

Multi-Parameter Patient Monitor User Manual

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CHAPTER 1: OVERVIEW

Welcome to use the Multi-Parameter Patient Monitor! The main purpose of this manual is to provide operating guide, instrument repair and maintenance information to users. The detailed performance indexes, routine installation, operation and maintenance method as well as safety information are illustrated in this manual. Before use, the operator shall carefully read this manual in order to properly and correctly operate this monitor, so that it can reach specified safety standards and performance indexes.

.1 Brief Introduction

The Multi-Parameter Patient Monitor is a multifunctional overall physiologic index monitor, which is applicable to monitor the C.O., CSI, ECG, NIBP, SpO₂, IBP, PR, RESP, TEMP and CO₂ in hospitals.

This product has the multi-parameter function which can be selected, combined and configured by the user according to his requirements (but the Multi-Parameter Patient Monitor which you are using probably only had part parameters and corresponding accessories selected by you when you bought it).

This product is composed of main machine and corresponding functional accessories such as ECG cable, blood pressure cuff, SpO₂ sensor, body temperature sensor, BP hose, IBP sensor, dehydration vase and sampling line.

This product has three input/output connectors for printer, network communication and external VGA monitor (option).

The intended use of this monitor is to monitor following parameters for single adult, pediatric and neonatal patient, to display patient data and waveforms, to store patient data in a trend database, and to generate alarms and recordings.

The Multi-Parameter Patient Monitor can be used to monitor the major parameters such as cardio output (C.O.), consciousness (CSI), electrocardiogram (ECG), body temperature (TEMP), impedance respiration (RESP), oxygen saturation (SpO₂), arterial blood pressure (IBP), noninvasive blood pressure (NIBP) and CO₂ (EtCO₂ and FiCO₂). It integrates the parameter measurement, display and record export as a whole, which forms a compact and portable monitor.

The monitor is capable of monitoring the following parameters:

- Anesthesia depth parameter (option): consciousness status index(CSI), electromyographic index(EMG), signal quality index(SQI), burst suppression prompt(BS), electrode impedance;
- Electrocardiogram (ECG): heart rate (HR), 7 , 3 or 12 leads ECG waveforms and ST segment analysis.
- Arterial blood pressure (IBP) (option):systolic pressure (SYS), diastolic pressure (DIA) and mean arterial pressure (MAP).
- Noninvasive blood pressure (NIBP): systolic pressure (SYS), diastolic pressure (DIA) and mean arterial pressure (MAP).
- Body temperature (TEMP): temperature of channel 1 (T1), temperature of channel 2 (T2) and temperature difference between the two channels (ΔT).
- Pulse oxygen saturation (SpO₂): SpO₂, pulse rate (PR) and SpO₂ plethysmogram.
- Respiration: respiration rate (RR) and respiration (impedance respiration or nasal tube respiration) waveform.
- Carbon dioxide (CO₂) (option): end-tidal carbon dioxide (EtCO₂), fractional inspiratory carbon dioxide (FiCO₂) and CO₂ waveform.



.2 Safety Information

.2.1 Classification

According to the type of protection against electric shock:

----- CLASS I, INTERNALLY POWERED EQUIPMENT.

According to the degree of protection against electric shock:

----- TYPE BF APPLIED PART or TYPE CF APPLIED PART. The connector with a symbol  beside is TYPE BF APPLIED PART; the connector with a symbol  beside is TYPE CF APPLIED PART.

According to the degree of protection against ingress of water:

----- Not protected (ordinary).

According to the method(s) of sterilisation or disinfection recommended by the manufacturer.

----- Equipment with method(s) of sterilisation or disinfection recommended by the manufacturer.


According to the degree of safety of application in the presence of a FLAMMABLE ANAESTHETIC MIXTURE WITH AIR or WITH OXYGEN OR NITROUS OXIDE:


----- EQUIPMENT not suitable for use in the presence of a FLAMMABLE ANAESTHETIC MIXTURE.

According to the mode of operation:

----- CONTINUOUS OPERATION.

.2.2 Prohibition

The marked symbol  on the Monitor means: Attention, consult accompanying documents (this manual).

Anywhere marked with  in the manual, means when you using this equipment, you shall pay more attention on it in order to guarantee the safety of the patient, operator or equipment.


WARNING


 **Do not use the Multi-Parameter Patient Monitor during the magnetic resonance imaging (MRI) or CT inspection process.**

 **Do not use this monitor in the presence of inflammable anesthetics or gases.**

.2.3 Cautions

WARNING











 **In order to make the monitor safe grounding, the hospital must provide the power socket with complete wire under voltage, zero line and protective grounding in accordance with national standard. Or the hospital bears all consequences.**

 **To ensure patient safety, verify the device and accessories can function safely and normally before use.**

 **To ensure patient safety, use only parts and accessories specified in this manual.**

 **Only qualified accessories can be used for the monitor.**

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-  In order to avoid losing time for diagnosis and treatment, please configure adequate alarm settings according to different conditions of each patient (for detailed setting methods, refer to ALARM SETTINGS in CHAPTER 6).
 -  When using the electrosurgery unit during the monitoring, the loop of the electrosurgery unit shall be properly connected to prevent from burning, even the life risk.
 -  The monitor must be operated on battery power if the external wiring is in doubt.
 -  When many parts of the monitor are connected each other or various equipments are connected to the same patient, pay attention to the danger of leakage current overlap.
 -  Magnetic and electrical fields are capable of interfering with the proper performance of the device. For this reason make sure that all external devices operated in the vicinity of the monitor comply with the relevant EMC requirements. Mobile phone, X-ray equipment or MRI devices are a possible source of interference as they may emit higher levels of electromagnetic radiation.
 -  **EXPLOSION HAZARD:** Do not use this device in the presence of flammable anesthetics, explosive substances, vapors or liquids.
 -  Keep the monitor dry, prevent it from water and humidity, and avoid strong collision. Once subject to accidental wetting, immediately clean the water offusing dishcloth.
 -  **ELECTRIC SHOCK:** Do not open the monitor housing. All servicing and future upgrades to this device must be carried out by personnel trained and authorized by our company only.
 -  Do not put the monitor in environments such as high temperature and high pressure, gas fumigation or liquid immersion. Before clean or sterilize the monitor, cut off the general power please.
 -  At the end of its service life, the product described in this manual, as well as its accessories, must be disposed of in compliance with the guidelines regulating the disposal of such products. If you have any questions concerning disposal of the products, please contact with us.
-
-

CHAPTER 2: INTRODUCTION

1. Screen Display

This monitor uses the high-resolution TFT color LCD, which can clearly display various physiological parameters and waveform of the patient. The standard interface of the monitor in the normal monitoring state is shown as Figure 2-6:

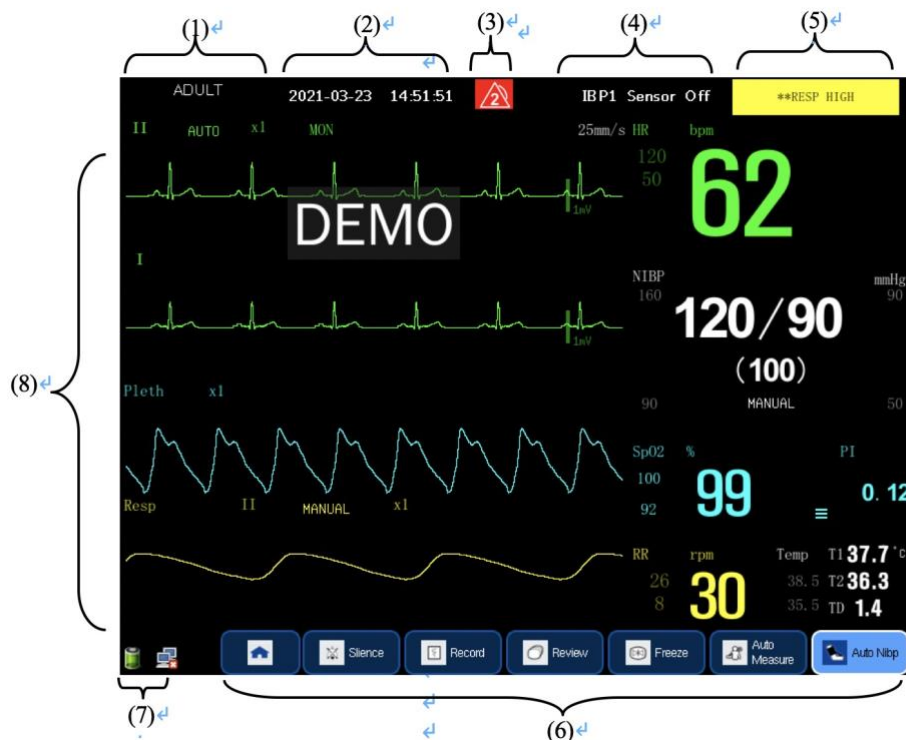


Figure 2-6

- (1) Display department, bed number, patient name or patient type. Select this area to open the menu of Patient information.
- (2) System time
Display the system time of the monitor. Select this area to open the menu of Time Setup.
- (3) The alarm status
、 or Physiological or technical alarms enabled, represents alarm mute, Have no icon means that it has not alarms happen.
- (4) Technical alarm area
Display the technical alarm message, and cyclically display if there are more messages. Select this area to open the menu of Technical Alarms list.
- (5) Physiological alarm area
Display the physiological alarm message, and cyclically display if there are more messages. Select this area to open the menu of Physiological Alarms list.
- (6) Intelligent hot key area
Display the intelligent hot keys, which are mainly used for shortcut operations.
- (7) Prompt message area

Display the network status icon and the battery status icon.

(8) Waveform and parameter area

Mainly display the waveforms of the physiological parameters and the corresponding measured parameter values. The icon of the parameter name is located at the top left corner of each channels.

.2 Intelligent Hot Keys

Intelligent hot keys are graphic hot keys displayed at the bottom of the main screen for the monitor, enabling you to quickly and easily access to certain functions. This monitor displays the following intelligent hot keys as Figure 2-7:






Figure 2-7

.3 Batteries


This monitor designed to operate on battery power during intra-hospital patient transfer or whenever the power supply is interrupted. The battery is charged automatically when the monitor is connected to AC power, no matter the monitor is powered on or not. If remove AC power excess 30s, then AC power is not applied to the monitor and AC power indicator is off.

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

-  and  : the battery is installed in the battery case of the monitor, and the green part indicates the battery capacity;
-  (red, flashing): the battery is not installed in the battery case of the monitor, or the battery will run out.

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

- Orange: The battery is being charged.
- Green: The battery is fully charged.
- OFF: No battery is installed or the battery is installed but the monitor is not connected to AC power.

The capacity of the battery is limited. When the battery capacity is too low, a flashing red symbol  shows in the status bar. At this moment, the AC power shall be applied to the monitor.

.3.1 Battery maintenance

.3.1.1 Conditioning a Battery

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

To condition a battery, follow this procedure:

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



.3.1.2 Checking a Battery

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

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

Please contact with the maintenance personnel if its operating time is significantly lower than the specified time.

NOTE


-  **Life expectancy of a battery depends on how frequent and how long it is used. For a properly maintained and stored lead-acid or lithium ion battery, its life expectancy is about 2 or 3 years respectively. For more aggressive use models, life expectancy can be less. We recommend replacing the lithium ion batteries every 3 years.**
 -  **The battery might be damaged or malfunctioned if its operating time is too short after being fully charged. The operating time depends on the configuration and operation. For example, measuring NIBP more frequently will also shorten the operating time.**
-

.3.2 Battery Recycling

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





WARNING

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

Chapter 3: *INSTALLATION and MAINTENANCE*

WARNING

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

 If the monitor is connected to another electrical instrument and the instrument specifications cannot tell whether the instrument combination is hazardous (e.g. due to summation of leakage currents), you should consult us or experts in the field to ensure the required safety of all instruments concerned.



NOTE

 The operations in this section are not all required. User-customized installation by authorized personnel is provided.

.1 Installation

.1.1 Unpacking and Inspection




Please open the package according to the positions marked on the packing case, and take out the monitor and accessories carefully.

-  Check the accessories against the packing list.
-  Check the monitor and accessories for any mechanical damage.

Contact the distributor immediately in case of any problem.

Friendly remind: Please save the packing case and packaging material for further transport and storage.

WARNING

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

.1.2 Environmental Requirements

The operating environment of the monitor must meet the requirements specified in ENVIRONMENTAL SPECIFICATIONS in APPENDIX A.

The environment where this monitor is to be used should be free from noise, vibration, dust, and corrosive or explosive and inflammable substances. Do not place the monitor against the wall, and do not plug up the dispersion holes on the back and two sides of the monitor for proper air circulation.

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

.2 Installation Method

.2.1 Connecting to AC Power Supply

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

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



WARNING



**Confirm the AC power supply is in conformity with the requirements of this equipment:
100-240V ~ 50/60Hz.**



Do not use three-wire to two-wire adapter with this instrument.



To avoid unexpected power interruption, do not use power outlet with a wall-mounted switch control.

.2.2 Equipotential Grounding

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



WARNING



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



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

.2.3 Connecting Patient Sensors and Probes

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



.2.4 Connecting the Network Cable

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

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



WARNING

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

.2.5 Replace the Fuse

1. Pull out the fuse socket.
2. Push up the fuse and replace it with a new one.
3. Push the fuse socket back .

.3 Powering ON the Monitor

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

1. Press the Power switch and the Power indicator is lighted on.
2. The boot-strap picture and wait a few seconds,the system displays the main screen.
3. At this time, you can operate the monitor using the keys and rotating mouse.


.4 Powering OFF the Monitor

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

1. Confirm the patient monitoring is finished.
2. Disconnect the cables and sensors between the monitor and the patient.
3. Press the Power switch, and the monitor will be powered off.



5 Maintenance

WARNING

-  The safety inspection or maintenance, which requires opening the monitor housing, must be performed by trained and authorized personnel only. Otherwise, equipment failure and possible health hazard may be caused.

.5.1 Inspection

WARNING

-  User should check the equipment, cables and probes for damage which may influence patient safety or the performance. The recommended checking cycle is one week or shorter. Replace the damaged before using.
-  Periodic security inspection should be carried out to test leakage current and insulation measurement. Recommended cycle is one year or you should undertake according the specified cycle and procedure by the institution.

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

Items to be inspected are:

- The environment and the power supply meet the specified requirements;
- The housing is clean and pollution free;
- Equipment, cables and probes for damage which may influence patient safety or the performance. Check and see if the cables or probes have crack before immersing in conducting liquid;
- Inspect the housing, keys, control knob, connectors and accessories for damage;
- Inspect the power cords for fraying or other damage and check the insulation;
- The grounding cables are correctly connected;
- Only specified accessories like electrodes, sensors and probes are applied;
- The monitor clock is correct;
- The audible and visual alarms functions normally.
- The printer functions normally and the printer paper meets the requirement;
- Inspect battery performance;
- All system functions are in good working condition.

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

.5.2 Probe Maintenance



Probes should be kept in dry and the temperature should lower than 45 °C .

Use probes with caution or you may damage the cover, crash the crystal and mechanical Parts, though

the probe is durable. Do not touch hard or pointed objects or bend it too much, for the sensor cover is made of plastic.

.5.3 Cleaning

WARNING



-  **Power off the monitor and disconnect the power cords from the outlet before cleaning probes;**
 -  **The maintenance, preventive inspection and cleaning work of SPO2 probe and NIBP cuff can be executed by users. For details, please refer to “Maintenance and Cleaning”.**
-

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

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

- **Diluted soap water**
- **Diluted ammonia water**
- **Diluted sodium hypochlorite (bleaching agent)**
- **Diluted formaldehyde (35 to 37%)**
- **Hydrogen peroxide (3%)**
- **Ethanol (70%) or Isopropanol (70%)**

WARNING

-  **concentration range from 500ppm (1: 100 diluted family use bleaching powder) to 5000ppm (1: 10 diluted family use bleaching powder) sodium hypochlorite is very effective, but the definite concentration is decided by how much organics (blood, plants and animal mucus) remaining on the monitor surface.**
 -  **The cleaning solutions above can only be used for general cleaning. If you use them to control infections, we shall assume no responsible for the effectiveness**
-

To avoid damage to the equipment, follow these rules:

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






.5.4 Disinfection

Disinfection or sterilization may cause damage to the equipment; therefore, conduct it only when it is included in the maintain plan, and clean the monitor before disinfection.

Recommended sterilization material: Alcohol based (Ethanol 70%, Isopropanol 70%), and aldehyde

based.

△ WARNING

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

Chapter 4: Menu Description

.1 Operation and Browsing

.1.1 Use of Knob

The knob can be used for the following operations:

- Rotation: clockwise or counterclockwise rotate to move the focus.
- Press: press the knob to execute a certain operation, such as entering a menu or executing a command.

The knob type main control keys are located in the main interface or menu. The highlighted block or box moving with the rotation of knob is called cursor. The cursor can be localized by rotating the knob in order to execute the desired operation.

.1.2 Use of Keys


The monitor is provided with three different types of keys:

- Soft keys: locations where the cursor can stay on interface, facilitating you to rapidly enter some menus or perform certain operations. They mainly include:
 - ◆ Parameter hot keys: they are used for selecting the parameter zone or waveform zone of certain parameter to enter the corresponding parameter setting menu.
 - ◆ Intelligent hot keys: physical shortcut keys that the user can configure. See Intelligent Hot Keys for details.
- Hard keys: physical keys on the monitor, such as main menu hard keys on the front panel, etc.
- Pop-up keys: menu keys related to the tasks, automatically appearing on the monitor screen if necessary. For example, confirmation pop-up key appearing when you need to confirm the change.

.1.3 Use of Touch Screen

Directly click the touch screen to easily and quickly complete some operations.

.2 Use of Main Menu

Press the key  on the monitor to open the “Main Menu” shown below. You can complete most of operations and settings through the “Main Menu” as Figure 4- 1 :

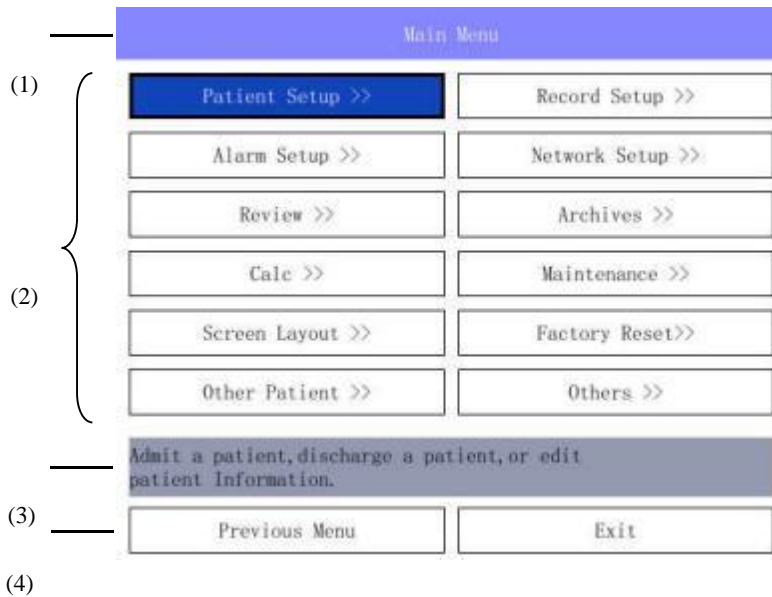


Figure 4- 1

The styles of various menus are similar to the main menu, which is generally composed of the following parts:

- (1) Menu title: Summary of current menu.
- (2) Main display area: Display options, buttons or prompt messages, etc.
“>>” indicates that you can enter the corresponding submenu.
- (3) Online help: Display help information according to the location of the cursor.
- (4) Confirm button area: Confirm the menu operation, and mainly include Return To Previous Menu, OK, Exit, Cancel and other keys.

.3 Operating Mode

The monitor has two operating modes.

- Monitoring mode

This is a daily operating mode when the patient is monitored. You can change some settings for different patients, such as alarm limit, parameter unit, etc. However, when in contact with the patient, the monitor will return the settings to the defaults according to the preset default settings.

- Demo mode

This mode is protected by a password and is only used for demonstration.

.4 Standby Mode

If you just want to temporarily interrupt monitoring, the monitor can be set to the standby mode.

To enter the standby mode:

- Expand the hot key, and select the monitor hot key “**Standby**”.

In the standby mode, the monitor suspends all alarms, all waveforms and values disappear on the screen, only the standby screen appears, but all settings and patient information still stay.

Click any point on the screen or any key to quit the standby mode. The monitor enters the monitoring mode to continue to monitor the patient.

.5 Measurement Setting

This section only introduces the general setting of measured parameters in the monitoring mode. For other specific function settings of various parameters, see the corresponding sections.

.5.1 Change of Parameter Settings

Each measured parameter have a setting menu. You can adjust all settings of this parameter in the submenu. Click each measured parameter in the parameter area to enter the setting menu of the parameter. For example, select the parameter area of SPO₂ to open the menu “SpO₂ Setup”.

The specific settings of each parameter are defined in the parameter setting menu, such as alarm limit, alarm switch, etc. You can respectively set different parameters as required.

.6 General Settings

General settings of the monitor refer to general settings defining how to make the monitor work, such as alarm volume, screen brightness. They often affect multiple measurements or display interfaces. Most of general settings can be defined in the configuration mode. This section mainly introduces some general settings in the monitoring or maintenance mode.

.6.1 System Time


Selecting the System time area of the screen to open the menu “Time Setup”, shown as Figure 4-2.



Figure 4-2

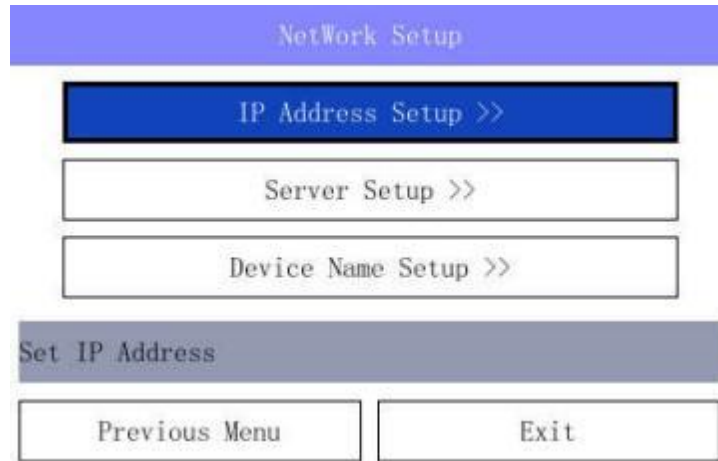
The Year, Month, Day, Hour, Minute and Second of the system time can be set in this menu.

NOTE

 **The changes to date and time will affect the storage of trends and events and may cause the loss of data.**

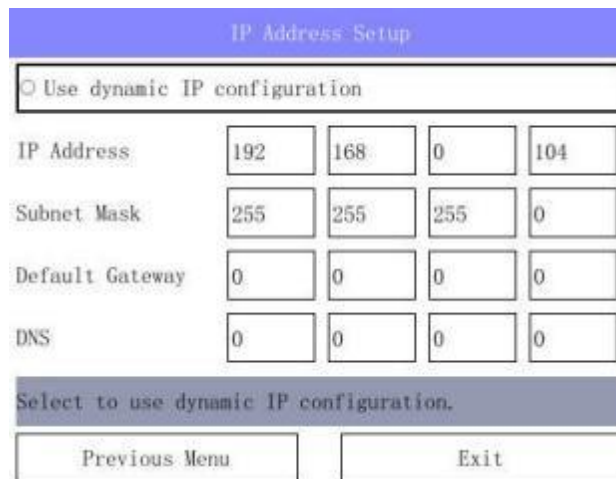
.6.2 Network Setup

In the “Main Menu”, select “Network Setup >>”.



.6.2.1 IP Address

Selecting IP Address in the Network Settings menu pops up the Network setting dialog box to set the IP address, shown as below.

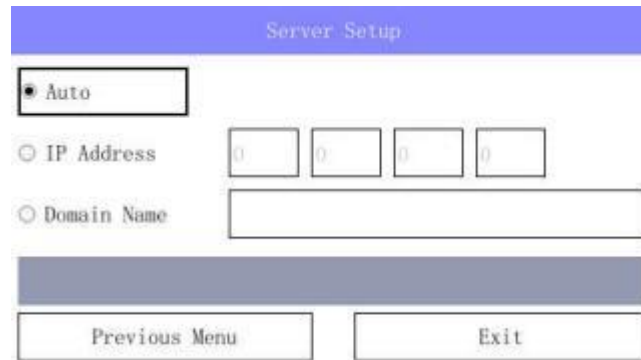


If “Use dynamic IP configuration (DHCP)” is selected, the monitor is distributed to an IP address automatically when it is turned on to prevent from the IP address conflict.

Set the IP address manually: Remove the selection of “Use dynamic IP configuration (DHCP)”, and then select the input field on the right side of “IP address” to set it manually. Select Ok button to confirm the selection, the monitor IP address will not change.

.6.2.2 Server

Selecting Server in the Network Settings menu pops up the Server Setup dialog box where the address of the central monitoring system server can be set, shown as below.



- **Auto:** The monitor searches the address of the server automatically.
- **IP address:** Input the IP address of the server manually.
- **Domain Name:** Input the domain name of the server via soft keyboard, such as <http://www.xxx.com>.

.6.2.3 Device Name

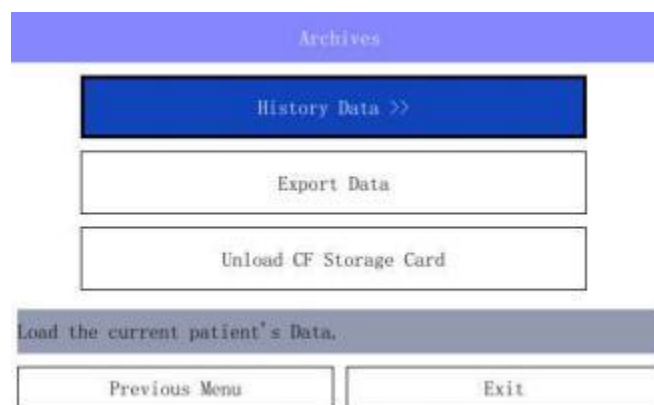
Selecting Device Name in the Network Settings menu pops up the Edit Device Name dialog box, shown as below.



The device name of the monitor can be set in this dialog box. If the monitor is not named, it shows “No Name”.

.6.3 Archives

In the “Main Menu”, select “Archives >>”.



- **History Date:** Load the current patient’s Data.
- **Export Data:** Transfer the current patient’s data to a PC.
- **Unload CF Storage Card:** Unload CF Storage Card.

.6.4 Maintenance

In the “Main Menu”, select “Maintenance >>”.



- **Factory Maintenance** and **System Maintenance** are the manufacturer maintenance buttons, which the user does not need to use.

- **Galibrate ECG:**

In the “Maintenance”, select “Galibrate ECG >>”.



- ☞ **Filter:** Filter switch for ECG.
- ☞ **Filter Freq:** Filter frequency for ECG.
- ☞ **Square Signal:** Square Signal for ECG.

- **Demo:**

This mode is protected by a password and is only used for demonstration.

- **Software Information:**

In the “Maintenance”, select “Software Information >>”.

Software Version

Serial No. : G3C001

GBA446: GM270002.7214

FunctionBoard: GM836300.6111.

KERNEL: 3.2.0-3.26-800600-449

Tue Mar 30 17:12:00 2021

Digital Oximeter: no

COM: 1566425, 390, 0, 77126

Digital Oximeter Software Version: 0.0

No: 22e000032702430000000e800c400e003c403c433000000000000001

Return to the previous menu.

Previous Menu	Exit
---------------	------

Show monitor software information.

■ **System Start Time:**

In the “Maintenance”, select “System Start Time>>”.



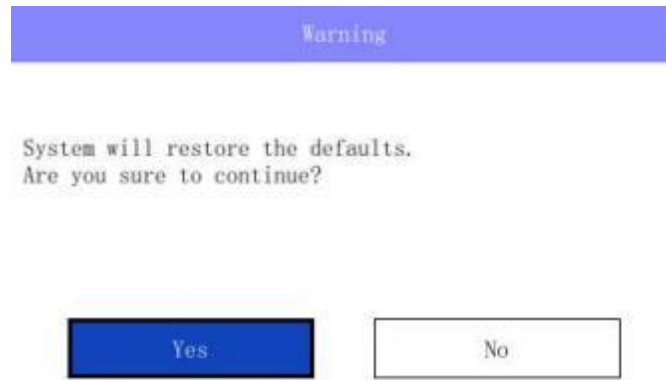
System Start Time		
Restart time 0:	2021-03-30	15:04:25
Restart time 1:	2021-03-30	15:06:32
Restart time 2:	2021-03-30	15:09:52
Restart time 3:	2021-03-30	15:43:22
Restart time 4:	2021-03-30	15:51:59
Restart time 5:	2021-03-30	15:57:42
Restart time 6:	2021-03-30	15:58:40
Restart time 7:	2021-03-30	15:59:55
Restart time 8:	2021-03-30	16:00:34
Restart time 9:	2021-03-30	17:12:01

Clear Time Previous Menu Exit

You can review all the stored start time events since the monitor is on in this list. The record list can record no more than 10 items of start time event in reverse order. You can browse start time event by rotating the mouse.

.6.5 Factory Reset

In the “Main Menu”, select “Factory Reset >>”.



Select Yes, the system reverts to the default settings.

.6.6 Setting Interface Layout

- (1) Select the hot key “Screens” or “Main Menu”→“Screen Layout >>” to enter the menu “Screens” :
- (2) There are optional interface layouts in the window “Screens” shown as Figure 4-5. select the necessary interface layout, and then click the menu “OK”.

