO_2, PR, NIBP and TEMP, can be monitored. The monitoring information could be displayed, reviewed and printed.

WARNING

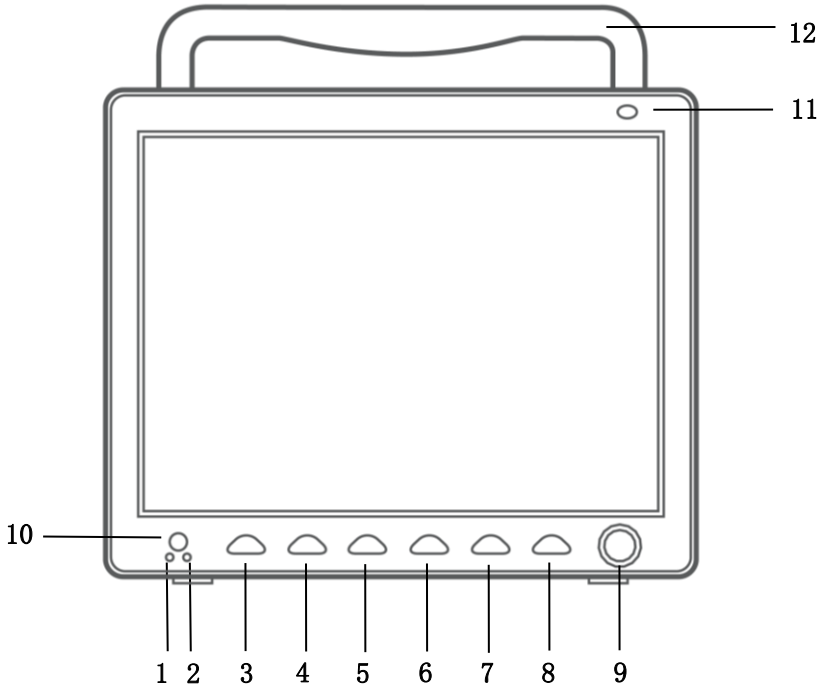
- **The monitor should be used by a qualified clinician or under the guidance of a professional clinician. Personnel who uses this monitor should be adequately trained. The personnel without authorized or who are not trained, shall not carry out any operation.**

2.2 Contraindications

No contraindications.

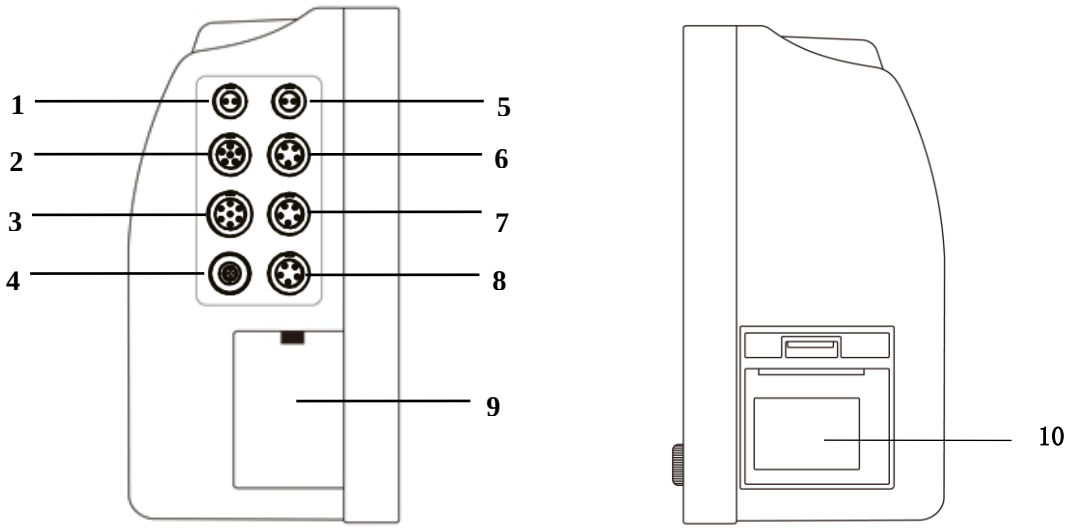
2.3 Main unit

Front view



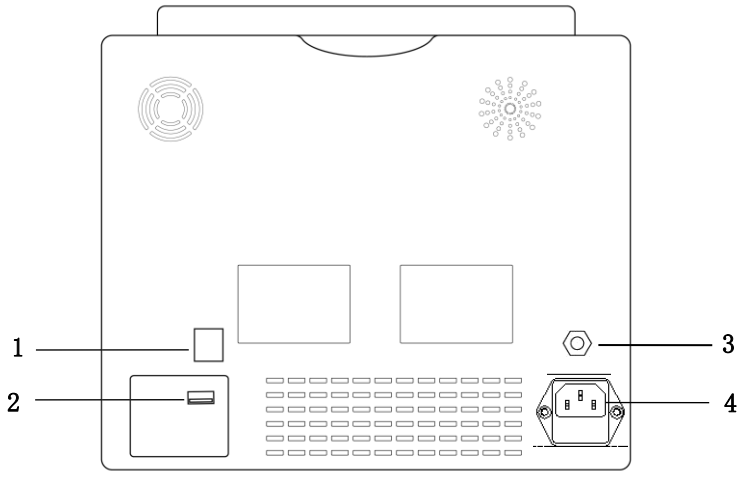
1	AC indicator: On: the monitor is connected to AC power supply; Off: the monitor is disconnected from AC power supply.
2	Battery indicator: it displays green and flickers under battery-powered condition, it always displays orange in charging state and green after fully charged.
3	MENU:Press this button to call up the SYSTEM MENU, in which the user may set up system information and perform review operation.
4	NIBP:Press it to inflate the cuff to start a blood pressure measurement. When measuring, press it to cancel the measurement and deflate the cuff.
5	REC/STOP:Press it to start a real time recording. The recording time can be set in "RT REC TIME" item under "RECORD" menu.
6	SILENCE:Push this button to suspend the alarm (with 1 minute and 2 minutes selectable), and a  symbol appears in the alarm area. Push this button for more than 1 second to mute all kinds of sounds (including alarm sound, heart beat, pulse tone, key sound). At the same time, a  symbol appears. Push this button again to restore all kinds of sounds and the  symbol disappears from the screen.
7	FREEZE:Freeze or unfreeze the waveform
8	MAIN:Whatever levels of menu the system is in, press the button and the system will always return to the main screen.
9	Rotary knob ◆ Rotating: clockwise or counter-clockwise rotating to move the cursor ◆ Pressing: press the knob to execute certain operations, such as entering a menu or processing a command.
10	ON/OFF ◆ ON: press this button to turn on the monitor ◆ OFF: in turning on state, keep pressing this button for 3 seconds can turn off the monitor.
11	Alarm indicator: indicating alarm level by different color and flicking frequency
12	handle

Side view



1	T1: Socket for channel 1 TEMP probe	
2	SpO_2: Socket for SpO_2 sensor	
3	ECG: Socket for ECG cable	
4	NIBP: Socket for NIBP cuff	
5	T2: Socket for channel 2 TEMP probe	
6	IBP/CO_2: IBP or CO_2 interface	Note: [6] and [7] can not be connected to a function at the same time; if connected, only the earlier connection is recognized.
7	IBP/CO_2: IBP or CO_2 interface	
8	Option: reserved interface	
9	Battery cover	
10	Recorder	

Rear view



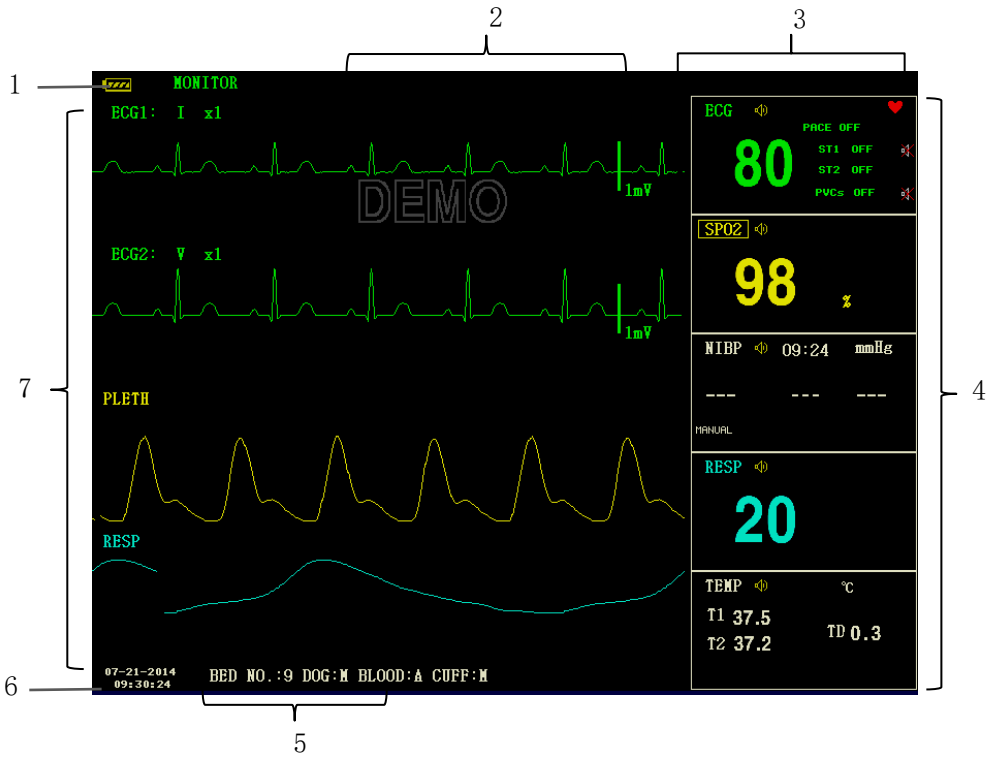
1	Network interface: standard RJ45 interface, connecting with the central monitoring system of our company by network cable
2	USB port: connecting with external memory devices
3	Equipotential grounding terminal: when the monitor is used together with other equipment, use a cable to connect other equipment to the equipotential terminal of the monitor, which eliminates the ground potential difference between the different devices to ensure safety.
4	AC power port. Fuse: T1.6AL250V

NOTE:

- **Replacement of fuse: unplug the power cord, then disassemble the screws by using tools.**
- **The network interface can only connect with the central monitoring system of our company to form a network monitoring system.**

2.4 Display

The monitor adopts high resolution color TFT LCD screen, which clearly displays all physiological parameters and waveforms of the patient. The following figure is a standard interface in normal monitoring state.



1.Battery indicator


The battery works normally, the solid part represents battery level.


Battery is low, it needs to be charged immediately, and the monitor generates low battery alarm.


The monitor does not contain internal battery.

2.Technical alarm area

Displaying technical alarms and prompt messages, cycle display for multiple pieces of information.

3.Physiological alarm area

Displaying physiological alarms, cycle display for multiple pieces of information.

4.Parameter area

Consisting of several individual areas, displaying the measured value corresponding to each parameter module. The name of an individual parameter is on the top left of its area.

5.Patient information area

BED NO.9:	Bed number of patient under monitoring
Other:	Patient type, three options: Cat, Dog or Other.
M	Patient sex, Male or Female.
BLOOD:A	Patient blood type.
CUFF L:	The cuff applied on the patient (set up in NIBP SETUP menu).

6.Date and Time

Indicating current date and time, available to calibrated if necessary.

7.Waveform area

Mainly displaying the waveform of physiological parameters, the name of each waveform is on the top left. ECG lead is selectable according to the demand. The filter mode is displayed at the top of screen. Gain of each channel is displayed above its waveform, at the right side of the waveform, there is a scale of one millivolt.

When a menu pops up in the interface, it always locates a fixed area in the middle of the waveform area, which will cover parts of the waveform, while the waveform will appear after exit the menu.

The waveform is refreshed at a certain speed, the speed adjustment please refer to the setup of each parameter.

Chapter 3 Installation

The portable monitor is designed to comply with relevant safety requirements of IEC 60601-1, IEC 60601-2-27 and IEC 80601-2-30 for medical electrical equipment. The system has a floating input for defibrillation proof and electrosurgical knife protection. If the correct electrodes (see the section about ECG Monitoring) are used and placed according to the manufacturer's instructions, the display will be restored within 5 seconds after defibrillation.

WARNING

- **If any sign of damage to the monitor function is detected, or an error message appears, do not use it on any patient. Contact biomedical engineer in the hospital or our maintenance engineer immediately.**
- **All analog and digital equipment connected to this device must be certified by specified IEC standards (e.g. IEC 60950 and IEC 60601-1), and all equipment shall comply with the requirements of IEC 60601-1-1 (valid versions) for connection. The person who connects the additional equipment to the input/output port, is responsible for the compliance with the IEC 60601-1-1 standard. If you have any questions, please contact us.**
- **When this device is connected to other electrical equipment in order to achieve a specific function, if the hazards of this combination can not be determined from the specifications of each equipment (for example, the risk of electric shock due to the accumulation of leakage current), please contact our company or experts in the hospital related this field to ensure that the necessary safety of all equipment in this combination will not be damaged.**
- **Please use our designated bracket (optional). When installing the bracket, please avoid the screws to touch the circuit board inside the machine.**

NOTE:

- **To ensure the monitor works normally, please read this chapter and the content about patient safety before use, and follow the requirements for installation.**
- **If the monitor finds any fatal error during self-test, it will alarm.**
- **Keep the package and packing materials for possible future transportation or storage.**

3.1 Open the Package and Check

Before opening the package, please check it carefully. If any damage is found, please contact the carrier immediately.

Open the package and take out the monitor and accessories carefully. Check the components according to the packing list to see whether the device has any mechanical damage or any part is missing. If there is any problem, contact the our company immediately.

WARNING

- **The disposal of packaging materials should obey the local regulations or the hospital waste disposal system. The packaging material must be keep out of the reach of children.**
- **The device may get biological contaminated during storage, transport or use. Please confirm that the package is intact before use, especially the disposable accessories. If any damage is found, please don't put is into use.**

NOTE:

- **Keep the package and packing materials for possible future transportation or storage.**

3.2 Environmental requirement

Please obey the following instructions to ensure the safety of electrical installation. The environment for potable monitor using shall properly away from vibration, dust, corrosive or flammable gas, extreme temperature or humidity and so on. When it is installed in a cabinet, there should be enough space in front of the device for convenient operation. When the door of the cabinet is opening, enough space at the back of the device should be guaranteed for convenient maintenance. Allow at least 2 inches (5 cm) of space around the instrument to ensure air circulation.

WARNING

- **The environment for use, storage and transport should meets the requirements described in this manual, otherwise the specifications of this product stated in this manual may not be able to achieved, or even cause damage to the device.**

Make sure that the device is free from condensation during working, when it is carried from one room to another room, condensation may appears. This is because it is exposed under humid air with different temperatures.

3.3 Install the Monitor

If everything goes well, please place the monitor on a flat surface or fix it on the wall. The installation of wall bracket please refer to its instructions.

3.3.1 Place on a Flat Surface

Place the monitor on a flat surface. The surface should be away from vibration, dust or corrosive drugs.

3.4 Connect the Power Cables

Please use the power cord equipped for the monitor. Plug the power cord to the power port on the monitor, and another end to a grounded three-core power socket.

If the monitor is equipped with an adopter, plug one end of the adopter to the power port on the monitor, and another end to a grounded three-core power socket.

NOTE:

- **Plug the power cord to the hospital outlet. If necessary, connect it with the equipotential ground wire.**
- **When the device is equipped with battery, it must be charged after transport or storage. If turn on the device directly without connecting with AC power supply, it may not work normally due to lack of electricity. The device can be charged after connecting with the AC power no matter it is turned on or not.**

Ground

In order to protect patients and medical personnel, the enclosure of portable monitor must be grounded. Therefore, the portable monitor is equipped with a removable three-wire cable, when it is inserted into a matching three-wire socket, the device will be grounded through the ground wire in the power cord. If there is no three-wire socket, consult the hospital's electrical management staff.

WARNING

- **Do not insert the three-core wire into a two-core socket.**

Connect the equipotential grounding terminal on the device to the grounding wire. If the hazards of a specific combination can not be determined from the specifications of each equipment (for example, the hazard caused by accumulation of leakage current), please contact the manufacturer or experts related this field to ensure that the necessary safety of all equipment in this combination will not be damaged.

Equipotential ground

The room protective grounding system is realized by power plugs grounding, it already includes the primary protection of the device. For internal examination of the heart or brain, the portable monitoring system must be individually connected to the equipotential grounding system. One end of the equipotential grounding wire (potential equalization wire) is connected to the equipotential grounding terminal on the rear panel of the device and the other end is connected to a connector of the equipotential system. If the protective grounding system is damaged, the equipotential grounding system undertakes the safety function of protecting the grounding wire. The examination of the heart (or brain) should only be carried out in a medical room with a protective grounding system. Before each use, check whether the device is in good working condition. The cable connecting the patient and the device must be free from electrolyte contamination.

3.5 Power on

3.5.1 Device inspection

1. Appearance inspection

   Appearance inspection for the installed monitoring system:

   • Carefully check the patient monitor for any mechanical damage.

   • make sure the monitor is correctly installed according to the specified installation program.

   • Make sure the cables connecting patient monitor and external equipment are undamaged, and connected to corresponding interfaces correctly.

   • Make sure the external module is connected correctly.

   • Make sure the battery cover is installed.

   The chapter *Maintenance and Cleaning* provides detailed information about the cautions, requirements of cleaning, cleaning procedure and recommended cleaning agent.

2. Functional inspection

   ■ Start

   1) Plug the power cord to the AC power port. If the device uses internal battery for power, please make sure that there is enough battery power in the battery.

   2) Turn on the patient monitor, it should start normally:

      • The red and yellow alarm lamp respectively light.

      • The system beeps for each time of powering on, and the LED indicator on control panel or the screen flickers once. If no beep sound or flickering, please stop using this monitor, and contact out company for maintenance.

      • There are no error messages appear on the screen.

   3) Check all functions that the patient may need to ensure the device could work normally.

WARNING

- **When the monitor is powered on, the system will check whether the alarm function (audio and light alarms) is normal. If the alarm function works abnormally, this monitor can not be used for patient monitoring and contact the manufacturer's maintenance department.**

NOTE:

- **Charge the battery to full for the first time of use. Keep the monitor connecting with main power supply before the battery is fully charged.**

■ Display

1) Ensure that all text are readable, and all images are clear.

2) Ensure that the device brightness is normal.

■ Main unit

Check whether the time displayed on screen is correct. If necessary, please adjust its time and date.

■ Check the Recorder

If your monitor is equipped with a recorder, open the recorder door to check if paper is properly installed. If it is out of paper, refer to the chapter *Recording* for details.

3.5.2 Start monitoring

1. Check whether the patient cables and sensors are correctly connected.
2. Check whether the settings of the monitor are correct, such as "PAT TYPE" and "Pacemaker".
3. For the detailed information about the measurement and monitoring of each parameter, please refer to relevant chapter.

3.6 Power off

Turn off the monitor according to the following steps:

1. Unplug the cables and sensors connecting with the patient.
2. Keep pressing ON/OFF button for 3 seconds to turn off the monitor.

Chapter 4 System Menu

This monitor features flexible configurations. You can customize monitoring content, waveform sweep speed, sound volume, and output content.Press the MENU button on the front panel of the monitor, the interface shown in the following figure will appear:

4.1 Patient Information Setup

Select the "PATIENT SETUP" item in the "SYSTEM MENU", the following patient information can be set by user:

DEPT.:	the department that the patient receives treatment
PAT NO.:	case number of the patient
BED NO.:	selectable from 1～100
DOCTOR:	name of the attending doctor
NAME:	patient's name (Valid characters: a~z, A~Z, 0~9, and the space, 12 characters can be input at most)
SEX:	patient's gender (female, male)
PAT TYPE:	Patient type (Available options: CAT, DOG and OTHER)
ADMIT:	date of admission (format: year/month/day)
BIRTH:	patient date of birth (format: year/month/day)
HEIGHT (cm/inch):	patient's height (turning the knob with the increase/decrease of 0.5 cm/inch each time), the unit of height in other menus accord with the unit set here.
WEIGHT (kg/lb):	patient's weight (turning the knob with the increase/decrease of 0.5 kg/lb each time), the unit of weight in other menus accord with the unit set here.
BLOOD:	blood type of the patient ((Available options: A, B, AB, O, N, "N" means unknown blood type)
SAVE:	to save the changes of patient information, corresponding information will be displayed in Patient information area
DELETE:	to delete the information of current patient, and to register a new patient

After clicking the "DELETE" button in this menu, a dialog box "CONFIRM TO DELETE" will pop up, you could select "YES" or "NO" to decide whether to clear current patient information.

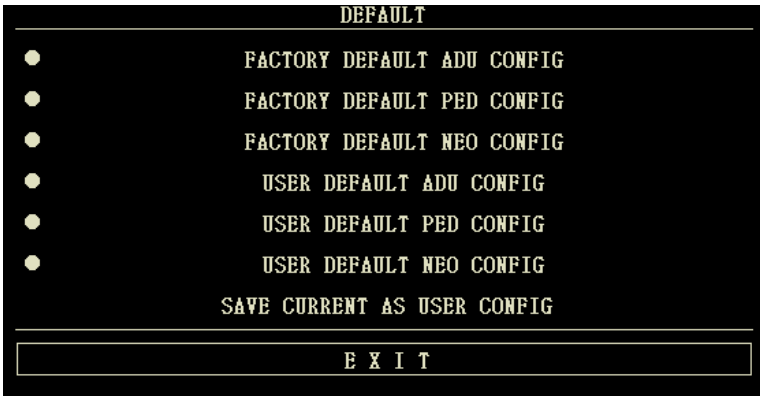
NOTE:

- **If you choose "YES", the information of current patient will be deleted.**
- **Please click "SAVE" button if the information of current patient is changed, otherwise the changes will be invalid.**

4.2 Default setup

NOTE:

- **After selecting any item in this sub-menu, the selected item will replace the current setup of the system and accordingly become the system default configuration.**



In this sub-menu, you can select both the factory default and the user-defined default. Also in this sub-menu, you can save the current system configuration as the user-defined default configuration. But at this time, the system will automatically save all the setups in the parameter menu, ECG gain and filter way as the user-defined default configuration according to the patient type. Also, a dialog box "CONFIRM TO SAVE" will pop up.

Select "YES" to save all configurations of current patient type as user-defined default configuration.

Select "NO" to give up the modification and the system will keep the previous configuration.

NOTE:

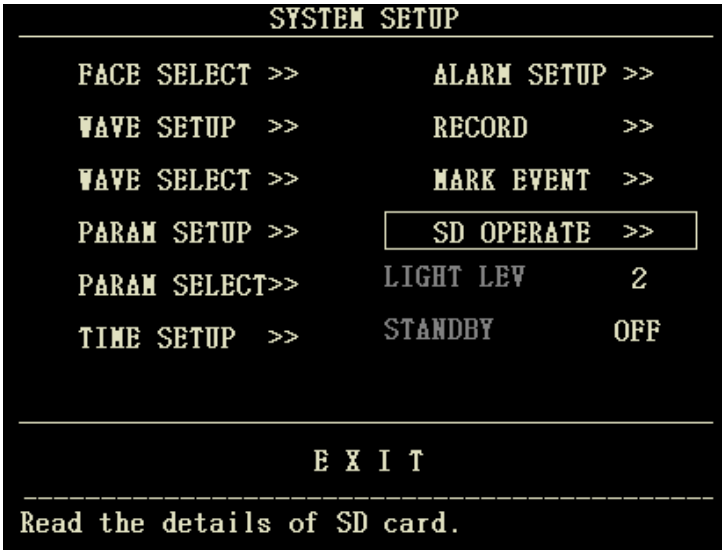
- **After selecting any item in the "DEFAULT" menu and exiting the dialog box, the "CONFIRM TO SAVE" dialog box will pop up, in which you can select "YES" to confirm your selection or "NO" to give up your selection.**

4.3 Trend Review, Measurement Review and Alarm Event Review

In the "SYSTEM MENU", there are "TREND GRAPH", "TREND TABLE", "NIBP RECALL" and "ALARM RECALL" items. Please refer to *Chapter 8 Recall* for detailed information.

4.4 System setup

Select the "SYSTEM SETUP" item in the "SYSTEM MENU", the following menu will appear:

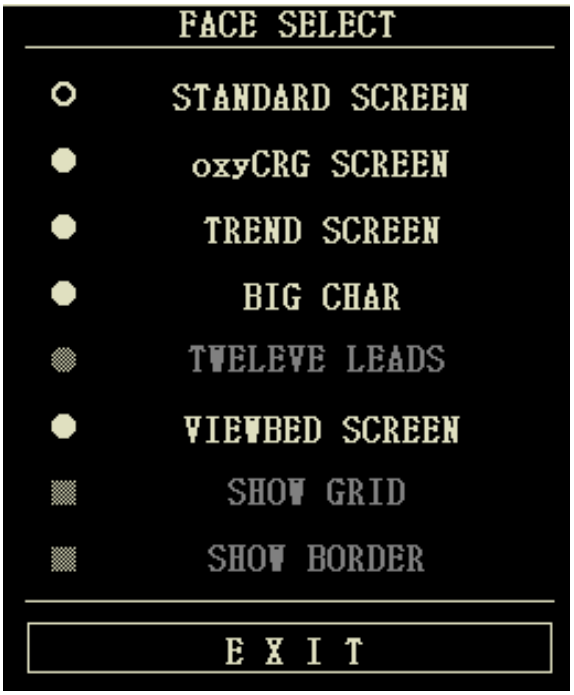


In the "SYSTEM SETUP" menu, user can set the following items.

