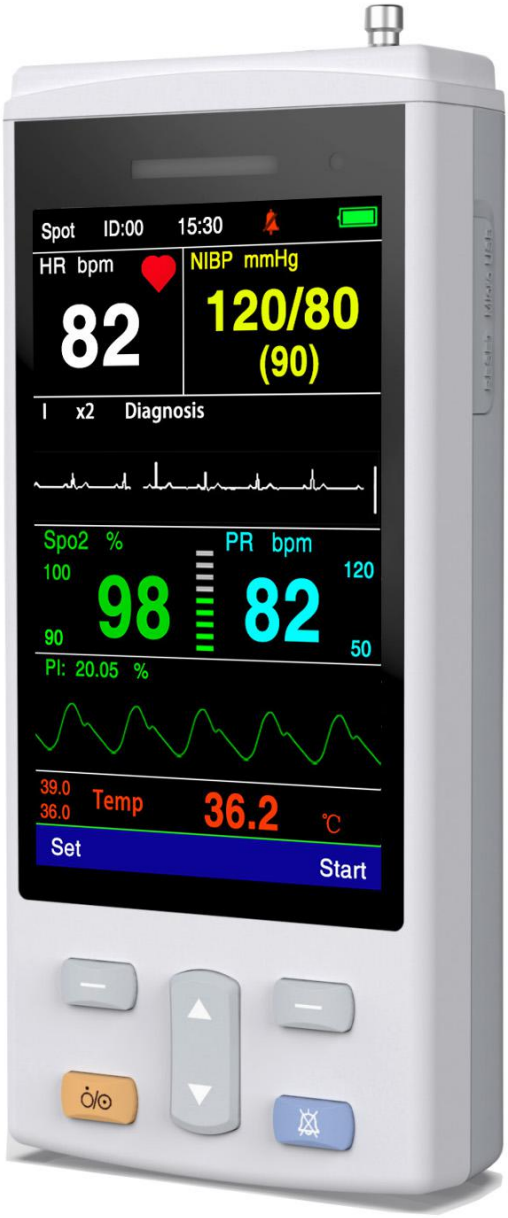
M6 Series Vet Operators'Manual



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Liability statement

The company does not make any form of guarantee for errors in this manual, installation errors, and operating errors, and does not assume any legal responsibility for incidental or inevitable damages.

The company considers that it should be responsible for the reliability, safety and performance of the instrument only under the following circumstances, namely: assembly operations, expansion, readjustment, performance improvement and maintenance are all carried out by personnel or institutions approved by the company; related electrical equipment Comply with relevant national standards; operate the instrument according to the instructions of this manual.

The contents of this manual can be changed without notice.

Warning

In order to use this equipment safely and continuously, the listed instructions must be followed. The instructions listed in this manual cannot replace medical procedures that are already being performed.

Don't rely on an audible alarm system to monitor animals. When monitoring animals, setting the volume too low or turning off completely may cause animal disasters. Remember that the most reliable method of animal monitoring is to combine the proper use of monitoring equipment with close monitoring of animals.

This device is intended to be used only by trained health care professionals in health care facilities.

To reduce the risk of electric shock, do not open the device. If necessary, ask qualified personnel to repair it.

This device may interfere with the ultrasound imaging system, which manifests as an interference signal on the ultrasound display. Keep the distance between these two devices as far as possible.

Exposing electrical contacts or connecting devices to saline or other liquids and conductive glue is very dangerous.

Electrical contacts and connections such as cable connectors, power supplies,

parameter module plug-in connectors, rack connectors, etc. must be kept clean and dry. If they are contaminated with liquid, they must be thoroughly dried. If further decontamination is required, please contact the seller or our company.

Warning

This is not a treatment device.

If the various hospitals or medical institutions responsible for using this instrument cannot achieve a satisfactory maintenance plan, it will cause abnormal instrument failure and may endanger personal health.

Quality assurance :

Free service range:
All equipment that meets the scope of the company's warranty service regulations can enjoy free service.
Charged service range:
(1) For equipment beyond the scope of the company's warranty service regulations, the company will implement fee-based services;
(2) Even during the warranty period, the product needs to be repaired due to the following reasons: man-made damage; the grid voltage exceeds: Out of the specified range of equipment; irresistible natural disasters.