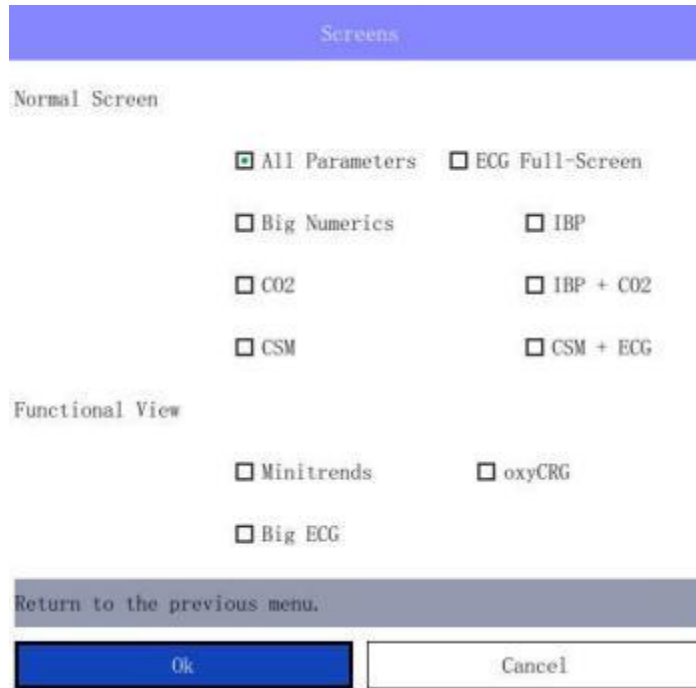
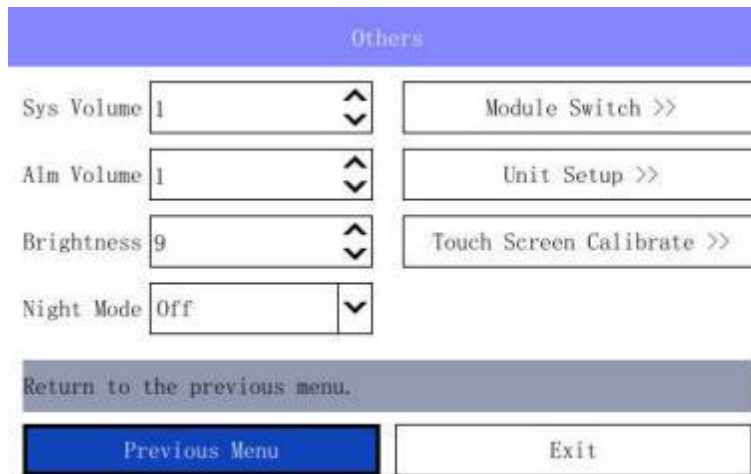


Figure 4-5

The options for the interface layout vary depending on the configuration of the monitor.

.6.7 Others

In the “Main Menu”, select “Others >>”.



.6.7.1 Volume Adjustment

Select “**Sys Volume**”:0~15. 0 represents that the system sound is turned off, and 15 represents the maximum volume.

Select “**Alm Volume**”:1~15. 1 represents the minimum volume, and 15 represents the maximum volume.

.6.7.2 Screen Brightness Adjustment

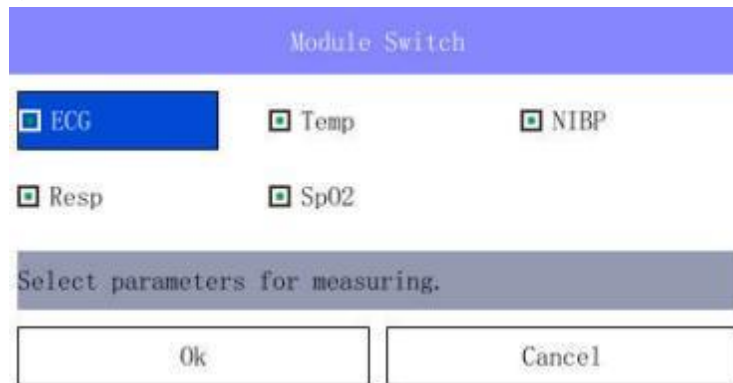
Select “**Brightness**”:1~9. 1 represents most dark, and 9 represents brightest. When using the batteries to supply power, you can set to low brightness to save the battery power.

.6.7.3 Night Mode

Select to turn the **Night Mode** “on” or “off”.

.6.7.4 Module Switch

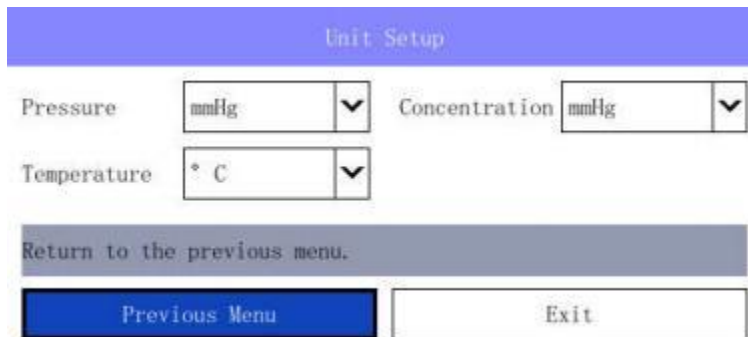
In the “Others”, select “**Module Switch >>**”.



Select the parameters that you want to display on the main screen.

.6.7.5 Unit Setup

In the “Others”, select “**Unit Steup >>**”.



Select the **Pressure** unit “**mmHg**” or “**kPa**”.

Select the **Concentration** unit “**mmHg**”, “**%**” or “**kPa**”.

Select the **Temperature** unit “**°C**” or “**°F**”.

.6.7.6 Touch Screen Calibrate

Select the “**Touch Screen Calibrate**” button of touch Screen Calibrate.

NOTE

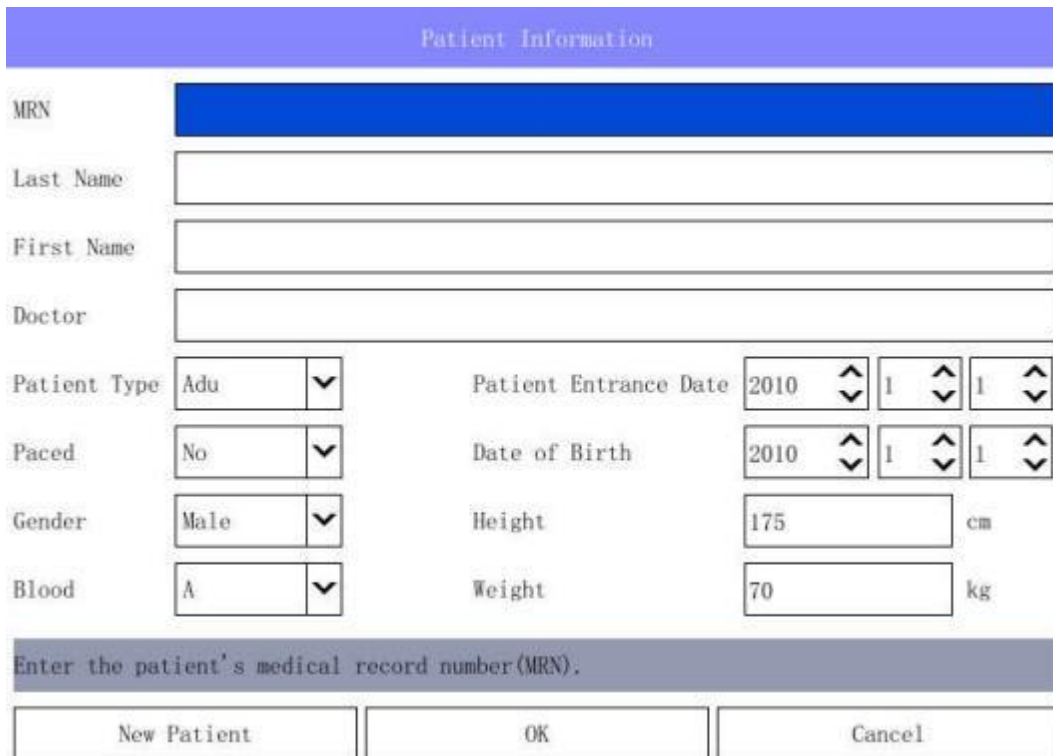
 **This setting requires a password**

Chapter 5: Patient Management

.1 Editing of Patient Information

Once the monitor is connected to the patient, the monitor displays and stores the physiological data of the patient, i.e. monitor the patient without editing the patient information. To edit or change the patient information:

- (1) Select the patient information area or “Main Menu”→“Patient Setup >>”to enter the menu “Patient Information” shown as Figure 5-1.



The screenshot shows a 'Patient Information' menu with the following fields and values:

- MRN: [Redacted]
- Last Name: [Empty]
- First Name: [Empty]
- Doctor: [Empty]
- Patient Type: Adu
- Patient Entrance Date: 2010 1 1
- Paced: No
- Date of Birth: 2010 1 1
- Gender: Male
- Height: 175 cm
- Blood: A
- Weight: 70 kg

Below the fields is a text prompt: "Enter the patient's medical record number (MRN):". At the bottom are three buttons: "New Patient", "OK", and "Cancel".

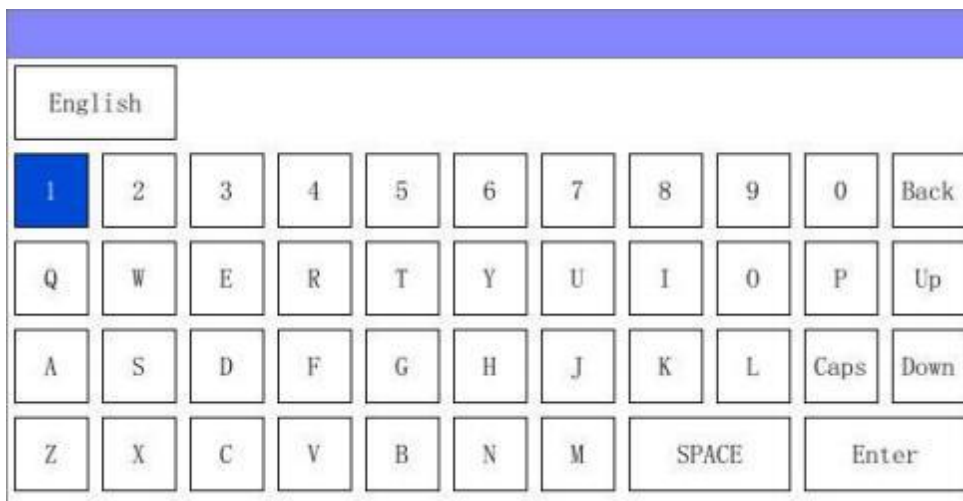
Figure 5-1

Enter or select the patient information in the menu “Patient Information”, in particular: “Patient Type”: determine the algorithm for the monitor to process and calculate some measurements as well as safety limit and alarm limit range applicable to some measurements.

- (2) Select “OK”.


(3) **Soft Keyboard:**

Select the input field on the right side of No as the figure above; the soft keyboard pops up, shown as below.



- **SPACE:** Space bar.
- **Caps:** Click this key to switch capitalization on or off.
- **Back:** Click this key to delete character in the front of the cursor.
- **Enter:** After finishing input,click this key, confirm the input over.

 **WARNING**

 **The system will assign a default value for “Patient Type”. The user must confirm whether the default value is used for the monitored patient.**

.2 Patient Information Inquiry and Acquisition

Select the patient information area or “Main Menu”→“Patient Setup >>”, and view the patient information in the pop-up menu.

.3 Modification or Deletion of Patient Information



When the monitored patient information of the monitor is incomplete or the patient information is necessarily changed:

- (1) Select the patient information area or “Main Menu”→“Patient Setup >>”, and make necessary change in the pop-up menu;
- (2) Select “OK”.

Chapter 6: Alarm

Alarm refers to a prompt audibly and visibly given the medical staffs by the monitor when the physiological parameters of the monitored patient are abnormal or the monitor fails to monitor.

WARNING

-  **The potential danger will be caused if the same or similar devices use different alarm preset values in any single area (such as intensive care unit or cardiac operating room).**
 -  **If the monitor is connected with the central monitoring system, the potential risk may exist on the alarm suspension, prohibition, mute and reset operations of the central monitoring system to the monitor.**
-

.1 Alarm Type

The monitor alarms can be divided into three types according to the alarm nature:

1. Physiological alarm

If a certain physiological parameter of the monitored patient exceeds the previously set upper or lower alarm limit of the parameter or the patient has physiological disorder which cannot be measured by a certain limit, the monitor will give a physiological alarm.

2. Technical alarm

Technical alarm refers to an alarm triggered by monitoring function failure or monitoring result distortion resulting from improper operation or system failure. The technical alarm message is displayed in the technical alarm zone.

3. Prompt message

In addition to the physiological alarm and the technical alarm, the monitor displays some messages related to the system. These messages are not involved with the vital signs of the patient generally. The prompt messages are generally displayed in the technical alarm zone and the prompt message zone. In addition, some prompt messages are displayed in the parameter zone. For example, NIBP related prompt messages are displayed below NIBP parameter values.

.2 Alarm Level

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

High level alarms

The patient's life is in danger and requires emergency treatment, or Serious technical problem occurs to the monitor.

Medium level alarms

Vital signs of the patient become abnormal, and patient requires immediate treatment.

Low level alarms

Vital signs of the patient become abnormal, and maybe requires treatment.

The level of a part of alarms information was default, and user can't change it. Such as "Sensor Off" in the PLETH channel, or "No Cuff" under the NIBP parameter, etc. The rest majority of the levels of physiological alarms and technical alarms can be changed according to requirement, such as setup kinds of alarm limit.

.3 Alarm Modes

When an alarm occurs, the monitor raises the user's attention by the following audible or visual indications: visual alarms, audible alarms or character flashes. And for audible alarms and character flashes, the monitor uses different alarm mode to indicate alarm levels.

Visual alarms

When a measured physiological parameter value exceeds the preset alarm limit, the alarm indicator on the front panel flashes.

- High level alarm —— "red and quick flash",
- Medium level alarm —— "yellow and slow flash",
- Low level alarm —— "yellow light without flash".

Audible alarms

When a measured physiological parameter value exceeds the preset alarm limit, the monitor uses different alarm tones to indicate different alarm levels to prompt users. The high level alarm phonates a triple-beep tone each nine seconds, the medium level alarm phonates a triple-beep tone each fifteen seconds, and the low level alarm phonates a triple-beep tone each twenty-three seconds. The sound pressure of auditory ALARM SIGNAL is 10dB.

- High level alarm —— "DU-DU-DU--DU-DU----DU-DU-DU--DU-DU",
- Medium level alarm —— "DU-DU-DU",
- Low level alarm —— "DU".


Character flashes

When a lead or sensor is disconnected to the monitor, the prompt information in the corresponding channel flashes once a second.

When a measured physiological parameter value exceeds the preset alarm limit, this frequency uses different flash frequency to indicate alarm levels in parameters area.

- High level alarm —— "red and quick flash",
- Medium level alarm —— "yellow and slow flash",
- Low level alarm —— "white and slow flash".

NOTE

 **When multiple alarms of different levels occur simultaneously, the monitor selects the alarm of the highest level for audible alarm and gives alarm.**

 **The ALARM SIGNAL shall be perceived correctly at a distance of 1 m from the equipment or part of equipment or from the OPERATOR'S POSITION.**

.4 Alarm Silence

In addition to the normal alarm status, you can also set the monitor to silence the alarm.

If you want to temporarily turn off the alarm sound, you can press the Silence key to temporarily turn off all current alarm sounds of the monitor, but the parameter visual alarms and character alarms are still displayed normally. The monitor enters the Silence state, and the “” icon will be displayed in the alarm status area. The alarm silence pause time is up to 120 seconds, count down in the physiological alarm information area of the screen, and when the countdown ends, the alarm sound is restored.

In the alarm mute state, if the monitor triggers a new physiological alarm or technical alarm, the alarm mute state is automatically canceled. You can also manually cancel the alarm mute by pressing the Silence key.

.5 Alarm Setting

.5.1 Alarm Volume Setting

In the “Main Menu”, select “Alarm Setup >>”.shown as Figure 6- 1:

Mass Alarm Setup					
Parameter	Alarm	Level	High Limit	Low Limit	Alarm Print
HR	On	Medium	120	50	Off
RR	On	Medium	40	8	Off
SpO2	On	Medium	100	92	Off
PR	On	Medium	120	50	Off
T1	On	Medium	38.5	35.5	Off
T2	On	Medium	38.5	35.5	Off
NIBP-Sys	On	Medium	160	90	Off
<input type="button" value="▲"/> <input type="button" value="▼"/>		<input type="button" value="Defaults"/> <input type="button" value="Auto Limits"/>		Page up to access more arrhythmia alarm settings.	
<input type="button" value="Previous Menu"/>			<input type="button" value="Exit"/>		


Figure 6- 1

WARNING

Do no monitor the patient by only depending on the audible alarm system. If the alarm sound is adjusted to the low volume, it may cause the patient danger. The user shall pay close attention to the actual clinical situation of the patient.

Take SpO2 as an example, select the SpO2 button, the SpO2 alarm setting item becomes settable.

Alarm

- “On”: when the parameter gives an alarm, the monitor will prompt according to the set alarm level and store the alarm information.
- “Off”: the icon “  ” will appear in the parameter area, and the monitor will not give an alarm prompt and store it.

Level


You can separately set the corresponding alarm level in this select box.

Alarm Limit

High Limit: 5~100. 5 represents the minimum volume, and 100 represents the maximum volume.

Low Limit: 1~99. 1 represents the minimum volume, and 99 represents the maximum volume.

 **WARNING**

 **Before starting monitoring, please check whether the alarm limit settings are suitable for the patient.**

 **The High Limit must be greater than the Low Limit.**

Alarm Print

When a parameter gives an alarm and only when the “Alarm Print” of the parameter are set to “On”, this alarm will trigger the printer to print the alarm related parameter values.

.6 Alarm Detection

The monitor will self-check when being powered on. When entering the monitoring interface, it indicates that the system is normal after self-checking, and the audible and visual alarm system has started working normally. If the alarm of the parameter independently measured is to be detected, check itself or check by using the simulator, adjust the alarm limit and check whether it can trigger alarm response.

.7 Alarm Response Measures

When the alarm occurs on the monitor, please follow the following steps to take the corresponding measures:

1. Examine the patient;
2. Confirm the alarming parameters or the alarm type;
3. Identify the alarm causes;
4. Release the alarm;
5. Check whether the alarm is eliminated.

 **WARNING**

 **When the alarm occurs, firstly examine the patient.**

Chapter 7: SpO₂ MONITORING

.1 Overview

SpO₂ measurement is based on two principles: Firstly, oxyhemoglobin and deoxyhemoglobin differ in their absorption of red and infrared light. Secondly, the volume of arterial blood in tissue changes during the pulse. A monitor determines SpO₂ (oxygen saturation) by passing red and infrared light into an arteriolar bed and measuring changes in light absorption during the pulsatile cycle. Red and infrared low-voltage light-emitting diodes (LED) in the sensor serve as light sources, a photodiode serves as the photo detector.

Because oxyhemoglobin and deoxyhemoglobin differ in light absorption, the amount of red and infrared light absorbed by blood is related to hemoglobin oxygen saturation. To identify the oxygen saturation of arterial hemoglobin, the monitor uses the pulsatile nature of arterial flow. During systole, a new pulse of arterial blood enters the vascular bed, and the blood volume and light absorption increase. During diastole, the blood volume and light absorption reach their lowest point. The monitor bases its SpO₂ measurements on the difference between maximum and minimum absorption (i.e., measurements at systole and diastole). By doing so, it focuses on light absorption by pulsatile arterial blood, eliminating the effects of nonpulsatile absorbers such as tissue, bone, and venous blood.

The monitor determines SpO₂ and pulse rate by passing two wavelengths of light, one red and one infrared, through body tissue to a photo detector. During measurement, the signal strength resulting from each light source depends on the color and thickness of the body tissue, the probe placement, the intensity of the light sources, and the absorption of the arterial and venous blood (including the time varying effects of the pulse) in the body tissue (shown as Figure 7-1).

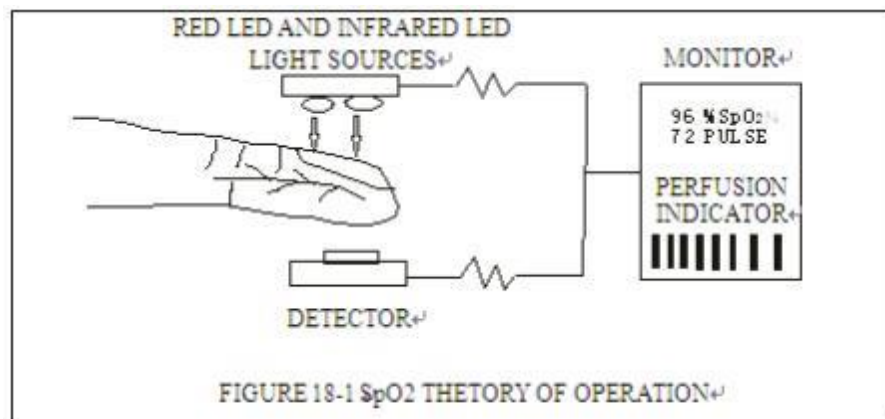


Figure 7-1

The monitor processes these signals, and respectively identify the pulse rate and calculate the blood oxygen saturation from the time constant parameter (tissue thickness, skin color, light intensity and venous blood) to the time variable parameters (arterial values and SpO₂). The blood oxygen saturation can be performed because the red light absorbed by previously oxygen-saturated blood is less than that oxygen-depleted blood.

The monitor can be used under low perfusion with same accuracy as normal condition.

The monitor measures the patient’s SpO2 and displays:

- PLETH waveform in the SpO2 waveform area.
- Oxygen saturation (SpO2 %) value in the SpO2 parameters area.
- Pulse rate (PR) value in the SpO2 parameters area.
- pulse intensity (perfusion indicator) in the SpO2 parameters area.

The monitor has been calibrated and is used for displaying the functional blood oxygen saturation. The monitor displays the plethysmography waveforms and parameter values on the screen, shown as Figure 7-2.

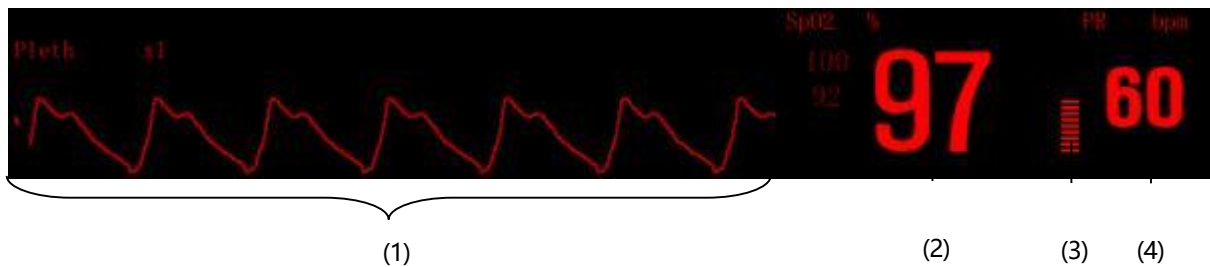









Figure 7-2





- (1) Plethysmography (Pleth) waveform: the pulse signal strength of the patient will not affect the magnitude of PLETH waveform.
- (2) Arterial blood oxygen saturation (SpO₂): oxyhemoglobin percentage of total hemoglobin.
- (3) Perfusion bar graph: in proportion to the pulse force.
- (4) Pulse rate (PR): detected pulse per minute (obtained from the Pleth waveform).

.2 Safety Information


WARNING

-  **If carbonyl hemoglobin, hemoglobin or dye dilution chemical exists, SpO₂ value will have a deviation.**
-  **The cables for electric surgical equipment cannot be entwined with the probe cable. The cables shall be connected carefully to reduce the possibility that the patient is wound or suffocated.**
-  **The monitor and the probe cannot be used in the magnetic resonance imaging (MRI) system as the induced current may cause potential injury. The monitor may affect the imaging of MRI equipment, and MRI may also affect the measurement accuracy of blood oxygen saturation.**
-  **Do not place the probe on the limb where the arterial catheter or intravenous injection tube remains.**
-  **Do not place the blood oxygen saturation probe and the blood pressure cuff onto the same limb as the vessel occlusion will affect the reading of pulse oxygen saturation in the blood pressure measurement.**
-  **Before starting test, test the probe cable. Unplug the blood oxygen saturation probe cable from the slot, then the screen will display the prompt message of “probe shedding” above the blood volume waveform and give a flicker alarm.**
-  **The continuous long-term monitoring may increase the unpredictable skin changes, such as**

allergies, erythrosis, blistering, necrosis, etc. Check the placement of newborn probe. It is particularly important to properly contact with the skin and take other measures according to the skin change. Check the placement location of the probe every 2-3 hours, and properly move when the skin changes. More frequent checking may be required for different patients.

-  Only use the blood oxygen saturation sensor specified in this manual, use it in according to the operating manual, and observe all warnings and notes.
-  When the patient has a tendency to hypoxia, the oximeter should be used for the analysis of the blood sample to fully know the patient's conditions.
-  Avoid using the monitor and the sensor when using the MRI equipment because the induced current may cause severe burn to the patient.
-  When the patient is continuously monitored for a long time, the attachment position of the blood oxygen saturation sensor shall be inspected every 2 hours, and the sensor shall be properly moved at the time of skin change or every 4 hours. More frequent checking may be required for some patients, such as newborns and patients with perfusion disorder or sensitive skin, because the continuous long-term monitoring may increase the unpredictable skin changes, such as allergies, erythrosis, blistering, pressure necrosis, etc.

NOTE

-  The cable of the blood oxygen saturation probe shall be placed on the the back of hand, with fingernails facing the light emitted by the light source of the blood oxygen saturation probe.
-

.3 Monitoring Steps

Follow the following steps:

1. Turn on the monitor.
2. Clean the measured part, such as color nail polish.
3. Place the blood oxygen saturation probe onto the appropriate part of the patient.
4. Connect the connector at one end of the cable for the blood oxygen saturation probe with SpO₂ jack of the jack panel for the monitor.

The plethysmography measuring process is basically the same, but the blood oxygen saturation probes and their placement methods are different for different types of patients. For details, refer to the instructions for the optional accessories of the user.

.4 Measurement Limit

If the measuring result looks inaccurate, firstly check the physiological signals of the patient in the form of replacement, and then inspect the monitor and the blood oxygen saturation probe. In the operation, the following situations may affect the measurement accuracy of the pulse oxygen saturation:

- Use of unsuitable probe;
- The blood oxygen saturation probe is placed on the limb where the blood pressure cuff or the arterial catheter is placed or the cannula remains in the blood vessel;
- Excessive exposure under lights, such as surgical lamp (especially lamp with xenon as a light source), bilirubin lamp, fluorescent lamp, infrared heating lamp or direct sunlight (the blood oxygen saturation probe can be covered with a black or opaque material);

- The patient excessively moves;
- Venous pulsation;
- Vessel stain, such as indocyanine green or methylene blue stain;
- Defibrillation.

Other physiological conditions or medical processes influencing the measurements of the tester: excessively high content of afunctional haemoglobin, insufficient blood supply and pigmentation.

Possible causes of pulse signal loss:

- The probe is too tight;
- The blood pressure cuff placed on the same limb as the blood oxygen saturation probe is being inflated;
- Artery occlusion occurs at the part close to the probe.

Only use the probe and the probe cable matched with the device. Select the suitable probe and observe all warnings and notes on the probe. Clear any impurity parts (such as nail polish) at the part where the probe is placed, and regularly observe whether the the position where the sensor is in contact with the patient is suitable.

If any problem is caused by the motion of the patient, one or more of the following measures are available for remedy:

- Properly and firmly place the probe;
- Move the probe onto the body part with less movement.

.5 SpO2 Setting

.5.1 SpO2 Parameter Setting

Select SpO2 parameter area, press the rotating mouse to enter the menu “SpO2 Setup”,shown as Figure 7-3:



Figure 7-3

AVRG.:

SpO₂ value displayed on the monitor is the result obtained by taking the average of data collected within a period of time. The shorter the average time is, the higher the response speed of the monitor is when SpO₂ value of the patient changes, but the measurement accuracy is lower. On the contrary, the longer the average time is, the lower the response speed of the monitor is when SpO₂ value of the patient changes, but the measurement accuracy is higher. When monitoring the

critical patients, the small average time is conducive to the timely analysis on the patient's condition.

The average period can be set to "**4 Beats**", "**8 Beats**", and "**16 Beats**".

Fill Waveform:

select "**Yes**" or "**No**" to enable or disable the waveform filling function;

Adjust Gain:


select "**x1/8**", "**x1/4**", "**x1/2**", "**x1**", "**x2**", "**x4**" or "**x8**", then the waveform amplitude will change.

Alarm Steup:

Selecting the "**Alarm Setup**" button can open the Mass Alarm Setup, you can view and modify the alarm on/off state, alarm upper and lower limits and alarm printing on/off state of all parameters currently measured.

.6 Maintenance and Cleaning

NOTE

 Clean the sensor and the surface of the probe before and after each use. You can wipe surfaces with 70% Isopropylic Alcohol and a dry cloth, and exposure to air for drying. This way can be used to clean the radiant and received parts of the probe also. You can wipe the cable with 3%

H2O2 or other reagent. But, the connective part of sensor can not touch the reagent.

 SpO2 sensor must be recycled or disposed of properly, complying with the local laws.