4.4.1 Face select

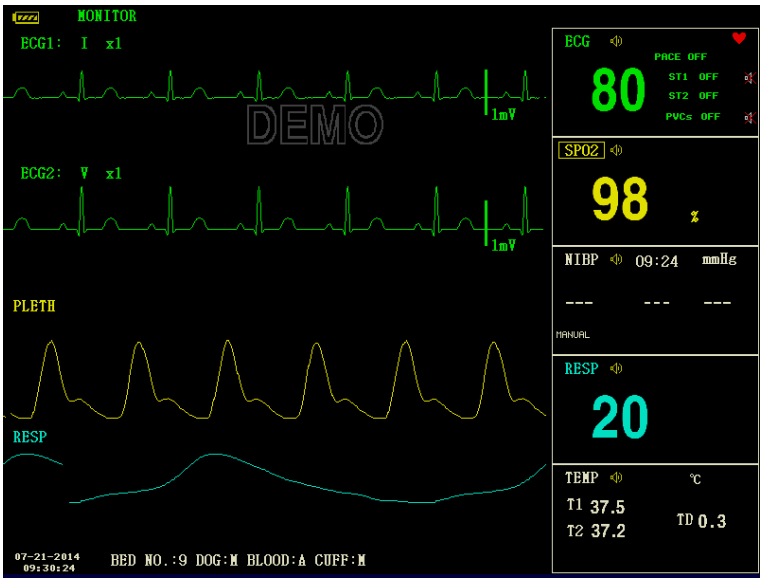
The system provides 5 display modes: "STAND SCREEN", "OxyCRG SCREEN", "TREND SCREEN", "BIG CHAR" and "VIEWBED SCREEN". You can choose any one of them according to clinical demand.

Select the "FACE SELECT" item in the "SYSTEM SETUP" menu to enter the following menu:



1. STAND SCREEN

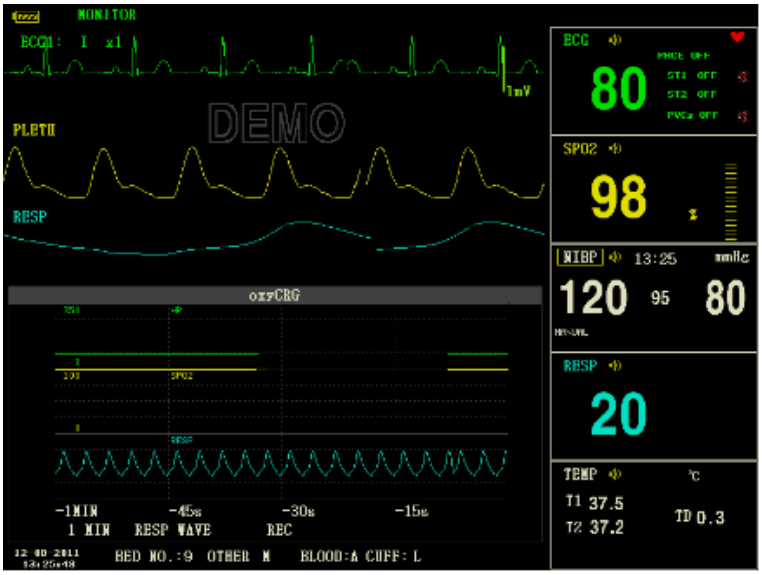
The "STAND SCREEN" is the default setting. If the current screen is not the standard screen, you may enter the standard screen by selecting "STANDARD SCREEN" and then selecting "EXIT" in FACE SELECT menu.



Stand Screen

2. OxyCRG SCREEN

If you want to enter the following interface, select "OxyCRG SCREEN" and then select "EXIT" in "FACE SELECT" menu.



OxyCRG Screen

OxyCRG screen is located at the lower part of the waveform area, consisting of the HR trend, the SpO_2 trend, and the RR (respiration rate) trend or the compressed RESP waveform. Below the RR trend or the compressed RESP waveform is the scale of the trend time. In addition, three labels are displayed beneath the time scale. The labels are detailed as below.

①Trend length

This label allows you to select the time duration of the trend graphs displayed. You can select either 1 min, 2 min or 4 min.

②Compressed RESP waveform/RR trend

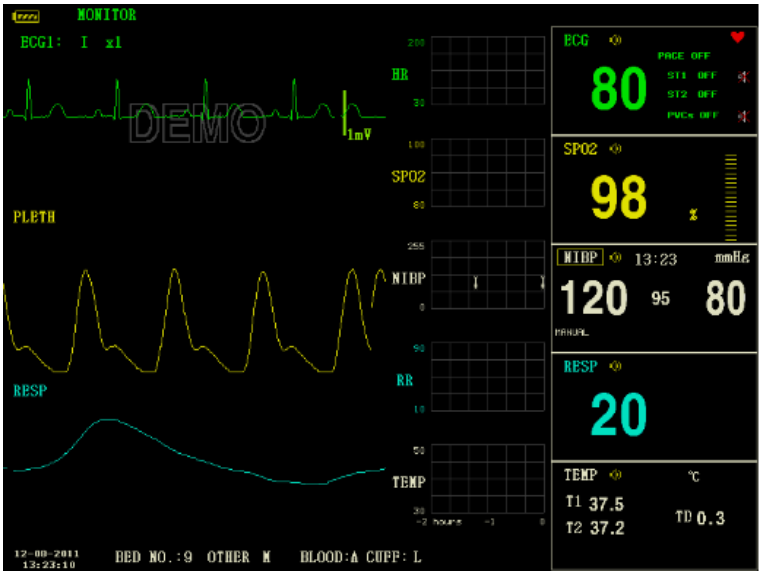
With this label, you can select to display the compressed respiration waveform or the RR trend. You can select either RESP WAVE or RR.

③Recording

You can select the REC label to print out the trend or the waveform displayed in the oxyCRG screen.

3. TREND SCREEN

If you want to enter the following interface, select "TREND SCREEN" and then select "EXIT" in "FACE SELECT" menu.



Trend Screen

■ Trend graph

In the waveform area, the trend graph is located on the right side of the corresponding waveform, displaying the trends of one parameter of each module. The parameter labels, as well as their scales, are displayed on the left of the trend graph.

■ Trend length

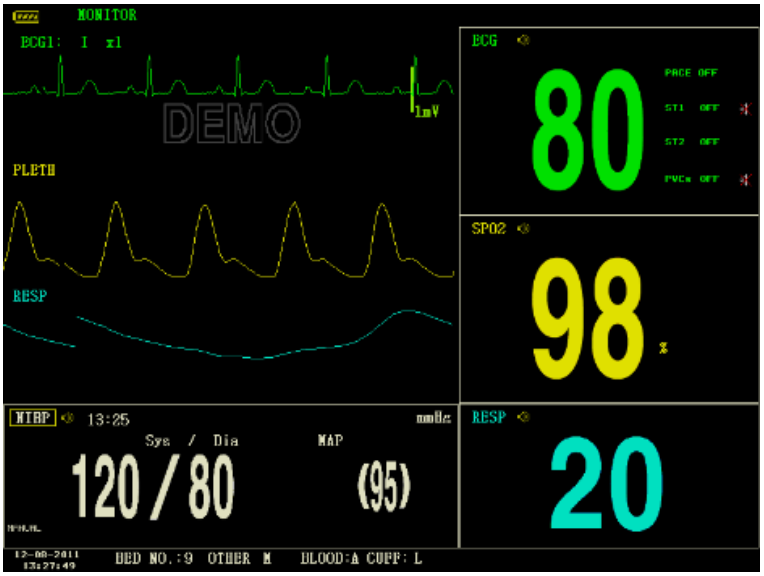
The trend length, located below the trend graph, is 2 hours. In the trend graph, the scale reading at the right end of X-axis is 0 hour, the reading at the left end is -2 hours.

■ Selecting a trend parameter

If a module has multiple trend parameters, you can select one from the parameter label options of the corresponding trend graph. The trend graph of the selected parameter will be displayed. For example, in the ECG trend graph, you can select either from the parameter label options: HR, ST, PVCs.

4. BIG CHAR

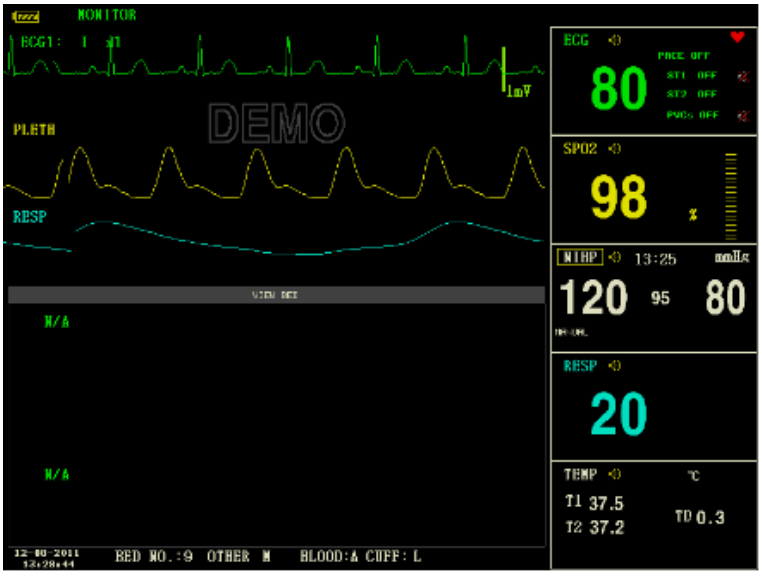
To view the parameter more clearly in a long distance.



Big Char

5. VIEWBED SCREEN

This monitor can display one parameter waveform and all measured data from another patient monitor in the same monitoring network system. To enter the following screen, open "FACE SELECT" menu, select "VIEWBED SCREEN" item, and then select "EXIT".



Viewbed Screen

The monitor that used to view the situations of other monitors, 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. It consists of the following parts.

①Viewbed monitor label

The viewbed monitor label allows you to select the viewbed monitor you want to view. It displays the bed number and patient's name of the viewbed monitor.

②Viewbed parameter area

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

③Viewbed waveform label

The viewbed waveform label allows you to select a waveform of the viewbed monitor.

④Viewbed waveform area

The viewbed waveform area is located beneath the viewbed waveform label. It displays the waveform selected through the viewbed waveform label. The scanning speed is 25 mm/s. In addition, information relating to the viewbed waveform is shown above the waveform.

4.4.2 Wave setup

1. Select "WAVE SETUP" item in the "SYSTEM SETUP" menu.
2. Adjust the wave type of a channel, the wave corresponding to this channel in the main interface will change accordingly.

4.4.3 Wave select

1. Select "WAVE SELECT" item in the "SYSTEM SETUP" menu.
2. The waveform in waveform area will show up or disappear accordingly by selecting corresponding parameter or canceling the selection. The parameter in gray is unadjustable.
3. If "FULL ECG" is selected, the full-lead ECG waveform will be displayed in the waveform area in one screen, if "STEP ECG" is selected, the step ECG waveform will be displayed in the waveform area.

NOTE:

- **"FULL ECG" and "STEP ECG" are set off as default, and these two functions can not be turned on at the same time.**

4.4.4 Parameter setup

1. Select "PARAM SETUP" item in the "SYSTEM SETUP" menu.
2. You can set the font color in parameter area and the color of waveform. The color of parameter value activating the alarm is red.

4.4.5 Parameter select

1. Select "PARAM SELECT" item in the "SYSTEM SETUP" menu.
2. The waveform and parameter will show up or disappear accordingly by selecting corresponding parameter or canceling the selection.

4.4.6 Time setup

1. Select "TIME SETUP" item in the "SYSTEM SETUP" menu.
2. You can set the "Date" and "Time" items. Use cursor to highlight the item that you want to modify and turn the knob to select time.

3. Then select "SAVE SET" button.

NOTE:

- **The system time shall be set when turning on the monitor (if you need to set the system time); otherwise, when you review the content containing time information, the system may not display the correct time.**

4.4.7 Alarm setup

Please refer to the sections about "Alarm".

4.4.8 Record setup

Select the "RECORD" item in the "SYSTEM SETUP" menu to pop up the following menu:

- REC WAVE1/REC WAVE2: The recorder could output up to 2 channels of waveform at a time. You can select the name of the waveform at the right column for "REC WAVE1" and "REC WAVE2". If you select "OFF", the waveform in this channel will not be output. These settings is applicable for real-time recording and timing recording.
- RT REC TIME: This item has two options, CONTINUAL and 8 s. "CONTINUAL" means once pushing the "REC/STOP" button on the recorder module or the monitor panel, the recorder will continuously print out the waveform or parameter until this button is pushed again.
- TIMING REC TIME: It represents the time interval between two recordings. Ten selections are available: "OFF, 10min, 20min, 30min, 40min, 50min, 1HOUR, 2HOURS, 3HOURS and 4HOURS". The system will start the recording process according to the selected time interval. The recording time is always 8 seconds.
- REC RATE: This item has two options, 25.0mm/s and 50.0 mm/s.
- REC GRID: It is used to determine output format: OFF is without grid, and ON is with grid.
- CLEAR REC TASK: When too many recording tasks existing, you can use this function to clear the alarm event that has been generated and is waiting for outputing.

NOTE:

- **The setup of "RT REC TIME" takes priority over the "TIMING RECTIMING".**
- **The recorder is a optional component.**
- **If two same waveforms are selected, the system will automatically change one of the waveform to a different one.**

4.4.9 Event setup

In the process of monitoring a patient, the occurrence of some events may have impacts on the patient, resulting in some changes on the waveform or parameters. To analyse these effects, you can manually mark some specific events. The event will be displayed on the trend graph and trend table to assist the analysis of patient's parameters at the time of the event.

The monitor has four types of events. You can specify their representations by yourself.

Select the "MARK EVENT" item in the "SYSTEM SETUP" to modify the events.

How to mark the event:

1. Use the rotary knob to select one from event A, B, C and D.

2. The @ symbol will appear in the front of the event being selected.

3. Once making a wrong selection, you can push the knob on the event again to give up the selection. Select

"EXIT" to exit the menu and consequently the selection will come into effect.

4.4.10 SD operate

Please refer to the chapter related to *SD Recall*.

4.5 Machine version

Select the "VERSION" item in the "SYSTEM MENU". In the popping up menu, you can learn the software version of the monitor.

Software name	MO-WE-9001
Specification	None.
Version	2.50311162128.66817
Naming standard	"Major adaptive upgrade", "Major enhancive software upgrade", "Major improvement software upgrade", "Minor corrective software upgrades", "Build"

4.6 Drug calculation

You can use the drug calculation and titration table function of the monitor to calculate the concentration of 15 kinds of drugs. Refer to the *Chapter Drug Calculation and Titration Table* for detailed information.

4.7 Maintain

4.7.1 User maintain

1. You need to select the "MAINTAIN" item in the "SYSTEM MENU", then select "USER KEY".
2. Input the password to enter the user maintain menu, then you can customize the maintenance settings. Items shown as below can be set:

- LANGUAGE: select the language you need
- LEAD NAMING: AHA or EURO
- HELP SETUP: ON/OFF
- NIBP OBSTRUCT SETUP: OFF/1/2/3

  This function is used to detect whether the patient moves during the blood pressure measurement. If the patient moves, the monitor will give an alarm message and stop the current measuring, or the measurement will be taken as usual.

  1) This function is set "OFF" as default.
  2) "OFF" represents the sensitivity is reduced to the minimum, "3" represents the sensitivity is increased to the maximum. The higher level the sensitivity is set and the easier to detect the interference of movement.

- "NETWORK CONFIGURATION": see *Section 4.7.3 Network Configuration* for details
- ALARM SET PASSWORD MODIFICATION: it is used to change the login password of "ALARM SETUP".

4.7.2 Factory maintain

1. You need to select the "MAINTAIN" item in the "SYSTEM MENU", then select "FACTORY KEY".
2. Input the password to enter the factory maintain menu, this function is available for specific maintenance personnel of our company only.

4.7.3 NET CONFIG

Click "NIT CONFIG" item, the following menu will pop up:

- NET TYPE: CMS / CUSTOM

CMS:the Server IP is fixed, "202.114.4.119","LOCAL IP CONFIG" is unavailable.

CUSTOM:when this item is selected, CMS and machine's IP can be changed as you need.The following is "LOCAL IP SETUP"menu.

- LAN CARD SET: 3G / Wireless / Wire

✧ **3G**

It is strongly required to use the accompanying 3G bracket provided by manufacturer. CDMA2000 is appointed network, but WCDMA can be ordered.

NOTE:

- **The monitor supports 3G, wireless and wire .**

✧ **Wireless**

It is strongly required to use the accompanying wireless network card provided by manufacturer. The router complied with IEEE802.11 (ordinary or household wireless network router) should be used, and it shall support the authentication method of WPA, WPA2 or WEP. Wireless network router should access to the Internet by WAN.

✧ **Wire**

The device has an interface for wire network mode, it accesses to wire LAN complied with IEEE802.3 by RJ45 connector. Wire network should access to the Internet by WAN of the router.

- NET TYPE: CMS or CUSTOM, select the network type according to your need

CMS

The Server IP is fixed "202.114.4.119". Once the monitor specifies the port number, the program will automatically obtain the local IP address and the port to be connected.

CUSTOM

In this mode, the IP address and subnet mask of the server, as well as the two items of this monitor can be set by user.

- LAN CARD SET: 3G/WIRELESS/WIRE

3G

The 3G network is mainly used to connect with the central monitoring system through the Internet WAN.

After selecting 3G network, restart the device, then the device will automatically obtain the WAN support (dynamic ip, DNS, etc.) from 3G card and its driver.

NOTE:

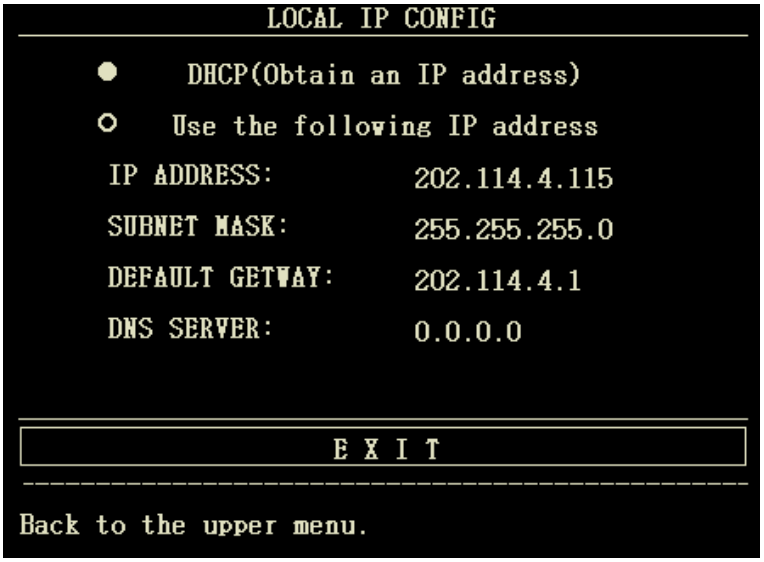
- **The 3G mode is available only when the "NET TYPE" is "CUSTOM". If the monitor is connected to central station, the central station software need to be installed on a server with fixed IP address, this address shall be set in the "SERVER IP".**

WIRELESS

After selecting wireless network, click "SELECT ROUTE" in "NET CONFIG" menu, then click "SEARCH ROUTES". All searched routers will be listed on the screen, you can select one of them to connect as your need. If you choose a router set with secure connection, a dialog box will pop up for you to enter the password.

When the network type is CMS, just make sure the connection between the device and the wireless router is successful. (The IP address of the server is 202.114.4.119, the IP address of this monitor and subnet mask are generated by the port number.)

When the network type is CUSTOM, if DHCP service is used, the device will automatically obtain the network support (dynamic IP of this monitor, gateway, DNS, etc.) through the DHCP. If specified IP is used, please set the IP address of this monitor and subnet mask, click "LOCAL IP CONFIG" button, the following menu will pop up:



Wire

When the network type is CMS, just make sure the connection between the device and the central station is successful. (The IP address of the server is 202.114.4.119, the IP address of this monitor and subnet mask are generated by the port number.)

When the network type is CUSTOM, make sure the monitor is connected to the router. If DHCP service is used, the device will automatically obtain the network support (dynamic IP of this monitor, gateway, DNS, etc.) through the DHCP. If specified IP is used, please set the IP address of this monitor and subnet mask.

- LOCAL NET NO: the physical bed number of the monitor
- SERVER IP: input the IP address or domain name of the server for central station software
- LOCAL IP CONFIG: when the "NET TYPE" is "CUSTOM", you can set the local IP address
- SELECT ROUTE: when the "LAN CARD SET" is set to "WIRELESS", click this button to enter the "SELECT ROUTE" menu, and start router searching and other operations.

4.8 Demo

Select the "DEMO" item in the "SYSTEM MENU" to enter the "DEMO KEY" dialog box. Input the password "2088", and click "CONFIRM" button, the system will enter DEMO status.

The demo waveform is an analog waveform set by the manufacturer only to show the performance of the machine and to train users.

In clinical application, this function is forbidden because it may mislead the medical staff to treat the DEMO waveform and parameters as the actual data of the patient, which may result in the delay of treatment or mistreatment. Therefore before entering this menu, you shall enter the password.

Chapter 5 Alarm

When the patient being monitored appears abnormal changes in vital signs, or the monitor itself occurs failure and fails to monitor the patient, it will remind the medical workers through sound, light, etc.

WARNING

- **In any single area (e.g. intensive care unit or cardiac operating room), there is a potential hazard that the same or similar devices use different alarm preset.**
- **When the monitor is powered on, the system will check whether the alarm function (audio and light alarms) is normal.**
- **When turning on the monitor, the system will send a beep sound and the alarm light flickers once. This function is used to check whether the alarm function is normal. Therefore, user shall pay attention to these signs when turning on the device. If the alarm function works abnormally, this monitor can not be used for patient monitoring, please contact the manufacturer or the maintenance service center.**

5.1 Alarm classification

The alarm is classified as physiological alarm, technical alarm and prompt message based on the property of alarms.

1. Physiological alarm

Generally, physiological alarm is activated in the following situations: one of the patient's physiological parameters exceeds the alarm limits, or the patient appears physiological abnormal, for example, HR exceeding the set limit. The information of physiological alarm is displayed in physiological alarm area.

2. Technical alarm

Technical alarm represents the alarms activated by abnormal monitoring or monitoring result distortion due to system failure, such as lead-off or low battery. The information of technical alarm is displayed in technical alarm area.

3. Prompt message

Except the physiological alarm and technical alarm, these messages refer to the displayed information about system status, which are not involved with patient vital signs. Prompt messages are often displayed in technical alarm area. Besides, some prompt messages are displayed in parameter area, for example, the messages related to NIBP are displayed in NIBP area.

5.2 Alarm level

The alarm is classified as high-level alarm, medium-level alarm and low-level alarm according to its severity.

1. High-level alarm

High-level alarm indicates the patient’s life is in danger or the monitor under using has serious problem in technical respect. It is the most serious alarm.

2. Medium-level alarm

Medium-level alarm means serious warning.

3. Low-level alarm

Low-level alarm is a general warning.

NOTE:

- **The level of all technical alarms and prompt messages and some of the physiological alarms are determined by the system, which can not be changed by user.**
- **The level of most of the physiological alarms need to be set by user, such as alarm limits.**

5.3 Alarm mode

When alarm occurs, the monitor may draw the user's attention in three ways as below：

- Audio alarm
- Light alarm
- Alarm message

5.3.1 Audio alarm

When alarm occurs, the monitor will make different sound to indicate alarms in different levels.

- High: "beep-beep-beep----beep-beep, beep-beep-beep----beep-beep", frequency: every 8 seconds
- Medium: "beep--beep-beep", frequency: every 8 seconds
- Low: "beep", frequency: every 8 seconds

Sound pressure range: 45 dB～85 dB

5.3.2 Light alarm

When alarm occurs, the alarm indicator will prompt different levels of alarms with different colors and flicker frequencies..

- High: alarm indicator flickers in red with high frequency
- Medium: alarm indicator flickers in yellow with low frequency
- Low: alarm indicator lights in yellow without flickering

5.3.3 Alarm message

When alarm occurs, alarm messages will be displayed in physiological alarm area and technical alarm area. For physiological alarms, the following marks will be used in front of the messages to indicate the alarm level.

- High: ***
- Medium: **
- Low: *

The system also adopts different background to indicate the alarm level of physiological alarm and technical alarm.

- High: red
- Medium: yellow
- Low: yellow

NOTE:

- **If one monitoring system has multiple alarm equipment, when an alarm occurs, the visual and audio prompts generated by all alarm equipment should keep the same.**
- **The way of alarm prompting is related to its level.**
- **When alarms of different levels occur at the same time, the monitor prompts the highest level alarm among them.**

5.4 Alarm setup

Select "ALARM SETUP" item in the "SYSTEM SETUP" menu, the initial password is "70808". Under this interface, user could set information about alarm sound and so on.

- ALARM VOL: selective from 1~7, 1 is the minimum volume, 7 is the maximum volume.
- ALM REC TIME: three options: 8 s, 16 s, 32 s.
- ALM PAUSE TIME: two options: 1 min and 2 min.
- ALM TYPE: UNLATCH.. "UNLATCH" refers to the situation that once the causes of alarm are eliminated, the alarm will disappear automatically.
- KEYVOL: selective from 1~7 and OFF.
- ALM SOUND: it can be set as "OFF", and the symbol "  " will appear on the screen.

  The system will cancel the "OFF" of alarm sound in the following situations:

  - The monitor is restarted;
  - The alarm status is changed, for example, the system enters alarm pause status, or the alarm sound is forbidden.

WARNING

- **When the alarm sound is turned off, the monitor will not make any sound even if a new alarm is triggered. Therefore, user must carefully choose whether to turn off the alarm sound.**
- **In SILENCE or ALARM PAUSE status, set the alarm sound is as "OFF", then the system will automatically terminate the status of SILENCE or ALARM PAUSE.**
- **When the alarm sound is "OFF", if the operator selects "SILENCE" or "ALARM PAUSE", the alarm sound will be restored to the previous volume when it is turned off, and at this time, the system will enter the status of silence or pause accordingly.**
- **Do not rely on the sound alarm system only for patient monitoring, user should pay close attention to the patient's actual clinical situation.**

NOTE:

- **When alarm sound is turned off, a symbol "  " will be displayed in technical alarm area.**
- **The alarm sound off is only valid when the device keeps turning on, once the device is restarted, this setup to will be restored to the previous set value.**
- **The symbol "  " means that the alarm sound is turned off, the system could not make any sound for the alarm, so user must be careful when using this function. There are two ways to exit this status. Method 1: Set the alarm sound as "ON" in the "ALARM SETUP". Method 2: Press the "SILENCE" button, the symbol will become "  ", then press the "SILENCE" button one more time, the system will return to normal alarm status.**

■ **Parameter alarm setup**

1. The parameter alarms can be set in "PARAM ALM SETUP", or their individual parameter menu.

2. When a parameter alarm is off, a symbol "  " displays near the parameter.

3. For the parameter whose alarm is set to "ON", the alarm will be triggered when at least one of the parameters exceeds alarm limit. The monitor will take the following actions:

- The screen displays the alarm information in a mode as described above;
- The monitor beeps in its corresponding alarm level and volume;
- Alarm indicator lights or flickers;
- Information of all parameter values at the alarm moment, and the waveform 4/8/16 seconds before and after the alarm are stored.
- If alarm recording is on, the recorder starts alarm recording. Refer to the chapter *Recording* for details.