The company hereby is not responsible for the direct, indirect or final damage and delay caused by the following situations (including but not limited to): components are disassembled, stretched, re-commissioned; replacement of accessories not approved by the company or caused by non The company authorized personnel to repair the machine.

Preface

This manual introduces the monitor's performance, operation methods and other safety information in detail. This is the best starting point for new users to start using the monitor.

The following symbols indicate some important tips, which users should pay attention to:
Warnings are information that you should know how to avoid injury to animals and medical personnel.
Caution is the information you should know how to avoid damage to your equipment.
Note is to emphasize important information.

This manual is for personnel who are familiar with the various measurements performed and have experience in using monitoring equipment.

This monitor is a handheld vital signs monitor, which can be used in the same-day surgery, surgery/anaesthesia recovery, emergency room and other occasions to monitor the vital signs of large and small animals.

The monitor can be powered by the built-in battery. It is easy to carry.

Practical range:
This monitor is suitable for the hospital to monitor and measure vital signs such as heart rate/pulse rate, non-invasive blood pressure (systolic blood pressure, diastolic blood pressure, mean blood pressure), electrocardiogram, blood oxygen saturation and Temperature.

Taboo occasions and warnings:
● This device is not a treatment device.
● If the device is not secured properly, it may fall, causing personal injury or equipment damage. To prevent personal injury or equipment damage, install the equipment in a fixed location.
● This device should not be used in the presence of magnetic resonance imaging (MRI) equipment, otherwise the induced current will cause animal burns.
● This equipment must not be operated in the presence of flammable anesthetic gas or other gases.
● This device cannot be used in places with electromagnetic radiation, such as places where mobile phones are used.
● In order to avoid personal injury, no one except qualified technicians can repair the equipment.
● Do not replace the power adapter of this device.
● Do not touch animals, this equipment or hospital beds during defibrillation.
Precautions:

● Before use, verify that the calibration is correct and that the device is working properly.
● Pay attention to the placement of power adapters, conduits and all cables to avoid the danger of strangling animals or tripping other people.
● This equipment is strictly prohibited to be blocked in order to radiate heat.
● If liquid spills into the cabinet of the device, please disconnect the power immediately and contact the maintenance personnel immediately.

Chapter I Overview Product Overview

■ For a comprehensive understanding of the monitor, please read the overview of the monitor.
■ To get an introduction to the various information displayed on the screen, please read the introduction to the screen display.
■ To master the operation method, please read the key function and basic operation of the monitor.
■ To understand the location of various interfaces, please read the external interface of the monitor.
■ To understand the precautions for using the monitor when powered by a battery, please read the built-in rechargeable battery.

Warning

Do not open the casing of the instrument to avoid possible electric shock hazard. Any maintenance and upgrade of the monitor must be carried out by service personnel trained and authorized by the company.

Warning

Do not use this instrument where flammable materials such as anesthetics are placed to prevent explosion.

Warning

Before use, the user should check whether the instrument and its accessories can work normally and safely.

Warning

To prevent delays in treatment, please make adequate alarm Setting for each animal. At the same time, it should be ensured that the alarm sound can be emitted when the alarm is issued.

Warning

Do not use mobile phones near the monitor. Mobile phones can generate excessively strong radiation fields that can interfere with the function of the monitor.

Warning

When the monitor is shared with electrosurgical equipment, the user should take care to ensure the safety of the animals being monitored.

Warning

The packaging must be disposed of in accordance with currently implemented waste control regulations, and the packaging must be kept out of the reach of children.

Carefulness

When the products and accessories described in this manual are about to expire, they must be disposed of in accordance with the relevant product disposal specifications. If you want to know more about this information, please contact our company or its representative office.

Carefulness

When in doubt about the integrity of the external grounding of the monitor and its arrangement, the internal battery must be used for operation.

1.1 Overview of the monitor

The handheld vital signs parameter monitor is a novel structure and small size device with a built-in battery, which is convenient for animal transfer and carrying for outpatient rounds. It can monitor and measure vital signs such as heart rate/pulse rate, non-invasive blood pressure (systolic blood pressure, diastolic blood pressure, mean blood pressure), electrocardiogram, blood oxygen saturation and Temperature for large or small animals.

Characteristics:
☆ 4-inch large screen, true color, wide viewing angle, high-brightness LCD display.
☆ The operation of the display interface is simple and convenient, intuitive and friendly.
☆ Built-in rechargeable battery, convenient to move and carry.
☆ Long-term monitoring data record browsing function.
☆ Automatic sound and light double alarm.