Chapter 8: NIBP MONITORING

.1 Overview

The non-invasive blood pressure (NIBP) module measures blood pressure using the oscillometric method. This monitor can be applied to adult, pediatric and neonate patients. Three measurements are available: manual, auto and continuous. Each mode displays the systolic pressure (SYS), mean arterial pressure (MAP), diastolic pressure (DIA) and PR (NIBP).

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

.2 Monitoring Procedure

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

- (1) Power on the monitor.
- (2) Check the patient type. If the patient type is incorrect, select a correct patient type in Patient Information dialog box.
- (3) Plug the air hose in the NIBP cuff connector of the monitor.
- (4) Apply a cuff of proper size to the upper arm or the leg of the patient.
- (5) Connect the cuff with the air hose.
- (6) Press the NIBP key on the front panel to start the NIBP measurement.

.3 Cuff Selection and Placement

- (1) Identify the patient limb circumference.
- (2) Select appropriate cuff; limb circumference is identified on each cuff.
- (3) Verify the cuff is completely deflated; place cuff around extremity being used and make sure the marking Φ matches artery location.
- (4) Verify the cuff is not wrapped too tightly around the limb. Excessive tightness may cause discoloration or ischemia of the extremities.
- (5) Make sure that the cuff edge falls within the range of the <-> mark. If it does not, use a larger or smaller cuff that will fit better.

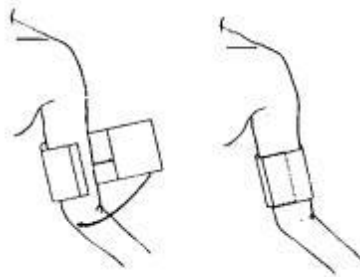













Figure 8-1

NOTE

-  The width of the cuff should be either 40% of the limb circumference (50% for neonates) or 2/3 of the upper arm length. The inflatable part of the cuff should be long enough to circle 50-80% of the limb. The wrong size cuff can cause erroneous readings. If the cuff size is in question, use a larger cuff.
-  The limb chosen for taking the measurement should be placed at the same level as the patient's heart. If this is not possible, use the following method to correct the measurement result:
 - If the cuff is placed higher than the heart level, add 0.75mmHg (0.10 kPa) for each centimeter of difference, or 1.9mmHg (0.25kPa) for each inch of difference.
 - If it is placed lower than the heart level, deduct 0.75mmHg (0.10 kPa) for each centimeter of difference, or 1.9mmHg (0.25kPa) for each inch of difference.
-  If you are in doubt about the accuracy of any reading(s), check the patient's vital signs by an alternative method before checking the function of the monitor.



WARNING

-  Use only the specified accessories for monitoring, or it will lead to the malfunction of the Monitor.
 -  You must not perform NIBP measurements on patients with sickle-cell disease or under any condition where the skin is damaged or expected to be damaged.
 -  For a thrombasthenia patient, it is important to determine whether measurement of the blood pressure shall be done automatically.
 -  Ensure that the setting is correctly made when performing measurements on children. Incorrect patient type setting may cause a danger to the patient because adult blood pressure level is higher than children.
 -  Before the measurement, you shall confirm your configuration is suitable to the patient (adult, pediatric or neonate).
 -  Do not apply the cuff to a limb that has an intravenous infusion or catheter in place. This could cause tissue damage around the catheter when infusion is slowed or blocked during cuff inflation.
 -  Auto non-invasive blood pressure measurements performed in long intervals may incur ischemia and neuropathy in the limb wearing the cuff. When monitoring a patient, examine the extremities of the limb frequently for normal color, warmth and sensitivity. If any abnormality is observed, change the position of the cuff on the patient or stop the blood pressure measurements immediately.
 -  Make sure the air tubing connecting the blood pressure monitor is not blocked, twisted, or tangled.
-

.4 Measurement Limit

Non-invasive blood pressure measurement uses the oscillometric method of measurement. The monitor detects the regular arterial pressure pulse. In some circumstances when the patient's condition makes it difficult to detect this pulse, the measurement becomes unreliable and the measurement time

increases. You should be aware that the following conditions could interfere with the measurement, make the measurement unreliable, prolong the measurement, or even make a measurement impossible.

- **Patient movement:** E.g.The patient is moving, shivering or jerking.
- **Cardiac arrhythmia:** E.g.The patient's cardiac arrhythmia has caused an irregular heartbeat.
- **Heart-lung machine:** E.g. Measurements will be impossible if the patient is connected to a heart-lung machine.
- **Pressure changes:** E.g.The patient's blood pressure is changing rapidly over the period of time during which the arterial pressure pulses are being analyzed to obtain the measurement.
- **Severe shock:** E.g.If the patient is in severe shock or hypothermia, reduced blood flow to the peripheries will cause reduced pulsation of the arteries.
- **Heart rate extremes:** The monitor is unable to perform pressure measurements at a heart rate of less than 15 bpm and greater than 300 bpm.

.5 NIBP Monitoring Interface

The NIBP measurement does not produce any waveform. Instead, it displays the measurement result in the NIBP parameters area as shown Figure 8-2.

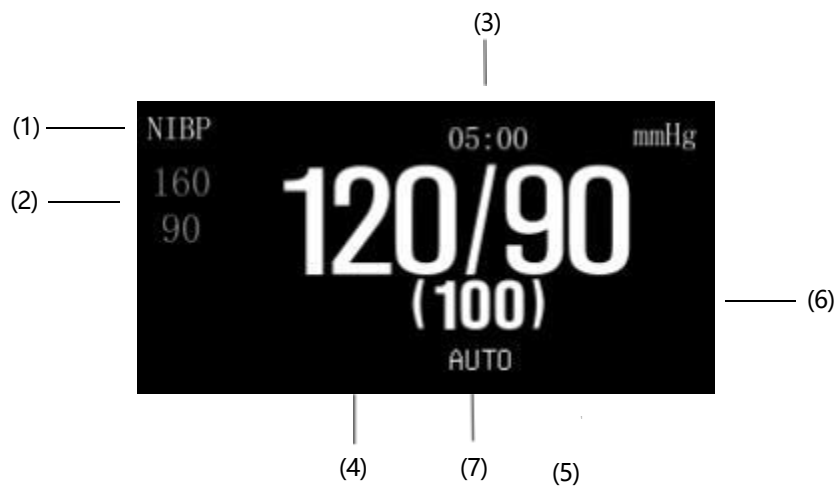


Figure 8-2

- (1) Pressure unit: mmHg or kPa
- (2) Alarm limit
- (3) Time to the next automatic measurement
- (4) Systolic pressure
- (5) Diastolic pressure
- (6) Artery mean pressure
- (7) Measuring mode

.6 NIBP Setting

Select NIBP parameter area, press the rotating mouse to open the menu “NIBP Setup”, shown as Figure 8-3:

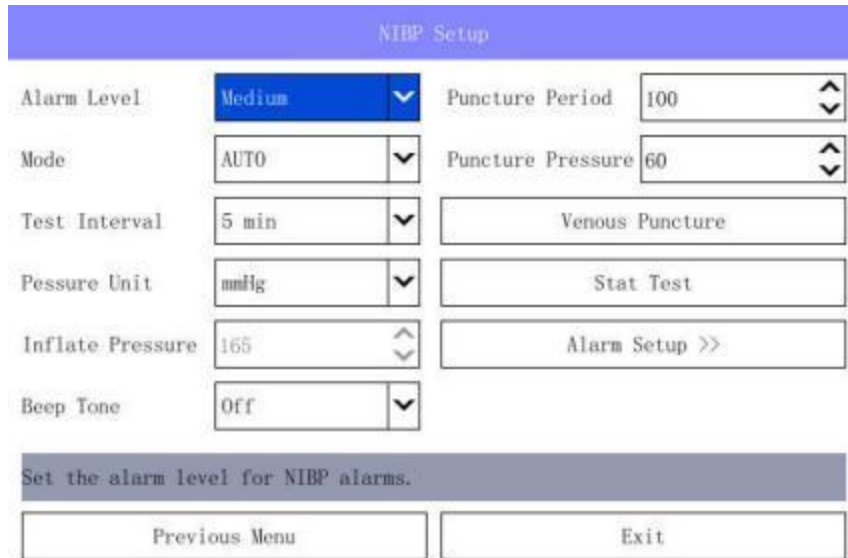


Figure 8-3

Alm Level:

Alarm levels can be set to "**High**", "**Medium**", and "**Low**" levels.

Alm Print:

On: When the alarm is triggered, the printer prints the waveform and value associated with the alarm.

Off: Turn off the alarm function.

Mode:

MANUAL: In this mode, a NIBP measurement shall be started manually by pressing the NIBP key on the front panel. Before manual NIBP measurement, the max cuff pressure should be set to a proper value.

AUTO: In this mode, the monitor periodically starts the NIBP measurement automatically at the preset time interval.

Test Interval:

In the AUTO mode, the test interval can be set.

Pressure Unit:

Select the pressure unit "**mmHg**" or "**kPa**".

Inflate Pressure:

In the MANUAL mode, the inflate pressure can be set.

Beep Tone:

According to the user's needs, the "**Beep Tone**" can be set to "**On**" or "**Off**", and the volume level is consistent with the alarm volume. The default setting is "**Off**". When a blood pressure measurement is completed, a measurement completion tone is sounded.

Puncture Period:

From the air inflating time, until the air is deflated.

Puncture Pressure:

The air inflating pressure.

Venous Puncture:

Selecting the "**Venous Puncture**" button to open venipuncture , the word "**VENOUS**" and the preset pressure are displayed in the information prompt bar, shown as Figure 8-4.

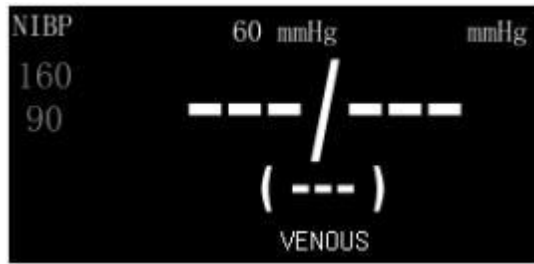


Figure 8-4

Selecting the “Venous Puncture” button again, and venipuncture turns off.

Stat Test:

Selecting the “Stat Test” button in the NIBP menu starts a continuous measurement which is provided for surgical or emergent patient. Its feature is that it continuously measures NIBP for five minutes once it is started, and the measurement mode adopted is simpler than other modes. After five minutes, the monitor restores to the status (auto or manual) before the continuous measurement.

Alarm Test:

Selecting the “Alarm Test” button can open the Mass Alarm Setup, you can view and modify the alarm on/off state, alarm upper and lower limits and alarm printing on/off state of all parameters currently measured, shown as Figure 8-5:

Mass Alarm Setup				
Parameter	Alarm	High Limit	Low Limit	Alarm Print
HR	On	120	50	Off
RR	On	40	8	Off
SpO2	On	100	92	Off
PR	On	120	50	Off
NIBP-Sys	On	160	90	Off
NIBP-Dbp	On	90	50	Off
NIBP-Map	On	110	60	Off
T1	On	38.5	35.5	Off
<input type="button" value="↑"/> <input type="button" value="↓"/>		<input type="button" value="Defaults"/> <input type="button" value="Auto Limits"/>		
Set alarm on/off switch, alarm limits and alarm recordings.				
<input type="button" value="Previous Menu"/>			<input type="button" value="Exit"/>	

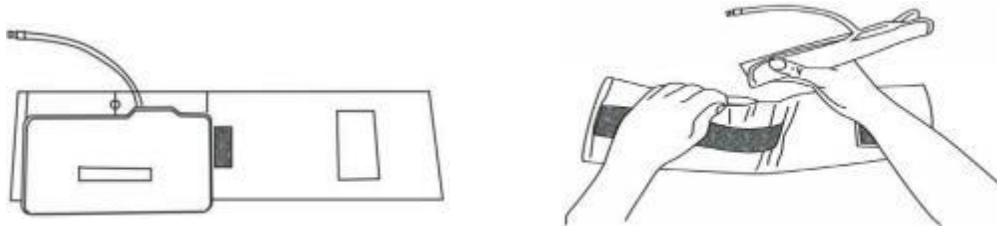
Figure 8-5

.7 Maintenance and Cleaning

.7.1 Reusable blood pressure cuffs

The cuff is not suitable for dry-cleaned. Instead, it should be machine or hand washed. Hand washing,

may prolong the service life of the cuff. Before washing, remove the latex rubber bladder. Allow the cuff to dry thoroughly after washing, and then reinsert the rubber bladder. The cuff can be disinfected by means of conventional autoclaving, gas, or radiation disinfection in hot air ovens, or sterilized by immersion in decontamination solutions. Remember to remove the rubber bladder if you use this method.



To replace the rubber bladder in the cuff:

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





.7.2 Disposable blood pressure cuffs

Disposable cuffs are intended for single patient use only. Do not sterilize or use autoclave sterilization for disposable cuffs. But they can be washed with a mild soap and water solution to control the infection.

NOTE

-  **Disposable blood pressure cuffs must be recycled or disposed of properly, complying with the local laws.**

WARNING

-  **Do not press or limit the rubber tube on the cuff.**
-  **Do not allow the water or detergent liquid get inside the NIBP connection, otherwise the monitor may be damaged.**
-  **When a reusable cuff is not connected to the monitor or is being cleaned, avoid splashing liquid into the rubber tube or the monitor inadvertently.**
-  **When cleaning the Monitor, only clean the connector external part, and do not clean its internal part.**

.8 Troubleshooting

The NIBP current status is displayed at the Measuring mode area, please adopt the following disposals if the messages shown as below appear.

Problems	Possible reasons	Suggestions and way out
Startup Fail	Monitor hardware error	Stop the NIBP measurement, and inform the

		qualified maintenance personnel specified by the supplier to repair.
No Cuff	The cuff is not properly tied up or no cuff	Tie up the cuff
Cuff Leak	The cuff, rubber tube or connector is damaged	Check and replace the air leakage part, if necessary, inform the qualified maintenance personnel specified by the supplier to repair.
Pulse too weak	The cuff is too loose or the patient's pulse is too weak.	Use other method to measure the NIBP.
Over Pressure	The pressure exceeds the specified safety upper limit	Remeasure it, if the failure continues, stop the NIBP measurement, and inform the qualified maintenance personnel specified by the supplier to repair.

Chapter 9: ECG MONITORING

.1 OVERVIEW

This Monitor adopts 5-lead (or 3-lead) ECG cable to collect the ECG signal from the patient, and it can simultaneously display seven (or three) leads of ECG signal. ECG channel displayed on the top part of the screen is the major channel of the ECG signal, and its lead is called the major lead. The Monitor calculates the heart rate value and controls the gain (if set in automatic mode) according to the data of the main lead. All leads adopt the same gain and same measurement mode. The Monitor can separately check whether the connection of a lead has fallen off, and display the prompt information in corresponding channel.

.2 ECG MONITORING

The ECG cable includes two parts: the main cable connecting the Monitor and the electrode lead line connecting the patient.

.2.1 PREPARATION

1. Select electrode

Generally, the electrode for monitoring is disposable electrode made from Ag-AgCl (silver - silver chloride). But before use, you shall confirm that the electrode is within the valid date. If the unqualified electrode is used, it will lead to inaccurate monitoring result.

2. Skin pretreatment

Because the skin is not a good conductor, if you want to gain good contact between the skin and the electrode, before installing the electrode, you shall carry out skin pretreatment at first.

- (1) If necessary, shave hair from skin at chosen site.
- (2) Rub the skin to accelerate the blood flow in the blood capillary of organs and remove the horny layer and greases of the skin.
- (3) Thoroughly cleanse the site with mild soap and water solution, but do not use the aether or pure alcohol, because it will increase skin resistance.
- (4) Dry the skin completely before applying the electrodes.

3. Attach the ECG lead to the electrodes prior to placement.
4. Place the electrode on the patient. If the conductive ointment is not applied to the electrodes, apply it before the placement.
5. Connect the electrode lead to the patient cable.
6. Confirm the Monitor is powered on and is ready for monitoring.

.2.2 ELECTRODE PLACEMENT

- (1) For the placement of the five-lead ECG electrode, refer to the figure as shown in Figure 9-1.

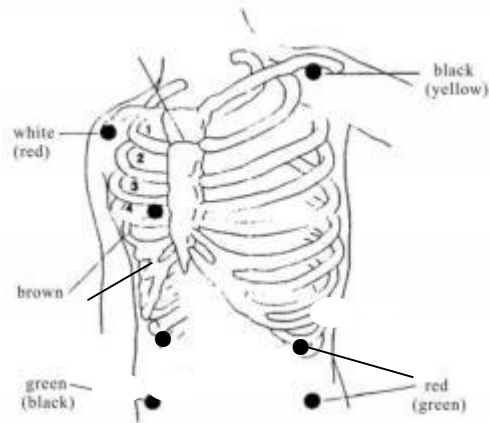


Figure 9-1 Positions of 5-Lead Electrode Placement

NOTE

- The sign name and color of the electrode shown above is American standard, while inside the brackets () is European standard.

- White (right arm or RA) electrode: near the right shoulder, directly below the clavicle.
- Black (left arm or LA) electrode: near the left shoulder, directly below the clavicle.
- Green (right leg or RL) electrode: on the right abdomen.
- Red (left leg or LL) electrode: on the left abdomen.
- Brown (chest or V) electrode: on the chest.

(2) Electrode placement for pacemaker patient

The pacemaker lead can pickup the best ECG waveform from the pacemaker patient. At this time, the electrode is usually placed on the mammillary line, the white and black electrodes are placed as shown in Figure 9-2.

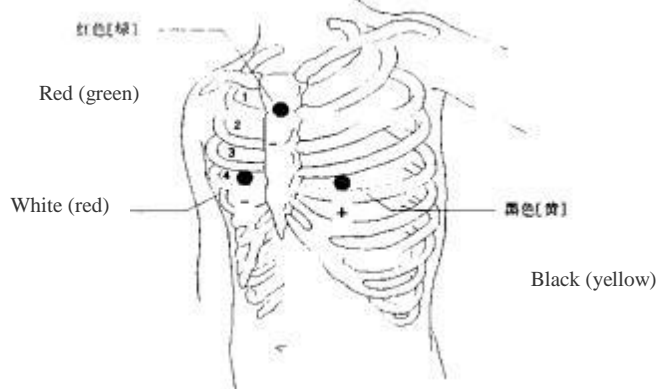


Figure 9-2 Positions of Pacemaker Patient's Electrode

(3) Electrode placement for surgical patient

Electrode placement during surgery is dependent on the type of surgery being performed. For example, with open chest surgery, the electrodes might be placed laterally on the chest or on the back. In the operating room, artifact can sometimes affect the ECG waveform

due to the use of electrosurgery equipment. To help reduce this, place the electrodes on the right and left shoulders, the right and left sides near the stomach, and place the chest lead on the left side at mid-chest. Avoid placing the electrodes on the upper arms. This will cause the ECG waveform to be too small.

NOTE

- **Select the place with stable ECG signal or little inference of skeleton activities to place the electrodes.**
-

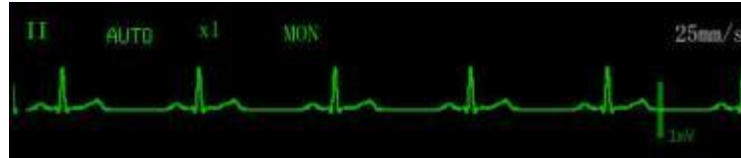
 **WARNING**

- **In order to ensure the patient's safety, all leads shall be connected to the patient.**
 - **The electrode shall be fixed properly to ensure the reliable contact of the conductor with skin.**
 - **Interference from a non-grounded instrument near the patient and ESU interference can cause inaccuracy of the ECG waveform.**
 - **When using Electrosurgery equipment, never place the ECG electrodes near the grounding plate of the Electrosurgery device. This will cause a great deal of interference with the ECG signal. The patient leads should be placed in a position that is equal distance from the Electrosurgery electrotome and the grounding plate to avoid burns to the patient.**
 - **When applying electrodes or connecting cables, make sure they are not connected to any conductive part or the ground. Verify that all ECG electrodes, including neutral electrodes, are securely attached to the patient.**
 - **When applying the ECG cable with no resistance to our patient monitor or other patient monitor that has no current limit resistance in it, the monitor cannot be applied to defibrillation.**
 - **Need for close surveillance of pacemaker patients, since rate meters may count pacemaker rate during cardiac arrest or some arrhythmias.**
 - **Do not touch the patient, bed or instrument during defibrillation.**
 - **Verify the lead fault detection prior to the start of monitoring. Unplug the ECG cable from the ECG connector and the flashing error message "Lead Off" will be displayed in the corresponding ECG channel.**
 - **Skin irritation may result from the continuous application of the ECG electrodes. These should be checked each day. If there is an indication of excess skin irritation, replace the electrodes or change the location of the electrodes every 24 hours.**
 - **Always dispose of, or recycle electrodes properly to prevent from environment contamination.**
-

.3 ECG CHANNEL

3.1 MAIN LEAD CHANNEL

The top part of the channels area that cannot be changed to any other channels is called as the main lead channel, shown as below:

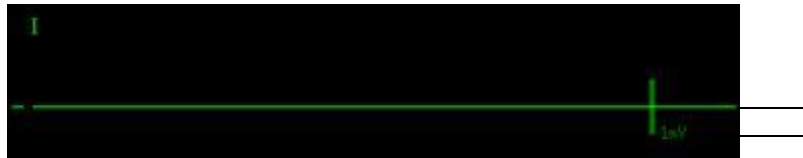


⑧

⑦ ⑥

- ① Main lead label
- ② gain mode
- ③ gain
- ④ measurement mode
- ⑤ Waveform speed
- ⑥ scale range
- ⑦ scale
- ⑧ ECG waveform

3.2 OTHER LEAD CHANNELS



④
③

②

- ① Other lead label
- ② scale
- ③ scale range
- ④ ECG waveform

Select the position ①, the current lead label switches among 6 leads (except the main lead). Labels in different channels are different, when the lead label in the current channel is switched, the lead label in other channels will be changed automatically.

4 ECG PARAMETER

4.1 HEART RATE

Except in Huge Digit mode, the heart rate is displayed on the top part of the parameters area, shown as below.



②

①

⑤

- ① Lower alarm limit ② Upper alarm limit ③ heart rate label ④ heart rate units
- ⑤ Measured heart rate value

Select the heart rate label (HR), the ECG Setup pops up, as shown in the figure below:



■ **HR Source**

- **Auto:** The monitor determines the heart rate source depending on the signal quality. ECG takes priority of SpO₂. Only when the ECG signal is bad and cannot be analyzed, the heart rate source is SpO₂. If the ECG signal becomes normal, the HR source changes to ECG automatically. Auto is set as a default.
- **ECG:** HR is always calculated from ECG.
- **SpO₂:** If the ECG signal is seriously interfered, you can select SpO₂, which means PR will be derived from PLETH waveform. In this case, “PR (SpO₂)” is displayed instead of “ECG (I, II, etc.)” while the PR reading is displayed below. The monitor activates pulse beeps instead of heartbeat beeps.
- **NIBP:** If the ECG signal and SpO₂ signal are seriously interfered, you can select NIBP, which mean PR will be derived from NIBP testing. In this case, “PR (NIBP)” is displayed instead of “ECG (I, II, etc.) and PR (SpO₂)”. When test NIBP once, test PR (NIBP) at the same time.

The heart rate source mark and heart rate label clearly show the current heart rate source. The list is as the following:

Label	Color of the heart rate value	Heart rate source mark	Source
HR	Green	I, II, III, aVR, aVL, aVF, V	ECG
PR	Green	SpO ₂	SpO ₂
PR	Green	NIBP	NIBP

NOTE

- **The pulse rate and heart rate use the same alarm limit and alarm switch. No matter where the heart rate value comes from, the alarm systems adopted are totally the same.**
- **When this monitor works abnormally because of overload or amplifier saturation, the prompt information will be displayed to remind the user.**

■ **Lead Set**

- **When 3-lead** is selected, I, II and III can be set. Only one ECG waveform is displayed at the top of the display.
- **When 5-lead** is selected, the leads I, II, III, aVR, aVL, aVF and V can be measured at the same time. 5-lead is the default.

■ **ST Mode**

- **Auto:** The monitor selects to display the ST segment or not automatically according to the ECG mode. In DIA mode, displays the ST segment, and in MON and OPR mode, hides ST segment.
- **Always On:** Always displays ST segment in the parameters area and Always On is set as a default.
- **Always Off:** Doesn't display ST segment.

NOTE

- **ST Mode can only be set by selecting DIAG Mode from the Lead Waveform menu**

■ **ECG1**

Select this button, then the main lead changes once.

The main lead can be selected among:

1. When you use 3-lead set, the monitor gives three lead options: I, II and III.
2. When you use 5-lead set, the monitor gives seven lead options: I, II, III, aVR, aVL, aVF and V.

In order to get accurate heart rate and gain control performance, the doctor shall select the lead of large range and little noise as the main lead.

In order to avoid emerging leads repeatedly, when the lead in the current channel is switched, the leads in the other channels will be changed automatically.

■ **ECG2**

Select this button, then the main lead changes once.

The main lead can be selected among:

1. When you use 3-lead set, the monitor gives three lead options: I, II and III.
2. When you use 5-lead set, the monitor gives seven lead options: I, II, III, aVR, aVL, aVF and V.

In order to get accurate heart rate and gain control performance, the doctor shall select the lead of large range and little noise as the main lead.

In order to avoid emerging leads repeatedly, when the lead in the current channel is switched, the leads in the other channels will be changed automatically.

■ **Gain Mode**

Select this button, the gain mode switches between AUTO and MANUAL modes.

Gain means the magnification times for the ECG waveform signal. This monitor has five magnification times that are $\times 1/4$, $\times 1/2$, $\times 1$, $\times 2$ and $\times 4$. The $\times 1$ is one time magnification, under which the range ⑦ of the scale ⑧ at the left side of the ECG waveform is 1 mV.

Then under the condition of $\times 2$ magnification, the range ⑦ of the scale ⑧ is 0.5mV, and so on. Detailed data refers to the following table:

Gain factor	AUTO	MANUAL	Scale range
$\times 1/4$	Adopted	Applicable	4 mV
$\times 1/2$	Adopted	Applicable	2 mV
$\times 1$	Adopted	Applicable	1 mV
$\times 2$	Adopted	Applicable	0.5 mV
$\times 4$	Adopted	Applicable	0.25 mV

Under 1 ECG and Huge Digit display format, the length of the scale ⑧ is 10mm. The waveform of 10mm displayed under $\times 1$ magnification times means the ECG signal is 1mV, under $\times 2$ means 0.5mV.

NOTE

- **All leads including the main lead and other leads adopt the same gain.**

This Monitor provides two methods to regulate the ECG waveform range:

- **AUTO mode:** Under the AUTO mode, according to the main lead waveform data, the Monitor will automatically regulate the gain to amplify the ECG waveform of the main lead without the distortion as possible. The defect of this mode is slow regulation speed.
- **MANUAL mode:** Under this mode, the Monitor doesn't regulate the ECG gain automatically. At this time, the ECG gain is regulated via the Adjust Gain button. The feature of this mode is fast response that the waveform will change immediately after the gain is regulated, and the waveform can be amplified to a distortion status to display.

■ **Gain**

Manually regulates the ECG gain. After selecting this button, regulate the gain via the rotating mouse. Rotate counterclockwise, the gain and waveform range become smaller, while rotate clockwise, the gain and waveform range become larger. After the accomplishment of the regulation, press down the rotating mouse again to exit the gain adjusting mode.

■ **Test Mode**

The Mode means the filter bandwidth of the ECG channel. The monitor has three modes: diagnosis (DIAG), monitoring (MON) and operation (OPR). Under the DIAG mode, the filter bandwidth is the widest, and the detailed information of the ECG signal can be got. The more detailed information is helpful to more accurately judge the status of the ECG

signal. But with the importation of the detailed information, the environmental noise, such as HF electrotome, may be introduced too. The noise mixes with the real ECG signal, so that the ECG signal cannot be distinguished. In order to adapt to the noise interference situation, the Monitor also provides two measurement modes, namely the MON mode and the OPR mode. Under these two modes, narrower bandwidth is adopted to measure and gain smoother signal. The user can make choices according to the exact situations, and the comparing data are as followings:

Mode	Bandwidth	Details	Noise
DIAG	0.05Hz~100Hz	Most	Most
MON	0.5Hz~40Hz	Medium	Medium
OPR	1.0Hz~25Hz	Least	Least

NOTE

- **All leads including the main lead and other leads adopt the same mode.**

- **Waveform Speed**

Select this button to regulate the waveform speed for parameters relating to ECG, including all ECG channels and PLETH channel. It has four speeds such as 3.125mm/s, 6.25 mm/s, 12.5 mm/s, 25 mm/s and 50 mm/s.

- **Cascade**

Turn on or off the cascade.

Well ECG should have characteristic as below:

- ◆ Tall, narrow and no cut marks
- ◆ Tall R-wave which is above or under of base line completely
- ◆ Pacemaker signal is not more than R-wave's height
- ◆ T-wave less than 1/3 height of R-wave
- ◆ P-wave less than T-wave

- **Paced**

Turn on or off the Paced

- **Beat Source**

Beat Source can be to start or stop the monitor tones, including heart beat tones, pulse tones and prompt tones for wrong operation.

- **Arrh. Analysis**

Change arrhythmia analysis settings, See the next section for more details.

- **Alarm Steup**

Selecting the “**Alarm Setup**” button can open the Mass Alarm Setup, you can view and modify the alarm on/off state, alarm upper and lower limits and alarm printing on/off state of all parameters currently measured.