4. The following information can be set in parameter alarm setup.

- ECG ALM SETUP: HR alarm, alarm level, alarm limits (high/low), ST alarm setup, ARR alarm setup;
- SpO_2 ALM SETUP: SpO_2 ON/OFF, alarm level, SpO_2 alarm limits (high/low), PR on/off, PR alarm limits (high/low);
- NIBP ALM SETUP: ON/OFF, alarm level, SYS alarm limits (high/low), MAP alarm limits (high/low), DIA alarm limits (high/low);
- RESP ALM SETUP: ON/OFF, alarm level, alarm limits (high/low), apnea alarm;
- TEMP ALM SETUP: ON/OFF, alarm level, T1 alarm limits (high/low), T2 alarm limits (high/low), TD alarm limits (high).

5.5 Alarm status

Except general alarm conditions, you can set the monitor to four different alarm status as below according to your need. The four alarm status have different symbols:

 Alarm pause

 Alarm off

 Silence

 Alarm sound off

5.5.1 Silence

Keep pressing the "SILENCE" button (over 1 second) on the control panel will turn off all the sounds. In SILENCE status, pressing the "SILENCE" button (no more than 1 second) will switch to the "ALARM PAUSE" status, and the alarm will be suspended temporarily in accordance with the time set before. In SILENCE status, keep pressing the "SILENCE" button (over 1 second), the system will exit current status and restore the alarm sound correspondingly, and back to normal alarm status. When the system is in "SILENCE" state, any new triggered alarm can terminate the "SILENCE" state, the system will return to normal alarm state (sound and light alarm).

5.5.2 Alarm pause

Press "SILENCE" button on the control panel to turn off all alarm sound, light prompt and physiological alarm information, so that the system will enter the "ALARM PAUSE" state. The countdown of alarm pause is displayed in the physiological alarm area and the symbol "  " is displayed in this area as well.

Time period of Alarm Pause: 1 min and 2 min.

When the "SILENCE" button is pressed again, the system will restore to its normal state. In addition, a new triggered alarm can also eliminate the "ALARM PAUSE" state, and the symbol"  " disappears.

NOTE:

- **After returning to the normal state, the presence of an alarm depends on whether the alarm condition is appropriate, but after the "SILENCE" button is pressed, the system will permanently turn off the alarm sound for lead-off or probe-off.**
- **The alarm pause time can be set in the "ALARM SETUP" menu as required, the default setting is 2 min.**

5.6 Measures for Alarm occurs

The alarm message appears in system information area or system alarm area. It is needed to identify the alarm and take actions appropriately according to the cause of the alarm.

1. Check the patient's condition;
2. Confirm the alarming parameter or the type of the alarm;
3. Identify the cause of the alarm;
4. Silence the alarm, if necessary;
5. When cause of alarm has been solved, check that the alarm is working properly.

You will find the alarm messages and prompts for each parameter in corresponding chapters related to this parameter in this manual.

5.7 Probe-off alarm

If the system alarms for probe falling off, user can press the "SILENCE" button on the front panel of the monitor. At this time, the alarm indicator stops flicking and the monitor enters the ALARM PAUSE state. Press the "SILENCE" button again or wait until the alarm pause is over, the monitor will no longer generate sound alarm for probe falling off, and instead remind the user in the form of alarm messages.

Chapter 6 Freeze

When monitoring a patient, you may freeze the waveform to view it carefully. Up to 34 seconds waveform can be reviewed. Besides, the frozen waveform can be output by recorder. The Freeze function of this monitor has following features:

- Freeze status can be activated under any operating screen.
- When entering the Freeze status, the system exits all other operating menus. At the same time, the system freezes all waveforms in the Waveform area, or full-lead ECG waveforms and the extra waveform (if available) on the Full-lead ECG screen. Nevertheless the Parameter area refreshes normally.
- The frozen waveforms can be reviewed or recorded.

6.1 Enter/Exit Freeze Status

6.1.1 Enter Freeze Status

In the Non-Freeze status, press the "FREEZE" button on the front panel of the monitor to let the system exit the Menu being currently displayed (if available), then enter the Freeze status and display the popup "FREEZE" menu. In the Freeze status, all waveforms are frozen. In other words, the system will no longer refresh the waveforms.

6.1.2 Exit Freeze Status

In the Freeze status, executing any of the following operations will command the system to exit the Freeze status:

- Select the "EXIT" option on the "FREEZE" menu;
- Press the "FREEZE" button on the front panel again;
- Press the non-immediate-to-execute button on the front panel and system buttons of MAIN and MENU;
- Execute any operation that may trigger the adjustment of the screen or display of a new menu.

After exiting the Freeze status, the system will discharge the Freeze status, clear screen waveforms and resume to display real-time waveforms.

6.2 FREEZE Menu

Press the "FREEZE" button on the panel, the FREEZE menu will appear on the bottom part of the screen. At the same time, the system enters the Freeze status.

- WAVE 1: to select the first frozen waveform to record. The pull-down list of this item gives you the names of all frozen waveforms displayed on the screen.
- WAVE 2: to select the second frozen waveform to record. The pull-down list of this item gives you the names of all waveforms displayed on the screen.
- RECALL: to review frozen waveforms.
- REC: after selected, the system begins recording the frozen waveforms selected in "WAVE 1" and "WAVE 2".
- EXIT: after pressed, the system closes the FREEZE menu and exits the Freeze status.

6.3 Reviewing Frozen Waveform

By moving the waveform, you may review a waveform of 34 seconds before the moment when it is frozen. For a waveform less than 34 seconds, the remaining part is displayed as a straight line. Use the rotary knob to move the cursor to the "RECALL" option on the FREEZE menu. Press the knob, the option displays "L-RIGHT". By turning the knob left or right, the frozen waveform on the screen will move left or right correspondingly. There is an arrow indicating upward under the right side of the last waveform. There is also a time scale beside the arrow. "0 s" is used to

mark the moment when waveforms are frozen. With waveforms moving right, this time mark will turn into "-1 s, -2 s, -3 s…".

6.4 Recording Frozen Waveform

In the Freeze status, you may output displayed frozen waveforms via the recorder. Maximum 2 waveforms can be output at one time. On the FREEZE menu, the pull-down lists of both "WAVE 1" and "WAVE 2" give you all names of frozen waveforms on the screen, from which you may select two waveforms. Select the "REC" option on the FREEZE menu to output parameters generated upon the freezing moment and the two selected frozen waveforms. If one of the two selected waveforms is set off or not available, only parameters and the other waveform are recorded. If these two selected waveforms are all set off or not available, only parameters are recorded. As for the function of recording frozen waveforms, you can only record the waveforms displayed upon the freezing moment. The recording time length is the same as the length of the waveform displayed on the screen. For example, if the speed of a waveform is relatively fast, then it needs shorter time to record it. When recording frozen waveforms, the system is still in the Freeze status. After completion of this recording, if required, you may select another waveform to be output, and select "REC" option again to record until the all necessary waveforms are recorded. You may also record frozen waveforms by pressing the "REC/STOP" button on the front panel. If selecting "REC" option without installing a recorder, the system will prompt "RECORDER ERROR" in the status bar. For more detailed information about recording, please refer to the chapter *Recording*.

Chapter 7 Recording

NOTE:

- **The recorder is an optional component.**

7.1 General Information for Recorder

A thermal array recorder is used for the Monitor.

Performance of the Recorder

- Recording speed: 25 mm/s or 50 mm/s.
- Waveform recording width: 48mm
- It can record up to 2 waveforms.
- The time and waveform of real-time recording are user-configurable.
- Auto recording interval is set by user, the waveform is in accordance with the real time recording.
- The alarm recording waveform is automatically selected by the monitor.

NOTE:

- **It is recommended to stop the recording when low battery alarm generated. Otherwise, the device may shutdown for out of power.**

7.2 Recording Type

The monitor provides several stripe recording types:

- Continuous real-time recording
- 8 seconds real-time recording
- Auto 8 seconds recording
- Alarm recording
- Freeze waveform recording
- Trend graph/table recording
- ARR review recording
- Alarm recall recording
- NIBP recall recording
- SD recall recording
- Drug calculation titration recording

Real-time Recording

Real-time recording starts as you pressing the "REC/STOP" button on the recorder.

The waveforms for continuous real-time recording and continuous 8 seconds recording are set in system setup (usually the first two waveforms are displayed on the screen). You can also configure it through the menu. Refer to related section for details.

In RECORD SETUP menu, user can choose to print two different waveforms at the same time, or print only one waveform by setting the other waveform off. If two waveforms are set off, the real time record will print out measured parameters only.

NOTE:

- **If certain recording is in process, and another parameter demands alarm recording, it will only be executed**

after the earlier recording is finished.

Auto Recording

The monitor starts a recording for 8 seconds according to interval time set in the "TIMING REC TIME" of the "RECORD SETUP " menu. Refer to the section "RECORD" in system setup for details.

Alarm Recording

- Parameter Alarm

The monitor records waveforms 4/8/16 seconds before and after the alarm (totally 8, 16 or 32 seconds) (which can be selected in System Menu).

All parameter values during the alarm will also be recorded.

Two waveforms will be output according to the following rules:

1) If multiple parameter alarms are switched on and triggered simultaneously, the recorder will print out those of the highest level. If parameters have the same alarm level, the latest alarm will be printed out.
2) If an alarm occurs during the recording of another parameter, it will be printed out after the current recording is finished.
3) If many alarms occur at the same time, their waveforms will be stored, and then printed in turn.

- ST Segment Alarm

The monitor records 2-channel ECG waveforms 4, 8, or 16 seconds prior to and after the ST alarm (totally 8, 16, or 32 seconds) (which can be selected in the menu). All parameter values during the alarm will also be recorded.

- Arrhythmia Alarm

The monitor records the waveform 4 seconds prior to and after the alarm (totally 8 seconds). All measurement results during the alarm will also be recorded.

Freeze Waveform Recording

The monitor prints out the selected waveforms under the FREEZE mode. In this way you can capture the abnormal waveforms on the screen by freezing and record it.

Trend Graph/Table Recording

The monitor can print out the trend graph and table in the current trend review interface.

Arrhythmia Review Recording

The monitor can print out the arrhythmia alarm event in the current ARR RECALL interface.

Alarm Recall Recording

The monitor can print out the alarm events in the current ALARM RECALL interface.

NIBP Recall Recording

The monitor can print out all the NIBP review events in NIBP RECALL interface.

SD Recall Recording

The monitor can print out the trend data of the case currently review.

Titration Table

The monitor can print out the messages in the current TITRATION interface.

Notes on Recording

- Recording type:
  Real-time recording
  Periodic recording
  Para alarm recording
  Arrhythmia recording
  Freeze waveform recording
  Trend Graph
  Trend Table
  Para alarm review
  NIBP review
  Titration Table
- Alarm parameters, alarm time and freeze time
- Patient bed number, sex, height, weight, date of birth, admission date
- Parameter name and value
- Recording time
- Waveform name
- Waveform amplitude (for ECG waveform only)
- ECG lead, scale, filter mode (if having ECG waveforms, it will be printed out within the first second or when changing the lead, gain and filter mode during real-time recording.)
- Date and time

7.3 Recording Start&Stop

Here are the methods for how to start the recording of each type:

Continuous real-time recording	Press REC/STOP to start/stop the recording.
8 seconds real-time recording	Press REC/STOP to start recording. It will automatically stop after 8 seconds recording.
Auto recording	The monitor starts a recording according to interval time set in the "TIMING REC TIME" of the "RECORD" menu. It will automatically stop after 8 seconds recording.
Alarm recording	When alarm recording is set ON, it automatically starts a recording when alarm occurs.
Frozen waveform recording	After accessing FREEZE menu, use knob to select two waveforms to be output. Then press REC button in the menu to print out the waveforms. If both "WAVE 1" and "WAVE 2" are set to "OFF", the measured parameters in frozen are printed out only.
Trend graph recording	Select "REC" button in the "TREND GRAPH" menu to print out the currently displayed trend graph.
Trend table recording	Pick "REC" button in the "TREND TABLE" menu to printout the currently

	displayed trend table.
Arrhythmia review recording	Select "REC" button in the "ARR RECALL" menu to print out the currently displayed arrhythmia waveform and related parameters.
Alarm review recording	Access the "ALARM RECALL" interface from "SYSTEM MENU", select "REC" button to print out the waveform and related parameters currently displayed.
NIBP review recording	Access the "NIBP RECALL" interface from "SYSTEM MENU", select "REC" button to print out the NIBP values currently displayed.
Titration table recording	Access the "TITRATION" interface from "DRUG CALC" menu, select the "REC" button to print out the titration information currently displayed.

Access the "RECORD" menu from the "SYSTEM SETUP" menu. Then select the "CLEAR REC TASK" button, all recording tasks will be stopped, and all stored alarms will be cleared.

NOTE:

- **You can press REC/STOP button on the control panel to stop any current recording process.**

7.4 Recorder Operations and Status Messages

Requirement for Record Paper

Only record paper satisfied the requirement can be used, otherwise the recorder may not work normally, or the recording quality may be poor, or the thermosensitive printer head may be damaged.

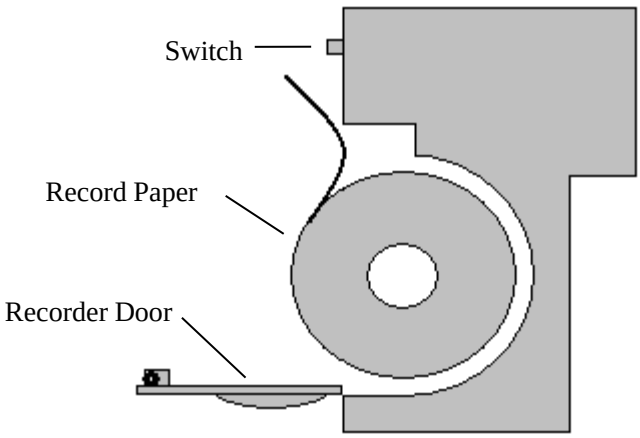
Proper Functioning

- When the recorder is working, the record paper goes out steadily. Do not pull the paper, or the recorder will be damaged.
- Do not operate the recorder without record paper.

Paper Out

When "RECORDER OUT OF PAPER" alarm is displayed, the recorder cannot start. Please insert record paper properly.

Inserting Paper



- Press the switch to open the recorder door.
- Insert a new roll of paper into the paper cassette, put the paper correctly and pay attention to the edges.

- Give out the paper from the recorder outlet.
- Close the recorder door.

NOTE:

- **Be careful when inserting paper. Avoid damaging the thermosensitive printer head. Unless replacing the recorder paper or troubleshooting, do not leave the recorder door open.**

Removing Paper Jam

When the recorder functions or sounds improperly, open the recorder door to check whether paper jam exists. If yes, re-install the recorder paper.

Recorder Status Message (Technical Alarm)

Message	Cause	Alarm Level	Solution
RECORDER OUT OF PAPER	Record paper runs out.	Low	Insert a new roll of record paper.
RECORDER ERROR	The communication of recorder is abnormal.	Low	Tun off the monitor and restart it.

After restarting the monitor, if error still exists, contact our service engineers please.

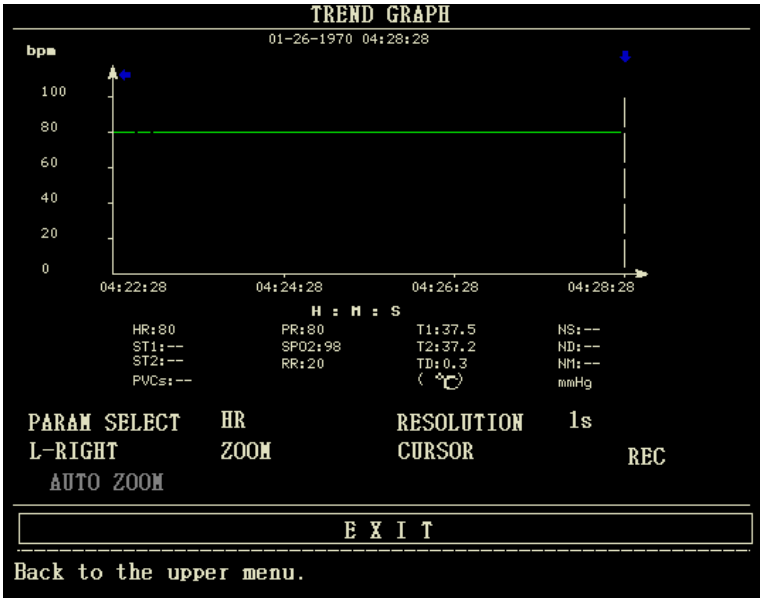
Chapter 8 Recall

The monitor provides 480-hour trend data of all parameters, storage of 4800 groups of NIBP measurement results and 71 alarm events. All these data can be output through recorder. By using SD card, the trend data and 72-hour ECG waveform can be reviewed. This chapter gives detailed instruction for reviewing these data.

8.1 Trend Graph

- The latest 1-hour trend is displayed in a resolution of every 1 or 5 seconds;
- The latest 480-hour trend is displayed in a resolution of every 1, 5 or 10 minutes;

Pick "TREND GRAPH" in the SYSTEM MENU to call up the following menu:



The y-axis stands for measured value and x-axis stands for time. The symbol "⬇" in above figure is the cursor of trend graph. The value that the cursor points to, is displayed under the trend graph, and its corresponding time is displayed above the trend. Other trends except NIBP trend are displayed in continuous curves. In NIBP trend graph, the symbol "*" represents the coordinate of the NIBP value.

To select trend graph of a specific parameter:

Pick PARAM SELECT item by using the cursor, and select a requested parameter name by turning the knob, then the trend graph of this parameter will be displayed.

To select 1-hour or 480-hour trend graph:

Pick RESOLUTION item by using the cursor, choose 1 s/5 s for 1-hour trend graph and 1min/5 min/10 min for 480-hour trend graph.

To view earlier or later trend curves:

When "▶" appears on the right part of the screen, pick "L-RIGHT" button, turn the knob clockwise to view later trend curves. When "◀" appears on the left part of the screen, select the "L-RIGHT" button, turn the knob counterclockwise to view earlier trend curve.

To change the display scale

Pick the "ZOOM" button to adjust the y-axis scale and thus change the trend curve in proportion. The value beyond maximum value will be represented by the maximum value.

To obtain trend data of a specific time

Select "CURSOR" button, and turn the knob to left/right, then the cursor will move accordingly, and the time to which the cursor points will change too. Parameter at this time is displayed below the x-axis. When "▶" appears on the right part of the screen, the trend graph pages down for later trend curve as the cursor moves here. When "◀" appears on the left part of the screen, the trend graph pages up for earlier trend curve as the cursor moves here.

To print out the trend curve

Press REC button to print out the trend curve of current selected parameter through the recorder.

Auto Zoom

The AUTO ZOOM is available only when the PARAM SELECT is set as "NIBP". If the current measured value exceeds the scale range, click "ATUO ZOOM" button, the scale will automatically adjust to proper range for current measurement.

Event marks on the trend graph

If an event is marked A, B, C, or D, then on the trend graph, the event type (A, B, C, or D) will be displayed at the point corresponding to the moment of marking.

Operation example

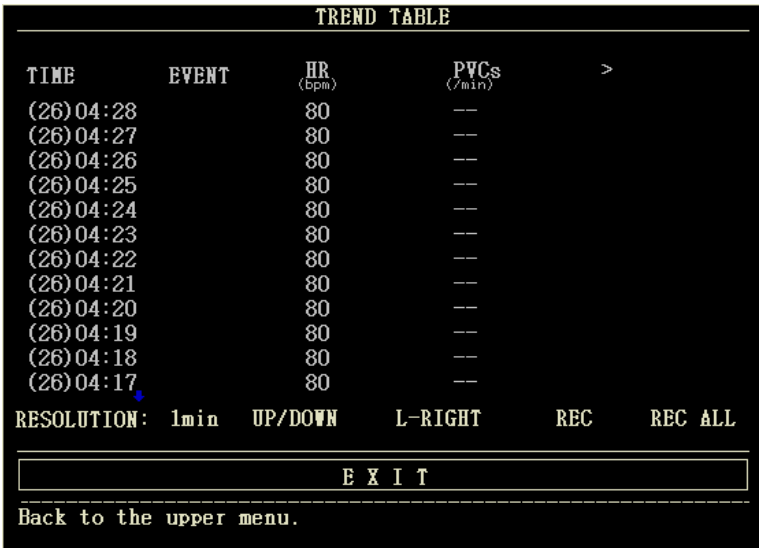
To view the NIBP trend graph of the lastest 1 hour:

- Select the "MENU" button on the front panel, the "SYSTEM MENU" will pop up.
- Pick TREND GRAPH item.
- Select the "PARAM SELECT" item, switch to "NIBP" by turning the knob.
- Adjust the "RESOLUTION" to 1s or 5 s.
- Select the "L-RIGHT" button, turn the knob to view the changes of trend graph time and trend curve.
- Stop at requested trend time section for careful review. Pick the ZOOM button to adjust the display scale if necessary.
- For measurement result of a specific time, pick CURSOR to move the cursor to this point, corresponding time and value will be displayed above and below the curve respectively.
- For printout of trend graph, pick REC to print the NIBP trend currently displayed.
- Pick EXIT to finish the reviewing.

8.2 Trend Table

- The latest 480-trend table data can be displayed at every 1 min, 5 min, 10 min, 30 min, or 60 min.

Pick TREND TABLE in the SYSTEM MENU to call up the following menu:



Time corresponding to each group of trend data is displayed at the leftmost list with date in brackets. Marked events are listed under the "EVENT" corresponding to the time of marking. Trend data of all parameter is divided into 6 groups.

HR ，PVCs

ST1，ST2

RR

T1，T2，TD

SpO_2，PR

NIBP （S/M/D）

To select trend table of a specific resolution:

Select the "RESOLUTION" item by using the cursor, turn the knob to change the options under resolution, then the time interval of trend data will be changed.

To view earlier or later trend data:

When a "up arrow" appears on the upper part of the screen, pick "UP/DOWN" button, turn the knob clockwise to view later trend data. When a "down arrow" appears on the upper part of the screen, select the same item, turn the knob counterclockwise to view earlier trend data.

To view trend data of different parameter

Pick L-RIGHT to select one from the 6 groups of parameters. A ">" by the rightmost item indicates following page available. And "<" by the leftmost item indicates previous page available.

To print out the trend table

Press REC button to print out the trend data of all parameters currently displayed through the recorder.

Event marks on the trend data

If an event is marked A, B, C, or D, the event type (A, B, C, or D) will be displayed at corresponding time in the trend table.

Operation example

To view the NIBP trend table:

- Select the "MENU" button on the front panel, the "SYSTEM MENU" will pop up.
- Pick TREND TABLE item.
- Select the "L-RIGHT" item, switch to "NIBP" by turning the knob.
- Adjust the "RESOLUTION" to the option that you need.
- Select the "UP/DOWN" button, turn the knob to view the NIBP trend data at different time.
- If you need to print the NIBP trend table, pick REC button, the recorder will print the NIBP trend data.
- If you need to print all trend tables, select "REC ALL" button, the recorder will print all trend data of all parameters.
- Pick EXIT to finish the reviewing.

8.3 NIBP recall

The monitor can review the latest 4800 groups of NIBP measurement data.

Pick NIBP RECALL in the SYSTEM MENU to invoke the result and time of the latest 9 measurements. Data is listed chronologically from the latest to the earliest. Nine measurements can be displayed in one screen. Pick UP/DOWN to view the earlier or later data. Pick REC to print out all measurement data of NIBP RECALL.

8.4 Alarm recall

The alarm recall includes physiological alarm recall and technical alarm recall.

■ Physiological alarm recall

Select "ALARM RECALL" in the SYSTEM MENU, then select "PHYSIOLOGICAL ALM RECALL" item. In this menu, user may set the conditions for alarm review, including:

1） Start and End time of review

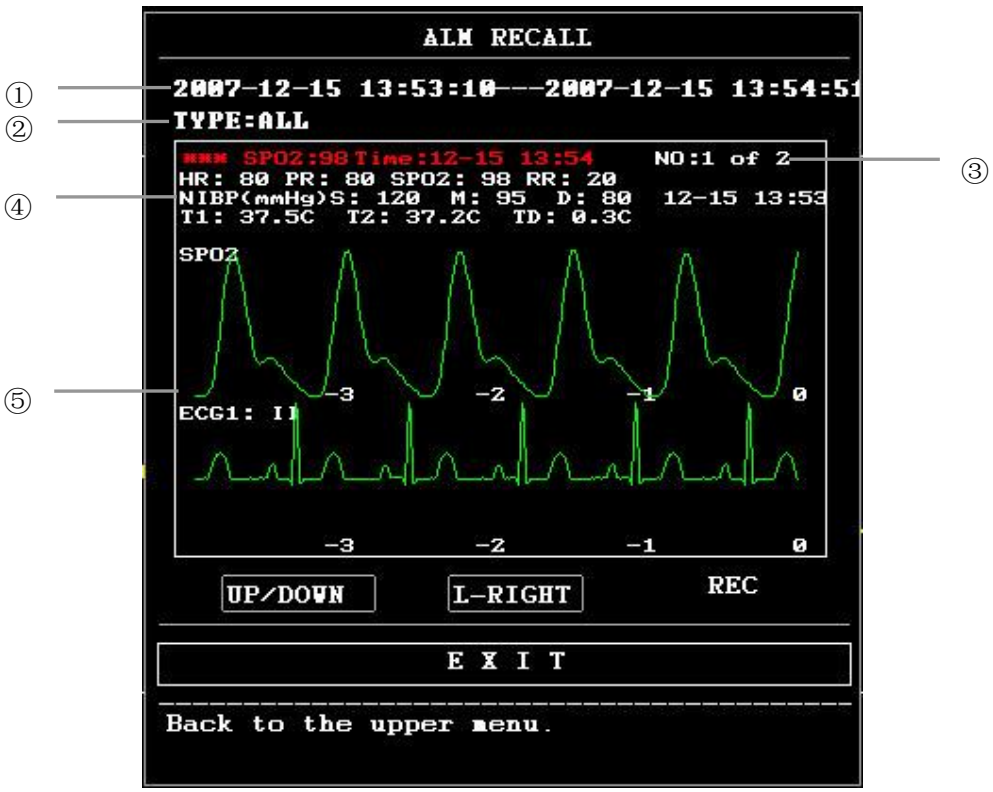
User may select the start time of review in the "BEGIN TIME" item, and the end time in the "END TIME". The end time can be set as the current time or the user-defined time.