Working environment:
Temperature
Working temperature: 0 ～ 40 (℃)
Transportation and storage temperature: -20 ～ 60 (℃)
Humidity
Working humidity: ≤ 85%
Transportation and storage humidity: ≤ 93%
Altitude
Operating altitude: -500-4,600 meters (-1,600-15,000 feet)
Transportation and storage altitude: -500-13,100 meters (-1,600-43,000 feet)

Power adapter
INPUT: 100－240 (V) AC, 50/60 (Hz)
OUTPUT: 5.0 (V) direct current, 2.0 (A)

Built-in lithium battery: 3.7V-2000mAh

Warning
Do not use the monitor outside the temperature and humidity range specified by the manufacturer, otherwise the performance specifications stated in Appendix II will not be met.

The hand-held vital signs monitor has rich functions, (as shown in Figure 1-1), it can be used to monitor animal signs. Users can also choose different measurement parameter configurations according to different needs.

This monitor can monitor main parameters such as electrocardiogram (ECG), blood

oxygen saturation (SpO2), non-invasive blood pressure (NIBP), Temperature (TEMP) and so on. It integrates the function, display and record output of the parameter measurement module to form a compact and light monitor. Its built-in battery provides convenience for animal movement, and can clearly display 2 to 3 waveforms and all monitoring parameter information on its high-resolution display interface.

1.1.1 Button and indicator light

Fig. 1-1 buttons and indicator light

• **Power** - Switch on/off
• **Mute** - Press this key to mute or unmute audible
• **Function 1** - Carry out functions as indicated by text showing on the lower left corner of screen
• **Function 2** - Carry out functions as indicated by text showing on the lower right corner of screen
• **Select** - Choose different options on setting menu
• **Alarm light** - Red light flashes when alarm is triggered or when battery is low.
• **Power light** - Solid red light indicates monitor is charging. Solid green light indicates monitor is full.

1.1.2 Power Socket on Bottom

Fig. 1-2 power socket

NOTE
Please use the power adapter as provided only. Do not use device while charging.

1.1.3 Reset Micro USB

Fig. 1-3 Reset Micro USB

Open the protecting shell, and plug a paper clip into the reset hole.
Press hard, the device will be reset.

Warning
USB data upload, ECG will not appear;

1.1.4 Ports on top

Fig. 1-4 Ports

NIBP: blood pressure cuff interface.
TEMP: Temperature probe interface.
S & E: The interface between the blood oxygen probe and the ECG lead wire. Or between the blood oxygen probe and EtCO2 part.

1.1.5 Mounting hole

Fig. 1-5 Mounting

NOTE Mounting hole is used with the optional Pole/Cage Mount device

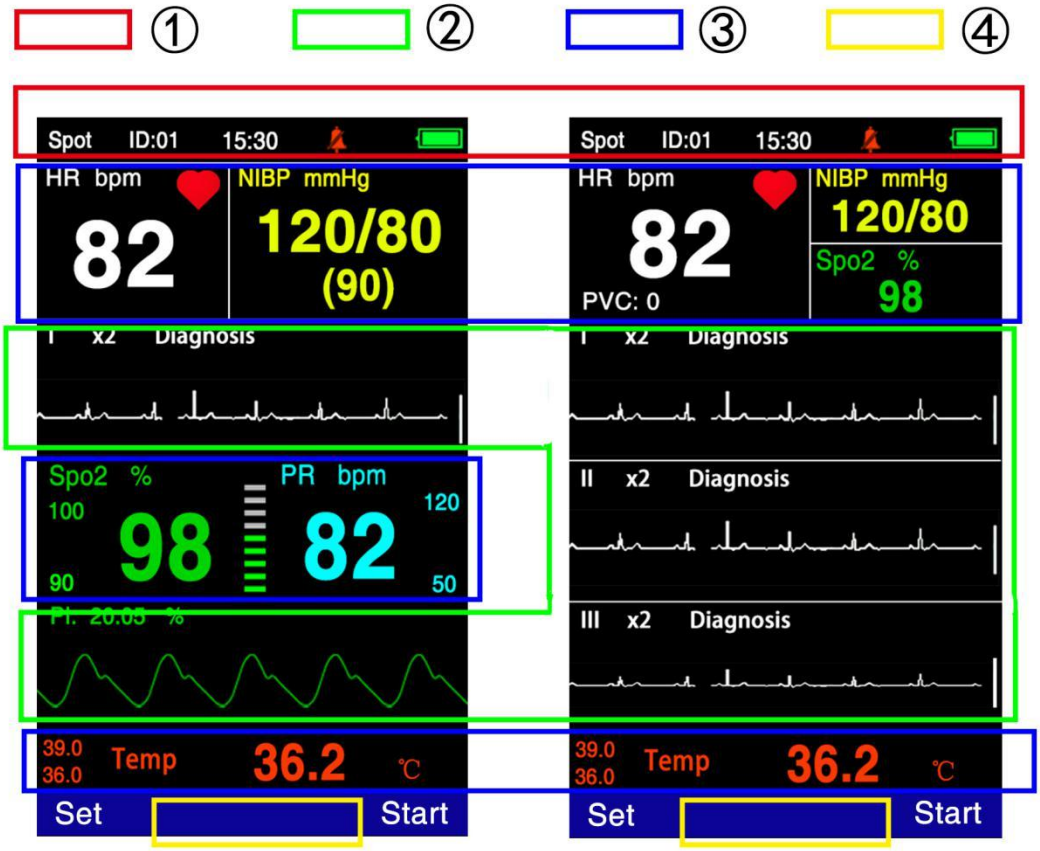
Define abbreviations:

Name	Definitions, abbreviations
ECG	Electrocardiography
TEMP	Temperature
NIBP	Non-invasive blood pressure
SPO2	Blood oxygen saturation
EtCO2	End tidal carbon dioxide
RR	Respiration rate
HR	Heart rate
PR	Pulse rate
PI	Perfusion index
PVC	Premature ventricular contractions
SYS	Systolic blood pressure
DIA	Diastolic blood pressure
MAP	Mean arterial pressure
Monitor	Guardianship mode
Spot	Field mode (multi-user measurement)

1.2 Introduction to the display interface

The monitor's display screen is a color LCD screen, which can simultaneously display the collected animal ID, waveform parameters, alarm information provided by the monitor, monitor status, clock, and other prompt information.

The main screen is divided into three areas (as shown in Figure 1-6):
1. Information area①④
2. Waveform area②
3. Parameter area ③



3 Lead ECG Interface **5 Lead ECG Interface**

Fig. 1-6 Main Interface

Information area introduction (①④):

The information area is located at the top of the screen, displaying the status of the monitor and the current user. The meaning of the content of the information area is as follows:

"Spot": Refers to the current working mode of the instrument.

"ID: 01": Refers to the current user serial number.

"15:30": Refers to the current time.

 : Battery power status.

Other prompt messages in the information area appear and disappear at the same time as the reported status, and are divided into:

The monitor prompts information, the physiological alarm is fixed in the area ④; the

technical alarm of NIBP is fixed under the NINP mmHg; the SpO2 technology alarm of the ECG 3-lead interface is fixed behind the PI value, and the SpO2 technology of the ECG 5-lead interface The alarm always appears below SpO2%; the Temp technical alarm always appears behind Temp;
Monitor alarm information (see the "Alarm Setting" chapter for specific setting methods);

 It is an alarm mute sign. This symbol appears when you short press the "Mute" button, indicating that all alarm sounds have been turned off artificially. The voice prompt will not resume until the operator shortly presses the "mute" button again to release the mute state.

Warning

 When the sign appears, the system will not be able to give an alarm sound prompt, so the operator should use this function with special care.

Introduction to the waveform area (②):

The waveform area of the ECG 3-lead interface displays 2 waveforms, and the waveform area of the ECG 5-lead interface displays 3 waveforms. The display sequence can be adjusted. The name of the waveform is displayed on the upper left of each waveform. ECG leads can be selected according to requirements. Each ECG wave also shows the gain of this channel and the filter method of the ECG wave. There is a 1 millivolt ruler on the left side of the ECG waveform. When the menu during screen operation, the menu always occupies a fixed position in the middle of the waveform area, making part of the waveform temporarily invisible. After exiting from the menu, the original screen display will be restored. The waveform is refreshed at the set rate. For the adjustment of the refresh rate of each waveform, please refer to the Setting of each parameter.