.4.2 ARRHYTHMIA ANALYSIS

.4.2.1 OVERVIEW

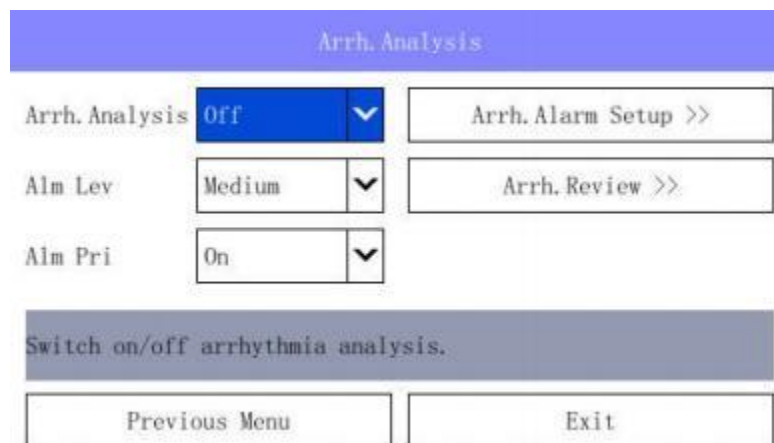
The monitor uses the user-selected primary or secondary ECG lead for arrhythmia analysis, including monitoring patient’s ECG, heart rate and ventricular arrhythmias. In clinical application, the medical professionals can use the arrhythmia analysis to evaluate patients’ condition and give proper treatment.

The arrhythmia analysis of the monitor has the following characteristics:

- Applicable to the monitoring of a patient either with a pacemaker or without a pacemaker.
- Disabled in the factory configuration.
- Capability of raising the doctor’s attention to the patient’s heart rate, by measuring and classifying the arrhythmia and the abnormal heartbeat and triggering the alarm.
- Capability of storing the latest 60 alarm events (including the ECG waveform respectively 5 seconds before and after the alarm), when performing the arrhythmia analysis. You can review the arrhythmia events through the menu below.

.4.2.2 ARRHYTHMIA SETTINGS

Select the heart rate label (HR)→“ECG Setup” →“Arrh. Analysis>>”.



- **Arrh. Analysis:** Switch On/Off arrhythmia analysis
- **Alm Lve:** Alarm levels can be set to "High", "Medium", and "Low" levels.
- **Alm Pri:** Select On for automatic start of recording when PVCs alarms occur.
- **Arrh. Alarm setup:** In the “**Arrh. Analysis**”, select “**Arrh. Alarm setup >>**”



Arrh. Alarm Setup			
	Alarm	Record	
Asystole	On	On	All Alarm On
Tachycardia	On	On	All Alarm Off
Vt (Vtach)	On	On	All Record On
Ext Tachy	On	On	All Record Off
Bradycardia	On	On	
Ext Brady	On	On	
V Brady	On	On	
Prolonged RR	On	On	
	▲	▼	
set Alarm or record for arrh.			
Previous Menu		Exit	

In this dialog, you can perform the following settings. The Alarm field indicates the alarm on/off status and Record indicates the alarm recording on/off status. You can change the settings as described below.

- **All Alarm ON:** Enables all arrhythmia alarms. When the Arrhythmia alarm occurs, the monitor gives alarm indications and saves the alarm;
- **All Alarm OFF:** Disables all arrhythmia alarms that can be disabled. When the Arrhythmia alarm occurs, the monitor neither gives alarm indications nor saves the alarm.
- **All Record ON:** Enables the recording of all arrhythmia alarms. The monitor starts recording when the Arrhythmia alarm occurs.
- **All Record OFF:** Disables the recording of all arrhythmia alarms. The monitor does not record when the Arrhythmia alarm occurs.
- **Alarm and Record for 23 Arrhythmia Options:** Arrhythmia alarm for every option singly.

ON: When this Arrhythmia alarm occurs, the monitor gives corresponding alarm indications and saves the alarm;

OFF: When this Arrhythmia alarm occurs, the monitor neither gives corresponding alarm indications nor saves the alarm.

- Select  or  to page up or down to move the table, and observe more data.

.4.2.3 ARRHYTHMIA REVIEW

In the “Arrh.Analysis”, select “Arrh. Events >>”



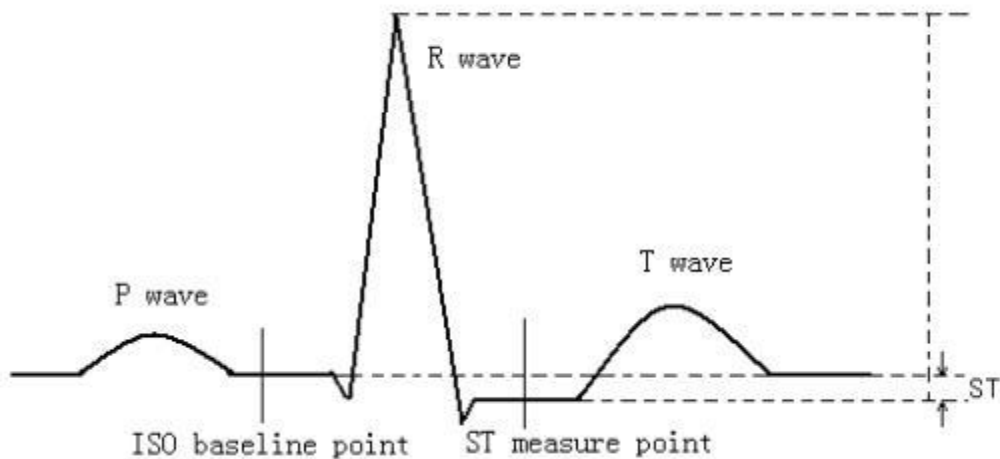
You can review all the stored arrhythmia events since the monitor is on in this list, including the time when the arrhythmia event occurred and the type of every arrhythmia event. The record list can record no more than 60 items of arrhythmia event in reverse order. You can browse arrhythmia event by rotating the mouse.

Caution

- Because all the arrhythmia events will be cleared away after the power is off, so you must think over carefully before turning off the monitor.

.4.3 ST SEGMENT

If set the contrast point of the ST measure point is R-wave crest, then ST measure value every time is minus-value that from the wave crest to two measure point as below:



If you start monitoring the patient HR or ECG wave which has change obviously, then require to adjust the position of ISO and ST point.

In the default settings, the ST segment is always displayed. In MON or OPR mode, the ST numerics might be severely distorted. The variance of the ST segment at the waveform tracks can be measured and the result is displayed numerically in the parameters area. Measurement symbols of the ST segment: “+” means positive elevation, “-” means negative elevation.

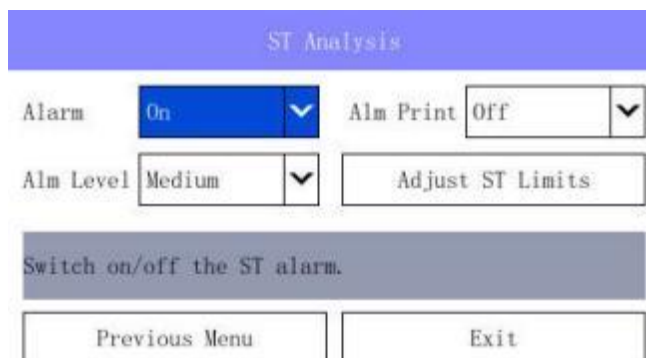
The ST segment is displayed as the following:



- ①label of the ST segment
- ②ST unit ③ ECG lead
- ④Measured value of corresponding to the lead ST segment

■ Alarm Analysis

Select the label of ST segment, the following menu appears.



Alarm:

on: The ST segment alarms are turned on, the monitor alarms when the measured ST segment value exceeds the preset alarm limit.

off: Icon is displayed on the left side of the main lead ST segment label, the ST segment alarms are turned off, and the monitor does not generate alarms when the measured ST segment value exceeds the preset alarm limit.

Alarm Level:

Alarm levels can be set to "High", "Medium", and "Low" levels.

Alm Print:

On: Select On for automatic start of recording when ST alarms occur.

Off: Select Off for close of recording when ST alarms occur.

Adjust ST Limits:

Selecting the “Adjust ST Limits” button can open the Adjust ST Limits, the following menu appears.



The high/low range of the ST alarm is shown in the following.

Range. High (mV)	Range. Low (mV)	Increment (mV)
(-2.56 ~ 2.56)	(-2.56 ~ 2.56)	0.01

.4.4 SETTING DEFIBRILLATION SYNCHRONIZATION

Defibrillation synchronization function means: when the patient monitor detected the R wave will output the defibrillation synchronization signal which is 100ms + 5 V by defibrillation synchronization port for defibrillation setting use.

 **WARNING**

- Defibrillation function has no harm for patient. The user could determine whether there is a need to use the function in accordance with the actual situation of the patient.
 - Before using, the user should insure that the Defibrillation and Patient monitor have passed the system testing and could be used together safely.
-

.5 MAINTENANCE AND CLEANING

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

 **WARNING**

- **If the ECG cable is damaged or aging, it shall be replaced by a new one.**
- **Before cleaning the ECG cable, be sure to disconnect the monitor from the ECG cable, or shut down the system and disconnect all power cords from the outlet.**

.6 TROUBLE SHOOTING

Possible reasons	Suggestions and way out
The ECG electrode has fallen off from the patient or from the Monitor.	Ensure the electrode, lead and cable are properly connected.
<p>The mode is not correctly set according to the environment.</p> <p>The power frequency is not set in accordance with the local power frequency. The Monitor is bad grounding.</p> <p>The electrode is badly connected to the patient.</p>	<p>Change the mode.</p> <p>Set the power frequency properly. Refer to REGION SETTINGS in CHAPTER 4 for detailed information.</p> <p>Check the grounding system of the Monitor.</p> <p>Keep the patient quiet, and guarantee the reliable connection of the electrode.</p>
<p>The ECG signal is very weak. (<0.25mV)</p> <p>The electrode is badly connected to the patient.</p> <p>The patient type is not correctly set.</p> <p>The gain is not enough.</p>	<p>Check the connection between the electrode and patient, ensure the reliable touch of the electrode and patient's skin.</p> <p>Correctly set the patient type.</p> <p>If it is in the MANUAL mode, please turn the gain to a right magnification.</p>

Chapter 10: RESP MONITORING

.1 OVERVIEW

This Monitor measures out the respiration movement waveform by the ECG cable with the impedance method. This respiration movement waveform is used to calculate the respiration rate and analyse the respiration status.

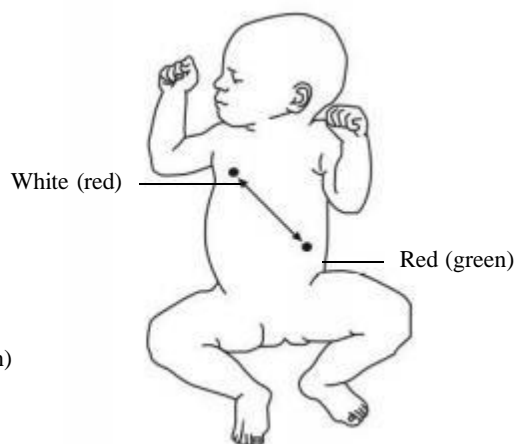
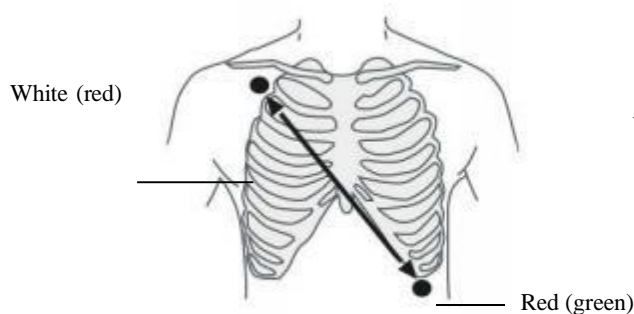
The Monitor can measure three lead respiratory waveforms such as I, II or III lead, of which, the II lead is generally used. Because of the different signal strength, the Monitor provides AUTO and MANUAL modes to adjust the gain. The respiratory waveform will be clear and without distortion if an appropriate gain is adopted.

.2 ELECTRODE PLACEMENT

The impedance respiration method of this Monitor is to monitor the patient's respiration by the impedance variation between the two electrocardiogram electrodes of I, II or III lead. Since the same electrodes are used for ECG and RESP monitoring, the electrode placement is very important. Some patients, due to their clinical condition, expand their chest laterally, causing a negative intrathoracic pressure. In these cases it is better to place the two electrodes used for RESP monitoring laterally in the right axillary and left lateral chest areas, at the maximum point of the breathing movement, to optimize the respiratory waveform.

NOTE

- **RESP monitoring is not recommended on very active patients, because it will cause false alarms.**
- **Place the red and white electrodes diagonally to optimize the respiration waveform.**
- **Try to avoid placing the electrodes so the liver area and the ventricles of the heart are in path between the electrodes used for respiration, to avoid cardiac artifact to overlay on the ECG. This is particularly important when monitoring neonate patients.**



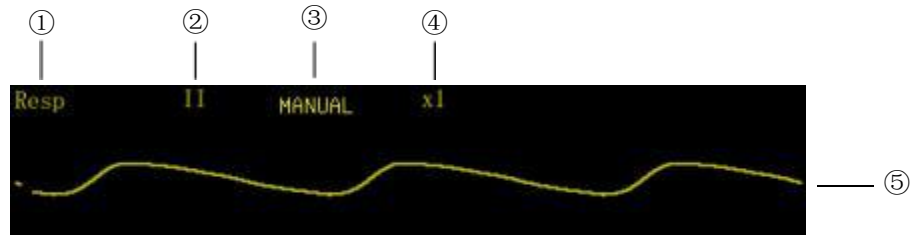
The electrode placement procedure refers to PREPARATION in CHAPTER 13.

.3 MONITORING INTERFACE

The RESP monitoring displays a RESP waveform in channels area and the measured respiration rate value in parameters area.

.3.1 RESP CHANNEL

RESP channel is shown as the figure below:



- ① RESP channel label. Select this label, the menu as the following figure shows pops up.
- ② Lead type: I, II or III, default lead II.
- ③ Gain mode: AUTO or MANUAL.
- ④ Gain: Four grades are available: $\times 1/2$, $\times 1$, $\times 2$ and $\times 4$. If the gain is too great, the top part of the waveform may be displayed as a straight line.
- ⑤ RESP waveform.

.3.2 RESPIRATION RATE

The respiration rate is displayed in the parameters area, shown as below:



- ① Lower alarm limit. The monitor generates alarms when the measured respiration rate value is less than it.
- ② Upper alarm limit. The monitor generates alarms when the measured respiration rate value is greater than it.
- ③ Respiration rate label. Select this label, the following menu appears.
- ⑤ Respiration unit
- ④ Measured respiration rate value.

Select the respiration rate label (RR), the following menu pops up:

Resp Setup			
RR Source	RESP	Gain Mode	MANUAL
Apnea Time	10 seconds	Adjust Gain	x1
Apnea Level	High	Lead	II
Apnea Alarm	Off	Fill Waveform	No
Waveform Speed	25mm/s	Alarm Setup >>	
Return to the previous menu.			
Previous Menu		Exit	

■ **RR Source:**

The respiration rate source can be viewed and selected in this menu. There are four options: Auto, RESP, T-RESP and CO₂. The monitor will display the RR value calculated from the chosen source. If it is set as Auto, the RR source is in accordance with the current channel, which is RESP when RESP channel is displayed or T-RESP when T-RESP channel is displayed.

■ **Apnea Time:** 10–120 seconds.

■ **Apnea Level:** High, medium and low.

■ **Apnea Alarm:**

On: When the patient’s cessation of breath exceeds the range, this monitor will produce alarm to indicate the user.

Off: Although the patient’s cessation of breath is an apnea event, this monitor will not produce alarm.

■ **Waveform Speed:** Select this button, the waveform speed switches among 3.125mm/s, 6.25mm/s, 12.5mm/s, 25mm/s and 50mm/s. Decrease it, the waveform is compressed, and you will see longer time quantum; increase it, the waveform is expanded, and you will get more detailed view.

■ **Gain Mode:** Select this button, the gain mode switches between AUTO and MANUAL modes.

■ **Adjust Gain:** This button is available only in manual mode. Select this button then turn the rotating mouse to adjust the gain. Four grades are available: $\times 1/2$, $\times 1$, $\times 2$ and $\times 4$. Press the mouse to exit the gain adjustment, and the RESP waveform will be displayed in chosen gain.

■ **Lead:** Select this button, the waveform switches among the waveforms of I, II and III leads.

■ **Fill Waveform:** Select this button, the RESP waveform speed will be filled or be blank.

The Waveform Speed button in the Display menu also can be used to change the RESP waveform speed. No matter which method is used, it will change both the waveform speed of the RESP and T-RESP simultaneously.

■ **Alarm Steup:**

Selecting the “**Alarm Setup**” button can open the Mass Alarm Setup, you can view and modify the alarm on/off state, alarm upper and lower limits and alarm printing on/off state of all parameters currently measured.

.4 PROMPT MESSAGES

In the status prompt bar of the RESP channel, the current respiration status message is displayed at the position ⑤.

Lead Off: The current lead is not properly connected. When the lead is not inserted on the Monitor or connected to the patient, this message shows.

RESP Apnea: When the RESP is set for RR source and the apnea alarm is on, if the patient’s cessation of breath is an apnea event then the system prompts "RESP Apnea".

Running: Except the above-mentioned condition, the system prompts “Running” .

Chapter 11: TEMP MONITORING

.1 TEMPERATURE PROBE INSTALLATION

The monitor is able to use two temperature probes simultaneously. Attach the temperature probe to the patient’s body where ought to be measured, to obtain two temperature values and the difference between them.

If a disposable temperature probe is used, plug the temperature probe cable in the temperature probe connector, and then connect the temperature probe with the cable; if a reusable temperature probe is used, connect the temperature probe with the temperature probe connector directly.

NOTE

- The disposable temperature probe is for single patient use only.

WARNING

- Be careful to avoid damaging the temperature probe and cable. When the temperature probe and cable are not in use, shape them into a loose round. If the cable is tangled too tightly or over-bent, mechanical damage may occur.
- The calibration of the temperature measurement function is desired every year (or as dictated by your Hospital Procedures Policy). If you need to calibrate the temperature measurement function, contact the manufacturer.

.2 Temp Monitoring Interface

The temperature measurement result is displayed in the parameters area, shown as Figure 11-1:

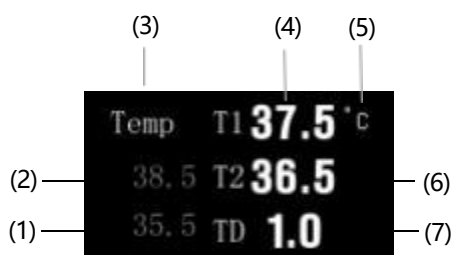


Figure 11-1

- (1) Temperature lower alarm limit. When the measured temperature value is less than it, the monitor generates alarms.
- (2) Temperature upper alarm limit. When the measured temperature value is greater than it, the monitor generates alarms.
- (3) Temperature label: Select this label, and the menu shown as below pops up.
- (4) Temperature difference: It is the absolute value of the difference between the temperature

values of two channels.

- (5) Temperature unit: °C or °F. See **Temp Setting** in CHAPTER 9 for the setting method.
- (6) Measured temperature value of channel 1: Measurement range: (0-50)°C.
- (7) Measured temperature value of channel 2: Measurement range: (0-50)°C.

.3 Temp Setting

Select Temp parameter area, press the rotating mouse to open the menu “**Temp Setup**”, shown as Figure 11-2:



Figure 11-2

Alm Level:

Alarm levels can be set to "**High**", "**Medium**", and "**Low**" levels.

Temp Unit:

Select the temperature unit “°C” or “°F”.

Alarm Setup:

Selecting the “**Alarm Setup**” button can open the Mass Alarm Setup, you can view and modify the alarm on/off state, alarm upper and lower limits and alarm printing on/off state of all parameters currently measured.

.4 Maintenance and Cleaning

Maintenance and cleaning of reusable temperature sensing probe for ear/forehead thermometer:

- Do not sterilize the temperature sensing probe of the ear/forehead thermometer with steam.
- Sterilize the temperature sensing probe only with alcohol-based detergent

- Cover the temperature sensing probe with the temperature sensing probe cover when not in use.
- Use an alcohol swab or cotton tissue moistened with alcohol (70% Isopropyl) to clean the

thermometer housing and the measuring sensor. Ensure no liquid enters the interior of the device.

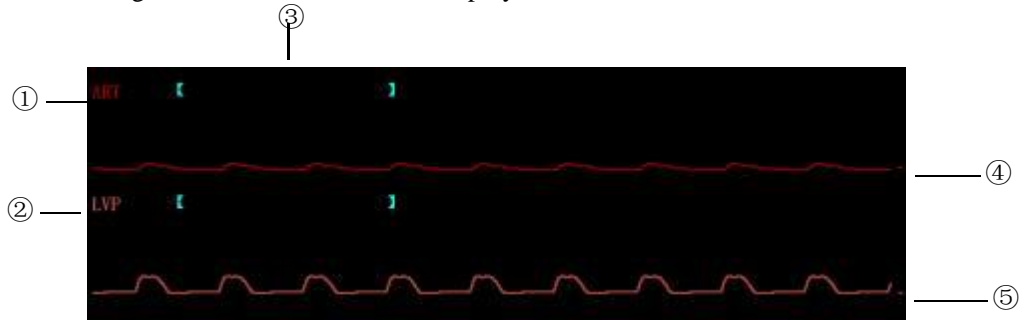
- Never use abrasive cleaning agents, thinners or benzene or other cleaning liquids.

■

CHAPTER 12: IBP MONITORING

.1 IBP CHANNELS

The monitor provides two channels to measure the invasive blood pressure (IBP, including systolic, diastolic and mean pressures), and displays two channels of waveforms and two parameters. The two channels of waveforms are displayed in a same or different waveform area, differentiated by color. When the two curves overlapped, the curve color will be the color of channel 2. The figure below is the channels displayed in different waveform area:



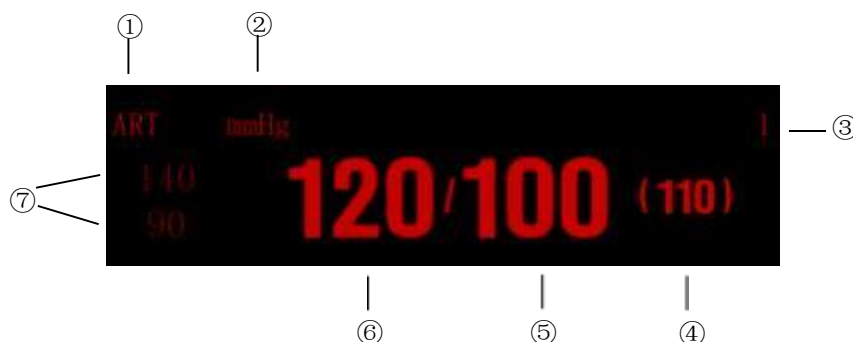
- ① Label of channel 1: Selecting this label pops up the menu of channel 1.
- ② Label of channel 2: Selecting this label pops up the menu of channel 2.
- ③ Status message: Displayed above the waveform. All the possible status messages are listed in the following table:

Message string	Meaning	Possible causation
No Response	The monitor can not get data from this channel	When the monitor is restarting, this message indicates that the channel has not been started yet, but this message will disappear in 5 seconds. Or the hardware of IBP module does not work properly and needs to be fixed.
Sensor Off	The pressure sensor isn't connected to the monitor.	The pressure sensor cable has fallen off from the monitor or from the pressure sensor.
NOT Zero	The channel wasn't zeroed	Operator has to zero the monitor after it is started. If not, the measured pressure is unusable.
Auto/Manual	This is a normal working message. It tells the current gain mode and gain ratio.	The channel works properly.

- ④ Waveform of channel 1.
- ⑤ Waveform of channel 2.

.2 IBP PARAMETER

The measured IBP values of two channels are displayed in the parameters area, the right side of the IBP channels, shown as below:



- ① IBP label of channel 1.
- ② IBP unit.
- ③ Indicates that this area displays the measured IBP values of channel 1.
- ④ Mean pressure (MEAN)
- ⑤ Diastolic blood pressure (DIA)
- ⑥ Systolic blood pressure (SYS)
- ⑦ Upper and Lower alarm limit of SYS

IBP values can vary in the range from -60mmHg to 500mmHg . Values not in this range will be displayed as invalid pressure, in the form of “---” or “--.-”.

But there are more reasons if these pressure values are displayed as invalid values, they are:

1. The actual pressure is not in the range from -60 mmHg to 500 mmHg .
2. The channel wasn't zeroed.
3. The cable is disconnected or not connected firmly.
4. The channel is not calibrated properly.
5. In zero processing.
6. Monitor is starting.

The IBP unit is the same as the NIBP unit. See REGION SETTINGS in CHAPTER 4 for detailed information.

.3 PRECAUTIONS

WARNING

- Use only the IBP transducer specified in this manual. Disposable IBP transducers should not be reused.
 - Parts and accessories used must meet the safety requirements of the medical electrical equipment standards.
 - Avoid conductive connection to the applied part likely to degrade safety.
 - When the monitor is used with high frequency surgical equipment, do not allow the transducer and the cable contact the high frequency surgical equipment to prevent the patient from burning caused by leakage current.
-

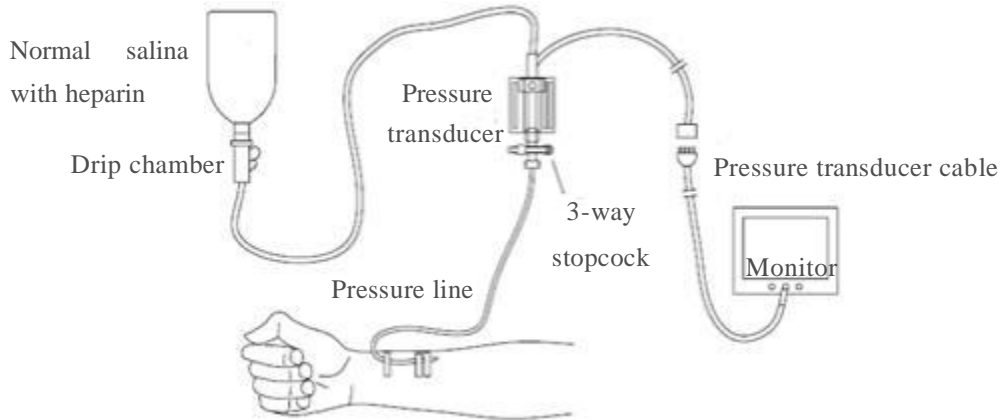
.4 MONITORING PROCEDURE

1. Plug the pressure cable into the IBP connector on the monitor and power on the monitor.
2. Prepare the pressure line and transducer by flushing the system with normal saline solution. Make sure the tubing and transducer system is free of air bubbles.

NOTE

- **In case of any entrapped air in the pressure system, re-fill the system with normal saline.**

3. Connect the catheter to the pressure line, making sure there is no air present in the catheter or pressure line.
4. Position the transducer so it is at the same level with the patient's heart, approximately mid-axillary line.
5. Verify the correct label is selected.
6. Zero the transducer.



.5 IBP MENU

.5.1 IBP CHANNEL MENU

Select the label of a target IBP channel, and the menu of this channel pops up, shown as below. In this menu, we can change the label of the channel, zero the transducer and select the display gain.

IBP Setup		
Lable	ART ▼	Zero
Gain Mode	AUTO ▼	Alarm Setup >>
Gain	0~500 ▼	
Return to the previous menu.		
	Previous Menu	Exit

■ **Lable**

Selecting this button switches the label of this channel. The label recycles in the order listed below:

Label	Definition
ART	Arterial Blood Pressure
CVP	Center Venous Pressure
RVP	Right Ventricle Pressure
LAP	Left Atria Pressure
RAP	Right Atria Pressure
PAP	Pulmonary Arterial Pressure
ICP	Intracranial Pressure
LVP	Left Ventricle Pressure

The selected label will be saved in 5 seconds and displayed in the corresponding channel. It does not take any other effect other than displaying.

■ **Gain Mode**

This button is to select the display gain mode for the channel. The gain mode switches between Auto and Manual when selecting this button. This function is disabled if the channel wasn't zeroed.

■ **Gain**

If the gain mode of the channel is Manual, we can use this button to increase/decrease display gain. The clockwise for decrease, whereas for increase. This operation zooms in the waveform in vertical direction. This function is also disabled if the channel wasn't zeroed.

■ **Zero**

In the first time we select this button, the corresponding channel will perform zero process. And selecting this button again will terminate the zeroing. The system will treat the detected absolute pressure value as the relative zero point. This zero point affects both the pressure values and the waveforms of the channel.

Zeroing procedure:

1. Disconnect the transducer from the patient.
2. Adjust the 3-way stopcock to close the channel leading to the patient. The transducer is open to the atmosphere through the stopcock.
3. Select the Zero button in the IBP channel menu to start zeroing.

■ **Alarm Stup:**

Selecting the “**Alarm Setup>>**” button can open the Mass Alarm Setup,you can view and modify the alarm on/off state, alarm upper and lower limits and alarm printing on/off state of all parameters currently measured.

.6 MAINTENANCE AND CLEANING

WARNING

- **Before cleaning the transducer, make sure the transducer is disconnected from the monitor, or the monitor is powered off and disconnected from AC power.**
-

.6.1 CLEANING OF IBP TRANSDUCER

After the IBP monitoring operation is completed, remove the tubing and the dome from the transducer and wipe the transducer diaphragm with water. To clean the transducer and the cable, wipe them using soap or the detergents listed below:

- Cetylcide
- Wavicide-01
- Wescodyne
- Cidex
- Lysol
- Vesphene

Do not immerse the connector in any liquid. After cleaning, dry the transducer thoroughly before storing. Slight discoloration or temporary increase of surface stickiness of the cable should not be considered abnormal. If it is necessary to remove the adhesive tape residue from the transducer cable, the double seal tape remover is recommended; use the remover with special caution to minimize the damage to the cable. Acetone, Alcohol, Ammonia and Chloroform, or other strong solvents are not recommended because they are harmful to the vinyl cabling if used for a long time.