2） Alarm recall event

In the pull-down list of ALARM RECALL EVENT, user can select the parameter that need to be reviewed. The selections include ALL (alarm events of all parameters), ECG, RESP, SpO_2, NIBP, TEMP.

After finishing the setup of all review conditions, press the "ALARM RECALL" button to access "ALARM RECALL" menu.

The PHYSIOLOGICAL ALARM RECALL interface is shown as below:



① Time span (Format: year/month/day/hour/minute--- year/month/day/hour/minute).

② Event type.

③ Serial number (Format: NO. xx of XX).

④ The value at the moment of alarming. NIBP result is excluded.

⑤ Two channels waveforms, stored for 8 s/16 s/32 s.

To view all waveforms during the alarming process

Pick L-RIGHT and turn the knob to view all 8/16/32 seconds waveforms stored.

Recording

Select "REC" button, all review data currently displayed will be output by the recorder.

■ Technical alarm recall

1) Select "ALARM RECALL" in the SYSTEM MENU, then select "TECHNICAL ALM RECALL" item.

2) Technical alarm events are arranged chronologically from the latest to the earliest. When the number of alarm events exceeds storage range, the latest events will be displayed. Pick UP/DOWN button, and turn the knob to view the earlier or later events.

8.5 SD recall

User can review patient data stored in the SD card on the monitor, or on the PC by using the sync software.

An empty SD card with at least 2G capacity is needed. The SD card mounted on the monitor could memory trend data (parameters including: HR, PVCs, ST1, SpO_2, PR, RR, T1, T2, TD, NIBP) and 72-hour ECG waveform. The trend data is stored per 1 minute.

NOTE:

- **For the review on PC by using the sync software, only ECG and SpO_2 related waveforms and parameter values can be reviewed. Refer to the instructions of sync software for details. This chapter only introduces the reviewing method on the monitor.**
- **Please first set the patient's information correctly before inserting SD card.**
- **If different patient's data need to be saved in one SD card, you should unmount the SD card first, and then modify patient's information. Make sure that the patient number is different.**

1. Enter SD OPERATE menu:

Select "MENU"→"SYSTEM SETUP"→"SD OPERATE", then you could enter the SD OPERATE menu.

2. Insert SD card

If SD card has been inserted and works normally, the prompt "SD device was found, please mount it by the button above." appears.

NOTE:

- **If information "SD device wasn't found, please enter SD card" appears, you should exit "SD OPERATE" menu, check if SD card or USB interface is normal. If the problem still exists, reboot the monitor.**

3. Mount SD card

If the monitor has found the SD card, select "MOUNT DEVICE" item, the system will display messages to indicate whether the SD card has been mounted successfully.

NOTE:

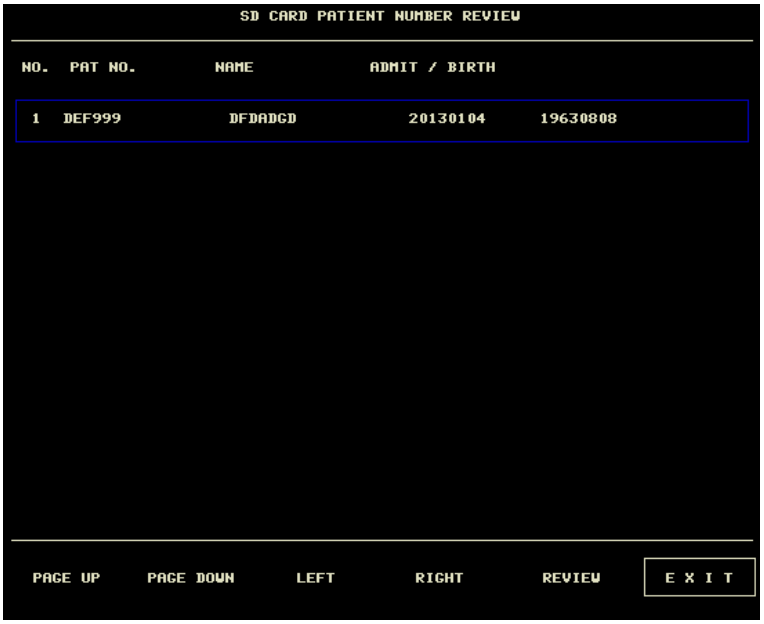
- **Data can be reviewed only after SD card has been mounted successfully for 90 seconds . Otherwise the two buttons "REVIEW TREND" and "REVIEW ECGWAVE" are invalid.**

4. Review trend

■ **Review trend**

①Select "REVIEW TREND" item in SD OPERATE menu.

The following menu will pop up. In this menu, you can select any patient you want to review.



The items from left to right in this menu are No., patient No., patient name, admission date and birth date. The information is displayed according to the content set in patient setup. The buttons at the bottom of menu includes:

- PAGE UP/PAGE DOWN: observe patient lists of other page.
- UP/DOWN: move the cursor to select a specified patient.
- REVIEW: press this button to call up the patient trend information.

②Reading trend data's information

The menu displays the trend data's information according to the selected patient.

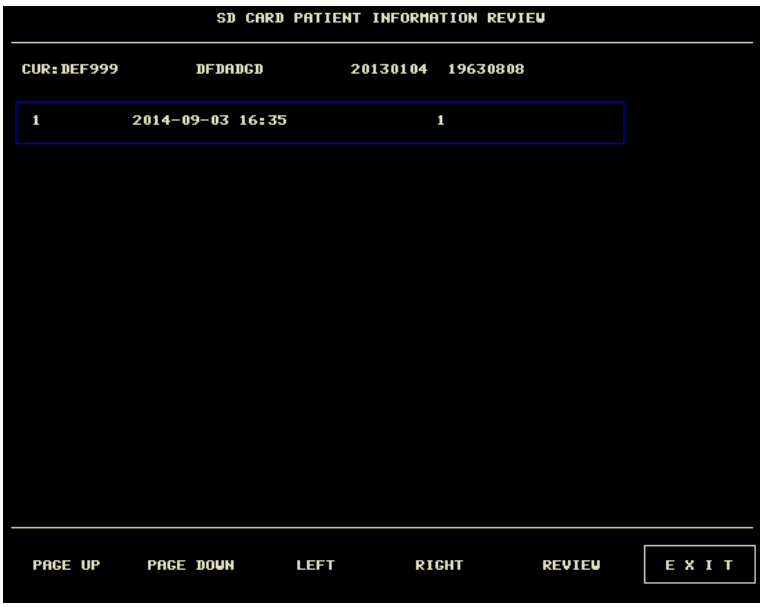
The header, from left to right is:

- Patient No.
- Patient's name
- Admission date
- Birth date

The content of list, from left to right is:

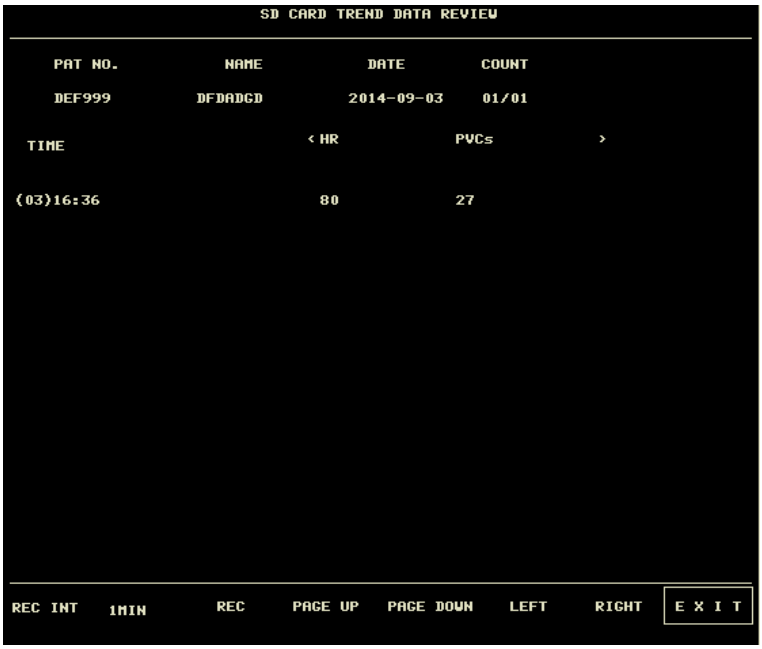
- The list number
- The time that the patient data was reviewed.

- The size of data having been saved to the time that the patient data was reviewed.



③Review trend data

Select an item in above menu by using the cursor, then press "REVIEW" button, the trend data will be displayed in a list. The resolution is 1 minute.

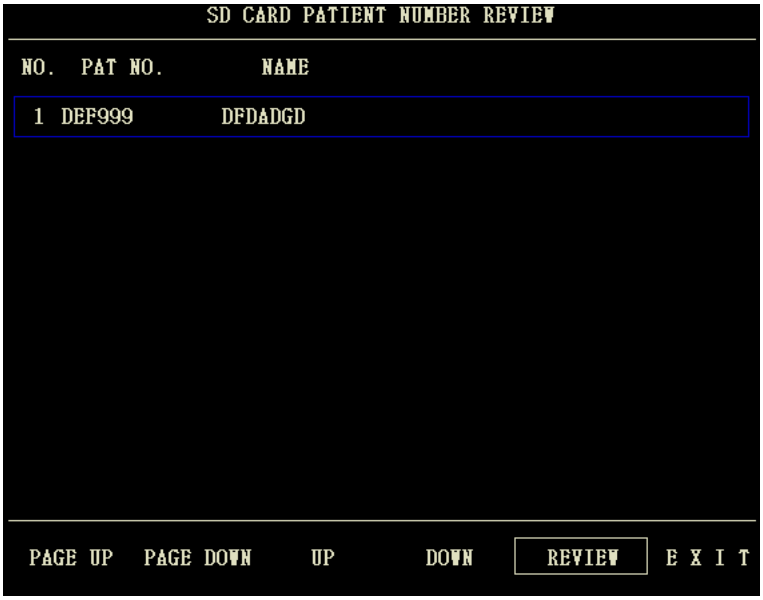


The buttons are:

- Page UP/ PAGE DOWN: to view trend data of different time.
- LIGHT/ RIGHT: to view trend data of different parameter.
- REC: to print current list.

■ **Review ECG waveform**

①Select the "REVIEW ECG WAVE" button in SD OPERATE menu, then choose a specific patient to review.

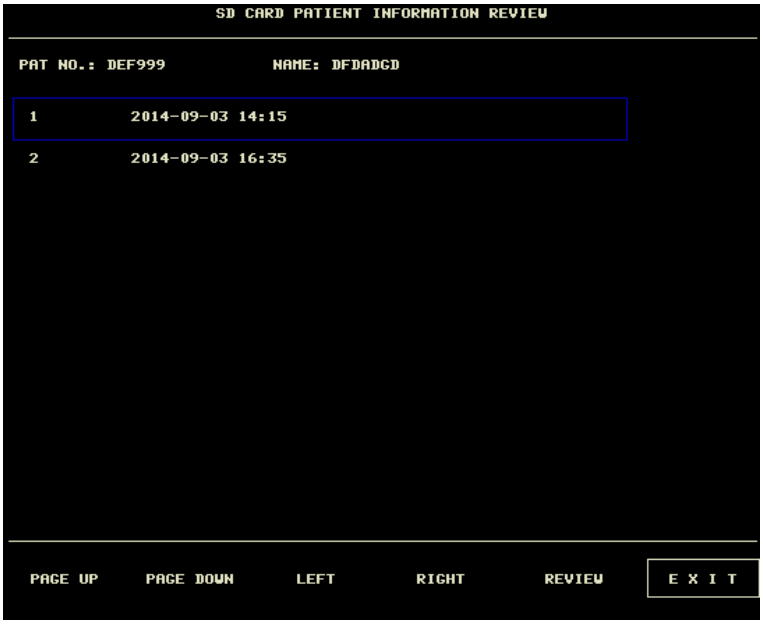


②Select time span you want to review

ECG data is saved in many different files. It need save ECG data in a new file per half an hour. For example, "2014-09-03 14:15" represents ECG file name, it also indicates the starting time that the file is saved.

Select the time span:

- To review the ECG waveform about "2014-09-03 14:15"
- By pressing cursor, select the item "1 2014-09-03 14:15"
- Press "REVIEW" button.



③Review ECG waveform

- The time span of one window is 5s.
- The window can display 3 channels ECG waveform. When the lead type is "5 LEADS", it displays

ECG I, ECG II and ECG V.

5-Lead

- When the lead type is "3 LEADS", it can displays only one channel waveform. The ECG lead is the same with the one displayed on the monitor.

5. Unmount SD card

Enter "SD OPERATE" menu, press "UMOUNT DEVICE". You can take out SD card only when the system displays the prompt "UMOUNT SD CARD SUCCESSFULLY, YOU CAN TAKE OUT THE CARD NOW."

Chapter 9 Drug Calculation and Titration Table

This Portable Patient Monitor provides drug calculation and titration table display functions for fifteen drugs and outputs the content of titration table on the recorder.

9.1 Drug Calculation

The drug calculations that can be performed by the system are AMINOPHYLLINE, DOBUTAMINE, DOPAMINE, EPINEPHRINE, HEPARIN, ISUPREL, LIDOCAINE, NIPRIDE, NITROGLYCERIN and PITOCIN. Besides DRUG A, DRUG B, DRUG C, DRUG D and DRUG E are also provided to flexibly replace any of the drugs.

Select "DRUG CALC" in SYSTEM MENU, the following interface will appear:

The following formulas are applied for dose calculation:

Concentration= Amount / Volume

INF Rate= Dose/Concentration

Duration= Amount / Dose

Dose= Rate × Concentration

Operating method:

In the Drug Calculation window, the operator should first select the name of the drug to be calculated, and then confirm the patient weight. Afterwards, the operator should also enter other known values.

Turn the knob to move the cursor to each calculation item in the formula, press the knob and turn it to select a value. When the calculated value is selected, the result of other items will be displayed correspondingly. Each calculation item has a range limit, and if the result is out of range, the system will display "---.--".

NOTE:

- **For the drug calculation, the prerequisite is that the operator must first of all enter the patient weight and drug name. Values given by the system at the beginning are a group of random initial values, which cannot be used as the calculation reference. Instead, a new group of values suitable for the patient should be entered according to doctor's advice.**
- **Each drug has its fixed unit or unit series. Operator must select the proper unit following the doctor's instruction. The unit will automatically adjust itself in its unit series according to the input value. If the result expressed by this unit exceeds the range, the system will display "---".**
- **After entering a value, a conspicuous prompt will appear in the menu warning the operator to confirm the correctness of the entered value. The correctness of input value is the guarantee for the reliability and safety of the calculated results.**

- **In neonate mode, Drip Rate and Drop Size items are disabled.**
- **For each entered value, the system will always give a dialog box asking for user's confirmation. You must be careful when answering each box. The calculated result is reliable only when the entered values are correct.**

■ Select the drug name: Turn the knob to pick the DRUG NAME item. You may select the drug name in the pull-down list, including AMINOPHYLLINE, DOBUTAMINE, DOPAMINE, EPINEPHRINE, HEPARIN, ISUPREL, LIDOCAINE, NIPRIDE, NITROGLYCERIN, PITOCIN, Drug A, Drug B, Drug C, Drug D and Drug E. Calculation for only one type can be generated each time.

NOTE:

- **Drug A/B/C/D/E are only codes for drugs instead of their real names. The units for these five drugs are fixed. The operator may select the appropriate units according to the convention of using these drugs. The rules for expressing the units are:**

  "mg" series units are fixedly used for drug A, B and C: g, mg, mcg.

  "unit" series units are fixedly used for drug D: unit, k unit, m unit.

  "mEq" is fixedly used for drug E.

■ Patient weight: After accessing the DRUG CALC window, the operator should enter the patient weight into the first or the second item. The entered weight will be used as the independent data only for the calculation of drug concentration.

NOTE:

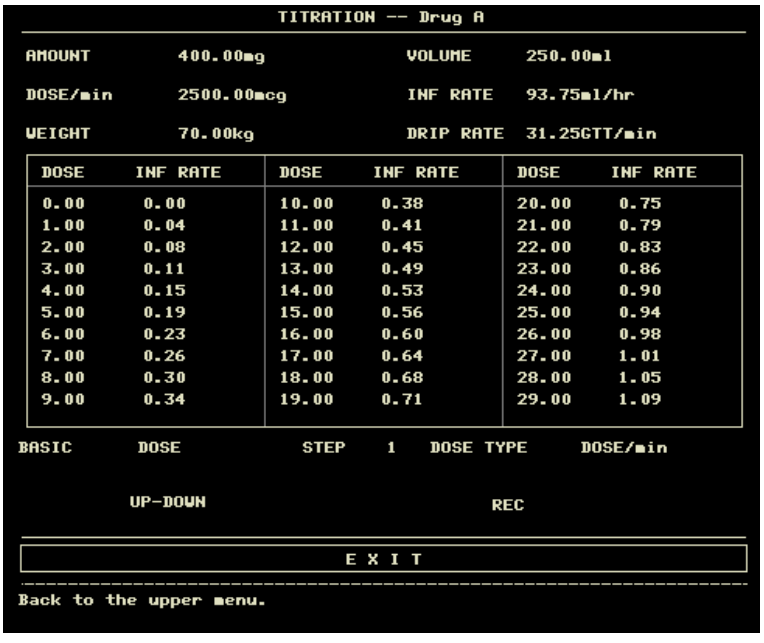
- **This drug calculation function acts only as a calculator. Information in this interface may not related to the patient being currently monitored. That means the patient weight in Drug Calculation menu and the data in Patient Information menu are independent from each other. Therefore, if the Weight in Patient Information changes, the value in Drug Calculation will not be affected.**

9.2 Titration Table

Access titration table:

Select "DRUG NAME" item in DRUG CALC menu, confirm your selection, then select "TITRATION≫" to enter the titration table interface.

The interface of titration table is as following:



■ Method to operate the titration table:

1) In the TITRATION table, turn the knob to pick BASIC item. Press and turn the knob to select either INF RATE or DOSE or DRIP RATE.

2) Move the cursor to STEP item. Press the knob to select step. The selectable range is 1 ~ 10.

3) Move the cursor to DOSE TYPE item. Press the knob to select the unit.

4) Move the cursor to UP-DOWN item, press and turn the knob to view the data in previous or following pages.

5) Move the cursor to REC item. After pressing the knob, the recorder prints out the data displayed in the current titration table.

6) Move the cursor to EXIT item, press the knob to return to DRUG CALC menu.

Chapter 10 ECG Monitoring

10.1 Introduction

The ECG monitoring produces a continuous waveform of the patient's cardiac electric activity to enable an accurate assessment of patient's current physiological state. Only proper connection of the ECG cables can ensure satisfactory measurement. The monitor displays 2-channel ECG waveforms at the same time in normal working, and provides 3/5-lead monitoring, ST segment analysis and arrhythmia analysis.

- The patient cable consists of 2 parts;
  The cable that connects to the monitor;
  The lead set that connects to the patient.
- For 5-lead monitoring, the ECG can derive two waveforms from two different leads. It is available to choose a specified lead to monitor from the left side of ECG waveform by using the knob.
- The monitor displays the Heart Rate (HR), ST segment and Arrhythmia analysis.
- All parameters above can be set as alarm parameters.

NOTE:

- **In the default settings of the monitor, the ECG waveforms are the top two waveforms displayed in the waveform area.**

10.2 Safety information

WARNING

- **Do not touch the patient, table nearby, or the equipment during defibrillation.**
- **Use only the ECG cables and electrodes provided by our company for monitoring.**
- **When connecting the cables and electrodes, please do make sure that the cables and electrodes are not in contact with any conductive part or the earth, especially all the ECG electrodes, including neutral electrodes are securely attached to the patient. Do not let them contact with any conductive part or the ground.**
- **Check the skin attached with ECG electrode patches for irritation everyday. If there is a sign of allergies, replace the electrodes every 24 hours or change the sites.**
- **Before starting the monitoring, inspect whether the lead works normally. Unplug the ECG cable from the socket, the screen will display the error message "ECG LEAD OFF" and the audible alarm will be activated.**

NOTE:

- **Please use defibrillation proof ECG cable during defibrillation.**
- **Interference from a non-grounded instrument near the patient and ESU interference can cause inaccuracy of the waveform.**
- **When a ECG device is unable to work, such as "ECG module communication stopped", "ECG module communication error" or "ECG module initialization error" appears, the monitor will stop monitoring automatically, and the prompt system alarm, which is a high-level alarm.**
- **For protecting environment, used electrodes must be recycled or disposed properly.**

10.3 Monitoring Procedure

10.3.1 Preparation

1. Prepare the patient's skin prior to placing the electrodes.

- The skin is a poor conductor of electricity, therefore preparation of the patient's skin is important to facilitate good contact between electrodes and skin.
- Shave hair from the sites where electrode patches attach to, if necessary.
- Wash sites thoroughly with soap and water. (Never use ether or pure alcohol, because this increases skin impedance).
- Rub the skin briskly to increase capillary blood flow in the tissues and remove skin scurf and grease.
- Before installing the electrodes, let the skin dry completely.

2. Attach clip or snap to electrodes prior to placement.
3. Install the electrodes on the patient. Before attaching, apply some conductive paste on the skin if the electrode does not contain conductive paste itself.
4. Connect the electrode lead to the patient cable.
5. Make sure the monitor is ready with power supply.

10.3.2 Choose Lead Type

1. Select the ECG parameter area, enter the ECG setup menu.
2. Set the "LESD TYPE" to "3 LEADS" or "5 LEADS" according to the lead type you applied.

10.3.3 Installing ECG lead

The following description takes America standards as examples.

NOTE:

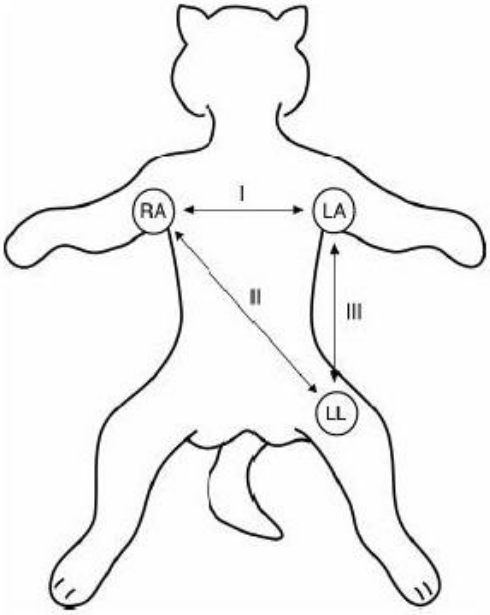
- **The following table gives the corresponding lead names used in Europe and America Standards. (Lead name is represented by R, L, N, F, C respectively in Europe Standard, while corresponding lead name in America Standard is RA, LA, RL, LL, V.)**

America Stand		Europe Standard	
Lead name	Color	Lead name	Color
RA	White	R	Red
LA	Black	L	Yellow
LL	Red	F	Green
RL	Green	N	Black
V	Brown	C	White

The 3-lead

The placement of 3-lead electrodes is shown as below:

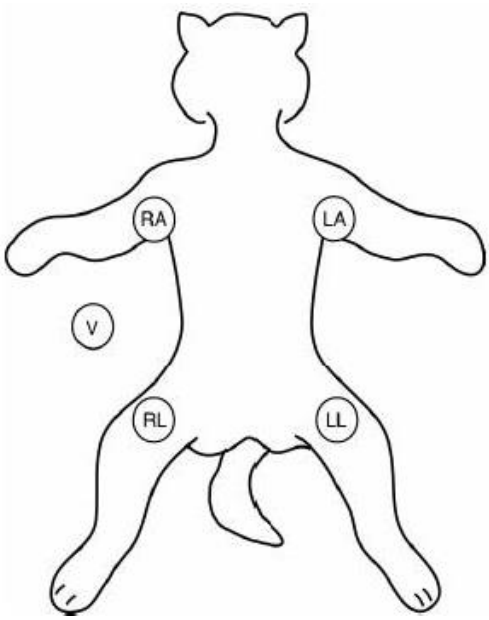
- RA (right arm)lead on the right foreleg
- LA (left arm) lead on the left foreleg
- LL (left leg)lead on the left hint leg



The 5-lead

The placement of 5-lead electrodes is shown as below:

- RA (right arm) lead: on the right foreleg.
- LA (left arm) lead: on the left foreleg.
- RL (right leg) lead: on the right hind leg.
- LL (left leg) lead: on the left hind leg.
- V (precordial) lead: exploring lead.



NOTE:

- **To ensure patient safety, all leads must be attached to the patient.**

Recommended ECG Lead Placement for Surgical Patients

The placing of the ECG leads will depend on the type of surgery that is being performed. For example, with open chest surgery the electrodes may be placed laterally on the chest or on the back. In the operating room, artifacts can

sometimes affect the ECG waveform due to the use of ES (Electrosurgery) equipment. To help reduce this you can place the electrodes on the right and left shoulders, the right and left sides near the stomach, and the chest lead on the left side of mid-chest. Avoid placing the electrodes on the upper arms, otherwise the ECG waveform will be too small.