Introduction to the parameter area (③):

The parameter area and the waveform are basically placed correspondingly. The parameters displayed in the parameter area are:

ECG

—Heart rate (unit: beats/minute)

SpO2

— SpO2 (unit: %)

— Pulse rate (unit: beats/minute)

NIBP

— From left to right, systolic blood pressure, diastolic blood pressure, mean blood pressure; (unit: mmHg or kPa)

TEMP

— Temperature (unit: Celsius ℃ or Fahrenheit ℉)

Alarm lights and alarm status:
In the normal state, the warning light does not light up.

When an alarm occurs, the alarm light flashes and lights up in red. For details, please refer to the "Alarm Setting" chapter.

For the specific content of the alarm information and prompt information, please refer to the relevant content of each parameter in the relevant chapters.

Chapter II Installation of the monitor

2.1 Unpacking and checking

Carefully take out the monitor and accessories from the packaging box, and save the packaging materials for future transportation or storage. Please count the accessories according to the packing list.

■ Check for any mechanical damage.

■ Check all exposed wires and insert some accessories.

When installing, leave at least 2 inches (5 cm) of space around the monitor to ensure air circulation. The environment in which the monitor is used should be reasonably protected from vibration, dust, corrosive or explosive gas, extreme temperature and humidity, and so on.

If you have any questions, please contact our sales department or agent immediately.

2.2 Electrical connection

Steps to connect the AC power cord:

■ Make sure that the AC power supply meets the following specifications:
100-240VAC, 50/60Hz

■ Use the power cord provided with the monitor. Plug the power cord into the monitor power connector, and plug the other end of the power cord into a grounded power socket.

Warning

Connect the power cord to a dedicated socket.

Warning

When there is a battery configuration, the battery must be charged after the instrument has been transported or stored. Therefore, if the instrument is turned on without connecting to AC power, the instrument may not work normally due to insufficient battery power. Switch on the AC power source and charge the battery regardless of whether the monitor is turned on or not.

2.3 Power on

After turning on the power switch, the system successfully enters the monitoring main screen after the system self-test, and the user can perform operations at this time.

Warning

If you find any signs of damage to the monitor function, or an error message appears, do not use this monitor to monitor the animals, and please contact the seller or our company.

Warning
If a fatal error is found during the self-check, the system will give an alarm.
Warning
Check all the monitoring functions that can be used to ensure that the monitor is functioning properly.
Warning
If equipped with a battery, the battery must be charged after each use to ensure that there is sufficient power reserve.

2.4 Sensor connection

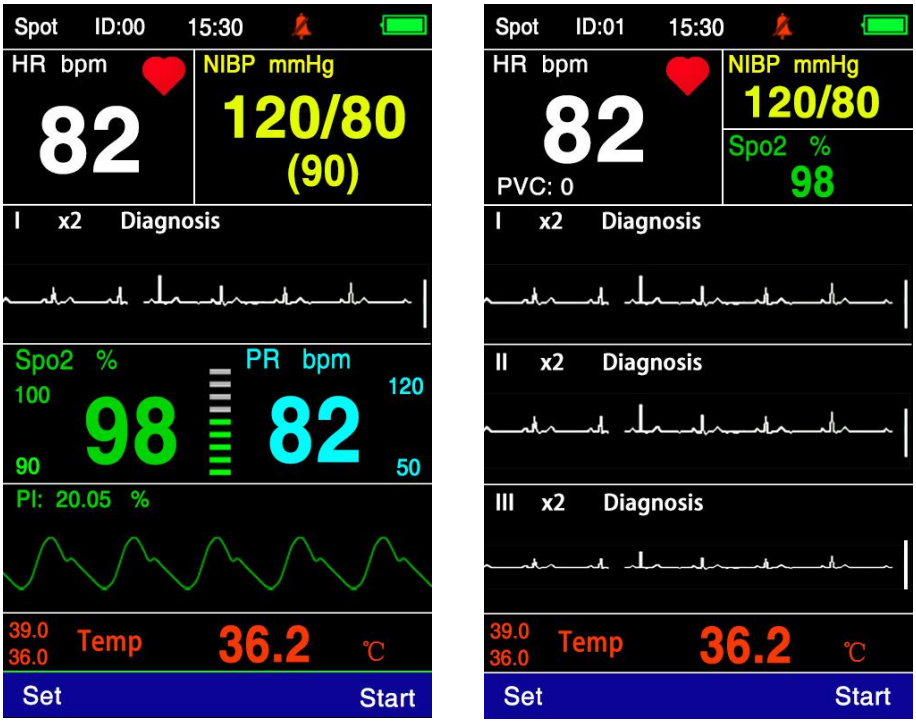
Connect the required sensors to the monitor and the animal's monitoring part.
Warning
Please refer to the relevant chapters for the correct connection methods and related requirements of various sensors.