NOTE

- **The disposable transducers or domes must not be reused.**
 - **To avoid contamination, the disposable transducers or domes must be reclaimed or disposed of properly, complying with the local laws.**
-

.6.2 STERILIZATION

Chemical Solution Sterilization

After finishing the cleaning, select an effective sterilant for chemical solution sterilization of the operating room equipment. Buffered glutaraldehyde (e.g. Cidex or Hospisept) is recommended. Do not use quaternary cationic detergents such as zephiran chloride. If the whole unit is to be sterilized, immerse the transducer but not the electrical connector into the sterilant for the recommended sterilizing period. Ensure that the dome has been removed. Then rinse all transducer parts except the electrical connector with sterilized water or saline. The transducer must be thoroughly dried before storing.

Gas Sterilization

For more complete asepsis, use gas sterilization. The transducer should be completely dry after cleaning. When ethylene oxide gas is used as the gas disinfectant, follow the operating instructions provided by the manufacturer of the gas disinfectant.

Chapter 13: CO₂ MONITORING

.1 Overview

CO₂ monitoring is to monitor the respiration of patient by detecting the concentration of CO₂ generated during respiration. The maximum concentration of CO₂ at the end of exhalation is called *End-Tidal CO₂* (EtCO₂). The minimum concentration of CO₂ at the end of inspiration is called *Fractional Inspiratory CO₂* (FiCO₂). CO₂ is generated by cells in the body during metabolizing, and is breathed out via breath system. The concentration of CO₂ breathed out from lung reflects directly the situation of metabolizing and breathe system. If the concentration of CO₂ is high, it means that metabolizing is excited, such as blood poisoning or acute fever. If the concentration of CO₂ is low, it is commonly because the output ability of heart is weak, or the heart stop beating, or the lung soak for the flux of blood is low or oxygen it carried is not enough. Monitoring CO₂ is used to warn the doctor of the abnormal of breathe and metabolizing for hocused patient.

The concentration of CO₂ is represented as a pressure level, with mmHg, kPa or % as its unit. Generally, the acceptable value is 38mmHg (5.1kPa or 5%) when air pressure is 760mmHg. The concentration of CO₂ varies very fast from 0% to 5% normally. To detect the concentration of CO₂ accurately, the monitor has to be very sensitive.

.2 Monitoring Procedure

The Side-stream CO₂ or Mainstream CO₂ module may be equipped with monitor. But the type of CO₂ Module you selected is only one of them, please read the corresponding introduction seriously before CO₂ monitoring.

.2.1 Side-stream CO₂

This section is only applicable to a monitor equipped with a Side-stream CO₂ module. Follow the procedure specified below to monitor the CO₂.

- (1) Attach the C5 Side-stream CO₂ Sensor to the monitor, and just plug the CO₂ Sensor into its receptacle and clicks into place.
- (2) For monitoring CO₂, select the side-stream sampling cannula kit that is appropriate for the patient size and application. Verify that the cannula kit is clean, dry and undamaged. Replace the cannula kit if necessary, shown as Figure 13-1.

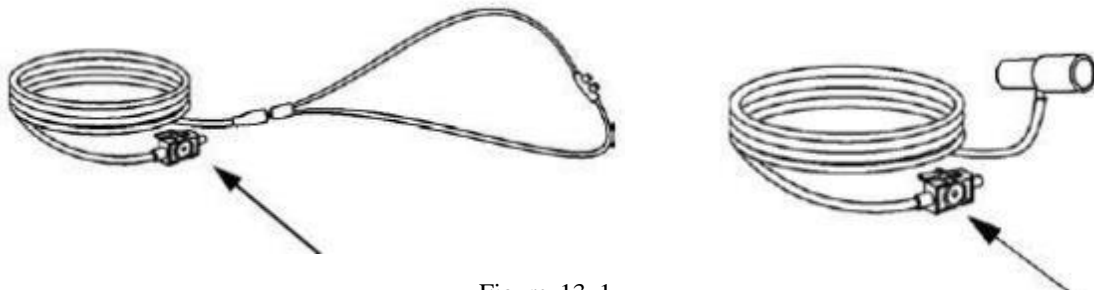


Figure 13-1

- (3) The sample cell of the sampling kit must be inserted into the sample cell receptacle of the Side-stream CO₂ Sensor shown as the picture below. A “click” will be heard when the sample

cell is properly inserted, shown as Figure 13-2.

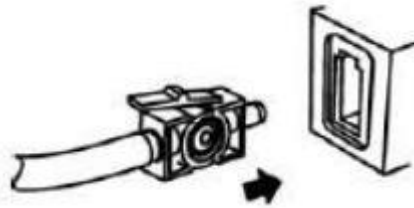


Figure 13-2

(4) Adapter Zeroing.

The function of a zero is to identify the optical characteristics of adapter windows, it is necessary only when requested. Such a request will occur if a change is detected in the CO2 Module. When zeroing, always keep all sources of CO2 away from the sensor, including your own breath. The zero only takes 15 to 20 seconds usually. Details of zeroing can be found in the following text.

- (5) Place the nasal cannula kits onto the patient. Some patients are prone to mouth breathing. The Oral/Nasal sampling cannula should be used on these patients, as most, if not all of the CO2 is exhaled through the mouth. If a standard nasal CO2 sampling cannula is used with these patients, the ETCO2 number and capnogram will be substantially lower than actual. When using the Nasal or Oral/Nasal CO2 sampling kits with oxygen delivery, place the cannula on the patient shown in the picture below (left) and then attach the oxygen supply tubing to the oxygen delivery system and set the prescribed oxygen, shown as Figure 13-3.

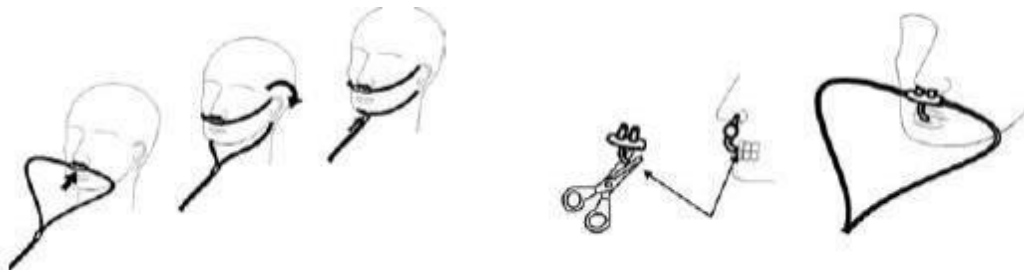


Figure 13-3

If the oral/nasal cannula is used, the oral sampling tip may need to be trimmed to adequately fit the patient. Place the cannula onto the patient as shown above (right). Observe the length of the oral cannula tip. It should extend down past the teeth and be positioned in the mouth opening. Remove the cannula from the patient if the tip needs to be trimmed.

- (6) The Adult/Pediatric side-stream on-airway adapter kits should be used when monitoring intubated patients with Endotracheal Tube diameters greater than 4.0 mm as shown following. Place the on-airway adapter at the proximal end of the airway circuit between the elbow and the ventilator circuit wye. Check that connections have been made correctly by verifying the presence of a proper capnogram on the Patient Monitor, shown as Figure 13-4.

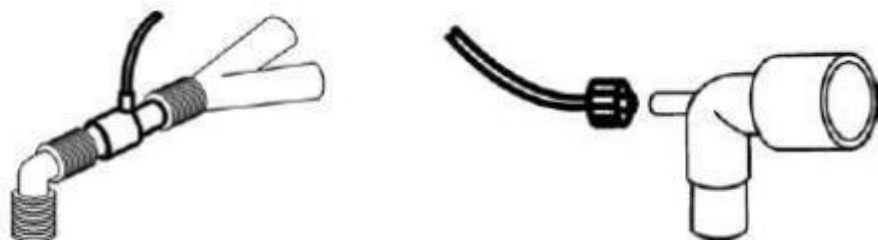












Figure 13-4

When using the CO₂ system with ventilator and anesthesia circuits that have an integrated airway adapter with a female Luer. Connect male luer connector to the female port on the airway adapter as shown above.

- (7) Enables the displaying of CO₂ channel via the Format Setup button in the Display menu.
- (8) Select the Start Pump button in the CO₂ channel menu to start air pump.
- (9) The CO₂ monitoring starts.

NOTE

-  **To monitor the CO₂, the CO₂ channel and the air pump must be enabled. If the monitor is in default settings, these two items must be reset.**
-  **After inserting the CO₂ Sensor connector into the receptacle of the host monitor, the monitor must be restarted.**
-  **For best results, wait 5 minutes to allow the Side-stream CO₂ Sensor to warm up before performing the Module Zero procedure.**
-  **Perform a zero whenever a different style adapter is installed, such as when changing from reusable to single patient use or when the system displays a message to perform a zero. But a Zero is not required when switching from one sampling accessory to another.**
-  **Do NOT cut the oral cannula tip when the cannula is on the patient.**
-  **The Nasal and Nasal/Oral Cannula kits are disposable, and intended for single patient use. It should not be disinfected for reuse or cross-used by different patients.**
-  **Use the Pediatric/Infant on-airway adapter kits when monitoring intubated patients with Endotracheal Tube diameters less than or equal to 4.0mm.**
-  **The Adult/Pediatric and the Pediatric/Infant on-airway adapters are intended for single patient use. Do NOT reuse or sterilize the adapter kit as system performance will be compromised.**
-  **Always insert the Sample Cell of the sampling kit into the Sample Cell Receptacle on the Module before inserting the on-airway adapter into the ventilator circuit. Failure to follow this, may introduce a leak in the circuit, thereby reducing set minute volume. Remove the sampling kit sample cell from the receptacle when not in use.**
-  **Remove the sampling kit from the Sidestream CO₂ Sensor Inlet Port when is not used to prolong the module's service life.**

2.2 Mainstream CO₂

Choose mainstream CO₂ sensor for optimal performance in monitoring intubated patients. This section is only applicable to a monitor equipped with a Mainstream CO₂ Sensor. Follow the procedure specified below to monitor the CO₂.

- (1) Insert the Mainstream CO₂ Sensor connector into the receptacle of the monitor as shown in the following figure. Make sure the arrows on the connector are at the top of the connector and line up the two keys of the connector with the receptacle and insert.
- (2) Select an appropriate Airway adapter based on the patient and monitoring situation. Verify that the adapter is clean, dry and undamaged. Replace the adapter if necessary. Connect the Mainstream Sensor to the Airway adapter as shown in the following figure. Slides on and clicks into place, shown as Figure 13-5.

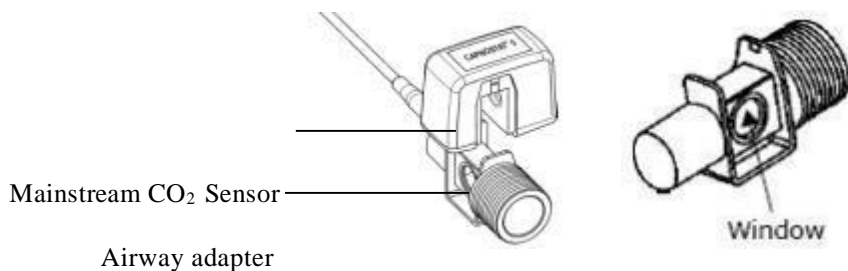


Figure 13-5

- (3) Zeroing. An "Adapter Zero" is a necessary procedure that adjusts the Mainstream CO2 sensor to the optical characteristics of each compatible CO2 adapter. When zeroing, always keep all sources of CO2 away from the sensor, including your own breath. The zeroing only takes 15 to 20 seconds usually. Details can be found in the following text.
- (4) Shown below is the combined CO2 Sensor with a patient circuit. Place the Airway adapter at the circuit, between the Elbow and the Wye, shown as Figure 13-6.

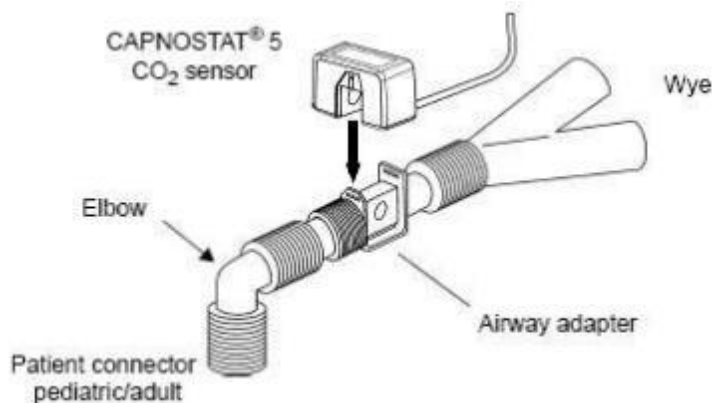


Figure 13-6

- (5) Selecting a appropriate Combined CO2/Flow Sensor for Pediatric/Adult, Pediatric or Neonatal, shown as Figure 13-7.

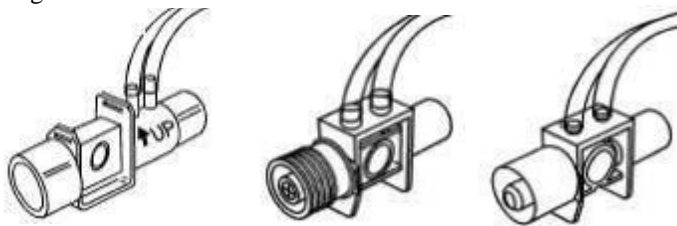


Figure 13-7

- (6) Connect the combined CO2/Flow sensor to the patient breathing circuit, shown as Figure 13-8.

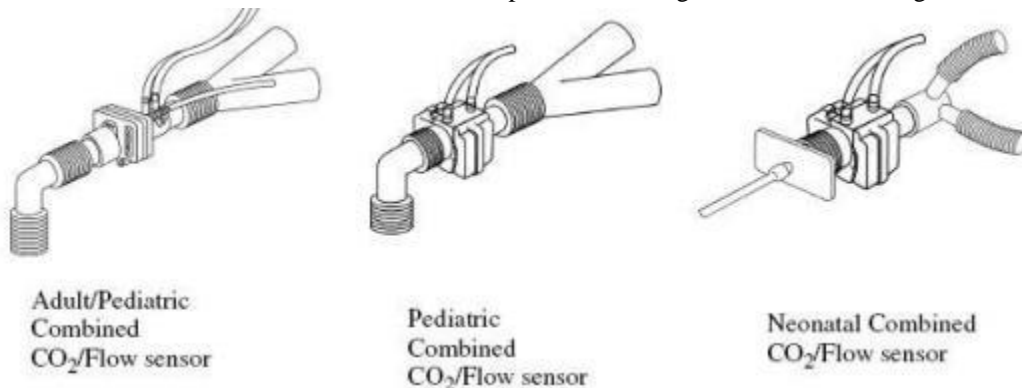








Figure 13-8

- (7) Enables the displaying of CO2 channel via the Format Setup button in the Display menu.
- (8) Select the Start Pump button in the CO2 channel menu to start air pump.
- (9) The CO2 monitoring starts.

NOTE

-  **To monitor the CO2, the CO2 channel and the air pump must be enabled. If the monitor is in default settings, these two items must be reset.**
-  **Make sure the arrows on the connector are at the top of the connector and line up the two keys of the connector with the receptacle and insert.**
-  **For best results, wait 5 minutes to allow the C5 CO2 Sensor to warm up before performing the Zero procedure.**
-  **Perform a zero whenever a different style adapter is installed, such as when changing from reusable to single patient use or when the system displays a message to perform a zero. But a Zero is not required when switching from the same type of Airway Adapter, such as a disposable to a disposable Airway Adapter.**
-  **The Airway Adapter is intended for single patient use. It should not be disinfected for reuse or cross-used by different patients.**
-  **To remove the connector, grasp the body portion of the connector back and remove. Do not remove by pulling cable.**

.2.3 Adapter Zeroing

A zeroing is performed whenever a CO₂ sensor is connected to the monitor for the first time. Thereafter, perform a zero whenever a different style adapter is installed, such as when changing from reusable to single patient use or when the system displays a message to perform a zero. Before performing a adapter zero, the sampling line should be removed from the patient circuit and the airway adapter type to be used in the circuit should be inserted into the module. Care should be taken ensure that the airway adapter is clear of any residual CO₂ gas.

- System does not allow adapter zeroing for 20 seconds after the last breath is detected.
- System does not allow adapter zeroing if temperature is not stable.
- An adapter zeroing cannot be performed if a sample cell or airway adapter is not connected to the module.

To perform a Adapter Zeroing:

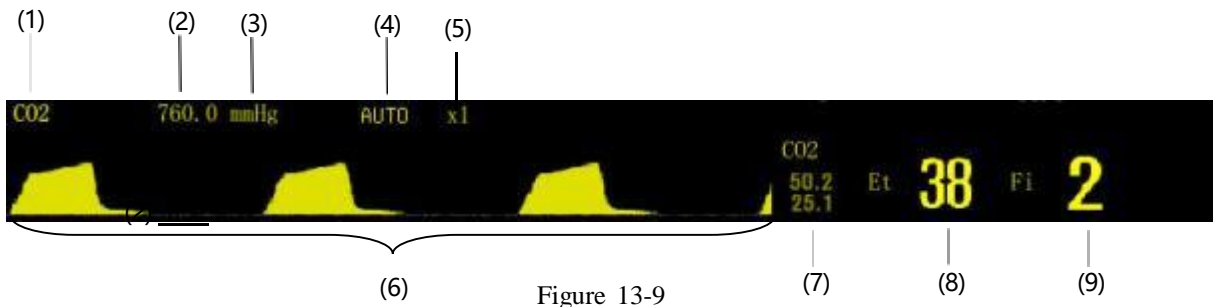
- (1) Connect the CO2 Module and, if necessary, wait for the sensor warm-up message to clear.
- (2) Connect a Sampling accessory to the CO2 Module, and make certain that the accessory is exposed to room air and away from all sources of CO₂, including the ventilator, the patient's breath and your own.
- (3) Query the status of the CO2 Module to check that the status bit "CO2 Sensor not ready to zero," is not set.

-
- (4) Place the CO2 Sensor onto a clean and dry Airway adapter that is exposed to room air and away from all sources of CO2, including the ventilator, the patient's breath and your own..
 - (5) Start the Sample Cell Zero. The maximum time for a Module zero is 40 seconds. The typical time for a zero is 15-20 seconds.

.3 CO2 Monitoring Interface

In CO2 monitoring, a CO2 waveform is displayed in the channel display area, and the end-tidal CO2 (EtCO2) measured value, the fractional inspired CO2 (FiCO2) measured value and the airway respiration rate (awRR) are displayed in the parameter channel display area.

CO2 channel of the channel display area is shown as Figure 13-9.



- (1) CO₂ waveform channel label.
- (2) Atmospheric pressure value.
- (3) Concentration unit.
- (4) Gain mode.
- (5) Gain size.
- (6) CO₂ waveform
- (7) Alarm limits.
- (8) End-tidal CO₂ (EtCO₂) measured value.
- (9) Fractional inspired CO₂ (FiCO₂) measured value.

.4 CO2 Setting

.4.1 CO2 Parameter Setting

Select CO2 parameter area, press the rotating mouse to open the menu “CO2 Setup”, shown as Figure 13-10:

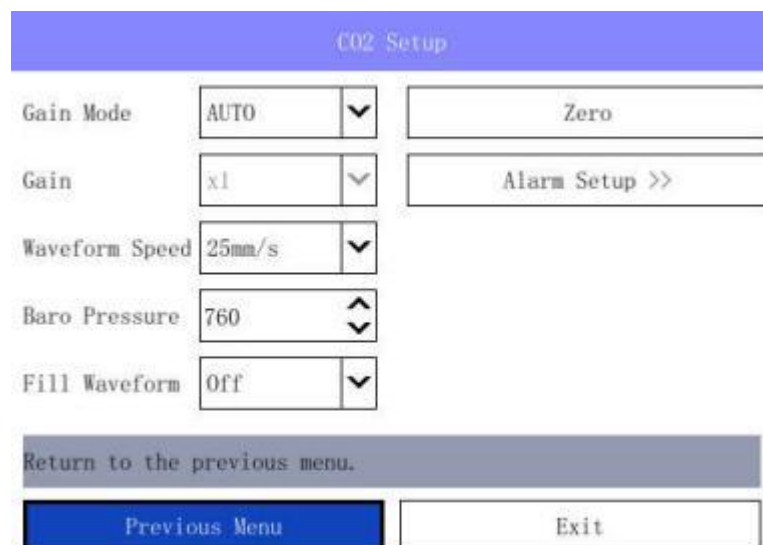


Figure 13-10

Gain Mode:

Select the gain mode of the CO₂ waveform to “**AUTO**” or “**MANUAL**”.

Gain:

When “**Gain Mode**” is “**MANUAL**”, the gain of the waveform display can be adjusted through this menu option. There are 5 gains to choose from, which are “**x1/2**”, “**x1**”, “**x2**”, “**x4**” and “**x8**”. After the user clicks this button, the selection is made by rotating the mouse. After selecting and then rotating the mouse to exit the gain selection, the CO₂ waveform will be displayed according to the selected gain.

Waveform Speed:

By clicking this button, the CO₂ waveform speed can be switched between 5 speeds: “**3.125mm/s**”, “**6.25 mm/s**”, “**12.5 mm/s**”, “**25 mm/s**” and “**50 mm/s**”. The CO₂ waveform speed is the same as the impedance respiration waveform speed. When the CO₂ waveform speed is switched, the impedance respiration waveform speed is also switched. The current CO₂ waveform speed can be viewed through the Impedance Breath Channel Information Bar.

Baro Pressure:

Set the current atmospheric pressure value in units of mmHg.

Fill Waveform:

Fill Waveform yes/no.

Zero:

Realize the mainstream sensor to zero.

Alarm Setup:

Selecting the “**Alarm Setup**” button can open the Mass Alarm Setup, you can view and modify the alarm on/off state, alarm upper and lower limits and alarm printing on/off state of all parameters currently measured.

.5 Maintenance and Cleaning

In case of an exception in the sampling system of the CO₂ module, check the entanglement of the sampling line. If the sampling line is not entangled, remove the dehydration vase. In this situation, if the dehydration vase is not blocked, the sampling line must have been blocked, and you must replace it with a new one. If the dehydration vase has been blocked, you should replace it with a new dehydration vase.

.5.1 CO₂ Sensor

For both Side-stream CO₂ and Mainstream CO₂ Sensor, cleaning the outside of the CO₂ Sensor:

- Use a cloth dampened with isopropyl alcohol 70%, a 10% aqueous solution of sodium hypochlorite (bleach), disinfectant spray cleaner such as mild soap.
- Wipe down with a clean water-dampened cloth to rinse and dry before use. Make certain that the sensor windows are clean and dry before reuse.

.5.2 Airway Adapters

Reusable adapters:





- Clean by rinsing in a warm soapy solution followed by soaking in a liquid disinfectant such as isopropyl alcohol 70%, a 10% aqueous solution of sodium hypochlorite (bleach), a glutaraldehyde 2.4% solution such as ammonia. It should then be rinsed out with sterile water and dried.
- May be disinfected using the methods listed below:
 - Steam Autoclave - adult adapters only
 - Immerse and soak in equivalent 2.4 glutaraldehyde solution for a 10 hour soak.
 - Immerse and soak in equivalent peracetic acid 0.26% solution for a 10 minute soak..
 - Before reusing the adapter, ensure the windows are dry and residue free and that the adapter has not been damaged during handling or the cleaning/disinfecting process.

Disposable adapters:

- Treat all single patient use airway adapters in accordance with institutional protocol for single patient use items.
- DO NOT insert any object, such as a brush, into the C5 CO2 airway adapter. Irreparable damage may occur to the CO2 windows.



WARNING

-  **The sampling line is disposable, must not re-sterilize or reuse it.**
 -  **Do not press or limit the sampling line.**
 -  **The dehydration vase is used to collect water drops condensed in the sampling airway and prevent water drops from entering the module. When the collected water reaches to a certain amount, remove the water to avoid blocking the airway.**
 -  **In the long-term use, dust or other substances may lower the air permeability of the filter material in the dehydration vase and may block the airway. In this situation, the dehydration vase must be replaced.**
-

NOTE

-  **The sampling line or disposable adapter must be recycled or disposed of properly, complying with the local laws.**
-

Chapter 14: Review

.1 Opening of Review Window

In the “Main Menu”, select “Review >>”, shown as Figure 14-1.



Figure 14-1

Select “Graphic Trends”, “Tabular Trends”, “NIBP List”, “Arrh.Events”, “Alams List” or “Full Disclosure” to open the corresponding review window.

.2 Graphic Trends

Select the hot key “Trends”, or select “Graphic Trends” in the menu “Review >>” to enter the window, shown as Figure 14-2.

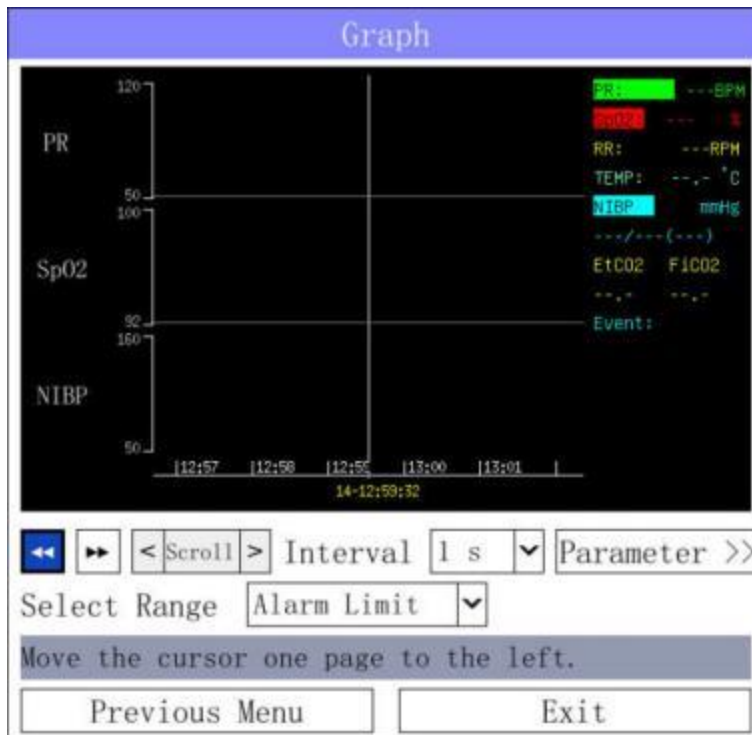


Figure 14-2

- Select the button “**Parameter >>**”, and select the parameters to be reviewed in the pop-up dialog box.
- Select “**Interval**”, and then select “**1s**”, “**5s**”, “**10s**”, “**30s**”, “**1min**”, “**2min**”, “**4min**”, “**8min**”, “**12min**” or “**16min**” according to the observation needs.
- Browse the trend chart in the following ways:

Select to move the trend cursor.

Select and to page to the left or right to move the trend chart.

- The cursor displays the moment corresponding to the current cursor position, and the parameter values for the moment are displayed on the right of the “**Graph**” window. They will vary with the movement of trend cursor.
- “**Select Range**” option, you can select “**Alarm Limit**”, “**Max Range**” and “**Manual Adjust**” to adjust the display amplitude by the above three methods. When “**Manual Adjust**” is selected, the amplitude can be enlarged and reduced by the button on the right.

.3 Tabular Trends



In the menu “**Review >>**”, select “**Tabular Trends**” to enter the window, shown as Figure 14-3.

MRN	Time	SpO2 %	PR bpm	NIBP mmHg
12345	13:17:11	---	---	---/---(---)
12345	13:18:11	---	---	---/---(---)
12345	13:19:11	---	---	---/---(---)
12345	13:20:11	---	---	---/---(---)

Figure14-3

- Select “**Interval**”, and then select “**1min**”, “**2min**”, “**5min**”, “**20min**” or “**30min**” according to the observation needs.
- Browse the trend table in the following ways:

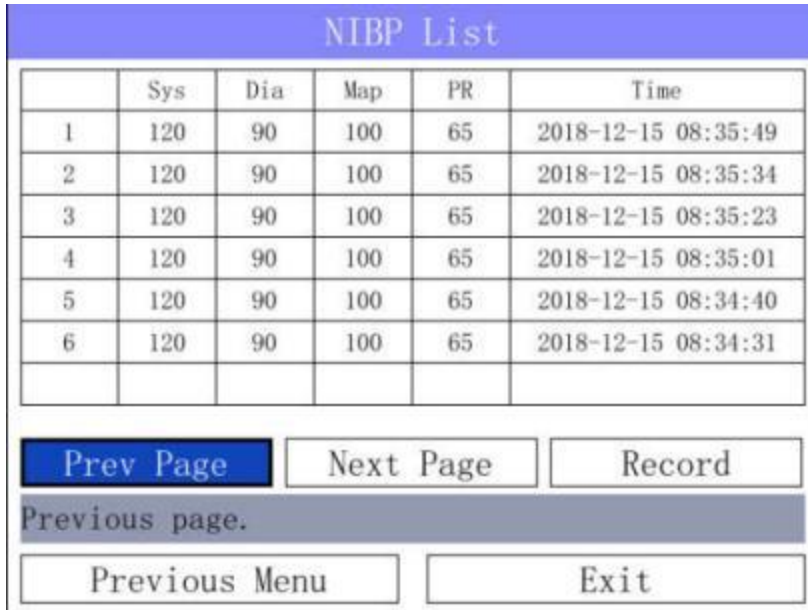
Select or to move the trend table to the left or the right, observe other parameters, and observe more data.