WARNING

- **When using electrosurgery equipment, leads should be placed in a position in equal distance from electrotome and the grounding plate to avoid cautery. Electrosurgery equipment wire and ECG cable must not be tangled up.**
- **When using Electrosurgery equipment, never place an electrode near the grounding of the electrosurgery device, otherwise there will be a great interference with the ECG signal.**
- **When the monitor is connected to a defibrillator and other high-frequency devices, it is recommended to use anti-defibrillation ECG leads, otherwise it may cause burns to the patient.**
- **When the monitor is used with a defibrillator, the operator should avoid contact with the patient or bed, and the defibrillation electrode should not touch the electrode of the monitor directly, for doing so may generate sparks then causing device damage or patient injury.**

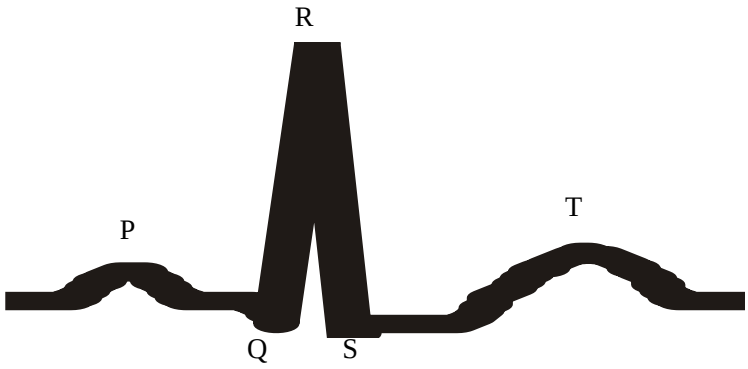
NOTE:

- **If a ECG waveform is not accurate, while the electrodes are correctly attached, try to change the lead.**
- **Interference from a non-grounded instrument near the patient and ESU interference can cause inaccuracy of the waveform.**

A good signal should be:

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

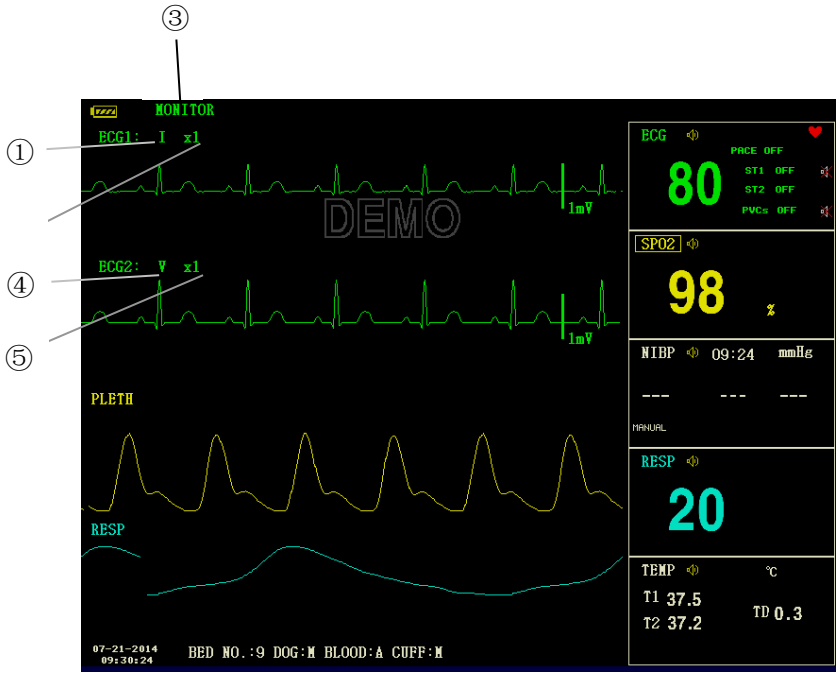
To obtain a 1 mv calibrated ECG wave, the ECG should be calibrated. A message "when CAL, can't monitor!" prompts on the screen.



Stand ECG Waveform

10.4 ECG Screen Hot Keys

The following figure is an interface of 5-lead monitoring, only for reference.



ECG Hot Key

Errore. L'origine riferimento non è stata trovata. Leads of channel 1:

1) The selectable leads are I, II, III, aVR, aVL, aVF, V.
2) When the ECG is 5-lead, the selectable leads are: I, II, III, aVR, aVL, aVF; V. When ECG is 3-lead, the selectable leads are: I, II, III.
3) Leads on the ECG waveform must not use the same name. Otherwise, the system will automatically change the ECG waveform name that has been used to another one.

Errore. L'origine riferimento non è stata trovata. Waveform gain of channel 1: to adjust the amplitude of ECG waveforms

Select gain value for each channel from ×0.25, ×0.5, ×1, ×2 and ×4. A 1mV scale displays on each ECG channel's one side. The height of the scale is directly proportional to the waveform amplitude.

Errore. L'origine riferimento non è stata trovata. Filter method: to display clearer and more detailed waveform

There are three filter modes for selection. In DIAGNOSTIC mode, the ECG waveform is displayed without filter. In MONITOR mode, the artifact that may cause false alarm is filtered. And the SURGERY mode could reduce artifacts and interferences from electrosurgery equipment. The filter mode is applicable for both channels, and it is displayed at the top of screen.

Errore. L'origine riferimento non è stata trovata. Leads of channel 2: refer to ①for detailed information.

Errore. L'origine riferimento non è stata trovata. Waveform gain of channel 2: refer to ②for detailed information.

WARNING

- **Only in Diagnostic mode, the system can provide non-processed real signals. In Monitor or Surgery mode, ECG waveforms may have distortion of different extent. In either of the latter two modes, the system can only show the basic ECG, the results of ST analysis may also be greatly affected. In Surgery mode, results of ARR analysis may be somewhat affected. Therefore, it is suggested that in the environment having relative small interference, you'd better monitor a patient in Diagnostic mode.**

NOTE:

- **When the input signals are too large, the peak of the waveform may not able to be displayed. In this case user could manually change the gain setup of ECG waveform according to the actual waveform so as to avoid the occurrence of the unfavorable phenomena.**

10.5 ECG setup

Turn the knob to move the cursor to the ECG hot key in parameter area, and press the knob to enter ECG setup menu.

- ALM REC: if set to "ON", HR alarm will be recorded once alarm happens.
- HR FROM

ECG: Heart rate will be detected by ECG wave.

SpO_2: Heart rate will be detected through PLETH, the monitor prompts "PULSE" at the right side of ECG hot key with pulse sound. Only pulse alarm is available. When the HR FROM is set to "PLETH", the system only carry on the alarm judgement of pulse rate, while the heart rate alarm will not be judged.

AUTO: The monitor distinguishes heart rate source according to the quality of signal. ECG source priority is higher than SpO_2 source. Only when the ECG signal is poor, which can not be analyzed, the system will choose SpO_2 source, and when the ECG signal quality returns to normal, the heart rate source automatically switch to the ECG. As long as the presence of ECG module, the heart rate value will be displayed, only when the ECG module does not exist, the pulse rate value will be displayed.

BOTH: The monitor displays HR and PR simultaneously. The PR value is displayed at the right side of SpO_2 hot key. Both HR alarm and PR alarm are available. As for the sound of HR or PR in BOTH mode, HR is given the priority, i.e., if HR is available, the system prompts the sound of heart rate, but if HR is not available, then it will prompt the sound of pulse rate.

- SWEEP

  Available options for ECG SWEEP are 12.5 mm/s, 25.0 mm/s, and 50.0 mm/s.
- LEAD TYPE: to select either 5 LEADS or 3 LEADS.
- HR CHANNEL

  "CH1" : to count the heart rate by channel-1 waveform

  "CH2": to count the heart rate by channel-2 waveform

  "AUTO": the monitor selects a channel automatically for HR calculation
- ECG ALM SETUP

  Input the initial password "70808" for alarm setup to enter its interface, the following items can be set:

  - HR ALM: pick "ON" to enable alarm prompt and data record during the heart rate alarm; pick

"OFF" to disable the alarm function, and there will be a  in parameter area.

- ALM LEV: selectable from "HI" and "MED". Level HIGH represents the most serious alarm.
- ALM HI: to set the upper limit of HR alarm.
- ALM LO: to set the lower limit of HR alarm.
- ST ALM SETUP: refer to the section *ST Segment Monitoring* in the following for details.
- ARR ALM SETUP: refer to the section *ARR Monitoring* in the following for details.

NOTE:

- **ECG alarm is activated when the heart rate exceeds ALM HI value or falls below ALM LO value.**
- **Please set the alarm limits according to clinical condition of individual patient.**
- **The setup of HR alarm limits is very important in monitoring process. The upper limit should not too high. Considering the factors of variability, the upper limit of HR alarm should 20 beats/min higher than the patient's heart rate at most.**
  - DEF POINT: refer to the section *ST Segment Monitoring* in the following for details.
  - ARR RECALL: refer to the section *ARR Monitoring* in the following for details.

OTHER SETUP: Pick this item to access ECG SETUP menu.

- BEAT VOL: 8 selections are available: OFF, 1~7. 7 indicates maximum volume. OFF indicates no sound.
- PACE: "ON" means the detected signal will be marked by a "¹" above the ECG waveform. "OFF" means no pacemaker analysis.

WARNING

- **For a patient using pacemaker, the heart rate meter may count the pacemaker pulse when patient appears cardiac arrest or arrhythmia. Therefore, do not entirely rely on the alarms of heart rate meter. Patient with pacemaker should be closely monitored.**
- **If monitoring a patient with pacemaker, set "PACE" to On. If monitoring a patient without pacemaker, set "PACE" to Off. If "PACE" is on, the system will not perform some types of ARR analysis. For detailed information, please refer to the section about arrhythmia analysis.**
- **When the "PACCE" is on, the arrhythmia events related to ventricular premature beat (including PVCs count) will not be detected, neither the ST segment analysis.**

- NOTCH: ON/OFF.
- EMG: ON/OFF.
- PITCH TONE: ON/OFF
- ECG CAL: pick this item to start calibrating ECG. The method to end calibrating: re-select this button in the menu or change the lead name on the screen.
- ADJUST WAVE POS:

  1. CHANNEL: CHANNEL I/CHANNEL II
  2. UP-DOWN: to adjust the up and down of channel-1/channel-2 ECG waveform

3. DEF POS: return to the original position

- DEFAULT: pick this item to access the ECG DEFAULT CONFIG dialog box, in which user may select either the FACTORY DEFAULT CONFIG or the USER DEFAULT CONFIG. After selecting one item and exiting the dialog box, the system will pop up a dialog box asking for user's confirmation.

10.6 ECG Alarm and Prompt Message

10.6.1 Alarms

Alarms occurring in the process of ECG measurement contain two types: physiological alarm and technical alarm. Prompt messages may also appear in the mean time. For the audio and visual features during the appearance of these alarms and prompt messages, please refer to the related description in *Chapter 5 Alarm*. In the screen, physiological alarms and prompt messages (general alarms) are displayed in the physiological alarm area of the monitor, while technical alarms, and prompt messages that unable to trigger alarms are displayed in the technical alarm area. This section does not describe the alarm part about arrhythmia and ST analysis.

Among physiological alarms, those belonging to the type that the parameter has exceeded the limits may activate the recorder to automatically output the parameters and related measured waveforms when the alarms occur on the condition that the alarm record switch in related menu is On.

Tables below describe respectively the possible alarms those may occur during the measurement.

Physiological alarms:

Message	Cause	Alarm level
ECG SIGNAL WEAK	No ECG signal of the patient is detected.	HIGH
HR HI	Measured HR value is higher than the upper alarm limit.	User-selectable
HR LOW	Measured HR value is lower than the lower alarm limit.	User-selectable

Technical alarms:

Message	Cause	Alarm level	Solution
ECG LEAD OFF or RESP LEAD OFF	ECG electrodes fall off the skin or ECG cables fall off the monitor.	LOW	Make sure that all electrodes, leads and patient cables are properly connected.
V LEAD OFF			
LL LEAD OFF			
LA LEAD OFF			
RA LEAD OFF			
MODULE ERROR	Occasional communication failure	HIGH	If the fault persists, stop using the measurement function provided by this ECG module, and inform the biomedical engineer or maintenance personnel of our company.
NOISE	ECG measuring signal is greatly interfered.	LOW	Make sure the patient is quiet, the electrodes are properly connected and AC power system is well grounded.

10.7 ST Segment Monitoring

- The default setting for ST segment monitoring is "OFF", so the monitor will not process ST analysis. You can switch it to ON when necessary.
- The ST segment algorithm can measure the elevation or depression of the ST segment on the user-specified lead. The relevant ST measurement results are displayed numerically at the parameter areas ST1 and ST2. View the trend data displayed graphically and in tables under "TREND GRAPH" and "TREND TABLE" menu.

- Unit: mV
- Measurement range: -2.0～+2.0 mV
- Meaning of the value: positive means elevating, negative means depressing.

NOTE:

- **When setting ST ANALYSIS on, the monitor will select "DIAGNOSTIC" mode. You can set it to "MONITOR" mode or "SURGERY" mode as required. However at this time ST value has been severely distorted.**

10.7.1 ST ON/OFF

To set the display of ST parameter on or off:

1. Select "ECG ALM SETUP" item in the "ECG SETUP" menu, refer to the "ECG SETUP" for details;
2. Then select "ST ALM SETUP" to enter its interface, set the "ST ANALYSIS" to on or off.

10.7.2 ST alarm setup

Select "ECG ALM SETUP" item in the "ECG SETUP" menu, input the initial password of alarm setup "70808", click "ST ALM SETUP"to modify the following items:

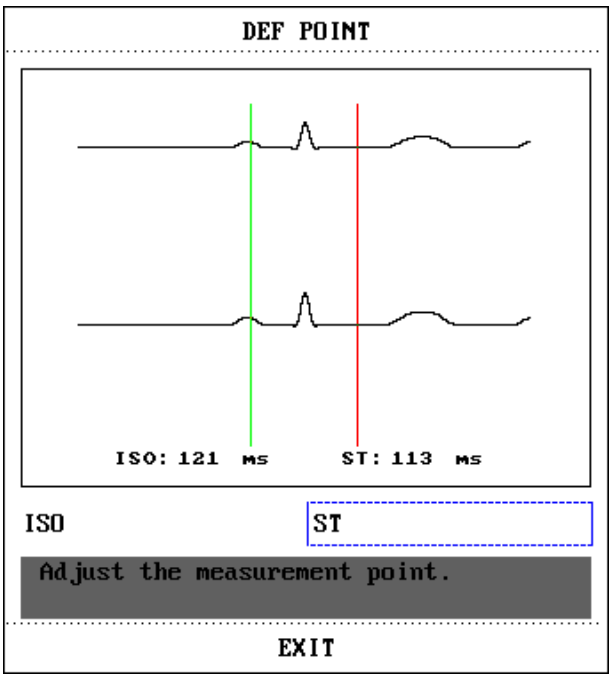
- ST ANAL: the switch for ST analysis. Set it to ON to activate the ST analysis or OFF to disable the ST analysis.
- ST ALM: pick "ON" to enable prompt message and data record during the ST analysis alarm; pick "OFF" to disable the alarm function, and there will be a  beside parameter area ST1. ST alarm is activated when the result exceeds the upper limit of ST value or falls below the lower limit of ST value.
- ALM LEV: to set the ST alarm level. There are three selections: "HI", "MED" and "LO".
- ALM REC: "ON" means that the system will enable the recorder for alarm recording.
- ALM HI: to set the upper limit of ST alarm. The maximum setting is +2.0. The minimum high limit should be 0.1 larger than the set low limit.
- ALM LO: to set the lower limit of ST alarm. The minimum setting is –2.0. The maximum low limit should be 0.1 lower than the set high limit.

10.7.3 DEF point setup

Identify the analysis point for ST segment.

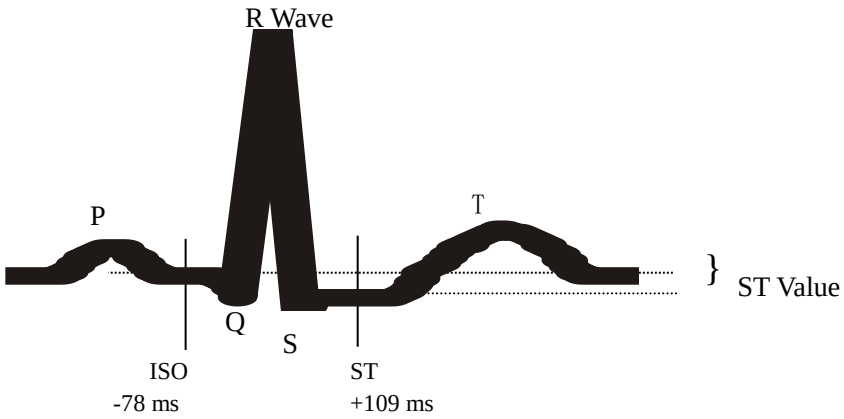
Select the "DEF POINT" item in "ECG SETUP" menu, in which the value of ISO and ST point can be set.

1. ISO (Base point): to set the baseline point.
2. ST (Starting point): to set the measurement point.



The ISO and ST are the two measurement points in ST segment, both of them can be adjusted.

The reference point is the position where the peak of R-wave locates (as figure below). The ST measurement value for each heartbeat complex wave is the difference between the two measurement points.



The position of measurement points (ISO and ST) should be adjusted at the beginning of monitoring, or the patient's HR or ECG waveform changes significantly. Abnormal QRS complex is not considered in ST segment analysis.

NOTE:

- **Abnormal QRS complex is not considered in ST segment analysis.**
- **The measurement points should be adjusted if the patient's HR or ECG waveform changes significantly, detailed instructions are described in the following.**

10.7.4 Adjust ISO/ST point

These two points can be adjusted by turning the knob.

For ST measurement points setting, enter the "DEF POINT" window. The QRS complex template displays in the window (If the channel is switched off, the system prompts "ST ANALYSIS KEY IS OFF!".). It is adjustable of the highlight lines in the window. You may select ISO or ST, then switch the knob left or right to move the line, then to decide the baseline point and the measurement point.

NOTE:

- **The alarm limits for two ST measurements are identical. The setting of alarm limits can not be made only for one channel.**

10.7.5 ST alarms and Prompt messages

Among physiological alarms, those belonging to the type that the parameter has exceeded the limits may activate the recorder to automatically output the parameters and related measured waveforms when the alarms occur on the condition that the alarm record switch in related menu is On.

Possible physiological alarms during ST measurement are listed as below.

Physiological alarms:

Message	Cause	Alarm Level
ST1 HI	ST measuring value of channel 1 is above the upper alarm limit.	User-selectable
STI LOW	ST measuring value of channel 1 is below the lower alarm limit.	User-selectable
ST2 HI	ST measuring value of channel 2 is above the upper alarm limit.	User-selectable
ST2 LOW	ST measuring value of channel 2 is below the lower alarm limit.	User-selectable

10.8 ARR Monitoring

Arrhythmia analysis

The arrhythmia analysis is used to monitor ECG of neonate and adult patient in clinical, detect the changing of heart rate and ventricular rhythm, and also save arrhythmia events and generate alarming information. Arrhythmia analysis can monitor the patient with or without pacemaker. Qualified personnel can use arrhythmia analysis to evaluate patient's condition (such as heart rate, PVCs frequency, rhythm and abnormal heartbeat) and decide the treatment accordingly. Besides detecting the changing of ECG, arrhythmia analysis can also monitor patients and give proper alarm for arrhythmia.

- The arrhythmia monitoring is shutoff by default. You can enable it when necessary.
- This function can call up the doctor's attention to the patient's heart rate by measuring and classifying the arrhythmia and abnormal heart beat, and triggering the alarm.
- The monitor can conduct up to 13 different arrhythmia analysis.
- The monitor can store the latest 60 alarm events (a single-channel ECG waveform 4 seconds before and after the alarm) during the arrhythmia analysis process. The operator can edit these arrhythmia events through this menu.

10.8.1 ARR Analysis ON/OFF

To set the ARR analysis on or off:

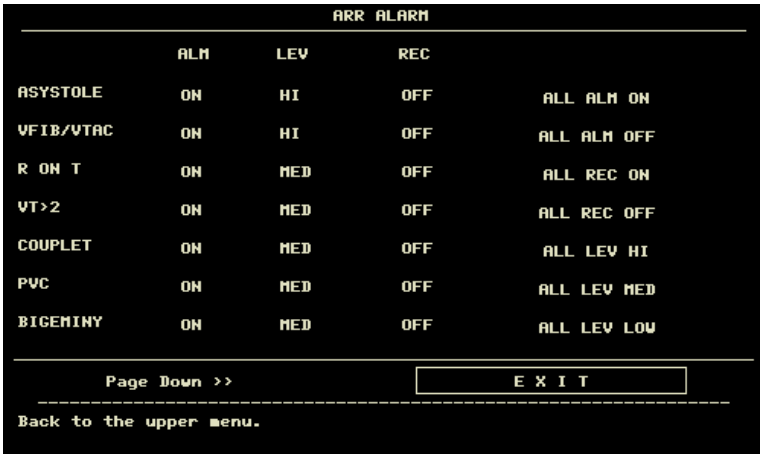
1. Select "ECG ALM SETUP" item in the "ECG SETUP" menu, refer to the "ECG SETUP" for details;
2. Then select "ARR ALARM" to enter its interface, set the "ARR ANAL" to on or off.

10.8.2 ARR alarm setup

Select "ECG ALM SETUP" item in the "ECG SETUP" menu, input the initial password of alarm setup "70808", click "ARR ALM SETUP"to modify the following items:

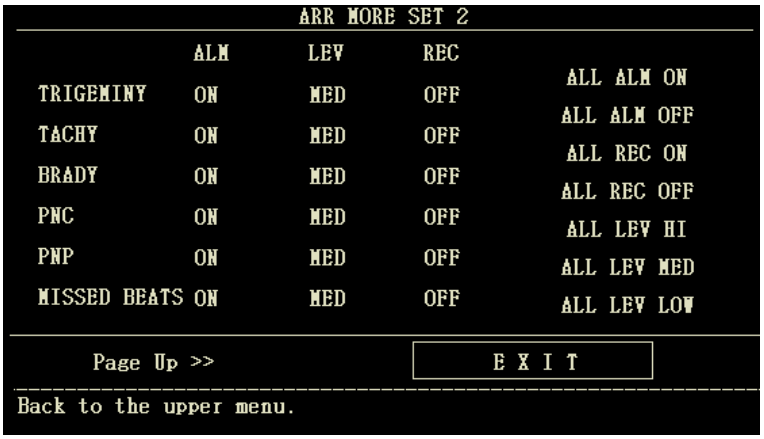
- ARR ANAL: Pick "ON" during monitoring. Default set is "OFF".
- PVCS ALM: pick "ON" to enable prompt message and data record when alarm occurs; pick "OFF" to disable the alarm function, and there will be a  beside PVCs parameter area.
- ALM LEV: selectable from HI, MED, LO. Level HIGH represents the most serious PVCs alarm.

- ALM REC: pick "ON" to enable the recording when PVCs alarm occurs.
- ALM HI: PVCs alarm is activated when the PVCs exceeds the set ALM HI value.
- ARR RELEARN: press this button to start a learning procedure.
- ARR ALM: to set the arrhythmia alarm. In this menu, "ALM" is the alarm switch, "LEV" is alarm level, "REC" is the switch of alarm recording.



Arrhythmia Alarm Setup

Select "Page Down" to enter the interface for following setup.

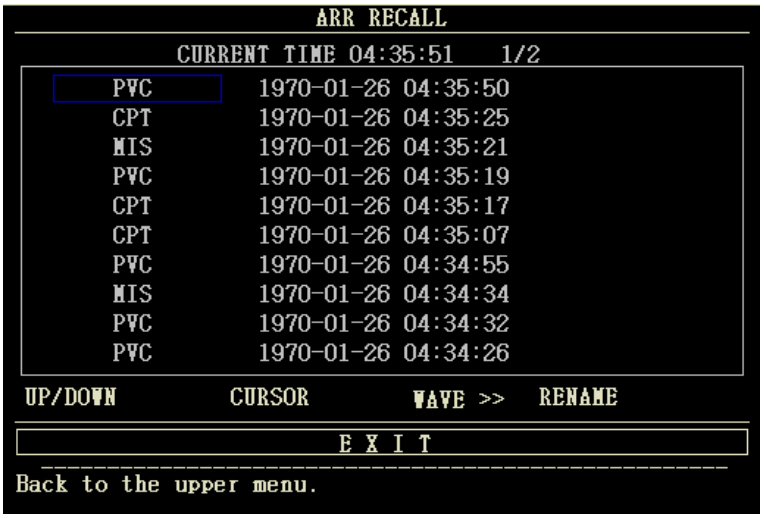


Arrhythmia Alarm Setup

You can pick ALL ALM ON to enable alarm function of all arrhythmia types and pick ALL ALM OFF to disable this function. Likewise, you can pick ALL REC ON to enable recording function for all arrhythmia types and pick ALL REC OFF to disable this function. Changing the ALM LEV can reset alarm level of all arrhythmia types.

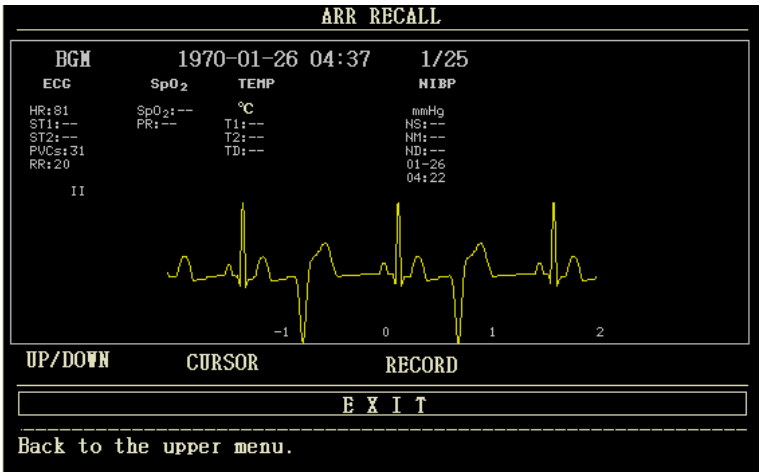
10.8.3 ARR Recall

1. Pick this item to review and edit the ARR analysis result.
2. Select "ARR RECALL" item in the "ECG SETUP" menu, the following interface will pop up.



The recent stored ARR events are listed in this interface:

- ✧ UP/DOWN: Observe event lists of other pages.
- ✧ CURSOR: Move the cursor to select an event in the list.
- ✧ RENAME: Rename the selected Arr. event. Turn the knob until your necessary name appears, then press the knob.
- ✧ WAVE: Press this button to display the waveform of the selected arrhythmia event, time of occurrence and the parameters at this time in the window.