Chapter III System Menu

- Main Interface
- Menu setting
- Working mode
- User Setting
- Alarm setting
- Blood pressure setting
- Blood oxygen setting
- ECG Setting
- Temperature
- System Setting
- Data review

3.1 Main Interface

Press the power button, the button is lifted, and the system enters the boot interface. The menu shown in Figure 3-1 :



3 Lead ECG Interface **5 Lead ECG Interface**

Fig. 3-1 Main Interface

According to the lead type of the ECG setting, it is determined whether the boot interface is a 3-lead or 5-lead interface. The 3-lead ECG can only display the waveform of one channel and one blood oxygen waveform; while in the 5-lead mode, it can display the waveform of three channels without the blood oxygen waveform.

- In SPOT mode (Energy-saving mode is on), within 1Min, if there is no key operation, the LCD display will be turned off and the instrument will be turned off

automatically.

- When the battery is low, the battery progress bar is empty, an audible alarm is generated at the same time, and the ALARM red light flashes regularly.
- The alarm sound switch status is displayed on the upper left corner of the screen, and the alarm sound switch can be set in the system Setting.
- The mute button can mute or unmute.
- The top displays the test mode, user ID, time, mute symbol, Bluetooth, and battery symbol.

Warning

The oldest record will be overwritten after the memory overflows.

3.2 Menu setting

In the boot interface, select the setup button in the upper left corner to enter the setup menu. The menu shown in Figure 3-2 :

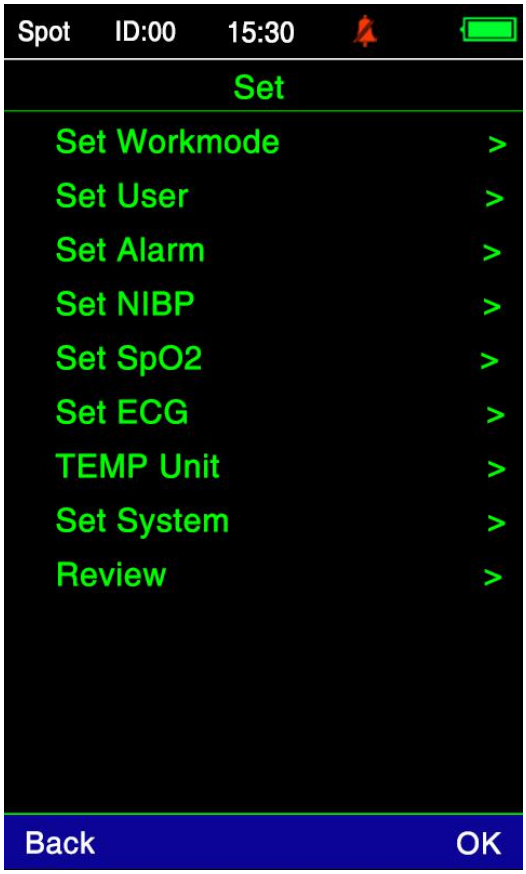


Fig. 3-2 Menu setting

3.3 Working mode

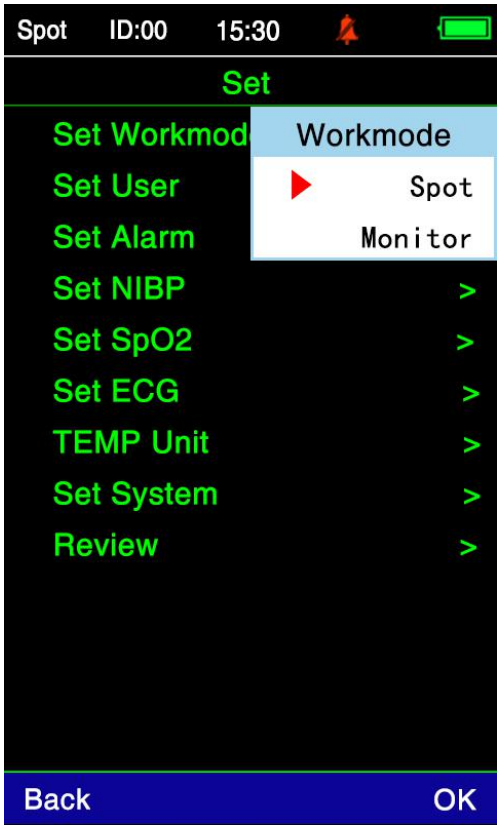


Fig. 3-3 Working mode

"Working mode": Spot mode and Monitor mode.