Select  or  to page up or down to move the trend table, and observe more data.

- **“ExportToUSB”**: When the monitor is equipped with USB function, after connecting the USB storage device, you can use this button to export the trend table data to the USB storage device.

.4 NIBP List

In the menu **“Review >>”**, select **“NIBP List”** to enter the window, shown as Figure 14-4.



NIBP List					
	Sys	Dia	Map	PR	Time
1	120	90	100	65	2018-12-15 08:35:49
2	120	90	100	65	2018-12-15 08:35:34
3	120	90	100	65	2018-12-15 08:35:23
4	120	90	100	65	2018-12-15 08:35:01
5	120	90	100	65	2018-12-15 08:34:40
6	120	90	100	65	2018-12-15 08:34:31

Previous page.

Figure 14-4

The window displays **“Sys”**, **“Dia”**, **“Map”**, **“PR”** and **“Time”** of the non-invasive blood pressure, in which **“PR”** comes from NIBP.

- Select the **“Prev Page”** or **“Next Page”** button to page forward and backward to view more data.
- Select **“Record”**, press the button, if the monitor is equipped with a printer, you can print the NIBP measurement data displayed in the current window.

.5 Arrh.Events

In the menu **“Review >>”**, select **“Arr.Events”** to enter the window, shown as Figure 14-5.



Figure 14-5

You can review all the stored arrhythmia events since the monitor is on in this list, including the time when the arrhythmia event occurred and the type of every arrhythmia event. The record list can record no more than 60 items of arrhythmia event in reverse order. You can browse arrhythmia event by rotating the mouse.

.6 Physiological Alarms

In the menu “**Review >>**”, select “**Alarms List**” to enter the window, shown as Figure 14-6.

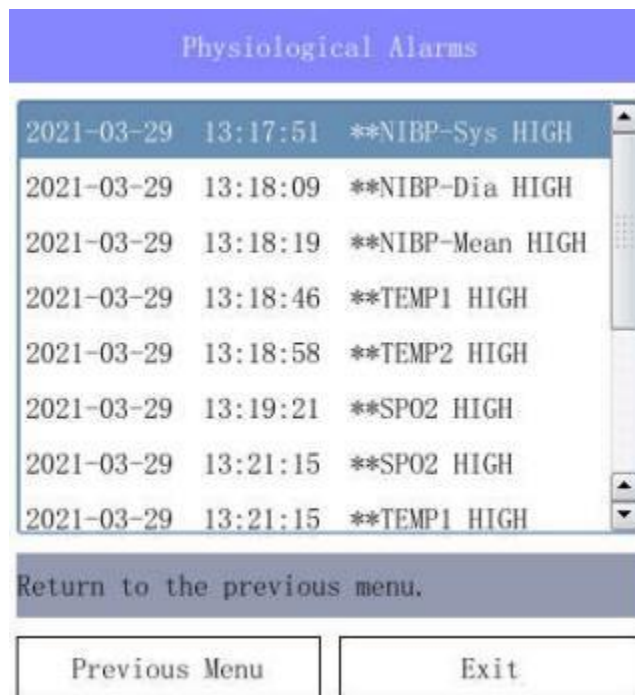


Figure 14-6

You can review all the stored physiological events since the monitor is on in this list, including the time when the physiological event occurred and the type of every physiological event and the reason for the alarm. The record list can record no more than

100 items of physiological event in reverse order. You can browse physiological event by rotating the mouse.

.7 Full Disclosure

In the menu “**Review >>**”, select “**Full Disclosure**” to enter the window, shown as Figure 14-7.



Figure 14-7

“Start time”: set the start time of the current review waveform;

“Go”: after selecting the time then clicks this button, the review interface display the waveform at that time;

“Prev page”, “Next page”: adjust the time of the trend forward or backward.

Chapter 15: Calculation

.1 Overview


The monitor provides the calculation function. The calculated values are not patient data directly measured, but are results calculated by the monitor according to the suitable data you provide.

The monitor can execute the following calculations:

- Pharmaceutical calculation
- Hemodynamic calculation


To execute certain calculation, please select “Calc >>” in the main menu.

NOTE

 The formulas are independent of other functions of the monitor. The calculated objects may not be patients monitored by the monitor. The calculating operation will not affect the monitored patient.



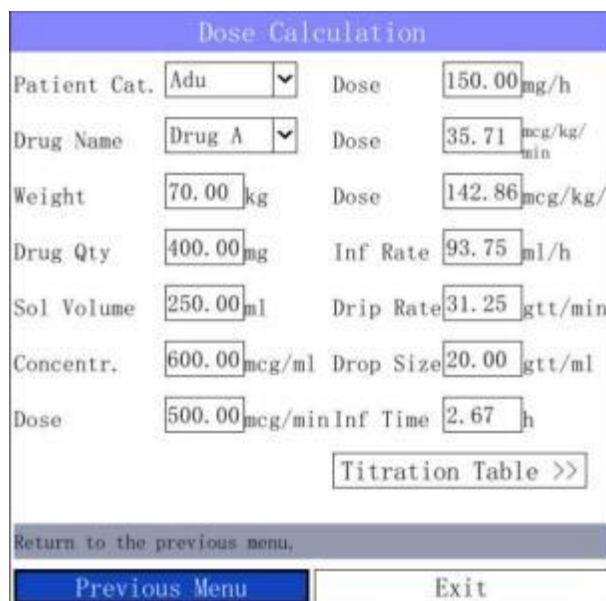
WARNING

 When calculating, you should carefully verify the correctness of input parameters and the suitability of calculation results. PaceTech shall not assume any responsibility for all consequences caused by the input and operation errors.

.2 Pharmaceutical Calculation

.2.1 Calculation Steps

- (1) In the “Main Menu”, select “Calc >>” → “Dose >>”, shown as Figure 15-1.



Dose Calculation			
Patient Cat.	Adu	Dose	150.00 mg/h
Drug Name	Drug A	Dose	35.71 mcg/kg/min
Weight	70.00 kg	Dose	142.86 mcg/kg/h
Drug Qty	400.00 mg	Inf Rate	93.75 ml/h
Sol Volume	250.00 ml	Drip Rate	31.25 gtt/min
Concentr.	600.00 mcg/ml	Drop Size	20.00 gtt/ml
Dose	500.00 mcg/min	Inf Time	2.67 h
Titration Table >>			
Return to the previous menu.			
Previous Menu		Exit	

Figure 15-1

- (2) Select “Patient Type” and “Drug Name”. In the drop-down list on the right side of “Drug Name”, select the required drugs from the following 15 drugs, in which the names of drugs A, B, C, D and E can be defined by the user.

Drugs A,B, C, D and E	Isoproterenol
Aminophylline	Lidocaine
Dobutamine	Sodium nitroprusside
Dopamine	Nitroglycerin
Epinephrine	Oxytocin
Heparin	

- (3) After the completion of the previous operations, the system will automatically give a set of default values. These data shall not be used as calculation results, but the known correct parameter values must be entered according to the doctor's instructions.
- (4) Enter the patient’s weight.
- (5) Enter the correct parameter values.
- (6) Confirm the correctness of calculation results.

.2.2 Calculation Unit

Each drug is calculated in a fixed unit or unit series. In the same unit series, the unit system will be adjusted with the entered parameter values.

The calculation units of various drugs are as follows:

- For drugs A, B and C, aminophylline, dobutamine, dopamine, epinephrine, isoproterenol, lidocaine, sodium nitroprusside and nitroglycerin, use the series units: g, mg, mcg.
- For drug D, heparin and oxytocin, use the series units: Unit, KU, MU.
- For drug E, use the unit: mEq.

When defining a drug, the operator should select drugA,B, C, D or E according to the unit series.

.2.3 Titration Table

After the completion of pharmaceutical calculation, select “Titration Table >>” in the “Dose Calculation” window to open the titration table, shown as Figure 15-2.

Titration Table					
Dose	150.00	mg/h	Inf Rate	93.75	ml/h
Drug Qty	400.00	mg	Sol Vol...	250.00	ml
Weight	70.00	mg	Drip Rate	31.25	glt/min
Dose	Inf Rate	Dose	Inf Rate	Dose	Inf Rate
0.00	0.00	7.00	4.38	14.00	8.75
1.00	0.62	8.00	5.00	15.00	9.38
2.00	1.25	9.00	5.62	16.00	10.00
3.00	1.88	10.00	6.25	17.00	10.62
4.00	2.50	11.00	6.88	18.00	11.25
5.00	3.12	12.00	7.50	19.00	11.88
6.00	3.75	13.00	8.12	20.00	12.50
<div style="display: flex; justify-content: space-between; align-items: center;"> Pre Page Next Page Interval 1 <input type="button" value="v"/> </div>					
Previous page.					
Previous Menu			Exit		

Figure 15-2

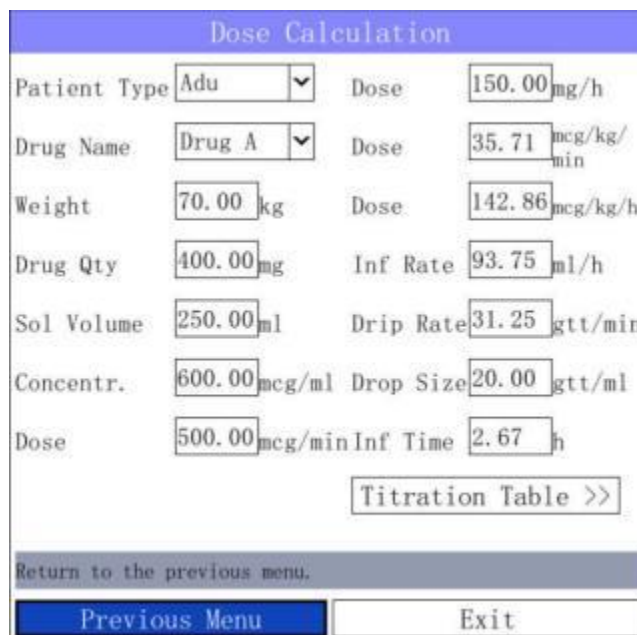
In the titration table, you can:

- Select “Pre Page” or “Next Page” to page up or down to view more data.
- Select “Interval” to set the step length.

.3 Hemodynamic Calculation

.3.1 Calculation Steps

- (1) In the “Main Menu”, select “Calc >>” → “Dose >>”, the menu “Dose Calculation” shown as Figure 15-3.



Dose Calculation			
Patient Type	Adu	Dose	150.00 mg/h
Drug Name	Drug A	Dose	35.71 mcg/kg/min
Weight	70.00 kg	Dose	142.86 mcg/kg/h
Drug Qty	400.00 mg	Inf Rate	93.75 ml/h
Sol Volume	250.00 ml	Drip Rate	31.25 gtt/min
Concentr.	600.00 mcg/ml	Drop Size	20.00 gtt/ml
Dose	500.00 mcg/min	Inf Time	2.67 h
Titration Table >>			
Return to the previous menu.			
Previous Menu		Exit	

Figure 15-3

- (2) Enter the correct parameter values.
 - If the calculation is performed to the monitored patient, the default values of HR, Art Mean and CVP are current real-time measured values; if C.O. measurement was made, the default value of C.O. will be the average of the selected C.O. measurements; height and weight come from the entered patient information. When the monitor fails to provide these data, it will display blank. You need to manually enter.
 - If the calculation is not performed to the monitored patient, you need to confirm or modify all input values.
- (3) Select the button “Calculate” to calculate the output parameter values.
 - For the output values out of the reasonable range, their background color is yellow. At this time, select “Range”, then the units behind all parameters will disappear. The reasonable ranges for the parameters out of the reasonable ranges will be displayed.
 - “---” represents invalid values.

.3.2 Input Parameters

Abbreviation	Unit	Full Name in English
C.O.	L/min	cardiac output
HR	bpm	heart rate
PAWP	mmHg	pulmonary artery wedge pressure
Art Mean	mmHg	artery mean pressure
PA Mean	mmHg	pulmonary artery mean pressure
CVP	mmHg	central venous pressure
EDV	ml	end-diastolic volume
H	cm	height
W	kg	weight

.3.3 Output Parameters

Abbreviation	Unit	Full Name in English
C.I	L/min/m ²	cardiac input
BSA	m ²	body surface area
SV	ml	stroke volume
SI	ml/m ²	stroke index
SVR	DS/cm ⁵	systemic vascular resistance
SVRI	DS.m ² /cm ⁵	systemic vascular resistance index
PVR	DS/cm ⁵	pulmonary vascular resistance

PVRI	$DS \cdot m^2/cm^5$	pulmonary vascular resistance index
LCW	$kg \cdot m$	left cardiac work
LCWI	$kg \cdot m/m^2$	left cardiac work index
LVSW	$g \cdot m$	left ventricular stroke work
LVSEI	$g \cdot m/m^2$	left ventricular stroke work index
RCW	$kg \cdot m$	right cardiac work
RCWI	$kg \cdot m/m^2$	right cardiac work index
RVSW	$g \cdot m$	right ventricular stroke work
RVSWI	$g \cdot m/m^2$	right ventricular stroke work index
EF	%	ejection fraction

Chapter 16: OTHER PATIENT VIEWING

.1 OVERVIEW

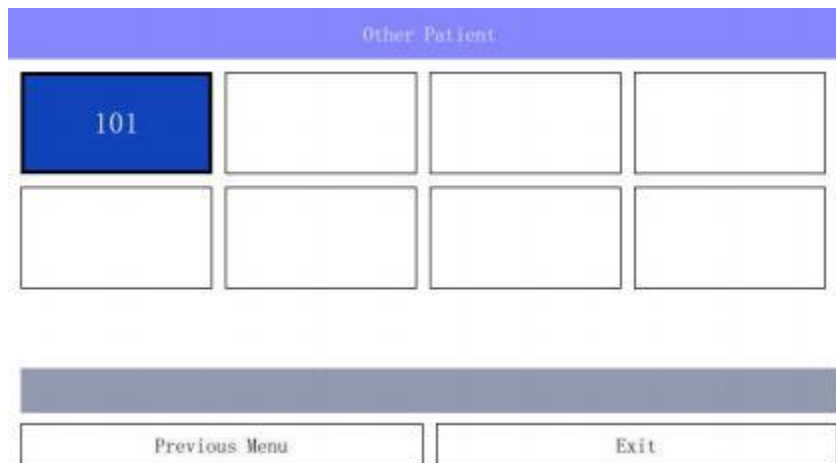
This monitor is able to view waveforms and measured parameter data from another patient monitor on the same monitoring network.

The other patient viewing function has the following features:

- The other patient viewing function must be realized by the LAN, so the viewing and viewed monitors should both be connected to the LAN.
- The LAN connection could be wire or wireless.
- The other patient viewing function doesn't depend on the central monitoring system. Whether the central monitoring system exists in the LAN doesn't influence this function.
- A monitor only can view one monitor and at the same time, only can be viewed by one monitor.

.2 SELECT MONITOR

Select Tools in the Main menu, and then select Other Patient, the following Other Patient--Select Monitor dialog box pops up.

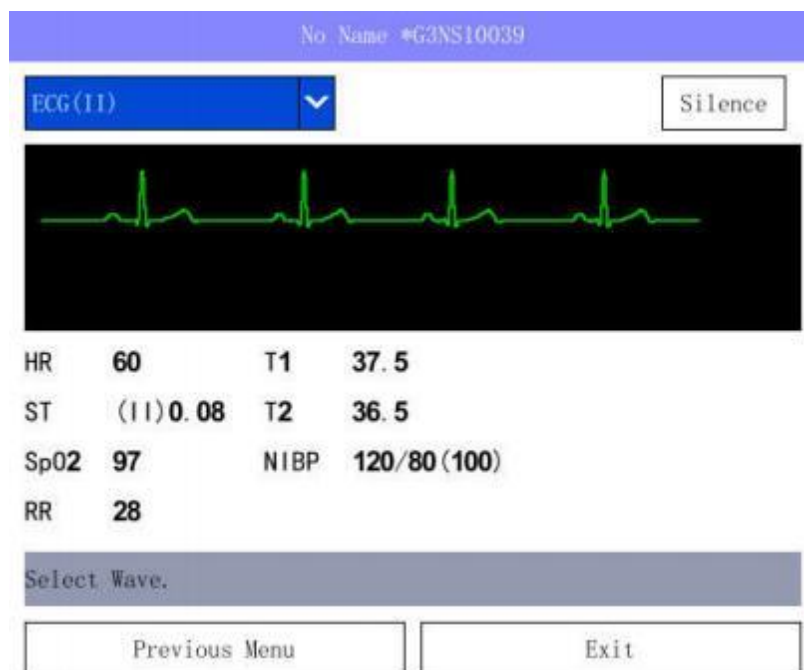


- All the device names of the monitors connected to the LAN are listed in this dialog box, such as “101” displayed in the figure above. The device name is set in the Edit Device Name dialog box and its detailed setting method refers to NETWORK SETTINGS in CHAPTER 4.
- One page of this information box can list 8 device names. When the connecting monitors exceed 8 sets, the device names will be displayed in divided pages and can be checked via the Prev. and Next buttons that aren't displayed if the connecting monitors are less than 8 sets.
- When the viewed monitor alarms, its device name is in red background, and the button restores to blue background when the viewed monitor no longer has physiological alarms.
- If the same device names exist in a LAN, they will be listed as “device name * serial No.” in this dialog box.

- Turn the rotating mouse to select the desired device name, and then press the rotating mouse to check the waveforms and parameter values of the corresponding monitor.
- This information box can't exit automatically, you can select the Exit button or press the Main menu key on the front panel to exit.

.3 OTHER PATIENT

Select the desired device name in the Other Patient—Select Monitor dialog box, the following window pops up.



- All the real-time parameter values of the viewed monitor are displayed in the lower part of this window. If a parameter value exceeds the alarm limit of the viewed monitor, it will be displayed in red.
- The parameter alarm doesn't change the audible alarms status of viewing monitor. The parameter alarm is related with the alarm limit of the viewed monitor, and has no relation with the alarm switch, alarm tone of the viewed monitor and the relevant alarm settings of the viewing monitor.
- A real-time waveform of the viewed monitor is displayed in the waveform area. There is a waveform selection field at the top left corner, select it, and the displayed waveform will switch among all the parameter waveforms.
- Silence: Press this key to close the occurent alarm sound of all parameters for the moment.

Chapter 17: PRINTING

.1 Overview

The printer is an optional configuration for this monitor. If the monitor equipped with a printer, there is a “Record Setup” button in the “Main Menu” for setting printer parameters.

The performance of the printer is described as below.

- Prints patient information and parameters.
- Print the waveform of the SpO₂.
- The optional printing rates: 25mm/s and 50mm/s.
- Multiple printing types are supported.

.2 Printing Types

The monitor supports the following types of printings:

- Real-time printing.
- Timer printing.
- Alarm printing.
- Trend graph printing.

.2.1 Real-time Printing

Press the Print key on the front panel, the real-time printing starts and the current waveforms are printed until the preset printing time is over or the Print key is pressed again, and then the measured parameter values at this moment are printed.




.2.2 Timer Printing

The monitor starts printing all the measured parameter values at the preset interval.

.2.3 Alarm Printing

The monitor starts printing all the measured parameter values when the monitor generates physiological alarms.

NOTE

-  To realize the alarm printing of a parameter, the Alarm Print in Set Printer Parameters dialog box, physiological alarms, and alarm and alarm printing of this parameter should be enabled.
-  In working status, the printer cannot be configured.
-  If the interval arrives but the printer is in work, the monitor will give up the parameter printing this time.

.3 Waveform and Parameter Printing

Press the Print key on the front panel, the printer prints waveforms until the preset printing time is over, then prints all the parameter values measured at this moment, and then stops.

Press the Print key to stop the current printing.





.4 Installing Printer Paper

The printer configured for the monitor is special thermal printer, which is usually installed on the side of the monitor in a built-in mode

If the printer is properly installed, only the Power indicator lights on. If the Error indicator lights on, it indicates that the printer is in paper lack status or the paper has not been installed properly. Do not print at this time, or it will damage the printer. Follow the procedure below to install the printer paper.


- (1) Press the latch above the paper compartment door to release the door.
- (2) The printer paper is a single side thermal paper, and the smoother side that has temperature sensitive coating on it shall be installed upside.
- (3) Pull the end of the paper out of the compartment and close the printer door. If the Error indicator lights off, the printer paper has been installed properly; if not, repeat the procedure specified above.

NOTE

-  Use the specified printer paper only. Other printer paper may cause the printer to print with poor quality, function improperly or not at all, or bring damage to the thermal print head.
 -  If the printer is not properly connected, the information “Printer is not probed correctly!” will be displayed at the lower left part of the Set Printer Parameters dialog box.
 -  Do not open the printer door when the printer is in work.
 -  Do not install any other types of printer to this monitor, otherwise the monitor will be damaged. If you have any doubt, please contact the manufacturer in time.
-

.5 Start and Stop Printer


You can manually enable the printer in the following ways:

- Select  on the monitor panel to enable the real-time printing.
- Select the button “**Record**” in the current menu or window to enable the record related to a specific function.

The printer will automatically enable the records in the following conditions:

- If the timed record function is enabled, the printer will automatically enable the record at the set time interval.
- When “**Alarm**” and “**Alarm Print**” of a parameter are set to “**On**”, the monitor will be triggered to enable the alarm record for one time once the parameter gives an alarm.

You can manually stop recording in the following way in the printing process:

- Select the key .

The printer will automatically stop printing in the following conditions:

- The printing task has been completed.
- The printer is out of paper.
- The technical failure occurs, causing the printer to fail to work.

.6 Printer Setting

In the “**Main Menu**”, select “**Recorder Setup >>**”, shown as Figure 17-1:

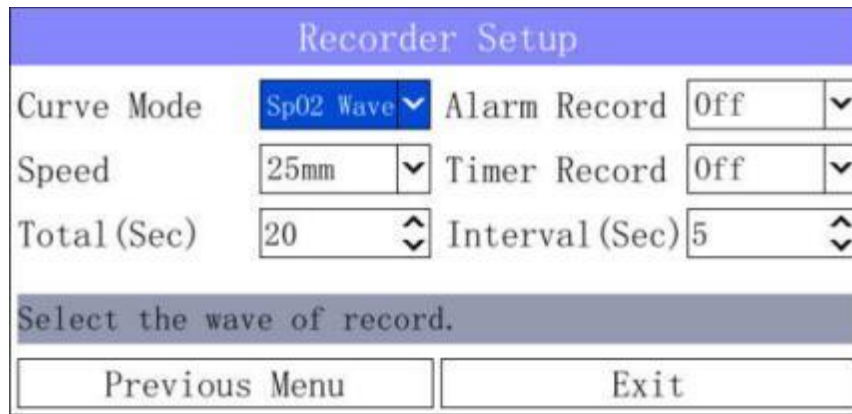


Figure 17-1

Curve Mode:

Printing mode of the curve.

“SpO2 Wave”: Print one waveform of the PLETH.

“NIBP List”: Print the list of NIBP.

Speed:

Select the recorder's print speed per second, available as: “25mm” and “12.5mm”.

When “Curve Mode” is “SpO2 Wave”: Supports selection of “25mm” and “12.5mm”.

When “Curve Mode” is “NIBP List”: this option is not available, the default speed is “25mm”.

Total(Sec):

When starting a real-time printing, the length of printing depends on the setting of the monitor. You can set the length of time you want to print. The default printing length is 20 seconds, optional 5~300 seconds.

Alarm Record:

Can be set to “On” or “Off”.

Alarm printing means that when the parameter alarm occurs, the monitor automatically starts printing once. The alarm prints only the parameter values and does not print the waveform.

Time Record, Interval(Sec):

You can set a certain time interval, and the printer automatically starts printing according to the set time interval. First set “Time Record” to “On” and set “Interval(Sec)” to the recording interval time you want.

NOTE

- ☞ To realize the alarm printing function of a parameter, it is necessary to enable “Alarm Printing” in the dialog box of “Set Printer Parameters” and the main alarm switch, and also enable the single “Alarm Switch” and “Alarm Printing” switch for this parameter.
- ☞ The printer cannot be configured in the printing state.
- ☞ If the set printing time interval is out and the printer is in a working state, the monitor will abandon the parameter printing.

.7 Clearing of Jammed Paper

When the running sound of the recorder or the output of recording paper is abnormal, firstly check whether the recorder is jammed with paper. If any, follow the following steps to clear:

- (1) Open the recorder door.
- (2) Remove the recorder, and clip the folded part.
- (3) Reinstall the recording paper, and close the recorder door.

.8 Cleaning of Recorder

After the recorder is used for a long time, shavings and impurities will be accumulated at the print head to affect the record quality and the service life of print head and roller. Please follow the following steps to clean:

- (1) Before cleaning, take measures to prevent the electrostatic damage to the recorder, for example, wear a disposable antistatic wrist strap.
- (2) Open the recorder door, and remove the recording paper in order to avoid interfering with cleaning.
- (3) Dip a moderate amount of alcohol with a cotton ball, and then gently wipe the surface of the thermal components for the print head.
- (4) After alcohol is completely dry, reinstall the recording paper, and close the recorder door.



WARNING



Do not use any articles that might damage the thermal components, such as abrasive paper.






Do not squeeze the thermal print head hard.

Chapter 18: MAINTENANCE



WARNING

-  The hospital or medical institution using the device shall establish a perfect maintenance plan, otherwise it may cause the device failure and the unpredictable consequences and may endanger personal safety.
 -  The safety inspection or maintenance that the device is required to be removed shall be performed by the professional maintenance staff. The operation of non-professional personnel may result in device failure and endanger personal safety.
 -  If you find any problems with with the device, please contact the maintenance personnel or PACETECH.
-

.1 Inspection

Before use and after continuous use for 6-12 months, repair or upgrade, the monitor should be comprehensively inspected by the qualified maintenance personnel to ensure the normal operation and working of the system.

The inspection items should include:

- The environment and the power supply meet the requirements.
- The monitor shell is clean and pollution-free.
- The shell, the keys, the knobs, the connectors and the accessories have no mechanical damage.
- The power line is wear-free, and the insulating property is good.
- The ground wire is correctly connected.
- Only the specified probe and accessories are used.
- The monitor clock is right.
- The functions of audible alarm, flicker alarm and visual alarm are normal.
- The printer is in good condition, and the printing paper meets the specified requirements.
- Inspect the batter performance.
- Various monitoring functions of the system are in good condition.

If you find the sign proving that the monitor function is damaged or the error message occurs, do not use the monitor for monitoring the patient and contact the relevant department of the hospital or the manufacturer.

The accessory interface on the side panel may be damaged in the normal use and can be replaced.

Normally, for the repairable device parts specified by the manufacturer, the circuit diagrams, the list of components, the legends, the detailed correction rules or other data necessary for the qualified technical personnel of the user to repair may be provided as required by the user.

Chapter 19: CLEANING

.1 Overview

Please keep your device and its accessories dustless. In order to prevent damage to the device, be sure to obey the following rules:

- Dilute detergent and disinfectant according to the manufacturer's instructions or reduce the concentration as far as possible.
- Do not immerse the device in the liquid.
- Do not pour liquid onto the device or its accessories.
- Do not make liquid flowing into the casing.
- Do not use abrasive materials (such as steel wool or silver polish) and any strong solvent (such as acetone or detergent containing acetone).



WARNING



Before cleaning the device, power off, and disconnect the power line with the socket.

NOTE



If you negligently pour liquid onto the device or its accessories, please immediately contact the maintenance personnel or PACETECH.



See the instructions accompanied by the accessories to clean or disinfect the reusable accessories.

.2 Cleaning

Periodically clean the monitor. Increase the cleaning frequency in the regions with serious environmental pollution or strong sandstorm. Before cleaning, consult or understand the provisions for the device cleaning and disinfection of the hospitals.



When cleaning the surface of the monitor, adsorb the non-corrosive detergent with clean, soft cloth, sponge or cotton ball, properly wring out and then gently wipe. The following detergents are available for use:

- Diluted suds.
- Diluted ammonia water, sodium hypochlorite (bleaching powder for washing) or formaldehyde (35%~37%).
- Hydrogen peroxide (3%).
- Ethyl alcohol (70%), isopropyl alcohol (70%).

When cleaning the device:

- (1) Power off, and disconnect the power line.
- (2) Absorb a moderate amount of detergent with a soft cotton ball, and wipe the display screen.
- (3) Absorb a moderate amount of detergent with soft cloth, and wipe the device surface.

**WARNING**






-  Sodium hypochlorite with concentration of range of about 0.05% (household bleaching powder diluted by 1:100) to 0.5% (household bleaching powder diluted by 1:10) is very effective. The specific concentration depends on how many organic matters (blood, animal and plant mucilage) exist on the device surface.
 -  The above detergents are only suitable for the general disinfection of the device. If the user uses them as the means of controlling the infectious disease, PACETECH will not assume any responsibilities for its effectiveness.
-

.3 Disinfection

Disinfection operation may cause a certain degree of damage to the monitor. It is recommended that you should disinfect the device if it is considered necessary in the maintenance plan of your hospital. Before disinfection, clean the monitor.

Recommended materials for the disinfection of the monitor: ethanol (70% alcohol, 70% isopropanol) and acetaldehyde.