In the arrhythmia waveform recall interface:

- ✧ UP/DOWN: To observe waveforms of other Arrhythmia events.
- ✧ CURSOR: To observe the whole 8s waveform of Arrhythmia event.
- ✧ RECORD: To print out displayed waveform of Arrhythmia event.
- ✧ EXIT: To return to ARR RECALL menu listing Arrhythmia events.

NOTE:

- **If there are more than 60 Arrhythmia events, the latest ones will be retained.**

10.8.4 PVCs Alarms and Prompt messages

Among physiological alarms, those belonging to the type that the parameter has exceeded the limits may activate the recorder to automatically output the parameters and related measured waveforms when the alarms occur on the condition that the alarm record switch in related menu is On.

Possible physiological alarms and technical alarms during PVCs measurement are listed as below.

Physiological alarm:

Message	Cause	Alarm Level
PVCS ALM	PVCs measuring value is above the upper alarm limit.	User-selectable

Arrhythmia alarm

The alarm is triggered when an Arrhythmia occurs. If the ALM is ON, the alarm sounds and the alarm indicator flashes. If the REC is ON, the alarm record will be printed out (the ECG waveform of the channel being analysed 4 seconds prior to and after the alarm).

Alarms and prompt messages related to arrhythmia analysis are listed as below:

Physiological alarm:

Message	Applicable Patient Type	Occurring Condition	Alarm Level
ASYSTOLE	All patients	No QRS complex is detected for consecutive 6 seconds.	User-selectable
VFIB /VTAC	Without pacemaker	Fibrillation wave for consecutive 4 seconds, or the number of continuous ventricular beats is larger than the upper limit of cluster ventricular beats (≥5). The RR interval is less than 600ms.	User-selectable
VT>2	Without pacemaker	3 ≤ the number of cluster PVCs < 5	User-selectable
COUPLET	Without pacemaker	2 consecutive PVCs	User-selectable
BIGEMINY	Without pacemaker	Vent Bigeminy	User-selectable
TRIGEMINY	Without pacemaker	Vent Trigeminy	User-selectable
R ON T	Without pacemaker	HR is less than 100, R-R interval is less than 1/3 of the average interval, followed by a compensatory pause of 1.25 times of the average R-R interval (the next R wave advances onto the previous T wave).	User-selectable
PVC	Without pacemaker	Single PVC not belonging to the type of above mentioned PVCs.	User-selectable
TACHY	All patients	5 consecutive QRS complex , RR interval is less than 0.5s.	User-selectable

BRADY	All patients	5 consecutive QRS complex, RR interval is longer than 1.5s.	User-selectable
MISSED BEATS	Without pacemaker	When HR is less than 100 beats/min, no heart beat is tested during the period 1.75 times of the average RR interval; or When HR is larger than 100 beats/min, no beat is tested with 1 second.	User-selectable
PNP	With pacemaker	No QRS complex and pacing pulse are available during the period 1.75 times of the average R-R interval (only considering patients with pacemaker.)	User-selectable
PNC	With pacemaker	When pacing pulse is available, no QRS complex exists during the period 1.75 times of the average RR interval (only considering patients with pacemaker.)	User-selectable

Applicable patient type: "All patients" refers to perform Arr.analysis on patients either with pacemakers or without pacemakers.

"Without pacemaker": refers to perform Arr. Analysis only on the patients without pacemakers.

"With pacemaker": refers to perform Arr. Analysis only on the patients with pacemakers.

Prompt message:

Message	Cause	Alarm Level
ARR LEARNING	The QRS template building required for Arr. Analysis is in process.	No alarm

NOTE:

- **Arrhythmia name displays in the alarm area.**

Chapter 11 RESP Monitoring

11.1 Introduction

Measurement method: chest impedance. When the patient breathes, the thoracic activity causes a change in the thoracic impedance between the two ECG electrodes. The monitor produces a respiratory wave on the screen by measuring the impedance change (due to the movement of the thorax), then it calculates the respiration rate based on the waveform cycle.

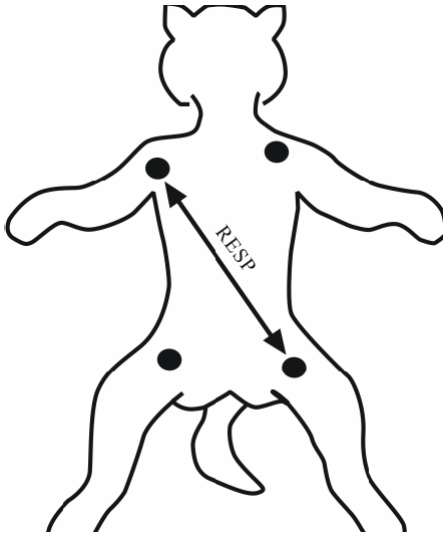
11.2 Safety information

WARNING

- **Respiratory measurement does not recognize the reason of suffocation, it will only give alarm if no next respiration is checked within the predetermined time after the last breath, so it can not be used for diagnostic purposes.**

11.3 Placement for RESP electrode

Since the same leads are used for ECG and respiration monitoring, the lead 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 crocodile clips 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.



Electrodes Placement

NOTE:

- **The RESP monitoring is not recommended to be used on patients who are very active, as this can cause false alarms.**
- **Placing the red and white electrodes diagonally to obtain the optimal respiration waveform. Avoid the liver area and the ventricles of the heart in the line between the RESP electrodes so as to avoid cardiac overlay or artifacts from pulsating blood flow. This is particularly important for neonates.**

11.4 RESP SETUP

Press RESP hot key on the screen to "RESP SETUP" interface:

- ALM REC: select "ON" to enable report printing upon RESP alarm.
- SWEEP: 6.25 mm/s, 12.5 mm/s, 25.0 mm/s
- WAVE AMP: RESP waveform can be amplified for displaying, amplification factor: ×0.25, ×0.5, ×1, ×2, ×4.
- RESP FROM: LL-RA or LA-RA
- RESP alarm setup:

  Enter the initial password "70808" to set the following contents:

  - ALM: when RESP alarm occurs, the system will prompt and store the alarm information after selecting "ON", it will not alarm when selecting "OFF", and "  " will appear in parameter area.
  - ALM LEV: HIGH, MED and LOW, high represents the most serious alarm.
  - ALM HI: set the upper alarm limit.
  - ALM LO: set the lower alarm limit.
  - APNEA ALM: set the time of judging an apnea case. Range: 10 ~ 40 s, increase / decrease 5 s after every rotating.
- DEFAULT: select it to "RESP DEFAULT CONFIG" menu, in which the user may select "FACTORY DEFAULT CONFIG" or "USER DEFAULT CONFIG". After selecting any of the items and exiting the dialog box, the system will pop up the dialog box asking for confirmation

11.5 RESP Alarm message

Among physiological alarms, those belonging to the type that the parameter has exceeded the limits may activate the recorder to automatically output the parameters and related measured waveforms when the alarms occur on the condition that the alarm record switch in the related menu is On.

Tables below describe the possible physiological alarms, technical alarms and prompt messages occurring during RESP measurement.

Physiological alarms:

Message	Cause	Alarm Level
RR HI	RESP measurement value is higher than upper alarm limit.	User-selectable
RR LOW	RESP measuring value is lower than lower alarm limit.	User-selectable
RESP APNEA	RESP can not be measured within specific time interval.	HIGH

Technical alarms:

Message	Cause	Alarm Level	Remedy
RESP LEAD OFF	RA, RL or LL falls off.	MED	Make sure all electrodes, leads and cables are connected normally.

Chapter 12 SpO_2 Monitoring

12.1 Introduction

SpO_2 Plethysmogram measurement is employed to determine the oxygen saturation of hemoglobin in the arterial blood. If, for example, 97% hemoglobin molecules in the red blood cells of the arterial blood combine with oxygen, then the blood has a SpO_2 oxygen saturation of 97%. The SpO_2 numeric on the monitor will read 97%. The SpO_2 numeric shows the percentage of hemoglobin molecules which have combined with oxygen molecules to form oxyhemoglobin. The SpO_2/PLETH parameter can also provide a pulse rate signal and a plethysmogram wave.

How the SpO_2 / PLETH Parameter Works

- Arterial oxygen saturation is measured by a method called pulse oximeter. It is a continuous, non-invasive method based on the different absorption spectra of reduced hemoglobin and oxyhemoglobin. It measures how much light, sent from light sources on one side of the sensor, is transmitted through patient tissue , to a receiver on the other side.The sensor measurement wavelengths are nominally 660nm for the Red LED and 880nm for Infrared LED. Maximum optical power output for the Red LED is 6.65 mW and the Infrared LED is 6.75 mW. Optical sensors as the light-emitting components, will bring influence to other medical devices applied the wavelength range. This information may be useful for clinicians who carry out optical therapy.
- The amount of light transmitted depends on many factors, most of which are constant. However, one of these factors, the blood flow in the arteries, varies with time, because it is pulsating. By measuring the light absorption during a pulsation, it is possible to get the oxygen saturation of the arterial blood. Detecting the pulsation gives a PLETH waveform and pulse rate signal.
- The SpO_2 value and the PLETH waveform can be displayed on the main screen.

12.2 Safety information

WARNING

- **Only the SpO_2 sensor specified in this manual can be used, please use it following the Use Manual, and obey all warnings and precautions.**
- **Check if the sensor cable is in normal condition before monitoring. After unplugging the SpO_2 sensor cable from the socket, the system shall display the error message "SpO_2 SENSOR OFF" and give the audible alarm.**
- **Do not use the SpO_2 sensor once the package or the sensor is found damaged. Instead, you shall return it to the vendor.**
- **ES (Electrosurgery) equipment cable and SpO_2 cable must not be tangled up.**
- **Prolonged and continuous monitoring may increase the risk of unexpected change of skin condition such as abnormal sensitivity, rubescence, vesicle, repressive putrescence, and so on. It is especially important to check the sensor placement of patient of poor perfusion or immature dermogram by light collimation and proper attaching strictly according to changes of the skin. Check the sensor placement periodically and move it when the skin deteriorates. More frequent examinations may be required for different patients.**
- **The person who is allergic to silicone or ABS can not use this device.**
- **The SpO_2 probe accompanying with the monitor is only intended for use in this monitor. The monitor can only use the SpO_2 probe supplied in this manual. It is the operator's responsibility to check the compatibility of the monitor, probe and extension cord before use, to avoid the patient's injury.**

NOTE:

- **SpO_2 waveform is not proportional to the pulse volume.**
- **Some models of functional tester or patient simulator can measure the accuracy of the device that reproduces the calibration curve, but it can not be used to evaluate the accuracy of this device.**
- **SpO_2 function is calibrated to show functional oxygen saturation.**
- **The PLETH waveforms are not normalized, so the accuracy of the measured values may decrease when the waveform does not tend to be smooth and stable. When the waveform tends to be smooth and stable, the measured value is the best value, and the waveform is the most standard.**
- **The update time of measurement data is less than 10 seconds, which depends on the PR value. Data averaging and other signal processing have no effect on SpO_2 displaying and data values transmitted.**
- **The device does not need to be calibrated during maintenance.**

12.3 SpO_2 Measurement

1. During measuring, make sure that the wearing parts meet the following conditions:

◆ Pulsating blood flow, and circulation perfusion is well.

◆ The thickness does not change, the thickness change will cause the mismatch for the sensor and wear parts.

2. PR will be displayed only under the following situations:

■ Select "HR FROM" as "SpO_2" or “BOTH” in the ECG SETUP menu.

■ Select "HR FROM" as “AUTO” in the ECG SETUP menu and there is no ECG signal.

NOTE:

- **Make sure the fingernail covers the light.**
- **The SpO_2 value is always displayed in a fixed place.**
- **The declaration for SpO_2 accuracy is supported by a clinical study covering the entire range.**

12.4 Monitoring steps

1. Switch on the monitor.
2. Insert the sensor plug into the SpO_2 jack.
3. Ear Sensor Placement

   You can easily place the ear sensor as shown below.

Ear Sensor Placement

4. Tongue Sensor Placement

You can easily place the tongue sensor as shown below.

Tongue Sensor Placement

WARNING

- **Check the wearing parts once per 2 to 3 hours to ensure the good skin texture and proper light alignment. If the skin texture changes, move the sensor to another location. It is best to change the wearing parts once per 4 hours.**

NOTE:

- **Do not use photoelectric oximeters and SpO_2 sensors during magnetic resonance imaging (MRI) scanning, as the induced current may cause burns.**

12.5 Measurement Limitations

During measuring, the measurement accuracy can be affected by:

- High-frequency electrical interference, such as the interference created by the host system, or interference from external sources, for example electrosurgical apparatus connected to the system.
- Diagnostic test.
- Electrosurgery unit.
- Intravascular dye injections
- Electromagnetic field effects, such as nuclear magnetic resonance equipment.
- Excessive patient movement(patient moves actively or passively).
- Improper sensor installation or incorrect contact position of the patient
- Place the sensor on an extremity that has a blood pressure cuff, arterial catheter, or intravascular line.
- Significant concentrations of non-functional hemoglobin, such as carboxyhemoglobin(COHb) and methemoglobin(MetHb).
- Bad circular perfusion of the part being measured
- For some special patients, it should be a more prudent inspecting in the measurement part. The sensor can not be clipped on the edema and tender tissue.

- When the device is carried from cold environment to warm or humid environment, please do not use it immediately.
- Make sure the optical path is free from any optical obstacles like rubberized fabric, to avoid inaccurate measurement.
- Excessive ambient light may affect the measurement result. It includes fluorescent lamp, dual ruby light, infrared heater, direct sunlight, etc.
- The SpO_2 sensor and photoelectric receiving tube should be arranged in a way with the subject's arteriole in a position there between.

12.6 SpO_2 SETUP

Turn the knob to move the cursor onto the SpO_2 hot key in the Parameter area, push the knob to "SpO_2 SETUP" menu.

- ALM REC: pick "ON", the system will output alarm information when SpO_2 alarm occurs.
- SWEEP: 12.5mm/s, 25.0 mm/s
- SpO_2 alarm setup

  Set the following contents after entering the initial password "70808":

  - SpO_2 ALM: pick "ON", the system will give alarm prompt and store alarm information when SpO_2 alarm occurs; pick "OFF", the system will not give alarm and instead display a  beside "SpO_2".
  - ALM LEV: set the alarm level, selectable from HI, MED and LO. HIGH represents the most serious case.
  - SpO_2 ALM HI and SpO_2 ALM LO: SpO_2 alarm is activated when the result exceeds set SpO_2 ALM HI value or falls below SpO_2 ALM LO value.
  - PR ALM: pick "ON", the system will give alarm prompt and store alarm information when PR alarm occurs.
  - PR ALM HI: PR alarm is activated when the pulse rate exceeds set PR ALM HI value.
  - PR ALM LO: PR alarm is activated when the PR falls below PR ALM LO value.

To further detect alarms for individual measurement parameters, perform a measurement check on yourself or by using the simulator, adjust the alarm limits setting and check if the correct alarm response is triggered.

WARNING

- **Set the upper limit of SpO_2 alarm to completely equal to off-state upper limit alarm. High-oxygen level will cause fibrous fibrosis for preterm infants. Therefore, the upper limit of the SpO_2 alarm must be carefully chosen according to accepted clinical practice.**

NOTE:

- **When the SpO_2 alarm set is lower than 85 %, upper and lower limit of alarm will be displayed continuously in the SpO_2 parameter area.**
- DEFAULT: select it to "SpO_2 DEFAULT CONFIG" menu, in which you can select "FACTORY DEFAULT CONFIG" or "USER DEFAULT CONFIG". After selecting one item and exiting the interface, the system will pop up the dialog box asking for your confirmation.

12.7 SpO_2 Alarm message

NOTE:

- **There is no alarm delay for SpO_2.**

SpO_2 alarm information

When the alarm switches are set to "ON" in relevant menus, the physiological alarms caused by the parameter exceeding the alarm limit may possibly trigger the recorder to automatically output the alarm parameter value and corresponding waveforms.

Tables below describe the possible physiological alarms, technical alarms and prompt messages occurring during SpO_2 measurement.

Physiological alarm:

Message	Cause	Alarm Level
SpO_2 HI	SpO_2 measurement value is higher than the upper limit of alarm.	User-selectable
SpO_2 LOW	SpO_2 measurement value is lower than the lower limit of alarm.	User-selectable
PR HI	PR measurement value is higher than the upper limit of alarm.	User-selectable
PR LOW	PR measurement value is lower than the lower limit of alarm.	User-selectable

Technical alarms:

Message	Cause	Alarm Level	Remedy
SpO_2 SENSOR OFF	SpO_2 sensor may be disconnected from the patient or the monitor.	LOW	Make sure the sensor is placed in patient's finger or other parts, and the connection between the monitor and the cables is well.
SpO_2 COMM ERR	SpO_2 module failure or communication error.	HIGH	Stop using the measuring function of SpO_2 module, notify biomedical engineer or our service staff.

Prompt message:

Message	Cause	Alarm Level
SpO_2 SEARCHING PR	SpO_2 module is searching for pulse.	No alarm
SpO_2 SEARCH TIMEOUT	SpO_2 module cannot detect SpO_2 signal for a long time.	HIGH

Chapter 13 NIBP Monitoring

13.1 Introduction

Measurement method: Oscillometry. It is applicable for adult, pediatric and neonate.

In order to know how the Oscillometry works, we compare it with auscultatory method:

- Auscultatory method: the doctor listens the blood pressure by the stethoscope, to obtain the systolic pressure and diastolic pressure. When the artery pressure curve is normal, the mean pressure can be calculated by the systolic pressure and diastolic pressure.
- Oscillometry: the blood pressure can not be listened by the monitor, it measures the vibration amplitude of cuff pressure. Cuff vibration appears when the blood pressure changes, the cuff pressure corresponding to the maximum amplitude is the mean pressure, the systolic and diastolic pressure can be calculated by the mean pressure.

In a word, the auscultatory method measures the systolic and diastolic pressure, then calculates the mean pressure. And the Oscillometry measures the mean pressure, then calculates systolic and diastolic pressure.

The clinical meaning for NIBP measurement must be determined by the physician.

When measuring during in representative patients group, compare the blood pressure values measured by the device and auscultatory method, its accuracy meets the requirements specified in IEC 80601-2-30:2009.

13.2 Safety information

WARNING

- **Before measuring, make sure that the monitoring mode and cuff type you selected are appropriate for your patient(cat, dog or other animals). As false settings may imperil patient's safety, higher adult settings are not suitable for pediatric and neonate.**
- **The animal on which the** NIBP **measurement is done must be no lessthan 2kg.**
- **You must not perform NIBP measurement on patients with sickle-cell disease or under any condition which the skin is damaged or expected to be damaged.**
- **Do not apply the cuff to a limb that has an intravenous infusion or catheter. This could cause tissue damage around the catheter when infusion is slowed or blocked during cuff inflation.**
- **NIBP measurement can be performed during electrosurgery and defibrillator discharge, as the device has the function of protecting burn patients.**
- **The device can be used in existence of electrosurgical equipment, but when using them together, user(doctor or nurse) should guarantee the patient's safety.**
- **Make sure that the air conduit connecting the blood pressure cuff and the monitor is neither blocked nor tangled.**
- **The width of the cuff should be either 40% of the limb circumference 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.**
- **If liquid is inadvertently splashed on the device or its accessories, or may enter the conduit or inside the monitor, please contact with the maintenance department in hospital.**

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 functioning of the monitor.**
- **When the alarm prompt information for low battery appears, it is not recommended to start NIBP measurement. As in this circumstance, it may cause device shutdown.**

13.3 Measurement Limitations

NIBP measurement can not be done on the patients with extreme heart rate(lower than 40 bpm or higher than 240 bpm) or connecting with heart-lung machine.

The measurement may be inaccurate or can not be done in the following conditions:

■ Patient Movement

Measurement will be unreliable or may be impossible if the patient is moving, shivering or having convulsions. As these conditions may interfere the detection of the arterial pressure pulsation, and the measurement time will be prolonged.

■ Cardiac Arrhythmia's

Measurement will be unreliable and may be impossible if the patient has irregular heartbeat arisen from cardiac arrhythmia, and the measurement time will be prolonged.

■ Pressure Change

Measurement will be unreliable and may be impossible if the patient's blood pressure is changing rapidly over the period of time during which the arterial pressure pulsation are being analyzed to obtain the measurement values.

■ Severe Shock

If the patient is in severe shock or hypothermia, measurements will be unreliable since the decrease for the blood flowed to the peripheries will cause the reduction of artery pulsation.

■ Fat patient

The thick fat layer under the limb will decrease the measurement accuracy, as the vibration from artery can not arrive to the cuff which is arisen from the fat damping.

13.4 Measurement steps

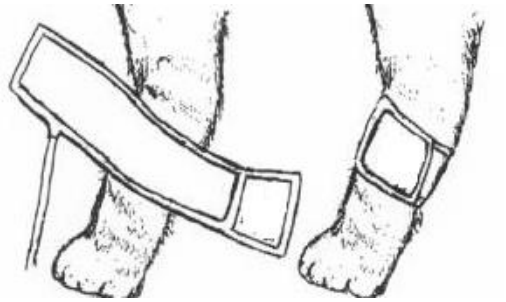
1. Confirm the patient type, if it is false, please change "Patient type" in "PATIENT SETUP" of "SYSTEM MENU".
2. Connect the airway tube with the NIBP interface of the device, then switch on thedevice.
3. Select the cuff, make sure the cuff is completely deflated, then apply the cuff to the patient's arm or leg following the instructions below.

■ Confirm the limb perimeter of the patient.

■ For a CAT

For conscious patients, measurements from the coccygeal artery can be taken by wrapping the cuff around the base of the tail. For anesthetized patients,measurements from the median artery on the foreleg can be used by wrapping the cuff around the forelimb, between the elbow and carpus. For cats less than five pounds when measurements are difficult to obtain, place the cuff around the leg above the elbow to obtain measurements from the brachial artery. Hair

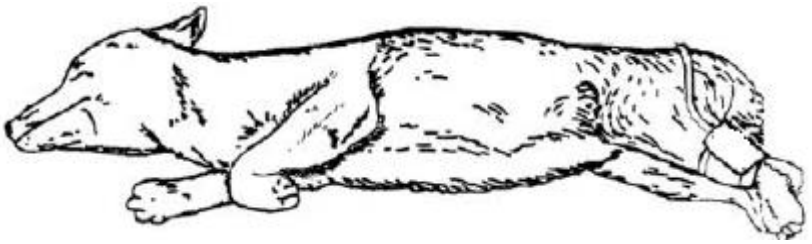
need not be clipped except when heavily matted.



Cat Cuff Placement

■ For a DOG

For measurements in dogs, it is preferable to use the right lateral, stemal or dorsal recumbent position. If the dog is in a sitting position, place the front paw on the operator's knee and take measurements from the metacarpus. The metacarpus, metatarsus and anterior tibial are recommended for the cuff placement. For anesthetized patients, most surgeries are done on the posterior part of the body so the metacarpal area of the forelimb is most convenient. In situations where this is not possible, place the cuff around the metatarsus just proximal to the tarsal pad or around the hind leg next to the hock. For conscious patients, measurements from the coccygeal artery can be used over the tail site.



Dog Cuff Placement

■ For larger animals

It is preferable for a large animal, such as a horse and a cow, to be in a stock, standing still. Measurments from the coccygeal artery on the ventral surface may be used by placing the cuff around the base of the tail.

4. Connect the cuff to the airway tube. Make sure that the airway tube is neither blocked nor tangled.
5. Select a measurement mode in "NIBP SETUP" interface. Refer to the following paragraphs "Operation Hints" for Details
6. Press "START" button on the front panel to start a measurement.

NOTE:

- **The limb chosen for taking the measurement should be placed at the same level as the patient's heart**
- **If the animal's hair over the artery site is too thick or matted for good contact, it should be clipped.**
- **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 encircle 50-80% of the limb. The wrong size of cuff can cause erroneous readings. If the cuff size is in question, then use a larger cuff.**

13.5 Operation hints

1. Manual operation

■ Select "MANUAL" in "INTERVAL" item of "NIBP SETUP" interface, then press "START" button on the front panel to start a manual measurement.

- During the idle time of auto measuring process, press "START" button on the front panel to start a manual measurement. Press "START" button again to stop manual measurement and the system continues auto measuring.

2. Auto measuring

Select a interval value in "INTERVAL" item of "NIBP SETUP" interface to perform auto measurement., then press "START" button on the front panel to start the first measurement, after finishing, the system will automatically measure according to the interval time.

3. Continuous measuring

Select "CONTINUAL" item in "NIBP SETUP" interface to start a continuous measurement. The precess will continue 5 minutes.

4. Stop measuring

During measuring, press "START" button on the front panel to stop measuring.

WARNING

- **In auto or continuous mode, if the time is too long, then the limb rubbed with the cuff may appear purpura, ischemia and nerve injury. So when monitoring the patient, patient's limb color, warmth and sensitivity should be checked frequently. Once any abnormality appears, please replace the cuff location or stop the NIBP measurement.**

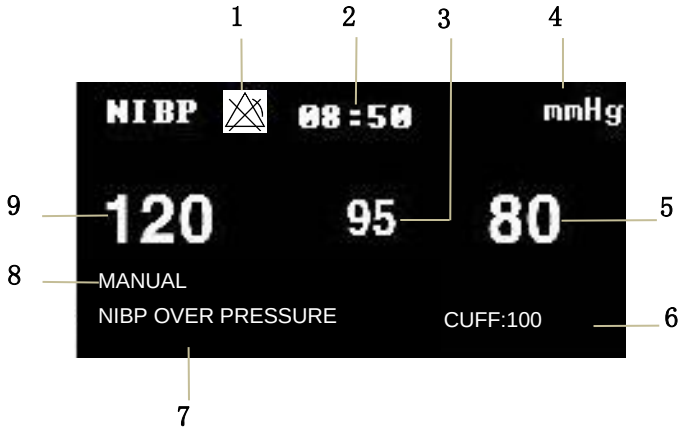
13.6 Amend results

Keep the limb to be measured and the patient's heart on one horizontal position. Otherwise amend the measurement results by the following methods:

- If the cuff is higher than the horizontal position of the heart, then the value should add 0.75 mmHg(0.10 kPa) after the displayed value.
- If the cuff is lower than the horizontal position of the heart, then the value should subtract 0.75 mmHg(0.10 kPa) after the displayed value.