- Spot mode will automatically sleep for 1 minute when there is no measurement operation (power saving mode is turned on);
- Monitor mode does not automatically sleep.
- If you switch from Spot mode to Monitor mode, you will be prompted to choose whether to keep the data in Spot mode. The drop-down box shown in Figure 3-4 :

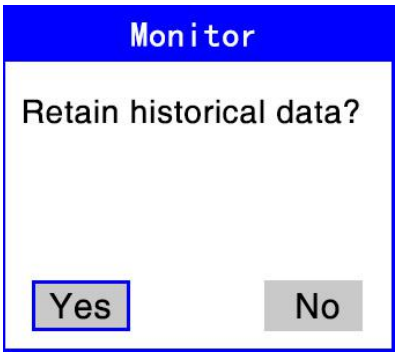


Fig. 3-4 Monitor prompt box

3.4 User Setting

Under the setting menu, select user setting and press the confirm key to enter the user setting interface menu. The menu shown in Figure 3-5 :

Spot mode Monitor mode

Fig. 3-5 User Setting

- The user setting interface shows different interfaces according to different working modes.
- "User Setting": User selection, add user, delete user.
- Up to 100 users (200 records per user) can be stored in Spot mode, and 48 hours of measurement data can be stored for single user data in monitoring mode.
- When the number of stored users in Spot mode has reached the maximum, it will prompt "Users are full", as shown in Figure 3-6. Only by deleting some users can you continue to add users.

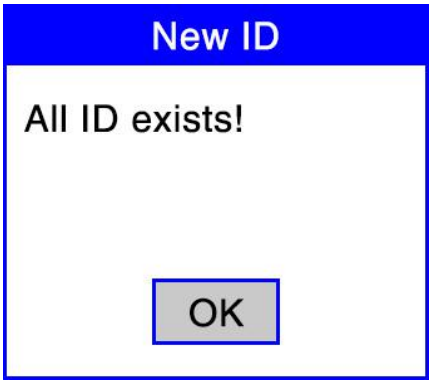


Fig. 3-6 Add user menu

Each time a user is added in the Monitor mode, it will prompt whether to keep the previous data, as shown in Figure 3-7.

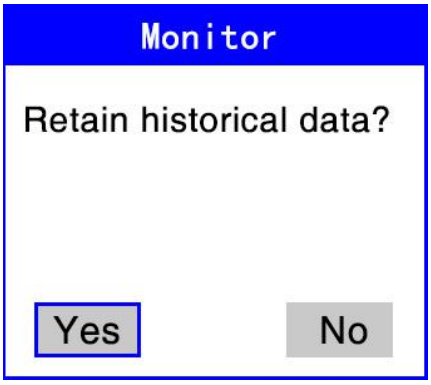


Fig. 3-7 Add user menu

3.5 Alarm Setting

Under the setting menu, select the alarm setting and press the confirm key to enter the alarm setting interface menu. The menu shown in Figure 3-8:

Spot mode Monitor mode

Fig. 3-8 Alarm Setting

The alarm setting interface shows different interfaces according to the type of ECG lead.

In the 3 lead ECG mode, there is no PVC, so there is no upper and lower alarm limit Setting. Only available in the 5 lead ECG mode.

The alarm setting can be modified according to the up and down buttons. The upper

limit of the same parameter cannot be lower than the lower limit. Similarly, the lower limit cannot be higher than the upper limit.

Alarm Limit Setting

Sys: 40-280 mmHg

Dia: 10-220 mmHg

Spo2: 0~100%

PR: 250 bpm ~ 0 bpm

Temp: 45° C ~ 18° C

HR: 500 bpm ~ 0 bpm

PVC: 500 bpm ~ 0 bpm

3.6 Blood pressure setting

Under the setting menu, select blood pressure setting and press the confirm key to enter the blood pressure setting interface menu. The menu shown in Figure 3-9 :

Fig. 3-9 Blood pressure setting

NIBP setting

Measurement mode: manual, auto, stat (continuous 5min measurement)

Measure systolic, mean, diastolic blood pressure and pulse rate

Cuff type: small , big cuff

Pressure unit: mmHg, KPA

Measurement interval: 1min, 2min, 3min, 5min, 10min, 15min, 30min, 60min, 90min.