**WARNING**

-  Dilute according to the manufacturer's instructions or reduce the concentration as far as possible.
 -  Do not pour liquid onto the device and its accessories. Do not soak them in the liquid.
 -  Do not make surplus liquid remain on the surfaces of the device and its accessories. Please immediately wipe with dry cloth.
 -  Do not disinfect with gas (EtO) or formaldehyde.
 -  Do not disinfect the monitor and its accessories at high pressure and high temperature.
-

ANNEX A: PRODUCT SPECIFICATIONS

A.1 ENVIROMNENTAL SPECIFICATIONS





Operating	
Temperature	(0 ~ 40)°C
Relative humidity	≤ 90 %
Air pressure	(70 ~ 106) kPa
Transport and storage	
Temperature	(-20 ~ 55) °C
Relative humidity	≤ 95 %
Air pressure	(50 ~ 106) kPa

A.2 POWER SOURCE SPECIFICATIONS

AC mains	
Input voltage	(100 ~ 240) V
Frequency	50/60 Hz
Power	100 VA
Fuse	T1.6AL, 250V, 20×5mm
Operating time	≥ 8 hours
Internal battery	
Number of battery	1
Type	lithium-ion battery
lithium-ion battery	
Nominal voltage	10.8V
Capacity	2600mAh
Operating time	>1.5 hour (when the battery is fully charged and the monitor measures the blood pressure every ten minutes)
Charge time	5 hours
lithium-ion battery	
Nominal voltage	10.8V
Capacity	5200mAh
Operating time	>3 hour (when the battery is fully charged and the monitor measures the blood pressure every ten minutes)
Charge time	10 hours

A.3 HARDWARE SPECIFICATIONS

Display	
Type	Color TFT LCD

Size	12.1 inches (diagonal, GM12) 15 inches(diagonal,GM15)
Resolution	800x600 pixels (GM12) 1024x768 pixels(GM15)
LED indicator	
Alarm indicator	1 (red or yellow)
Power indicator	1 (green)
Charge indicator	1 (green or orange)
Audio indicator	
Speaker	Giving audio alarms, heart beat tones, pulse tones and prompt tones for operation; Support PITCH TONE and multilevel tone function; Alarm sound in accordance with IEC 60601-1-8.
Controll	
knobs	rotating mouse,GM12/GM15
keys	7 (power switch, silence key, alarm key, freeze key, NIBP key, print key and main menu key) (GM12/GM15)
Connectors	
Power supply	1 AC power connector
Parameter measurement	ECG, RESP, NIBP, SpO ₂ , TEMP1, TEMP2, IBP1, IBP2, CO ₂ , CSM
	1 standard RJ45 network connector
	1 standard color VGA monitor connector
	1 equipotential grounding connector
	1 USB (optional)
RS232	1 RS232 (optional)

A.4 DATA STORAGE

Trend data	≥24 hours
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A.5 ECG SPECIFICATIONS

Lead type	3-lead: I, II and III 5-lead: I, II, III, aVR, aVL, aVF and V
Lead naming style	AHA
Noise level	≤30μV
Frequency response	Filter mode: (0.5 ~ 40) Hz Non-filter mode: (0.05 ~ 100) Hz
Input offset current	≤0.1μA

Sensitivity selection	2.5mm/mV (×1/4), 5mm/mV (×1/2), 10mm/mV (×1), 20mm/mV (×2), 40mm/mV (×4) and AUTO
Sweep speed	3.125mm/s, 6.25mm/s, 12.5mm/s, 25mm/s and 50mm/s
Display linearity	Corresponding to ±15 mm of the vertical axis center, the error should be less than ±10 %
Input impedance	≥ 5M Ω
Common mode rejection	Diagnose mode ≥ 89dB Monitor mode ≥104dB Operation mode ≥109dB
Time constant	monitoring lead: ≥ 0.3 s standard ECG lead: ≥ 3.2 s
Accuracy of standard signal	1mV ± 5 %
Recovery time after defibrillation	< 5s
ESU protection	Incision mode: 300W Congelation mode: 100W Restore time: ≤10s The monitor complies with the requirements of ANSI/AAMI
Display stability	
Time excursion	The excursion after electrified for 60min is not greater than 5mm from the initial position which is the baseline position after electrified for 15 min.
Temperature excursion	The average baseline excursion is not greater than 0.5mm/°C in the range from 5°C to 40°C
Voltage excursion	The baseline excursion is not greater than 1mm and the display sensitivity changes not greater than ±10% when the supply voltage fluctuates transiently
Polarized voltage	Corresponding to ±300mV polarized DC voltage, the display sensitivity changes not greater than ±5 %
Hart rate (HR)	
Measurement range	(15 ~ 350) bpm
Measurement precision	±1bpm or ±1 %, whichever is greater
Resolution	1bpm
Cancel alarm	The monitor have the function of cancelled alarm
Alarm limit and allowable deviation	high: (60 ~ 300) bpm, allowable deviation ±10% low: (10 ~ 200) bpm, allowable deviation ±10%
Alarm on/off	Open
Alarm level	Medium
Default alarm limit	adult (high: 120bpm low: 50bpm) pediatric (high: 160bpm low: 75bpm) neonate (high: 200bpm low: 100bpm)
Alarm happen time	HR from 80bpm increase to 120bpm: ≤10s HR from 80bpm decrease to 40bpm: ≤10s

<p>Heart Rate Meter Accuracy and Response to Irregular Rhythm</p>	<p>When tested in accordance with the ANSI/AAMI EC13-2002 Section 4.1.2.1 e), the indicated heart rate after a 20 second stabilization period is:</p> <p>Figure 3a (Ventricular Bigeminy) 40±2 bpm</p> <p>Figure 3b (Slow Alternating Ventricular Bigeminy) 30±2 bpm</p> <p>Figure 3c (Rapid Alternating Ventricular Bigeminy) 60±2 bpm</p> <p>Figure 3d (Bi-directional Systoles) 30±2 bpm</p>
<p>Response time to heart rate changes</p>	<p>Meets the requirement of ANSI/AAMI EC13-2002: Section 4.1.2.1 f).</p> <p>Less than 11 sec for a step increase from 80 to 120 BPM</p> <p>Less than 11 sec for a step decrease from 80 to 40 BPM</p>
<p>Response time of tachycardia alarm</p>	<p>When tested in accordance with ANSI/AAMI EC13-2002 Section 4.1.2.1 g, the response time is as follows:</p> <p>Figure 4ah: ≤40s</p> <p>Figure 4a: ≤40s</p> <p>Figure 4ad: ≤40s</p> <p>Figure 4bh: ≤40s</p> <p>Figure 4b: ≤40s</p> <p>Figure 4bd: ≤40s</p>
<p>Heart Rate Averaging</p>	<p>The average Heart Rate is computed in line with the ANSI/AAMI EC13-2002 Section 4.1.2.1 d) as follows:</p> <p>The average heart rate is calculated on the basis of the mean RR-interval of the last 16 beats, unless the heart rate calculated using the last 4 beats is less than or equal to 48, then this rate is used.</p> <p>The displayed Heart Rate is updated once per second.</p>
<p>Tall T-Wave Rejection</p>	<p>When tested in accordance with the ANSI/AAMI EC13-2002 Section 4.1.2.1 c), the heart rate meter will reject all T-waves with amplitudes less than 1.0mV, 100 ms QRS, a T wave duration of 180ms and a Q-T interval of 350 ms.</p>
<p>PACE Pulse</p>	<p>Pulse is bated in line with the conditions YY-1079 as follows:</p> <p>1. Without overshoot</p> <p>1) Synchronous pacemaker:</p> <p style="padding-left: 20px;">When 2ms, 2mV ~ 700mV , -2mV ~ -700mV</p> <p style="padding-left: 20px;">When 0.1ms, 2mV ~ 700mV , -2mV ~ -700mV</p> <p>2) Asynchronous pacemaker: Not applicable</p> <p>3) Double pulse pacemaker: Not applicable</p> <p>2. With overshoot: Not applicable</p>
<p>ST segment measurement</p>	
<p>Measurement range</p>	<p>(-2.0 ~ +2.0) mV</p>
<p>Measurement precision</p>	<p>(-0.8 ~ +0.8) mV: ±0.02mV or ±5 %, whichever is greater</p>

	Other: Unspecified
Resolution	0.01mV
Alarm on/off	Open
Alarm level	Medium
Default alarm limit	ST(II) high: 0.20mV low: -0.20mV

A.6 RESP SPECIFICATIONS

Measurement technique	Thoracic impedance
Lead	Optional: lead I, lead II and lead III; default lead II
RR	
Measurement range	(0 ~ 120) rpm
Measurement precision	± 1rpm or ± 5 %, whichever is greater
Resolution	1rpm
Alarm range	high: (5 ~ 156) rpm low: (0 ~ 40) rpm
Alarm allowable deviation	± 2 rpm or ± 10 %, whichever is greater
Alarm on/off	Open
Alarm level	Medium
Default alarm limit	adult (high: 40rpm low: 8rpm) pediatric (high: 40rpm low: 8rpm) neonate (high: 50rpm low: 8rpm)

A.7 SpO₂ SPECIFICATIONS

Measurement range	(0~ 100) %
Measurement precision	(70 ~ 100) %: ±3 % (0 ~ 69) %: Unspecified
Alarm allowable deviation	±2 %
Resolution	1%
Alarm range	High: (5~100)% Low: (1~99)%
Default Alarm on/off	On
Default Alarm level	Medium
Default alarm limit	High: 100% low: 92%
Show updating time	1 second
Red light	660nm
Infrared light	940nm
The max luminous intensity	1200mcd

A.8 PR SPECIFICATIONS

Measurement range	(25 ~ 250) bpm
Measurement precision	±1 bpm or ±2 %, whichever is greater
Resolution	1bpm
Alarm range	High: (60~300)bpm Low: (10~200)bpm
Alarm allowable deviation	±10 %
Alarm on/off	On
Alarm level	Medium
Default alarm limit	Adult: (High: 120bpm Low: 50bpm) Pediatric: (High: 160bpm Low: 75bpm) Neonate: (High: 200bpm Low: 100bpm)
Show updating time	1 second

A.9 NIBP SPECIFICATIONS

Measurement technique	Oscillation
Displayed parameters	Systolic pressure, diastolic pressure, mean arterial pressure
Mode of operation	Manual, auto and continuous
Measurement interval in auto mode	2/3/4/5/6/7/8/9/10/15/20/25/30/35/40/45/50/55 minutes and 1/1.5/2/2.5/3/3.5/4/4.5/5/5.5/6/6.5/7/7.5/8 hours
Measurement time in continuous mode	5 minutes
Measurement range	adult: Sys: (30~270) mmHg or (4.0~36.0) kPa Dia: (10~200) mmHg or (1.3~26.7) kPa Map: (20~225) mmHg or (2.7~30.0) kPa pediatric: Sys: (30~235) mmHg or (4.0~31.3) kPa Dia: (10~200) mmHg or (1.3~26.7) kPa Map: (20~225) mmHg or (2.7~30.0) kPa neonate: Sys: (30~135) mmHg or (4.0~18.0) kPa Dia: (10~120) mmHg or (1.3~16.0) kPa Map: (15~125) mmHg or (2.0~17.0) kPa
Measurement accuracy	Measurement accuracy of static pressure: ±3mmHg Clinical: average error: ±5mmHg, standard deviation: ≤8mmHg
Resolution	1mmHg
Alarm allowable deviation	±5%
Overvoltage protection	adult: 297 ± 3mmHg pediatric: 235 ± 3mmHg neonate: 147 ± 3mmHg

Systolic pressure alarm range	High: (32~270)mmHg or (4.27~36.00)kPa Low: (0~268)mmHg or (0.00~35.73)kPa
diastolic pressure alarm range	High: (12~200)mmHg or (2.67~29.07)kPa Low: (10~198)mmHg or (1.33~26.40)kPa
mean arterial pressure alarm range	High: (22~220)mmHg or (2.93~29.33)kPa Low: (20~218)mmHg or (2.67~29.07)kPa
Alarm on/off	On
Alarm level	Medium
Default alarm limit	Adult: Sys: High(160mmHg or 21.33kPa) Low(90mmHg or 12.00kPa) Dia: High(90mmHg or 12.00kPa) Low(50mmHg or 6.67kPa) Map: High(110mmHg or 14.67kPa) Low(60mmHg or 8.00kPa)
	Pediatric: Sys: High(120mmHg or 16.00kPa) Low(70mmHg or 9.33kPa) Dia: High(70mmHg or 9.33kPa) Low(40mmHg or 5.33kPa) Map: High(90mmHg or 12.00kPa) Low(50mmHg or 6.67kPa)
	Neonate: Sys: High(90mmHg or 12.00kPa) Low(40mmHg or 5.33kPa) Dia: High(60mmHg or 8.00kPa) Low(20mmHg or 2.67kPa) Map: High(70mmHg or 9.33kPa) Low(25mmHg or 3.33kPa)

A.10 TEMP SPECIFICATIONS

Number of channels	2
Displayed parameters	T1, T2 and ΔT
Measurement range	(0 ~ 50.0)°C
Measurement precision	25.0 ~ 45.0°C: ± 0.2 °C other: ± 0.4 °C
Resolution	0.1°C
Alarm range	high: (35.0 ~ 45.0) °C low: (25.0 ~ 42.0) °C
Alarm allowable deviation	± 0.2 °C
Alarm on/off	Open
Alarm level	Medium
Default alarm limit	high: (38.5°C or 101.3°F) low: (35.5°C or 95.9°F)
Minimum time for accurate measurement	Armpit: <100s Oral cavity or rectum: <80s
Max measurement time from 38°C to 40°C and 38°C to 36°C	20s
Measurement mode	direct mode

A.11 IBP SPECIFICATIONS

Number of channels	2
Pressure readings	Systolic pressure, diastolic pressure and mean pressure
Pressure labels	ART, CVP, RVP, LAP, RAP, PAP, ICP and LVP
Measurement range	(- 10 ~ 300) mmHg
Measurement precision	± 0.133 kPa (1 mmHg) or ± 2 %, whichever is greater
Resolution	1mmHg
Alarm on/off	Open
Alarm level	Medium
Default alarm limit	high: 140mmHg low: 90mmHg

A.12 CO2 SPECIFICATIONS

Measurement technique	Infrared absorption technique
Displayed parameter	EtCO ₂ , FiCO ₂ , awRR
Measurement range	(0 ~ 19.7) % or (0~150)mmHg or (0~20)kPa
Resolution	0.1mmHg: (0~69)mmHg 0.25mmHg: (70~ 150)mmHg
Accuracy	0~40mmHg: ± 2 mmHg 41~70mmHg: ± 5 % of reading 71~100mmHg: ± 8 % of reading 101~150mmHg: ± 10 % of reading Above 80BPM ± 12 % of reading
Alarm allowable deviation	± 10 %
Alarm on/off	On
Alarm level	Medium
Alarm range	EtCO ₂ : High:(15~76)mmHg Low:(0~60)mmHg FiCO ₂ : High:(0~76)mmHg awRR: High:(5~ 120)bpm Low:(0~40)bpm
EtCO ₂ Default alarm limit	Adult: (High:50.2mmHg Low:25.1mmHg) Pediatric: (High:50.2mmHg Low:25.1mmHg) Neonate: (High:44.8mmHg Low:30.4mmHg)
FiCO ₂ Default alarm limit	Adult: (High:15.2mmHg) Pediatric: (High:15.2mmHg) Neonate: (High:15.2mmHg)
awRR Default alarm limit	Adult: (High:40pbm Low:8pbm) Pediatric: (High:40pbm Low:8pbm) Neonate: (High:50mmHg Low:8mmHg)
Respiration Rate Range	0~150bpm
Respiration Rate Accuracy	± 1 bpm
Calibration	No routine user calibration required. An airway adapter zero is required when changing to a different style of airway

	adapter
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A.13 DEFIBRILLATION SYNCHRONIZATION

The farthest delay time	35ms (R crest to pulse rising)
AMP	High level: 3.5~5V, the max provide 1mA output electricity Low level: <0.5V, the max receive 5mA output electricity
Pulse width	100 ± 10%
Output impedance	Rating 50 Ω
Rise and drop time	No more than 3 ms

A.14 CSM SPECIFICATIONS

Detected EEG range	±400μV
Noise level	< 2μVp-p, < 0.4μV RMS, 1 ~ 250Hz
Common mode rejection rate (CMRR)	> 140dB
Input impedance	> 50 mega-ohm
Sampling rate	2K.(to be 14 bits resolution)
CSI and updating	0 ~ 100. filter6 ~ 42Hz, updating per every second
Signal quality index	0 ~ 100(logarithmic)filter75 ~ 85Hz, updating per every second
Burst Suppression prompt (BS%)	0 ~ 100% , filter 2 ~ 42Hz , updating per every second
Alarm range(CSI)	High: (2 ~ 99)% Low:(1 ~ 98)%
Alarm on/off	Open
Alarm level	Medium
Default alarm limit	High: 60% Low:40%

ANNEX B: Monitoring Cardiac Output

The Cardiac Output (C.O.) measurement invasively measures cardiac output and other hemodynamic parameters using a technique called thermodilution. This can be used to determine the flow rate of a system by introducing a cold solution into the system and measuring the resulting drop in the temperature at a downstream site. This temperature change is displayed as a curve and the monitor calculates the C.O. value from this curve. As cardiac output varies continuously, a series of measurements must be carried out to achieve a reliable C.O. average value. Always use the average of multiple thermodilution measurements for therapy decisions.

The C.O. measurement generates:

- A C.O. measurement curve
- An average C.O. value
- Cardiac index (CI)
- Blood temperature (TB)
- Hemodynamic parameters

(1). Connecting the Cardiac Output Cables

The monitor uses the right heart thermodilution method. A fluid of known volume and temperature is injected into the right atrium through the proximal port of a pulmonary artery (PA) (Swan-Ganz) catheter. The injectate bolus mixes with the blood in the right ventricle and the change in blood temperature is measured with a thermistor at the distal end of the catheter in the pulmonary artery.

To connect the C.O. cables:

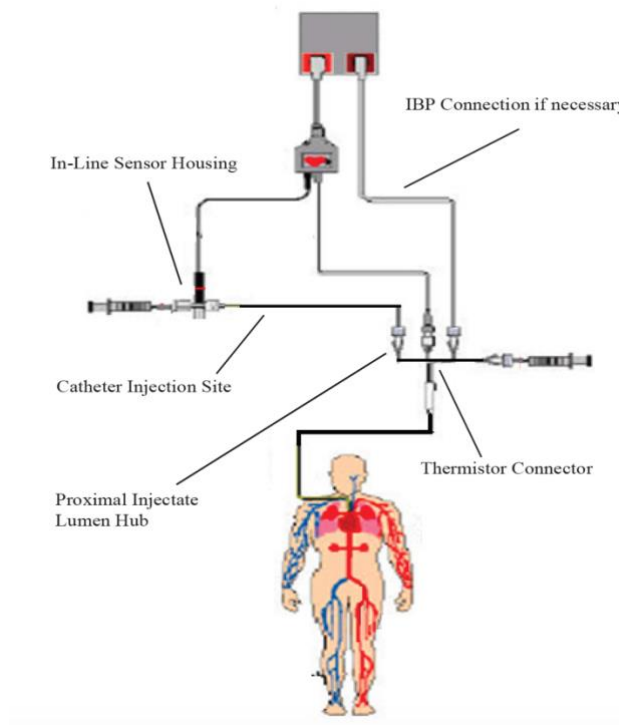
1). Plug the C.O. cable into the Cardiac Output connector on the module.

Note — Follow your hospital standards to avoid unintentional extraction of the C.O. catheter. Secure the cable using the mounting clip shipped with each C.O. cable. You may also find it helpful to loop the C.O. cable, tape the loop, and attach it to the undersheet of the patient’s bed using a safety pin.

2). Connect one end of the In-Line Sensor Cable to the C.O. cable and the other end to the In-Line Sensor Housing on the Medex Control Syringe.

3). Connect the Catheter Injection Site on the Medex Control Syringe to the Proximal Injectate Lumen Hub of the PA line.

4). Attach the Thermistor Connector of the C.O. cable to that of the PA line.



(2). Influencing Factors

The following factors can influence C.O. readings:

- Patient movement
- Patient anxiety
- Heart rate and heart beat variation
- Cardiac abnormality (for example, valvular insufficiency)
- Bladder inflation
- Improper catheter position
- Catheter damage
- Improper injection time
- Incorrect dosage

(3). Setting up the Cardiac Output Measurement

Before measuring the C.O., configure the proper measurement settings:

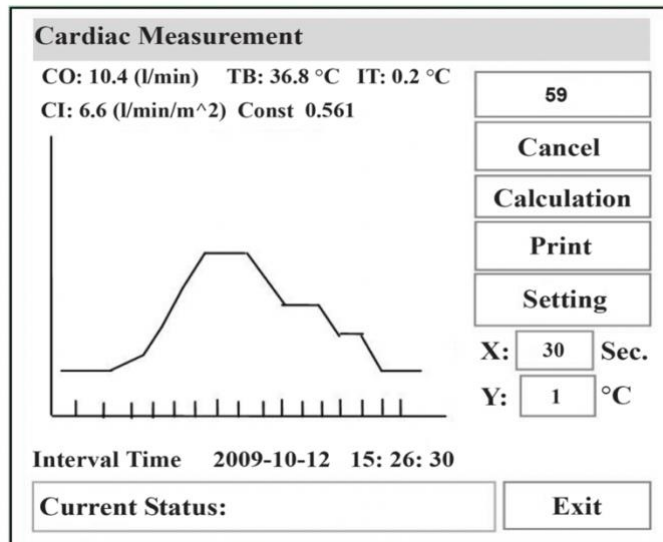
- 1). Rotate the navigation wheel to the TB (blood temperature) area at the bottom of the monitoring screen and press the wheel to display the Cardiac Setup menu.
- 2). Rotate the navigation wheel to C.O. Measurement and press the wheel.
- 3). Rotate the navigation wheel to Setting and press the wheel.
 - Meas. Interval: time between two measurements. The options are: 1 minute to 5 minute.
 - Injectate temp: sets the injection temperature when the Injectate temp is in Manual mode. You can set a value ranging from 0 °C to 25 °C.
 - Injectate mode: set to Manual mode to enter an injection temperature manually; set to Auto mode to acquire the injection temperature automatically.
 - Injectate Vol.: sets the dosage to 1 cc, 3 cc, or 10 cc.
 - Catheter: choose your catheter type, the options are: 131HF7, 141HF7, 151F7, 831HF75, 132F5, 139HF75, 096F6, and others. If your catheter does not belong to the numbered ones above, choose others.
 - Const.: enter the value according to the Instructions for Use of your catheter when the catheter type is set to Others. Otherwise, the monitor sets the value automatically based on the selected catheter type.
 - Height: sets the patient height, ranging from 40 cm to 210 cm.
 - Weight: sets the patient weight, ranging from 2 kg to 100 kg.
- 4). Rotate the navigation wheel to OK and press the wheel to save the settings.
- 5). Rotate the navigation wheel to X (time scale) and press the wheel. Rotate the navigation wheel to a value and press the wheel to confirm. The options are: 30 seconds and 60 seconds.
- 6). Rotate the navigation wheel to Y (temperature scale) and press the wheel. Rotate the wheel to a value and press the wheel to confirm. The options are: 0.5 °C, 1 °C, 1.5 °C and 2.0 °C. The lower the value, the taller the curve. You can configure the temperature scale according to the temperature difference.

(4). Measuring the Cardiac Output

To measure the C.O.:

- 1). Connect the C.O. cable. See Connecting the Cardiac Output Cables on page 12-1.
- 2). Configure the C.O. settings. See Setting up the Cardiac Output Measurement on page 12-2.
- 3). Rotate the navigation wheel to the TB (blood temperature) area at the bottom of the monitoring screen and press the wheel to display the C.O. Setup menu.
- 4). Rotate the navigation wheel to C.O. Measurement and press the wheel to display the C.O. Measurement window.
- 5). Rotate the navigation wheel to Start and press the wheel to confirm the selection.
- 6). Inject the solution into the right atrial port of the Swan-Ganz catheter. The optimal injection rate is 2.5 ml/second.

At the end of the measurement, the thermodilution curve displays in the C.O. Measurement window and the cardiac output value,



7). Repeat the procedure until you have completed the measurements you want to perform. You can perform a maximum of six measurements before calculating the C.O. and CI values. If you perform more than six measurements without rejecting any, the oldest will automatically be deleted when a seventh curve is stored.

Note — Perform an injection within 4 seconds after Start is selected.

An interval is necessary between two measurements. Set a correct interval for the C.O. measurements. New measurements cannot be started unless the interval times out.

The greater the injectate volume and the colder the temperature, the more accurate the measurement will be. Reduced injectate volume or higher injectate temperature can reduce the accuracy.

To ensure the greatest measurement accuracy for adult patients, use a cold injectate (< 8°C) of 10 ml volume, if not contraindicated by the patient’s condition. Your choice of injectate volume should be based on the injectate temperature and the patient’s cardiac output.

(5) Editing and Saving RH C.O. Measurements

It is important to identify and reject erroneous measurements (called “trials”). This is because the monitor uses all the measurement trial values you do not reject to calculate the averaged cardiac output.

Before rejecting the erroneous trials, consider the similarity of the values and the shape of the C.O. curve. A normal C.O. curve has one smooth peak and returns to the temperature baseline level after the peak.

To reject unsatisfactory trials:

- 1). Rotate the navigation wheel to the TB (blood temperature) at the bottom of the screen and press the wheel.
- 2). Rotate the navigation wheel to C.O. Measurement and press the wheel.
- 3). Rotate the navigation wheel to Calculation and press the wheel.
- 4). Rotate the navigation wheel to the C.O. curve window you want to reject and press the navigation wheel. A window asks for confirmation to delete the record. Rotate the navigation wheel to OK and press the wheel to delete the C.O. curve. Rotate the navigation wheel to Cancel and press the wheel to keep the curve.
- 5). Rotate the navigation wheel to Exit and press the wheel to exit the submenu.
- 6). Repeat to return to the monitoring screen.

If all values are different from each other, there may be true hemodynamic instability caused, for example, by severe cardiac arrhythmia. The monitor stores the averaged values in the calculations database and displays them in the Calculation window.

(6) Documenting the Cardiac Output Measurements

You can document C.O. measurements on the recorder:

1. Rotate the navigation wheel to the TB (blood temperature) at the bottom of the screen and press the wheel.
2. Rotate the navigation wheel to C.O. Measurement and press the wheel.

3. Rotate the navigation wheel to Print and press the wheel to print the current measurement.
4. Rotate the navigation wheel to Exit and press the wheel to exit the submenu.
5. Repeat to return to the monitoring screen.

(7) Cardiac Output Curve Alert Messages

After each measurement trial, the monitor analyzes the thermodilution curve. If the curve appears abnormal, a curve alert message displays in the C.O. procedure window. The curve alert messages are not error messages and do not necessarily mean that the measured values are invalid.

The following table describes the C.O. curve alert messages:

C.O. Curve Alert Message	Possible Cause
No C.O. catheter	No C.O. catheter is detected.
No injection temperature sensor	No injectate temperature sensor is detected.
Baseline Error	The patient is resuming normal temperature.
Measurement timeout	No C.O. catheter or injectate temperature sensor is detected.
Injection temperature too high	The injectate temperature is over 30 °C. Change the injectate solution and perform the measurement again.
Injection Delay	The injection began 10 seconds after you pressed Start in the Cardiac Measurement window. The C.O. measurement value may not be correct.

(8) Hemodynamics

The monitor can perform hemodynamic calculation according to the averaged C.O. values.

To perform a hemodynamic calculation:

- 1). Rotate the navigation wheel to the TB (blood temperature) at the bottom of the screen and press the wheel.
- 2). Rotate the navigation wheel to C.O. Measurement and press the wheel.
- 3). Rotate the navigation wheel to Calculation and press the wheel.
- 4). Rotate the navigation wheel to Hemodynamics and press the wheel.

In the Hemodynamics window, enter the following hemodynamic parameters for calculation:

- C.O.: averaged C.O. value.
 - Height: not a user-configurable item. This is the patient height previously set for C.O. measurements.
 - Weight: not a user-configurable item. This is the patient weight previously set for C.O. measurements.
 - HR: heart rate.
 - MAP: mean arterial pressure.
 - CVP: central venous pressure.
 - PAM: mean pulmonary arterial pressure.
 - PAW: pulmonary artery wedge pressure.
- 5). Rotate the navigation wheel to Start Cal. and press the wheel to display the calculation result.
 - 6). Rotate the navigation wheel to Print and press the wheel to print the calculation result. Rotate the wheel to Exit and press the wheel to exit the window.
 - 7). Rotate the navigation wheel to Exit and press the wheel to exit the submenu.
 - 8). Repeat to return to the monitoring screen.

Note — The monitor takes the MAP value in the Calculation window and other necessary values in the Setting window into account when performing hemodynamic calculations.

(9) Changing the Blood Temperature Alarm Settings

The monitor shows the temperature of blood (TB) at the same time the C.O. measurement is taken. It displays on the bottom of the screen.

Note — TB alarms are paused during the C.O. measurement. TB alarms automatically reactivate when you complete the measurement procedure.

9-1) Configuring the Audible Blood Temperature Alarm

To turn on or off TB audible alarms:

- 1). Rotate the navigation wheel to the TB (blood temperature) at the bottom of the screen and press the wheel.
- 2). Rotate the navigation wheel to TB Alarm and press the wheel to turn on the audible alarm. To turn off the audible alarm, deselect TB Alarm.
- 3). Rotate the navigation wheel to the X and press the wheel.

9-2) Changing the Blood Temperature Alarm Limits

To change the TB alarm limits:

- 1). Rotate the navigation wheel to the TB (blood temperature) at the bottom of the screen and press the wheel.
- 2). Rotate the navigation wheel to TB Alarm High Limit and press the wheel. Rotate the navigation wheel to an option and press the wheel to set the value.
- 3). Rotate the navigation wheel to TB Alarm Low Limit and press the wheel. Rotate the navigation wheel to an option and press the wheel to set the value
- 4). Rotate the navigation wheel to the X and press the wheel.