13.7 NIBP display

There is no waveform for NIBP measurement, it only displays the NIBP measurement results. The following figure is only used for reference, your device may display a different interface.



1. Alarm is off
2. Measurement time
3. Mean pressure
4. Unit: mmHg or kPa
5. Diastolic pressure
6. Current cuff presure
7. Prompt information area: display the prompt information related to the NIBP.
8. Measurement mode
9. Systolic pressure

13.8 NIBP SETUP

Move the cursor to the NIBP hot key, press it to enter the "NIBP SETUP" interface.

- ALM REC: select "ON" to enable report printing upon NIBP alarm.
- Unit: mmHg or kPa
- INTERVAL

Interval time in AUTO mode: 1/2/3/4/5/10/15/30/60/90/120/240/480/960 minutes. After selecting the interval time, the information "Please start" will appear in the NIBP prompt area, then press "START" button to start the first auto measurement. Select "MANUAL" in interval time to stop auto measuring and enter to manual measurement.

- INFLATION

Press this button to select the initial pressure value for the cuff next time, there are different pre-inflation value ranges in different default configurations, as shown in the following table.

Default configurations	Default inflation value (mmHg/kPa)	Selectable inflation value in manual mode in NIBP 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

Press "MENU" button to enter "SYSTEM MENU" menu, then select a factory or user configuration in "DEFAULT" menu, after configuration, return to the main interface to select NIBP hot key to enter "NIBP SETUP" menu. Here the initial value for "Inflation" is the initial inflation pressure value corresponding to default configuration, as shown in the above table. Move the cursor to the "Inflation" item and press it, inflation value range(as shown in the above table) in

MANUAL mode can be seen.

NOTE:

- **"Inflation" is used to help user select the cuff inflation pressure next time, but the subsequent inflation is the measurement value of last systolic pressure based on the same patient. The system momorizes the value, which can shorten the measurement time of the same patient and increase the measurement accuracy.**
- **If user only sets the "Patient type" in "PATIENT SETUP" interface, does not perform any selection in "DEFAULT", the system will operate according to the initial setting of relative module parameter in "Patient type". The change of default type setting in "DEFAULT" will alter the "Patient type" in "PATIENT SETUP" interface.**

■ NIBP alarm setup

Enter the initial password "70808" to set the following contents:

- ◆ AlM: when pressure alarm occurs, the system will prompt and store the alarm information after selecting "ON", it will not alarm when selecting "OFF", and "  " will appear in parameter area.
- ◆ ALM LEV: HIGH, MED and LOW, "HIGH" represents the most serious alarm.

Pressure alarm is set according to the HIGH and LOW limits, alarm is activated when the pressure is higher than the HIGH limit or lower than the LOW limit. Alarm for systolic pressure, mean pressure and diastolic pressure can be set separately.

■ RESET

Restore measurement status of the pressure pump. Press this button to restore the initial settings of the pressure pump. When the pressure pump does not work properly and the system fails to give prompt information for the problem, press this button to activate self-test procedure, thus restore the system from abnormal performance.

■ CONTINUAL

Start a continuous measurement, after selecting it, the menu will automatically disappears and measure continuously.

■ CALIBRATE(NIBP pressure calibration)

NIBP pressure calibration should be performed once per two years at least or once when you thought that the reading is inaccurate.

Prepared materials:

- Standard manometer
- Metal container(500 ml)
- Spheroidal air pump
- Airway tube
- T-shape connector

Procedures of the Pressure Transducer Calibration:

Replace the cuff with a metal container with a capacity of 500 ml ± 5%. Connect a calibrated standard manometer, spheroidal air pump(error less than 0.8 mmHg) and airway tube to the NIBP cuff jack of the module by a T-shape connector. Set the monitor in "CALIBRATE" mode. Inflate the pressure in the metal container to 0, 50 and 200 mmHg

by spheroidal air pump separately. The difference between the indicated pressure of the standard manometer and the monitor will not exceed 3 mmHg. Otherwise, please contact our customer service.

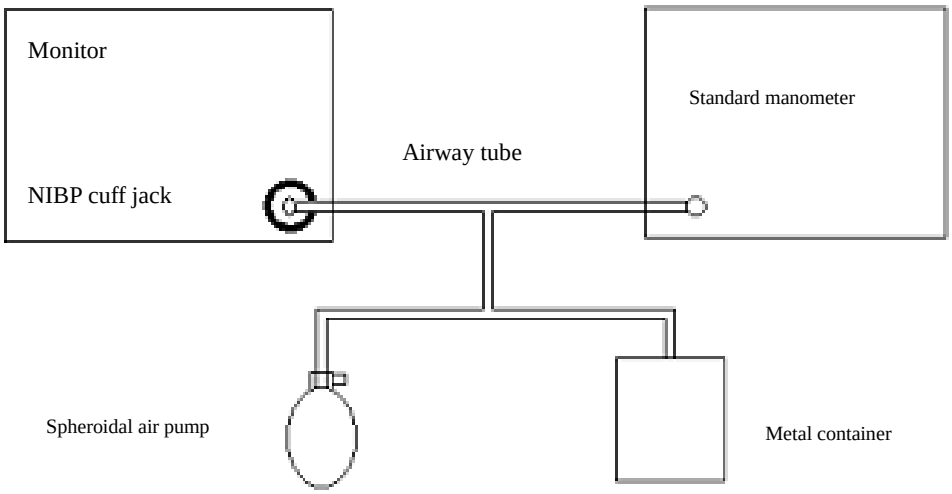


Diagram of NIBP Calibration

■ PNEUMATIC

It is mainly used to check whether the airtight condition of the air circuit is good. If the test passes, the system will not prompt any information. Otherwise it will prompt corresponding information in NIBP information area. NIBP air leakage test should be performed once per two years at least or once when you thought that the reading is inaccurate.

Prepared materials:

- ◆ Adult cuff: one
- ◆ Airway tube: one
- ◆ Cylinder: one

Procedure of the air leakage test:

1. Set the "Patient type" to "Adult".
2. Connect the cuff with the NIBP cuff jack.
3. Wrap the cuff around the cylinder of an appropriate size.

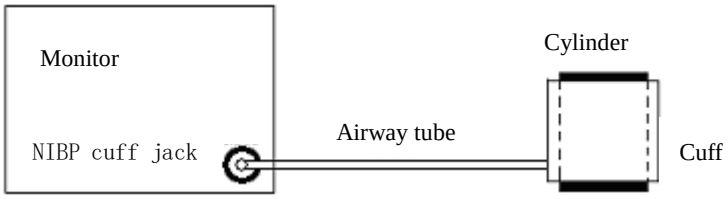


Diagram of NIBP Air Leakage Test

4. Select "PNEUMATIC" in NIBP menu, then the information "Pneum testing..." will display in the NIBP parameter area.
5. The system will automatically inflate to 180 mmHg.
6. The system will automatically deflate after about 20s, it indicates that the air leakage test has finished.
7. If no prompt information appears in NIBP parameter area, it indicates that the airway is in good situation and no air leaks exist. However if the prompt information “NIBP PNEUMATIC LEAK”

appears, it indicates that the airway may have air leaks. In this case, the user should check whether the connection is loose. After confirming properconnections, the user should re-perform the pneumatic test.

If the failure prompt still appears, please contact the manufacturer for maintenance.

WARNING

- **This pneumatic test other than being specified in the EN 1060-1 standard is to be used by the user to simply determine whether there are air leaks in the NIBP airway. If at the end of the test, the system prompts that the NIBP airway has air leaks, please contact the manufacturer for maintenance.**

- DEFAULT: Select "DEFAULT" to enter "NIBP DEFAULT CONFIG" interface, the user may select "FACTORY DEFAULT CONFIG" or "USER DEFAULT CONFIG". After selecting, the system will prompt for your confirmation.

13.9 NIBP Calibration

When the user can not calibrate the NIBP, please contact with the maintenance personnel. The cuff pressure transducer should be maintained by the qualified service personnel, and it should be checked and calibrated once per two years at least.

13.10 NIBP Alarm Message

Physiological alarm belongs to the alarm which triggers by the parameters exceeding the limits, which may activate the recorder to automatically output the parameters and related measured waveforms when the alarms occur on the condition that the alarm record switch in the related menu is On.

Tables below describe the possible physiological alarms, technical alarms and prompt messages occurring during NIBP measurement.

Physiological alarms:

Message	Cause	Alarm Level
SYS HI	NIBP SYS measuring value is above upper alarm limit.	User-selectable
SYS LOW	NIBP SYS measuring value is below lower alarm limit.	User-selectable
DIA HI	NIBP DIA measuring value is above upper alarm limit.	User-selectable
DIA LOW	NIBP DIA measuring value is below lower alarm limit.	User-selectable
MEAN HI	NIBP MAP measuring value is above upper alarm limit.	User-selectable
MEAN LOW	NIBP MAP measuring value is below lower alarm limit.	User-selectable

Technical alarms(display in the prompt area below NIBP value):

Message	Cause	Alarm Level	Remedy
NIBP SELF TEST ERROR	Transducer or other hardware of NIBP module is incorrect.	HIGH	Stop using measuring function of NIBP module, notify biomedical engineer or Our service staff.
NIBP COMM ERR	Communication with NIBP module is failed.	HIGH	If failure persists, stop using measuring function of NIBP module, notify

			biomedical engineer or Our service staff.
NIBP LOOSE CUFF	Cuff is no properly wrapped or no cuff exists.	LOW	Properly wrap the cuff.
NIBP AIR LEAK	Cuff, hose or connector is damaged.	LOW	Check and replace the leaking parts, if required, notify biomedical engineer or Our service staff.
NIBP AIR PRESSURE ERROR	Stable pressure value is not available. e.g. hoses are tangled.	LOW	Check if the hoses are tangled, if failure persists, notify biomedical engineer or Our service staff.
NIBP WEAK SIGNAL	Cuff is too loose or patient pulse is too weak.	LOW	Use other methods to measure blood pressure.
NIBP RANGE EXCEEDED	Measurement range exceeds the specified upper limit.	HIGH	Reset NIBP module, if failure persists, stop using measuring function of NIBP module, notify biomedical engineer or Our service staff.
NIBP EXCESSIVE MOTION	Affected by arm motion, signal noise is too large or pulse rate is not regular.	LOW	Make sure that the patient under monitoring is motionless.
NIBP OVER PRESSURE	Pressure has exceeded the specified upper safety limit.	HIGH	Measure again, if failure persists, stop using measuring function of NIBP module and notify biomedical engineer or Our service staff.
NIBP SIGNAL SATURATED	Excessive motion	LOW	Stop the patient from moving.
NIBP PNEUMATIC LEAK	During pneumatic test, leak is detected.	LOW	Check and replace the leaking parts, if required, notify biomedical engineer or Our service staff.
NIBP SYSTEM FAILURE	Operation of blood pressure pump system is failed.	HIGH	Stop using measuring function of NIBP module, notify biomedical engineer or Our service staff.
NIBP CUFF TYPE ERROR	Cuff type does not comply with the patient type.	LOW	Select an appropriate cuff type
NIBP TIME OUT	Measurement time has exceeded 120 seconds (adult) or 90 seconds (neonatal).	HIGH	Measure again or use other measurement methods.
NIBP ILLEGALLY RESET	Abnormal module reset	HIGH	Reset again.

MEASURE FAIL	The system cannot perform measurement, analysis or calculation during measuring.	HIGH	Check the cuff. Make sure that the patient under monitoring is motionless. Measure again.

Prompt message: (display in the prompt area below NIBP value)

Message	Cause	Alarm Level
Manual measure…	During manual measuring mode.	No alarm
Cont measuring…	During continuous measuring mode.	
Auto measuring…	During automatic measuring mode.	
Please start	After selecting interval time in MENU	
Measurement over	Press START/STOP key during measuring to stop measuring.	
Calibrating…	During calibrating	
Calibration over	Calibration over	
Pneum testing…	During pneumatic test	
Pneum test over	pneumatic test over	
Resetting...	NIBP module in resetting	
Reset failed	NIBP module reset failed	

Chapter 14 TEMP Monitoring

14.1 Introduction

Two TEMP probes can be used together to obtain 2 temperature data, via comparing, the temperature difference can be obtained.

14.2 Safety information

WARNING

- **Verify whether the probe cable is normal before monitoring. Unplug the temperature probe cable from the socket, the screen will display the error message "T1/T2 TEMP OFF" and the audible alarm is activated.**
- **Take and place the temperature and cable carefully, and they should be rolled to loose loop when not used. If internal electric wires are pulled too tight, the mechanical damage will appear.**
- **The calibration of the temperature measurement is necessary for every two years (or as frequently as dictated by your Hospital Procedures Policy). When you need calibrate the temperature measurement, contact the manufacture please.**

14.3 Measurement

Measurement steps:

1. Select an appropriate TEMP probe according to patient type and measurement requirement.
2. Insert the probe cable into the TEMP jack directly.
3. Attach the TEMP probe to the patient properly.
4. Confirm that the alarm settings are suitable for the patient.

NOTE:

- **Disposable TEMP probe can only be used once for one patient.**
- **The self-test of the temperature measurement is performed automatically once per 30s during the monitoring. The test procedure lasts about 1s, which does not affect the normal measurement of the temperature monitoring.**

14.4 TEMP SETUP

Move the cursor to the TEMP hot key, then press the button to enter to "TEMP SETUP" menu.

- ALM REC: Select "ON" to enable report printing upon TEMP alarm.
- UNITt: ℃ or ℉
- TEMP alarm setup

After entering the initial password "70808", the following contents can be set:

  - ALM: pick "ON" to enable prompt message and data record during the TEMP alarm; pick "OFF" to disable the alarm function, and prompt the  symbol beside TEMP area.
  - ALM LEV: set the alarm level, three options: HIGH, MED or LOW.
  - Alarm for T1, T2 and TD occurs when the measured temperature exceeds set alarm high limit or falls below alarm low limit.

- DEFAULT: select "DEFAULT" to enter "TEMP DEFAULT CONFIG" interface, the user may select "FACTORY

DEFAULT CONFIG" or "USER DEFAULT CONFIG". After selecting, the system will prompt the user to confirm, then exit.

14.5 TEMP Alarm message

The alarm which triggers by the parameters exceeding the limits, which may activate the recorder to automatically output the parameters and related measured waveforms when the alarms occur on the condition that the alarm record switch in the related menu is On.

Tables below describe the possible physiological alarms, technical alarms and prompt messages occurring during TEMP measurement.

Physiological alarms:

Message	Cause	Alarm Level
T1 HI	Measuring value of channel 1 is above upper alarm limit.	User-selectable
T1 LOW	Measuring value of channel 1 is below lower alarm limit.	User-selectable
T2 HI	Measuring value of channel 2 is above upper alarm limit.	User-selectable
T2 LOW	Measuring value of channel 2 is below lower alarm limit.	User-selectable
TD HI	Difference between two channels is larger than upper limit.	User-selectable

Technical alarms:

Alarm Message	Cause	Alarm Level	Remedy
T1 SENSOR OFF	Temperature cable of channel 1 may be disconnected from the monitor.	LOW	Make sure that the cable is properly connected.
T2 SENSOR OFF	Temperature cable of channel 2 may be disconnected from the monitor.	LOW	Make sure that the cable is properly connected.

Chapter 15 Battery

15.1 Introduction

The device can configure the rechargeable battery(lithium battery), which can ensure that the device can be used normally when the patient is moving in hospital or in the condition of power failure. The battery can be charged once connecting to the AC, no matter whether the the device is powered on. When sudden power interruption appears, the system will operate by the battery.

15.2 Battery status information

The battery status information displays the battery condition, which can be used to estimate the monitoring time.


The battery works normally, and the solid represents the battery power.


The battery power is low and low-battery alarm appears, it indicates that the battery needs to be charged immediately.

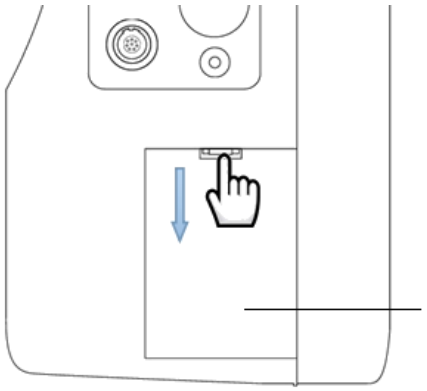

The battery is not installed.

Working by the battery can only maintain a period of time. Too low voltage will trigger high-level technical alarm "Low battery", then you should charge to the battery, otherwise it will shut down after the first alarm (about 5 minutes).

15.3 Battery installation

Refer to the following contents to install or replace the battery:

1. Unscrew the screws, then open the battery compartment cover.



2. Disconnect the battery and the internal connection lines, then install the new battery.
3. Install the battery compartment cover, then screw on the screws.

15.4 Check for battery performatnce

The battery performance may decrease with the increasing of use time. Please refer to the following steps to check the battery performance.

1. Disconnect the connection between the device and the patient to stop all monitoring and measurement.
2. Connect the device to AC to continuously charge the battery for above 10 hours.
3. Disconnect the AC, use the battery to supply power for the device till shutdown.
4. Battery-powered time reflects the battery performance.

If the battery-powered time is obviously lower than the time claimed in the Specification, please replace the battery or contact the service personnel.

WARNING

- **Please read the manual and safety information carefully before using the rechargeable lithium battery(hereinafter referred to as "battery").**
- **Keep the battery out of children's reaching.**
- **Don't take out the battery during monitoring.**
- **Don't connect the anode and cathode falsely to avoid explosive hazard.**
- **Don't heat the battery or throw it into the fire.**
- **Don't use the battery near the fire source or in the environment of temperature over +60℃.**
- **Don't throw the battery into the water, nor wet the battery.**
- **Don't destroy the battery: don't chisel the metal into the battery, or hammer or knock the battery, or use other methods to destroy the battery, to avoid the the battery heating, smoking, deformation or burning, even producing risks.**
- **Only the battery specified by the manufacturer can be used.**
- **The battery can only be used in the device. Necessary maintenance must be performed by qualified and trained service engineers ONLY.**
- **If the electrolyte exudes and enters your eye, please don't knead your eye, use clean water to rinse immediately and go to the doctor.**
- **If there is the sign of battery damage or leakage, please replace it immediately. Don't use the faulted battery.**

NOTE:

- **In order to protect the environment, please recycle the scrap battery as the regulations.**
- **When the device is turned off arisen from power failure, the system will save the latest settings before power failure when it is turned on again.**

15.5 Battery maintenance

The battery should be maintained periodically to prolong its use life, pay attention to the following instructions:

- During storing the battery, please charge to it once per 3 months at least.
- Battery performance must be checked once per 2 years. And it also should be checked when the device is maintained or you doubt the battery is the fault source.
- Please take out the battery before transporting the device or the device is not used over 3 months.
- If the device is not used for a long time, and the battery is not taken out, please charge to the battery once per 3 months, to avoid shortening the battery life.

15.6 Battery recycle

The battery should be replaced and recycled properly if it has obvious damage or it can not store the power normally. The disposal of scrap battery should follow the relevant laws and regulations.

WARNING

- **Don't disassembly the battery, or throw it into the fire, or make it short circuit. As battery burn, explosion or leakage may injury to the human.**

Chapter 16 Care and Cleaning

Only use the material and method listed in this chapter to clean or maintain the device. Otherwise we do not provide any guarantee.

Our company has verified the cleaning and disinfection methods described in the manual. Professional personnel in hospital should obey the manual to ensure sufficient cleaning and disinfection.

16.1 Introduction

Keep the device and accessories out of dust. In order to prevent damage, please obey the following rules:

- Please dilute the detergent and disinfectant according to the manufacturer's instructions, or adopt the lower concentration as soon as possible.
- Don't immerse the device into the liquid.
- Don't pour the liquid into the device or accessories.
- Don't allow liquid to enter into the enclosures.
- Don't use abrasion material(such as steel wool or silver polishing agent) and any strong solvent(such as acetone or the detergent contained acetone).

16.2 Cleaning

The device should be cleaned periodically, in the area of seriously polluted or greater sand wind, cleaning frequency should be increased. Before cleaning, please consult or understand the regulations about device cleaning in advance.

Selectable detergents:

- Diluted ammonia water
- Diluted sodium hypochlorite(Bleaching powder).
- Hydrogen Peroxide(3%)
- Alcohol(70%)
- Isopropanol(70%)

When cleaning the device with the adsorption detergent, or wipe the residual detergent after cleaning, please use the clean and non-corrosive soft cloth or paper towel.

16.2.1 Cleaning for host

Clean the device surface according to the following steps:

1. Turn off the power and unplug the power cord.
2. Use the soft cloth adsorbed proper detergent to completely wipe the external surface(including the LCD) of the device until that there is no obvious dirt.
3. After cleaning, please use the new cloth or paper towel adsorbed proper tap-water to wipe the residual detergent until that there is no obvious dirt.
4. Place the device in ventilation and shady environment for air drying.

WARNING

- **Before cleaning, make sure that the device is switched off and disconnected from the power cord.**

CAUTION

- **If the liquid is poured into the device or the accessories carelessly, please contact with our company or our service personnel immediately.**

16.2.2 Cleaning for the reusable accessories

16.2.2.1 Cleaning for the ECG lead cables

1. Use the soft cloth adsorbed proper detergent to completely wipe the lead cable surface until that there is no obvious dirt.
2. After cleaning, please use the new cloth or paper towel adsorbed proper tap-water to wipe the residual detergent until that there is no obvious dirt.
3. Use a dry soft to wipe the residual water.
4. Place the lead cable in ventilation and shady environment for air drying.

16.2.2.2 Cleaning for NIBP cuff

Clean the cuff:

1. Take out the gasbag before cleaning.
2. The cuff should not be dry-cleaned, but it can be machine-washed or hand-washed, and the latter method may prolong the service life of the cuff. The cuff can be sterilized by means of conventional autoclaving, gas, or radiation sterilization in hot air ovens or disinfected by immersing in decontamination solutions, but remember to remove the gasbag if you use this method.
3. After cleaning, please use the new cloth or paper towel adsorbed proper tap-water to wipe the residual detergent until that there is no obvious dirt.
4. Use a dry soft to wipe the residual water.
5. Place the cuff in ventilation and shady environment for air drying.

Replace the gasbag:

After cleaning, install the gasbag into the cuff according to the following steps:

1. Roll up the gasbag lengthwise, place it into the cuff from the cuff side of the big opening.
2. Thread the leather hose of airbag from the small hole on the cuff, from inside to outside.
3. Adjust the gasbag location in cuff.

16.2.2.3 Cleaning for SpO_2 probe

1. Use the soft cloth adsorbed proper detergent to wipe the probe and lead cable surface until that there is no obvious dirt.
2. Use the cotton swab adsorbed proper detergent to completely wipe the contact position between the probe and the patient until that there is no obvious dirt.
3. After cleaning, please use the new cloth or paper towel adsorbed proper tap-water to wipe the residual detergent until that there is no obvious dirt.
4. Use a dry soft to wipe the residual water.
5. Place the probe in ventilation and shady environment for air drying.

16.2.2.4 Cleaning for TEMP probe

1. Use the soft cloth adsorbed proper detergent to wipe the contact position between the probe and the patient

until that there is no obvious dirt.

2. After cleaning, please use the new cloth or paper towel adsorbed proper tap-water to wipe the residual detergent until that there is no obvious dirt.
3. Use a dry soft to wipe the residual water.
4. Place the probe in ventilation and shady environment for air drying.

16.3 Disinfection

To avoid extended damage to the device, disinfection is only recommended when stipulated as necessary in the Hospital Maintenance Schedule. The device should be cleaned firstly before disinfection.

Disinfectant recommended: alcohol(70%), isopropanol(70%).

If alcohol or isopropanol is used in both cleaning and disinfection, please cleaning cloth for disinfection.

Chapter 17 Maintenance

WARNING

- **The hospital or medical institution using the device should establish a perfect maintenance plan, otherwise it may result in device failure and unpredictable consequences, even endanger personal safety.**
- **All safety inspections or maintenance works to the components to be disassembled should be carried out by professional service personnel, otherwise it may result in device failure, even endanger personal safety.**
- **If any problem has been found, please contact the service person or our company.**

17.1 Check

The device should be completely checked before using, or after continuous use of 6 to 12 months, maintenance or upgrading, to ensure normal operation and working.

The items to be checked should include:

- Environment and power meet the requirements.
- No abrasion and good insulation performance for the power cord.
- No mechanical damage for the device and accessories.
- The accessories specified are used.
- Alarm functions are normal.
- The recorder works normally, the recording paper conforms with specified requirements.
- Battery performance.
- Each monitoring function is in good working state.
- Ground impedance and leakage current conform requirements.

If any signs of damage to the instrument can be found, please don't use the monitor to perform any monitoring on the patient. And contact the medical engineer of the hospital or the maintenance engineer of the company.

All inspections that require to open the device must be carried out by qualified service personnel. Safety and maintenance inspections may also be carried out by personnel of the Company.

17.2 Troubleshooting

- **Power failure**

Install the battery when using the device. As if the mains is disconnected, the device supplied power by the battery, which only sustains a period of time, and it will be automatically switched to mains when it is connected. A low battery voltage will trigger a high-tech alarm "Low battery", and it will shut down after the first alarm (about 5 minutes), then all trend data will be lost.

- **Troubleshooting**

Other problems related to ECG measurement

Symptoms	Possible reasons and solutions
Noisy ECG signal or no QRS waveform is checked.	• Make sure that the patient does not tremble. Incorrect ECG filter. • The electrode is poor in quality or placed in a wrong position. Check the electrodes, cables and their placement. Refer to "ECG

	Monitoring" for details. • Replace a lead. Remove the ECG cable from the interface and insert it again.
Thick ECG baseline.	ECG cable is looped. Other power cables are close to ECG lead cables. Inappropriate power frequency.

Other problems related to RESP measurement

Symptoms	Possible reasons and solutions
Failure in RESP measurement.	• Check electrode quality and placement. • Other electrical equipment may interfere the measurement.

Other problems related to NIBP measurement

Symptoms	Possible reasons and solutions
NIBP measurement can not be performed.	• Check whether the cuff is bent, stretched, squeezed, or loose. • Use a cuff in proper size.

Other problems related to TEMP measurement

Symptoms	Possible reasons and solutions
Failure in TEMP measurement.	• Check whether a appropriate probe is used. • Try the other one.

Other problems related to SpO_2 measurement

Symptoms	Possible reasons and solutions
The signal is weak.	• Check the probe and its placement. • Note that skin pigmentation can cause deviations. • Make sure the patient is not trembling.

Other problems related to battery

Symptoms	Possible reasons and solutions
Battery working time significantly shortens.	• Maintain the battery according to the descriptions in the manual

Other conditions

Other possible conditions and reasons are listed in the table.

Other operation problems

Symptoms	Possible reasons and solutions
The device can not print.	• The battery power is low and the host is not connected to AC.
The measurement value does not display.	• Check if you have selected the required parameters for the waveform or digital area.
The device can not turn on.	• Check whether the power cord is connected correctly. • Check the fuses and replace them if necessary.
The screen stop in LOGO interface.	• Replace the mainrboard, or contact the engineer to re-brush the mainboard program.

17.3 Maintenance plan

The following tasks can only be performed by the professional maintenance staff authorized by our company. Please contact the service personnel when you need the following maintenance. Before test or maintenance, the device must be cleaned and disinfected.

Check/maintenance items	Frequency
Safety check according to IEC60601-1.	When replacing the power supply or after the device falls off.
NIBP air leakage check.	At least once per two years, or check according to the provisions of the hospital.
NIBP pressure check.	At least once per two years, or check according to the provisions of the hospital.
NIBP calibration.	At least once per two years, or check according to the provisions of the hospital.
TEMP calibration.	At least once per two years, or check according to the provisions of the hospital.

Chapter 18 Accessories

WARNING

- **Use only the accessories specified in this chapter, as other accessories may damage the monitor or fail to meet the specifications stated in this manual.**
- **Disposable accessories can only be used once, repeated use may lead to performance degradation or cross infection.**
- **If you find any damage to the accessories packing or accessories, please do not use the accessories.**

18.1 ECG Accessories

Accessory No.	Accessory name	Description	Remark
2.3.04.00005	5-lead, American Standard, TPU, gold-plated button-type	Repeatable	/
2.3.04.00006	5-lead, European standard, TPU, gold-plated button-type		
2.3.04.00007	5-lead, American Standard, TPU, children's gold-plated clip-type		
2.3.04.00008	5-lead, European Standard, TPU, children's gold-plated clip-type		
2.3.05.00354	Veterinary ECG clip	Repeatable	/

18.2 SpO_2 Accessories

SpO_2 probe

Accessory No.	Accessory name	Description	Remark
2.3.08.00065	Digital tongue-clip SpO_2 probe (CMS-N-SPO2 6P, 3M, yellow)	Repeatable	/

18.3 NIBP Accessories

Airway tube

Accessory No.	Accessory name	Description	Remark
2.3.11.00064	NIBP extension tube, L = 3 m (direct-plug connector and fast connector(female))	Repeatable	/

Cuff

Accessory No.	Accessory name	Description	Remark
2.3.11.00001	Neonatal cuff, repeatable	Limb perimeter(6~11 cm)	/
2.3.11.00002	Infants cuff, repeatable	Limb perimeter(10~19 cm)	
2.3.11.00003	Children cuff, repeatable	Limb perimeter(18~26 cm)	
2.3.11.00004	Adult cuff, repeatable	Limb perimeter(25~35 cm)	
2.3.11.00005	Adult cuff, repeatable, large size	Limb perimeter(33~47 cm)	
2.3.11.00006	Leg cuff for adult, repeatable	Limb perimeter(46~66 cm)	

18.4 TEMP Accessories

TEMP probe

Accessory No.	Accessory name	Description	Remark
2.3.06.00013	R25=2.252K temperature probe, body surface type, CMS-N-TEMP 2P, PVC, L = 3 m	Repeatable	/
2.3.06.00014	R25=2.252K temperature probe, body cavity type, CMS-N-TEMP 2P, PVC, L = 3 m		

Chapter 19 Default Settings

This appendix documents the most important default settings of your monitor as it is delivered from the factory. For a comprehensive list and explanation of default settings, see the Configuration Guide supplied with your monitor. The monitor's default settings can be permanently changed in Configuration Mode.

NOTE:

- **If your monitor has been ordered preconfigured to your requirements, the settings at delivery will be different from those listed here.**

19.1 Alarm and Measurement Default Settings

Settings are only entered once per table row if they are the same for all patient categories.

19.2 Alarm

Name	Factory Default
ALARM VOL	1
ALM REC TIME	32 s
ALM PAUSE TIME	2 min
ALM TYPE	UNLATCH
KEYVOL	1
ALM SOUND	ON

19.3 ECG

Name	Factory Default		
	OTHER	DOG	CAT
FILTER	Monitor		
HR ALM	ON		
ALM LEV	MED		
ALM REC	OFF		
ALM HI	120 bpm	160 bpm	200 bpm
ALM LO	50 bpm	75 bpm	100 bpm
HR FROM	AUTO		
HR CHANNEL	CH1		
LEAD TYPE	5 LEADS		
SWEEP	25.0 mm/s		

Arrhythmia analysis

Name	Factory Default		
	OTHER	DOG	CAT
ARR ANAL	OFF		
PVCS ALM	OFF		
ALM LEV	MED		
ALM REC	OFF		

ALM HI	10

ST-segment analysis

Name	Factory Default		
	OTHER	DOG	CAT
ST ANAL	OFF		
ST ALM	OFF		
ST ALM LEV	MED		
ST ALM SEC	OFF		
ST ALM HI	0.20		
ST ALM LO	-0.20		

19.4 RESP

Name	Factory Default		
	OTHER	DOG	CAT
ALM	ON		
ALM LEV	MED		
ALM REC	OFF		
ALM HI	30 rpm		100 rpm
ALM LO	8 rpm		30 rpm
SWEEP	25 mm/s		
APENA ALM	20 s		
WAVE AMP	X1		
RESP FROM	LL-RA		

19.5 SpO_2

Name	Factory Default		
	OTHER	DOG	CAT
SpO_2 ALM	ON		
ALM LEV	HI		
ALM REC	OFF		
SpO_2 ALM HI	100		95
SpO_2 ALM LOW	90		80
SWEEP	25 mm/s		
PR ALM	ON		
PR ALM HI	120 bpm	160 bpm	200 bpm
PR ALM LO	50 bpm	75 bpm	100 bpm

19.6 NIBP

Name	Factory Default		
	OTHER	DOG	CAT

ALM	ON		
ALM LEV	MED		
ALM REC	OFF		
SYS ALM HI	160 mmHg	120 mmHg	90 mmHg
SYS ALM LO	90 mmHg	70 mmHg	40 mmHg
MEAN ALM HI	110 mmHg	90 mmHg	70 mmHg
MEAN ALM LO	60 mmHg	50 mmHg	25 mmHg
DIA ALM HI	90 mmHg	70 mmHg	60 mmHg
DIA ALM LO	50 mmHg	40 mmHg	20 mmHg
UNIT	mmHg		
INTERVAL	MANUAL		
INFLATION	150 mmHg	100 mmHg	70 mmHg

19.7 TEMP

Name	Factory Default		
	OTHER	DOG	CAT
ALM	ON		
ALM LEV	MED		
ALM REC	OFF		
T1 HI	39.0		
T1 LO	36.0		
T2 HI	39.0		
T2 LO	36.0		
TD HI	2.0		
UNIT	℃		

Appendix A Product Specification

A.1 Classification

Anti-electroshock type	Class I, internal and external powered equipment
Anti-electroshock degree	Type CF defibrillation-proof applied part
Harmful liquid proof degree	IPX0
Working mode	Continuous working

A.2 Physical characteristic

Device model	Dimension(L×W×H)	Weight
CMS8000VET	314mm×145mm×264mm	<3.0 kg(excluding accessories)

A.3 Working environment

If used or stored outside the specified temperature and humidity range, the device may not meet the performance specifications listed here.

Working environment	
Temperature	+5~+40 ℃
Humidity	30~75 %
Atmospheric pressure	700~1060 hPa
Storage environment	
Temperature	-40~+55 ℃
Humidity	≤95 %(no coagulation)
Atmospheric pressure	500~1060 hPa

A.4 Power supply

Input voltage	100–240 V ～
Frequency	50/60 Hz
Input power	≤150 VA
Fuse	FUSE T1.6AL250V
Internal battery	
Battery type	Li-ion battery
Battery voltage	7.4 VDC
Battery capacity	5000 mAh
Minimum power supply time	120 min Working conditions: use a new fully charged battery, ambient temperature: 25 ℃. Device configuration: continuous measurement for ECG and SpO_2; NIBP measurement in AUTO mode, measurement interval: 15 minutes
Charging time	90%: about 4 hours,fully charged: 5 hours

A.5 Display

Dimension(diagonal)	12.1 inch, color TFT display
Resolution	800×600
Display information	Up to 8-channel waveform

A.6 LED on host

Alarm indicator	One alarm indicator(red / yellow)
Battery indicator	One
AC power indicator	One

A.7 Recorder (Option)

Recorder type	Thermal dot-matrix
Waveform	2-channel
Recording width	48 mm
Paper length	20 m
Paper speed	25 mm/s、50 mm/s
Recording type	Continuous real-time recording 8-second real-time recording Auto 8-second recording Parameter alarm recording Waveform freeze recording Trend graph/table recording ARR events review recording Alarm event review recording NIBP review recording SD card review recording Drug calculation and titration table recording

A.8 Data storage

Trend recall	Short: 1 hour, resolution: 1 second
	Long: 480 hours, resolution: 1 minute
Alarm event recall	Physiological alarm: review for 71 alarm events of all parameters and 8/16/32-second of corresponding waveform. Technical alarm: 500 technical alarm events
Arrhythmia alarm event review	Review for 60 arrhythmia alarm events and 8-second of corresponding waveform.
NIBP measurement review	Review for the latest 4800 groups of NIBP data
SD card review	Trend data review: resolution: 1 minute 72-hour ECG waveform

A.9 ECG

Lead mode	3-lead: I, II, III 5-lead: I, II, III, aVR, aVL, aVF, V
Waveform	3-lead: 1-channel waveform 5-lead: 2-channel waveform, up to 7-channel waveform can be displayed on one display.
Lead style	AHA(American standard), IEC(European standard)

Sensitivity	2.5 mm/mV(×0.25),5 mm/mV(×0.5),10 mm/mV(×1),20 mm/mV(×2), 40 mm/mV(×4)	
Scan speed	12.5 mm/s, 25 mm/s, 50 mm/s	
Frequency response (bandwidth)	Diagnosis: 0.05~75 Hz(+0.4 dB, -3 dB); 76~150 Hz(+0.4 dB,-4.5 dB) Monitoring: 0.67~40 Hz(+0.4 dB, -3 dB) Surgery: 1~20 Hz(+0.4 dB, -3 dB)	
CMRR	Monitoring: ≥100 dB Surgery: ≥100 dB Diagnosis: ≥90 dB	
NOTCH	50/60 Hz(NOTCH filter can be turned on or off manually)	
Lead-off check	DC for active lead: ≤0.1 μA	
Baseline recovery time	After defibrillation ≤5 s(under monitoring and surgery)	
Calibration signal	1 mV(peak-to-peak value), accuracy: ±5 %	
Pacing pulse		
Pulse display	II lead	
Pulse indicator	Pulse is marked if the requirements of ANSI/AAMI EC13:2002, Sect. 4.1.4.1 are met: Amplitude: ±2~±700 mV Width: 0.1~2 ms Rise time: 10~100 μs	
Pulse Rejection	Pulse is rejected if the requirements of ANSI/AAMI EC13-2002: Sect. 4.1.4.1 are met: Amplitude: ±2~±700 mV Width: 0.1~2 ms Rise time: 10~100 μs	
Minimum input slew rate	4 V/s RTI	
Alarm limit	**Range(bpm)**	**Step(bpm)**
HR high limit	OTHER: (low limit+1)~300 DOG / CAT: (low limit+1)~350	1
HR low limit	15~(high limit-1)	
HR		
Measurement limit	OTHER: 15~300 bpm DOG / CAT: 15~350 bpm	
Accuracy	±1 % or ±1 bpm, whichever is greater	
Resolution	1 bpm	
Alarm accuracy	±2 bpm	
Maximum suppression ability for T wave	1.2 mV	

HR mean	In the RR interval within the latest 6 seconds, take the average value after removing the maximum and minimum values. The heart rate displayed on the screen is refreshed in every second.
Response time for heart rate meter to HR change	80 to 120 bpm: < 8 s 80 to 40 bpm: < 8 s
Heart rate meter accuracy and response to irregular rhythm	After stable phase(20s), the HR values are: Bigeminy ventricular: 80 bpm±1 bpm Bigeminy ventricular alternative lente: 60 bpm±1 bpm Bigeminy ventricular alternative rapid: 120 bpm ±1 bpm Systoles bidirectional: 95 bpm±1 bpm
Time to ALARM for tachycardia	
Tachycardia ventricular: amplitude =1 mV(p-v), heart rate =206 bpm	Gain 1.0: 8 s
	Gain 0.5: 8 s
	Gain 2.0: 8 s
Tachycardia ventricular : amplitude =2 mV(p-v), heart rate =195 bpm	Gain 1.0: 8 s
	Gain 0.5: 8 s
	Gain 2.0: 8 s
Arrhythmia type	ASYSTOLE, BIGEMINY, VFIB/VTAC, TRIGEMINY, PVC, R ON T, COUPLET, MISSED BEATS, VT>2, PNC, TACHY, PNP, BRADY
ST-segment measurement	
Measurement range	-2.0 mV~+2.0 mV
Accuracy	-0.8 mV~+0.8 mV: ±0.04 mV or ±10 %, whichever is greater. Other range: unspecified

A.10 RESP

Measurement method	Impedance
Waveform gain	2.5 mm/mV(×0.25),5 mm/mV(×0.5),10 mm/mV(×1),20 mm/mV(×2), 40 mm/mv(×4)
Measurement impedance range	0.3~5 Ω
Base line impedance range	500~2500 Ω
Differential input impedance	>2.5 MΩ
Bandwidth	0.2~2.5 Hz
Scan speed	6.25 mm/s, 12.5 mm/s, 25 mm/s
RR	
Measurement range	0~150 rpm
Resolution	1 rpm
Accuracy	±2 rpm

Apnea alarm	10~40 s	
Alarm limit	**range(rpm)**	**Step(rpm)**
Alarm high limit	OTHER: (low limit+1)~ 120 DOG / CAT: (low limit+1)~150	1
Alarm low limit	OTHER: 0~(high limit-1) DOG / CAT: 0~(high limit-1)	

A.11 NIBP

Measurement method	Oscillometric			
Working mode	Manual, Auto, STAT			
Measurement Interval in AUTO Mode	1, 2, 3, 4, 5, 10, 15, 30, 60, 90, 120, 240, 480, 960 min			
Measuring Period in STAT Mode	5 min			
Measurement parameters	SYS, DIA, MEAN			
NIBP measurement range(mmHg)		OTHER	DOG	CAT
	Systolic pressure	40~270	40~200	40~135
	Diastolic pressure	10~215	10~150	10~100
	Mean pressure	20~235	20~165	20~110
Accuracy	Maximum mean error: ±5 mmHg Maximum Standard deviation: 8 mmHg			
Pressure resolution	1 mmHg			
Cuff pressure accuracy	±3 mmHg			
Over-pressure protection	OTHER Mode: 297 mmHg±3 mmHg DOG Mode: 240 mmHg±3 mmHg CAT Mode: 147 mmHg±3 mmHg			
Alarm limit	**Range(mmHg)**			**Step(mmHg)**
High limit of systolic pressure	OTHER: (low limit+1)~270 DOG: (low limit+1)~200 CAT: (low limit+1)~135			1
Low limit of systolic pressure	40~(high limit-1)			
High limit of diastolic pressure	OTHER: (low limit+1)~270 DOG: (low limit+1)~150 CAT: (low limit+1)~215			
Low limit of diastolic pressure	10~(high limit-1)			
High limit of mean pressure	OTHER: (low limit+1)~235 DOG: (low limit+1)~165 CAT: (low limit+1)~110			
Low limit of mean pressure	20~(high limit-1)			

A.12 SpO_2

Measurement and display range	0~100 %	
Resolution	1 %	
Accuracy	70~100 %: ±2 %; 0~69 %: unspecified;	
Updating cycle	About 1 s	
Alarm limit	**Range(%)**	**Step(%)**
SpO_2 high limit	(low limit+1)~100	1
SpO_2 low limit	0~(high limit-1)	
PR		
Measurement and display	25~250 bpm	
Resolution	1 bpm	
Accuracy	±2 bpm or ±2%, whichever is greater	
Updating cycle	1 s	
Alarm limit	**Range(bpm)**	**Step(bpm)**
PR high limit	(low limit+1)~250	1
PR low limit	0~(high limit-1)	

A.13 TEMP

Measurement method	Thermistor method	
Channel	Dual-channel	
Probe type	YSI-2.252 K	
Measurement site	Body surface probe: armpit Body cavity probe: oral, rectum	
Measurement range	0~50 ℃	
Resolution	0.1 ℃	
Accuracy	±0.1 ℃	
Updating cycle	About 1 s	
Response mean time	<10 s	
Alarm response time	≤2 min	
Unit	℃ or °F	
Alarm limit	**Range(℃)**	**Step(℃)**
T1/T2 high limit	(low limit +1)~50	1
T1/T2 low limit	0~(high limit-1)	
TD high limit	0~50	

Appendix B System Alarm Prompt

PROMPT	CAUSE	MEASURE
"XX HIGH"	XX value exceeds the higher alarm limit.	Check if the alarm limits are appropriate and the current situation of the patient.
"XX LOW"	XX value is below the lower alarm limit.	
XX represents the value of parameter such as HR, ST1, ST2, RR, SpO_2, NIBP, etc. in the system.		
"ECG saturation, the signal is invalid"	ECG signal exceeds the measurement range.	Check the connection between the electrode and lead cable; Check the patient' condition.
"ECG WEAK SIGNAL"	The ECG signal of the patient is too small so that the system can not perform ECG analysis.	Check the connection between the electrode and lead cable; Check the patient' condition.
"RESP APNEA"	The respiration signal of the patient is too small so that the system cannot perform RESP analysis.	Check the connection of the linking wire and the current situation of the patient.
"ASYSTOLE"	Patient suffers from Arr. Of ASYSTOLE.	Check the patient' condition; Check the connection between the electrode and lead cable.
"VFIB/VTAC"	Patient suffers from Arr. of VFIB/VTAC.	Check the patient' condition; Check the connection between the electrode and lead cable.
"COUPLET"	Patient suffers from Arr. of COUPLET.	Check the patient' condition; Check the connection between the electrode and lead cable.
"BIGEMINY"	Patient suffers from Arr. Of BIGEMINY.	Check the patient' condition; Check the connection between the electrode and lead cable.
"TRIGEMINY"	Patient suffers from Arr. of TRIGEMINY.	Check the patient' condition; Check the connection between the electrode and lead cable.
“R ON T ”	Patient suffers from Arr. of R ON T.	Check the patient' condition; Check the connection between the electrode and lead cable.
"TACHY"	Patient suffers from TACHY.	Check the patient' condition; Check the connection between the electrode and lead cable.
"BRADY"	Patient suffers from BRADY.	Check the patient' condition; Check the connection between the electrode and lead cable.
"VT>2"	Patient suffers from Arr. of VT>2.	Check the patient' condition; Check the

		connection between the electrode and lead cable.
“MISSED BEATS”	Patient suffers from Arr. of MISSED BEATS.	Check the patient' condition; Check the connection between the electrode and lead cable.
"PNP"	The pacemaker is not paced.	Check the connection of the pacemaker; check the connection between the electrode and lead cable; check the patient' condition.
"PNC"	No pacemaker signal is captured.	Check the patient' condition; Check the connection between the electrode and lead cable.
"ECG LEAD OFF or RESP LEAD OFF"	RL lead of ECG is not connected correctly or ECG lead is not connected correctly.	Check the connection of RL lead or ECG lead cable.
"V LEAD OFF"	The V lead of ECG is not connected correctly.	Check the connection of V lead.
"LL LEAD OFF"	The LL lead of ECG is not connected correctly.	Check the connection of LL lead.
"LA LEAD OFF"	The LA lead of ECG is not connected correctly.	Check the connection of LA lead.
"RA LEAD OFF"	The RA lead of ECG is not connected correctly.	Check the connection of RA lead.
"RESP LEAD OFF"	At least one lead among RA, RL and LL is not connected correctly.	Check the connection of RA, RL or LL lead.
"SpO_2 SENSOR OFF"	SpO_2 sensor is not connected correctly.	Check the connection of SpO_2 sensor.
"SpO_2 SEARCHING PR"	SpO_2 sensor is not connected correctly or the patient's arm is moving.	Check the connection of SpO_2 sensor; Check the patient' condition.
"SpO_2 SEARCH TIMEOUT"	The pulse signal of the patient is too small so that the system cannot perform pulse signal analysis.	Check the connection of sensor; Check the patient' condition.
"T1 SENSOR OFF"	T1 sensor is not connected correctly.	Check the connection of T1 sensor.
"T2 SENSOR OFF"	T2 sensor is not connected correctly.	Check the connection of T2 sensor.
"ECG NOISE"	larger interference signals appear	Check the connection of ECG lead cable;

	in the ECG signals.	Check the current situation of the patient. Check if the patient moves a lot.
"XX COMM ERR"	XX module can't communicate normally with the host.	Re-start up the monitor, if the error still exists, contact the manufacturer.
XX represents all the parameter modules in the system such as ECG, NIBP, SpO_2, etc.		
"KEYBOARD COMM ERR"	The keyboard has failures, which cannot be used.	Contact the manufacturer for repair.
"WIRELESS CONNECT ERROR"	The network part in the system appear problems, so the system can't achieve network function.	Contact the manufacturer for repair.
"CAN'T FIND WIRELESS DEVICE"		
"LOW POWER"	Low battery.	Charge the battery by connecting the AC cord.
"RECORDER OUT OF PAPER"	No recording paper	Install the recording paper.
"RECORDER ERROR"	The recorder communicates abnormally.	Turn off the device and restart it.
"NIBP INIT ERR"	NIBP initialization error	Execute the reset program in the NIBP menu. If the failure still exists, contact the manufacturer for repair.
"NIBP SELFTEST ERR"		
"NIBP ILLEGALLY RESET"	During NIBP measurement, illegal reset occurs.	Check the airway of NIBP to check if there are clogs. Then measure again, if the failure still exists, contact the manufacturer for repair.
"NIBP COMM ERR"	The NIBP communication part has problem.	Execute the reset program in the NIBP menu. If the failure still exists, contact the manufacturer for repair.
"NIBP LOOSE CUFF"	The NIBP cuff is not connected correctly.	Re-connect the NIBP cuff.
"NIBP AIR LEAK"	The NIBP cuff is not connected correctly or there are leaks in the airway.	Check the connection of each part or replace with a new cuff. If the failure still exists, contact the manufacturer for repair.
"NIBP AIR PRESSURE ERROR"	Problem happens when measuring the curve. The system can't perform measurement, analysis or calculation.	Check the connection of each part or replace with a new cuff. If the failure still exists, contact the manufacturer for repair.
"NIBP WEAK SIGNAL"	Problem happens when measuring the curve. The system	Check if the setup of patient type is correct. Check the connection of each part or replace

	can't perform measurement, analysis or calculation.	with a new cuff. If the failure still exists, contact the manufacturer for repair
"NIBP RANGE EXCEEDED"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check the connection of each part or replace with a new cuff. If the failure still exists, contact the manufacturer for repair.
"NIBP EXCESSIVE MOTION"	The patient's arm moves.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
"NIBP OVER PRESSURE"	Perhaps folds exist in the airway.	Check for the smoothness in the airway and patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
"NIBP SIGNAL SATURATED"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
"NIBP TIME OUT"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
"NIBP CUFF TYPE ERR"	Perhaps the used cuff does not fit the patient type sey.	Check if the patient type is set up correctly. Check whether the cuff conforms to the patient's type.
"NIBP PNEUMATIC LEAK"	NIBP airway has leaks.	Check the connection of each part or replace with a new cuff. If the failure still exists, contact the manufacturer for repair.
"MEASURE FAIL"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
"NIBP SYSTEM FAILURE"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.

Appendix C Abbreviations

C.1 Unit list

Abbreviation	Description
µA	microampere
µV	microvolt
A	ampere
Ah	ampere hour
bpm	beat per minute
ºC	centigrade
cm	centimeter
dB	decibel
ºF	fahrenheit
g	gram
h	hour
Hz	hertz
inch	inch
k	kilo
kg	kilogram
kPa	kilopascal
L	litre
lb	pound
m	meter
mAh	milliampere hour
mcg	microgram
mEq	milli-equivalents
mg	milligram
min	minute
ml	milliliter
mm	millimeter
mmHg	millimeters of mercury
cmH_2O	centimeters of water
ms	millisecond
mV	millivolt
mW	milliwatt
MΩ	megaohm
nm	nanometer
rpm	breaths per minute

s	second
V	volt
VA	volt ampere
Ω	ohm
W	watt

C.2 Terminology list

Abbreviation	Description
AC	alternating current
Adu	adult
AHA	American Heart Association
aVF	left foot augmented lead
aVL	left arm augmented lead
aVR	right arm augmented lead
BP	blood pressure
CMS	central monitoring system
COHb	carboxyhemoglobin
DC	direct current
Dia	diastolic
DPI	dot per inch
ECG	electrocardiograph
EMI	electromagnetic interference
ESD	electro-static discharge
ESU	electrosurgical unit
HR	heart rate
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
LA	left arm
LCD	liquid crystal display
LED	light emitting diode
LL	left leg(electrode)
MAP	mean arterial pressure
MetHb	methemoglobin
MRI	magnetic resonance imaging
N/A	not applied
Neo	neonate
NIBP	noninvasive blood pressure
oxyCRG	oxygen cardio-respirogram

Ped	pediatric
Pleth	plethysmogram
PR	pulse rate
PVC	premature ventricular contraction
RA	right arm
Rec	record, recording
Resp	respiration
RL	right leg(electrode)
RR	respiration rate
SpO_2	arterial oxygen saturation from pulse oximetry
SV	stroke volume
SYS	systolic pressure
TD	temperature difference
Temp	temperature
USB	universal serial bus