(10) Changing the Blood Temperature Unit

To change the TB unit:

- 1). Rotate the navigation wheel to the TB (blood temperature) at the bottom of the screen and press the wheel.
- 2). Rotate the navigation wheel to Temp Unit and press the wheel.
- 3). Rotate the navigation wheel to an option (°C or °F) and press the wheel.
- 4). Rotate the navigation wheel to the X and press the wheel.
- 5). Repeat to return to the monitoring screen.

Note — When you change the TB unit, the change displays wherever temperature parameters are displayed on the monitor.

(11) Safety Information

Warning Ensure that the computation constant for the measurement is appropriate to the injectate volume, injectate temperature, and catheter type.

If you need to change the Swan-Ganz catheter, follow the instructions in its manual.

(12) Technical Specification

Parameter	Specification
Measuring method	Right heart thermodilution
Unit	°C or °F
C.O. range	0.1 l/min - 20.0 l/min
C.O. accuracy	± 0.2 l/min or ± 5%, whichever is greater
Blood temperature range	27 °C - 43 °C (80.6 °F - 109.4 °F)
Blood temperature accuracy	± 0.1 °C
Injectate temperature	0 °C - 27 °C (32 °F - 80.6 °F)
Alarm delay	< 10s

ANNEX C: AG Specifications

AG Specification (Optional)

Waveform: Max can get 5 waveforms, designed to monitor respiratory concentrations of CO₂, N₂O, O₂, and gas mixtures containing any two of the five anesthetic agents halothane, Enflurane, Isoflurane, Sevoflurane and Desflurane.

sample flow :50±10 ml/min

Calibration	No span calibration is required for the IR bench. An automatic zero reference calibration is performed at startup and then every 24 hours ¹	
Warm-up time	ISA CO ₂ : < 10sec(Concentrations reported and full accuracy) ISA OR +/AX+: < 20sec(Concentrations reported, automatic agent identification enabled and full accuracy)	
Typical rise time at 50ml/min sample flow	CO ₂ ≤200ms (≤250ms for ISA OR+/AX+) N ₂ O ≤350ms Agents ≤350ms O ₂ ≤450ms ²	
Primary agent threshold (ISA OR +/AX+)	0.15vol% When an agent is identified, concentrations will be reported even below 15vol%.	
Secondary agent threshold (ISA OR +/AX+)	0.2vol%+10% of total agent concentration	
Agent identification time (ISA OR +/AX+)	< 20seconds (typically < 10 seconds)	
Total system response time	< 3seconds (with 2m sampling line)	
Gas	Range ³	Accuracy
CO ₂	0 to 15vol% 15 to 25vol%	± (0.2 vol%+2% of reading) Unspecified
N ₂ O	0 to 100vol%	± (2 vol%+2% of reading)
HAL、 ENF、 ISO	0 to 8vol% 8 to 25vol%	± (0.15 vol%+5% of reading) Unspecified
SEV	0 to 10vol% 10 to 25vol%	± (0.15 vol%+5% of reading) Unspecified
DES	0 to 22vol% 22 to 25vol%	± (0.15vol%+5% of reading) Unspecified

ANNEX D: Modified Earlier Warning Score (MEWS)

- In MEWS, predefined ranges are assigned to (sub) scores for physiological parameters and clinical observation.
- Each subscore has a color code to indicate the level of risk associated with it.

	3	2	1	0	1	2	3
HR	<40		41-50	51-90	91-110	110-130	>131

- All subscores added together make up the total MEWS score.
- The total score is assigned to color graded risk bands. The color reflects the severity of the escalation and includes the required response (Action List).

Score	Critical Risk	Response
0-4	Low	Hospital defined response
5-6	Medium	Hospital defined response
7+	High	Hospital defined response

ANNEX D: ANESTHESIA DEPTH MONITORING

OVERVIEW

This series of anesthesia depth monitor could be easily used for the patients everywhere of the hospital, the principle is to monitor the patient’s narcosis situation with the feedback of EEG signal when the patients are anesthetized and sedative. This instrument is a non-invasive monitoring device, it normally uses the changing signals from EEG when using anesthetic and sedative as the monitoring basis, there should be bridge-wise professional persons monitoring the consciousness level of the patient who is anesthetized by means of analyzing the EEG signal which is the high frequency changing data that represents consciousness level. This monitor could calculate the consciousness status index based on the mentioned principle so that the consciousness level could be evaluated.

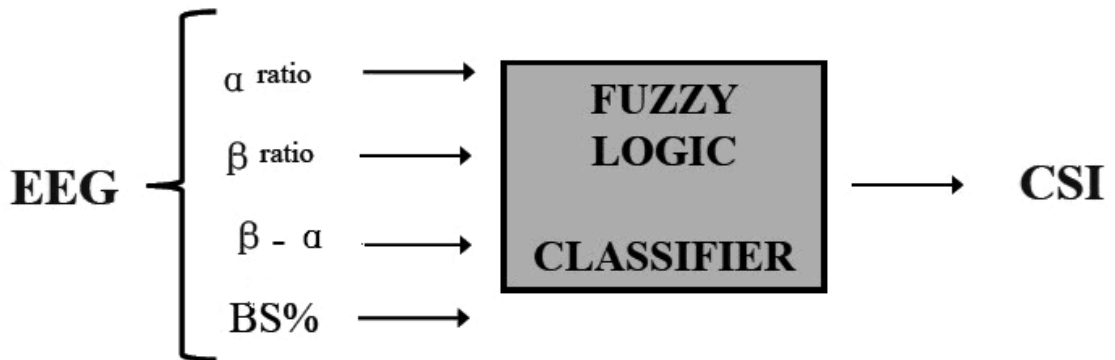
The consciousness status index is reflected by means of analyzing the EEG signal frequency.

The EEG energy was calculated by special frequency range. They indicate two kinds of energy rate which are α and β . These two values represent the essence which the energy changes from high frequency to low frequency during the anesthesia process. The relationship of the values is analyzed as independent parameter of their own.

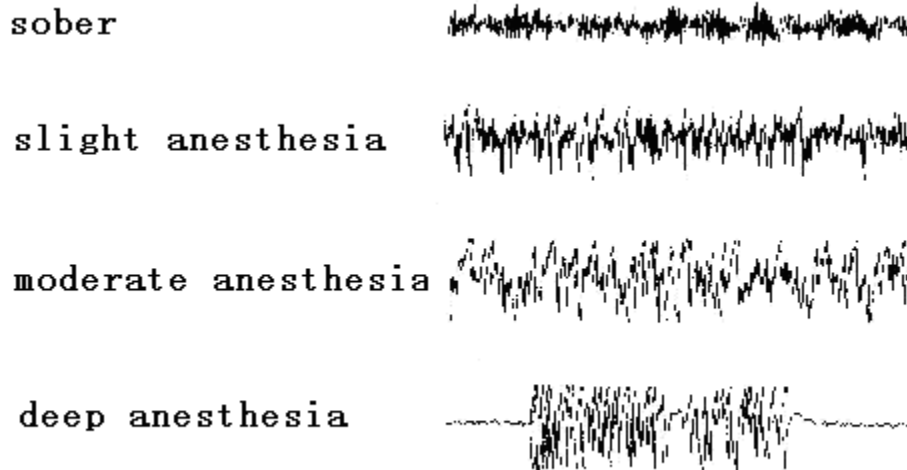
$$\alpha_{ratio} = \ln (E_{30-42.5Hz} / E_{6-12Hz})$$

$$\beta_{ratio} = \ln (E_{30-42.5Hz} / E_{11-21Hz})$$

These four parameter values could be input into a fuzzy logic categorizing system so that the consciousness status index could be calculated.



The frequency of EEG will become slower and the vibration amplitude will become higher when anesthetic concentration increases.



CSM combine the subparameters of many EEG into the self-adapting Nerve fuzzy inference system.

CSM translates the CSI to one value from 0-100.

The anesthesia depth monitoring (CSM) is a Multi-functional comprehensive physiological indexes monitoring, real time synchronous recording shows the changes& mutual relationship of CSI、BS%、EMG% and SQI% so that the physiological& pathological situation could be synthetically judged.

NOTE:

- We should pay attention to the potential harm that the current total spill may exceed the allowed limitation when the patient's body is connected to other equipments.
- The data from this equipment could be considered together with the data& clinical symptom from other monitor so that the anesthetics and sedative could be used at the most suitable level.
- The current carrying parts of plugs, electrodes and electrode plates including joint of leads and the electrodes could not get in touch with other conductive objects, including the ground.

SKIN PREPARATION AND ELECTRODE PLACEMENT

To ensure impedance is not too high when skin contact with electrodes, instruments should be cleaned before using and skin should be dried. No stimulative soap and water for skin cleaning is recommended.

NOTE:

- Use alcohol to clean the skin is not recommended because it will lead to a thin film residue on the skin so that cause high impedance. If you use alcohol, must ensure that more than 30 seconds of drying time before the electrodes be attached.

Clean and dry skin should using damp cloth or gauze to gently wipe with; the preparation work of skin is helpful for remove non-conductive residue.

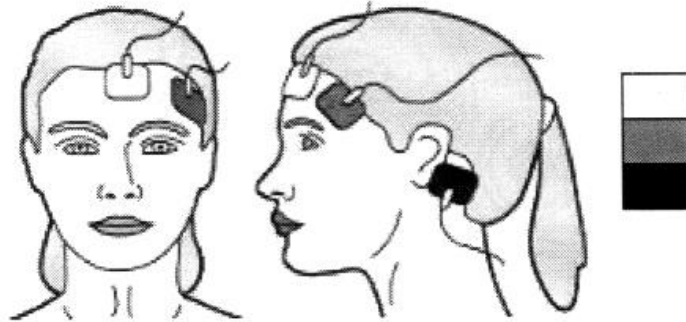
The location for attaching electrodes is as the photo below. Monitor's powerful signal processing capabilities can ensure that measured values will not be affected even the location between two electrodes as small as 2cm

(0.78in) . However, we recommend attaching the electrodes at the skull part which has fewer muscle fibers, thus achieving a higher quality signal.

NOTE:

- **Ensure that no part of the electrodes is lifted from conductor, including ground and wall.**
- **If skin rash or other abnormal conditions, please remove the electrodes from the patient.**
- **Replace electrodes once every 24 hours to check the skin condition.**

Shown as photo:



white: Middle of the forehead

green: Left side of the forehead

black: Left side of Mastoid bone behind the ear

NOTE:

- **Attach electrodes to the skin; connect leads to the appropriate electrodes. Shown as photo is the left attaching method; the same position attached to the right side can also be used. Attach electrodes away from the location of surgical trauma as far as possible.**

PARAMETER OF ANAESTHESIA DEPTH MONITORING

The consciousness status index (CSI)

CSI that be compartmentalized is from 0 to 100. 0 denote placid EEG; 100 denote active EEG, meaning sober state. Generally, CSI adapting range is from 40 to 60.

CSI	Clinic state
90-100	sober
80-90	drowsihead
60-80	Slight anesthesia
40-60	adapt to anaesthesia operation
10-40	Deep anesthesia, mostly circs maybe happen BS
0-10	Examination nearby, BS%>75, when CSI<3, EEG be on a zero potential differences actually

Electromyography % and electromyographic bar (EMG)

Facial EMG may be larger when Depth of anesthesia index is normal. By adding an EMG filter, monitor can remove most of the potential interference wave which may affect the quality of the EMG. EMG index will display in percentage form.

Generally EMG only be active when patient awake. But when the patient asleep, if EMG increases, the reason could be:

- During surgery, Reflex response caused by pain or shock
- lack of muscle reflex
- Muscle stiffness caused by drugs (such as painkillers)
- Due to the external electric field (e.g., diathermy)

We should always pay attention to electromyographic bar, especially when Depth of anesthesia index is suddenly increased. If the increase of the Depth of anesthesia index associated with muscle activity, it may cause electromyography interference. When this situation occurs, we have to pay attention to the influence of anesthesia drugs which patient received during the surgery. When the anesthesia has nothing to do with EMG, the Nerve muscle groups' drugs can cause the Depth of anesthesia index decrease. Once patients received the Nerve muscle groups' drugs, they can not active comfortable as awake, so the Depth of anesthesia index is a very valuable reference value in the control of anesthetics.

Signal quality index (SQI%)

Signal quality index is the quality of collected EEG's signal. The calculation principle is based on percentage of pseudo-difference number in the past one minute.

Burst Suppression prompt (BS %)

Monitor includes Burst Suppression prompt; it will prompt when EEG is isoelectric or waves turn to the formation of "flat" line. Burst Suppression can display the burst suppression ratio of EEG signal in the last 30 seconds as percentage form. For example: Burst Suppression % = 20 readings, which means the percentage of EEG isoelectric is 20% in the last 30 seconds.

Electrode impedance

White and black electrode impedance is measured continuously; low electrode impedance (usually value is between 1 to 3k ohm) basically can working regular. The optimal impedance is less than 1,000 ohm.

Electrode alarm

During the calculation of the Depth of anesthesia index, signal interruption will lead to the electrode alarm; and also cause EEG invalid or interruption. Electrode alarm is usually caused by simultaneously using of diathermy or

electrode connection error (too high electrode impedance or Electrode leads' connection error). When the above situation occurs, the red error light (2) will be lit. Depth of anesthesia index will not be counted in this case.

DISPLAY SCREEN INTRODUCTION

Click the System menu, select "CSM Configs" menu, and go to the main interface of anesthesia care. As shown below:

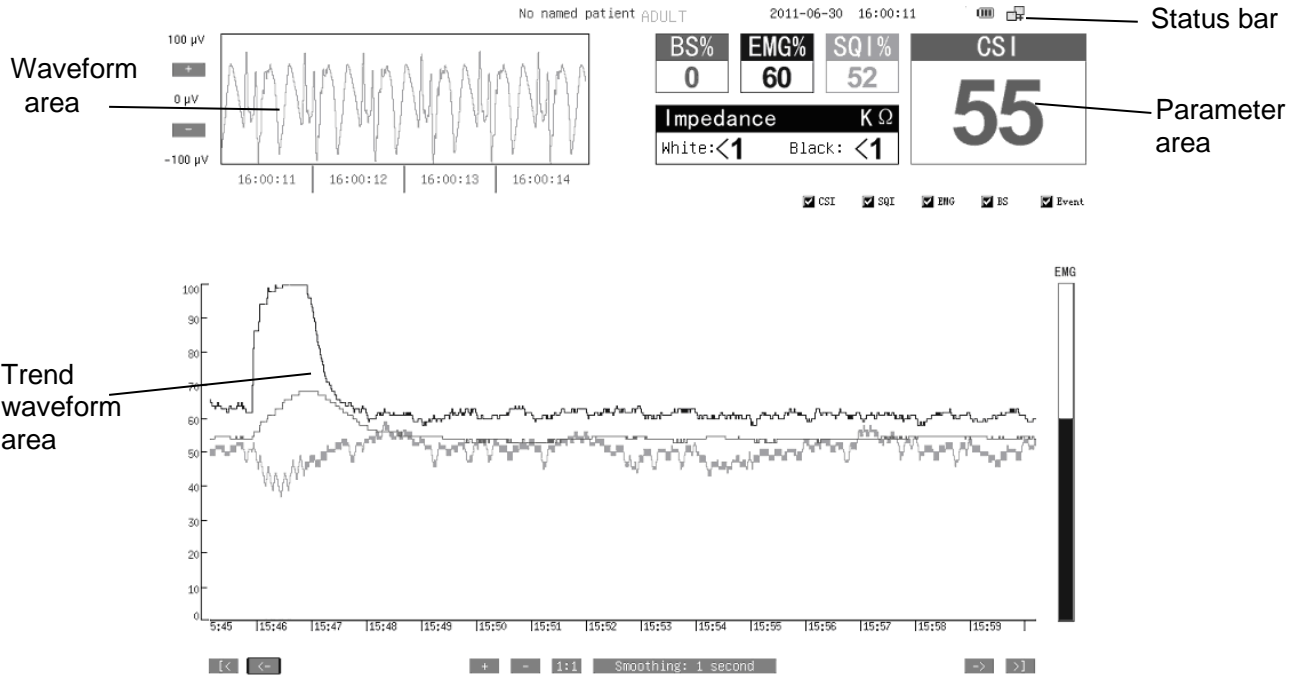


Figure (a) host interface

When the style set of parameter area is "vertical", the anesthesia care interface will be displayed by the right side of the monitor screen by the way of Parameters side by side. (The style set of parameter area will be specified in the later section). The main interface is shown below:

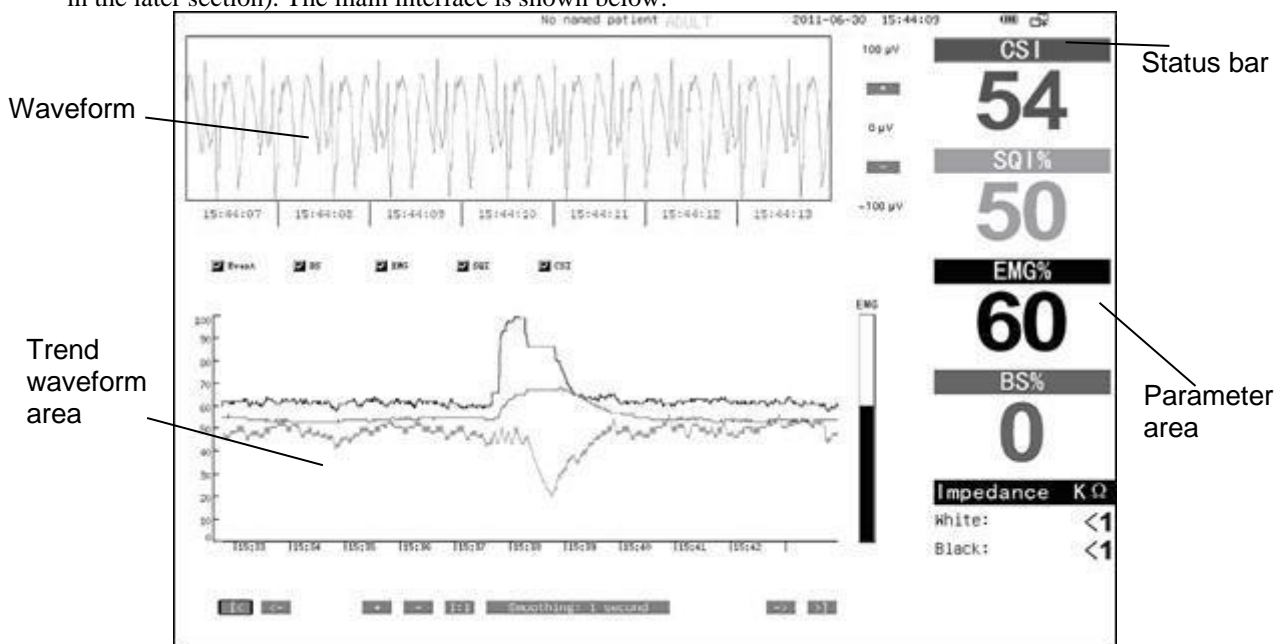
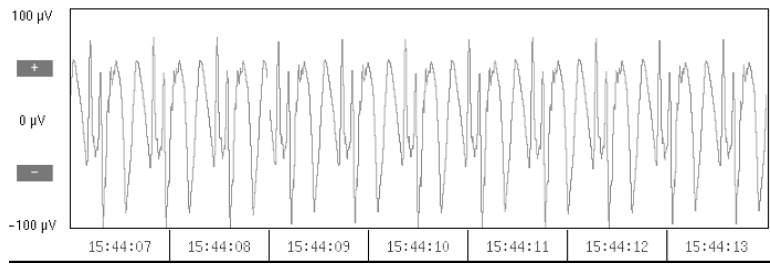


Figure (b) host interface

WAVEFORM CHANNEL

Brainwaves displayed in waveform channel, refer to the following figure:

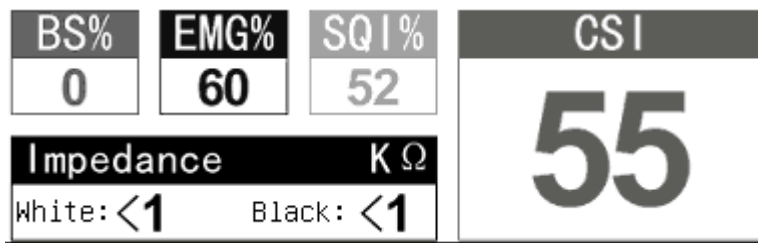


EEG Waveform channel

- ◆ “+”: increase EEG scale, in the range of (5 ~ 180) μV , adjust step length to 10, in the range of (5 ~ 50) μV ; adjust step length to 5.
- ◆ “-”: decrease EEG scale, in the range of (-180 ~ -5) μV , adjust step length to 10, in the range of (-50 ~ -5) μV ; adjust step length to 5.

PARAMETER DATA AREA

Real time monitoring data of BS、EMG、SQI、CSI、Impedance, displayed on parameter data area. in the following figure :



Parameter display area

CSI: Anesthesia depth monitoring index sign & measured value

EMG: myoelectricity index sign & measured value

SQI: signal quality index sign & measured value

BS: burst suppression index sign & measured value

Impedance K Ω : unit-area impedance of electrode

White: White color electrode impedance index sign & measured value

Black: Black color electrode impedance index sign & measured value

TREND GRAPH AREA

Trend graph display window, in the following figure:

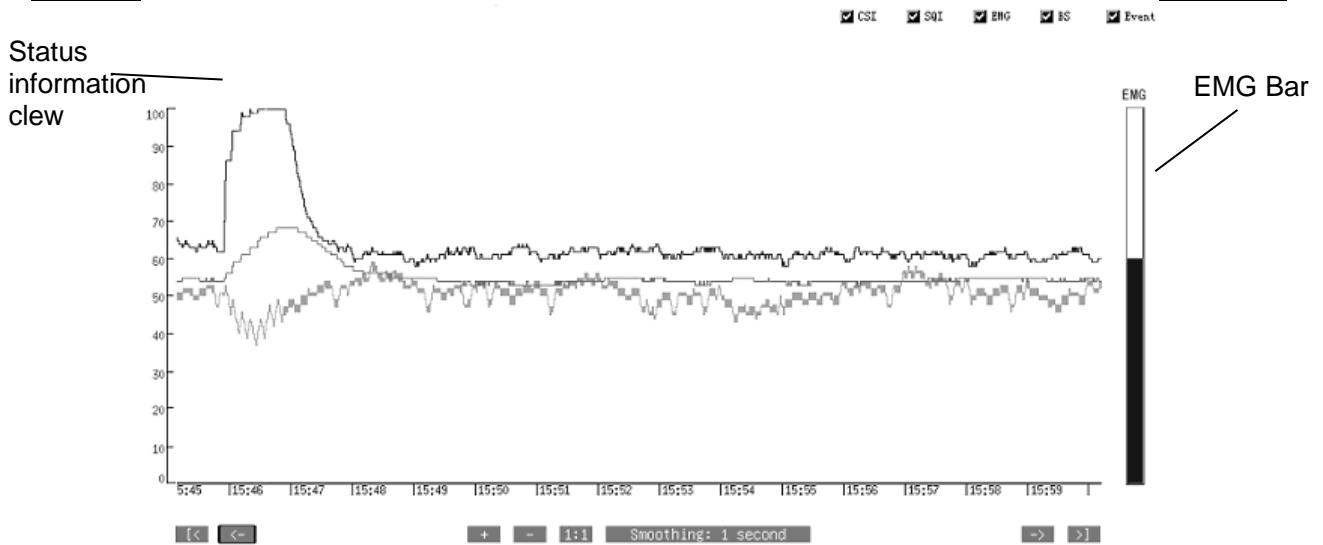


Figure 13.5 Trend graph

- (1) **5 checkbox**: select the waveform and event sign of parameters displayed in trend graph
- (2) **[<]**: turn to front page of trend graph quickly by rotary mouse
- (3) **[<-]**: Turn the rotary mouse to make time coordinate move left one square, for the page viewing trend graph.
- (4) **[+]**: enlarge the resolution of trend graph; resolution setting range: 1 second,5 second, 10 second, 20 second, 30 second, 60 second, 90 second, 120 second, Step length: 1 second
- (5) **[-]**: reduce the resolution of trend graph, Step length: 1 second.
- (6) **[1:1]**: resolution-retrieving 1 second
- (7) **Smoothing: 1 second**: current resolution value
- (8) **[->]**: Turn the rotary mouse to make time coordinate move right one square, for the page viewing trend graph.
- (9) **[>]**: turn to tail page of trend graph quickly by rotary mouse
- (10) **EMG Bar**: Whatever smoothing filtering is 1s or the history waveform record be displayed or not, real time EMG tool bar display the newest EMG value.

Clew:

When checking trend graph, the trend graph will not rolling display, if current screen not display the tail of trend graph, the trend graph is under recording status; If turn to tail page or enlarge resolution of screen to display the tail of trend graph, the rolling display will appear.

All the information are displayed on the upper left corner of trend sheet. When the connection show normally, there are no any information showed in the interface.

Display:
NO Data
Sensor Alarm
Artefact
Sensor Alarm/Artefact

SQI low
Impedance high
Artefact/ SQI low
Sensor Alarm/ SQI low
Artefact/ Sensor Alarm/ SQI low
Artefact/ Impedance high
Sensor Alarm/ Impedance high
Artefact /Sensor Alarm/ Impedance high
SQI low/ Impedance high
Artefact/SQI low/ Impedance high
Sensor Alarm/SQI low/ Impedance high
Artefact/Sensor Alarm/SQI low/ Impedance high

SETTINGS

Operating the shuttle key in the main interface, rotating the shuttle key to complete The rotative switchover between the “manu” button, “+” and “-” in the Waveform Area, “[<]”, “<-”, “+”, “-”, “1:1”, “->”, “>]” in the trend area, Then confirm the selected items by the shuttle key.

MENU

Press the Main Menu Key and select the “Depth of anesthesia Settings” bottom by pressing the Rotating mouse to pops up the following menu:



● **Global Settings**

Pressing the “Global Settings” enter into setting operation dialog box as follow :



Figure Csm Set

Selecting CSI/ SQI/ EMG/ BS/Imp according waveforms’ color.
 Parameter Area Style: Select Parameter Area display horizontal in the upper right (as Figure 13.2 (a)) or display vertical in the right (as Figure 13.2 (b)).
 Alarm On/Off, High, Low, Alarm Level just for CSI parameter.

Trend Step: the user can select a step, and the trend Graph data will be showed according to the selected step (reduction or magnification) in the showing area.

Range Eeg : adjust the waveform Eeg range (5~180) μ V.

- **Event List**

Click “event list”, popup “event information” list box, as follows:

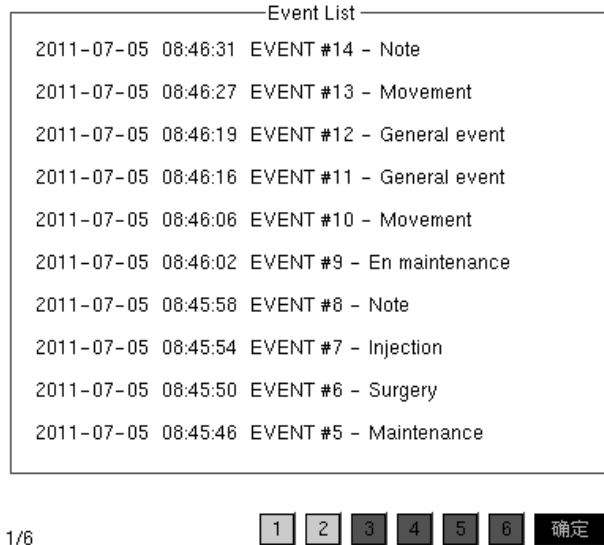


Figure event list

Click “event list” option, enter into event list function, this function will list the latest 60 times event information. This info box lists all event info detected by monitoring device since starting up, also list all record moment and events. This info box displays 10 events on every page, totally 6 pages 60 times. All of these are listed in inverted order, which means the latest event is recorded on first line first page. User can

- **Display Format**

The function of switchover interface can be used to switch from anesthesia deepness guardianship to multi parameter guardianship. The default setting is anesthesia deepness guardianship, which is the main interface after starting up.

NOTE:

Only when ceased anesthesia deepness guardianship monitoring, interface switchover can be conducted.

After starting monitoring, “interface switchover” will become gray and cannot be conducted.

- **Start/stop monitoring**

Start/stop anesthesia deepness monitoring function menu. Start, monitoring device will receive monitoring information from submachine. Stop, no more information flow to multiparameter monitoring device, without monitoring information displaying on interface. Default setting is “stop monitoring”.

- **Last Page/Next Page**

Click “previous page” or “behind page” then turn over tendency curve of anesthesia deepness.

CSM SPECIFICATIONS

Detected EEG range	$\pm 400\mu$ V
Noise level	$< 2\mu$ Vp-p, $< 0.4\mu$ V RMS, 1 ~ 250Hz
Common mode rejection rate (CMRR)	> 140 dB

Input impedance	> 50 mega-ohm
Sampling rate	2K.(to be 14 bits resolution)
CSI and updating	0 ~ 100. filter6 ~ 42Hz, updating per every second
Signal quality index	0 ~ 100(logarithmic)filter75 ~ 85Hz, updating per every second
Burst Suppression prompt (BS %)	0 ~ 100%, filter 2 ~ 42Hz, updating per every second
Alarm range(CSI)	High: (2 ~ 99)% Low:(1 ~ 98)%
Alarm on/off	Open
Alarm level	Medium
Default alarm limit	High: 60% Low:40%