Measurement interval in Auto (automatic mode).

3.7 Blood oxygen setting

Under the setting menu, select the blood oxygen setting and press the confirm key to enter the blood oxygen setting interface menu. The menu shown in Figure 3-10:

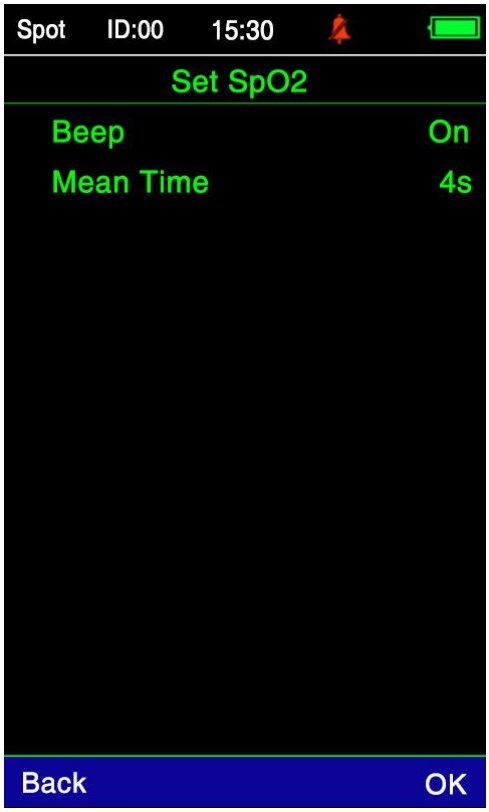


Fig. 3-10 Blood oxygen setting

SpO2 setting

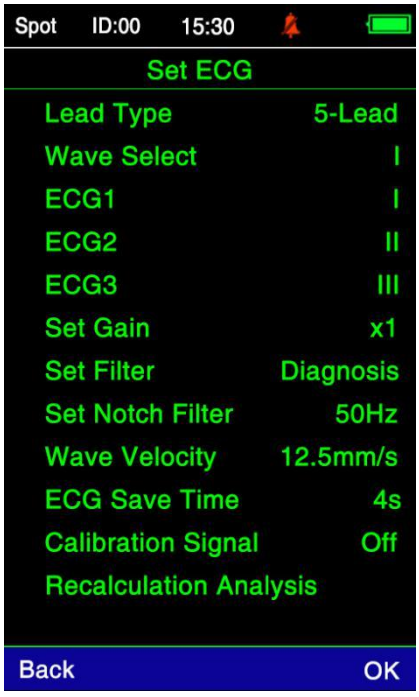
Pulse sound: on, off.

Average time: 4s, 6s, 8s, 10s, 12s, 14s, 16s, 30s, 60s, 120s.

3.8 ECG Setting

Under the setting menu, select ECG setting and press the confirm key to enter the ECG setting interface menu. The menu shown in Figure 3-11 :

3 Lead ECG Mode



5 Lead ECG Mode

Fig. 3-11 ECG Setting

ECG Setting

Lead type: 3-lead, 5-lead.

Waveform selection: Three leads: I, II, III

Five leads: I, II, III, AVR, AVL, AVF, V1

ECG1: I, II, III, AVR, AVL, AVF, V1

ECG2: I, II, III, AVR, AVL, AVF, V1

ECG3: I, II, III, AVR, AVL, AVF, V1

Gain Setting: x0.25, x0.5, x1, x2

Filter Setting: Diagnosis (diagnosis mode), Monitor (monitoring mode), Surgery (surgery mode), Strong (strong wave mode).

Notch Filter: 50Hz, 60Hz, off.

Wave velocity: 6.25mm/s, 12.5mm/s, 25mm/s.

Storage time: 4s, 6s, 8s, 10s, 12s, 14s, 16s, 30s, 60s, 120s.

Calibration signal: on, off.

Recalculate the analysis.

3.9 EtCO2 setting

ETCO2 Set Up

CO2 Unit: Choose mmHg, kPa or %

Apnea Time(s): Set time device will alarm with no breaths detected.

Note: Monitor must detect 3 breaths before this timer is activated.

CO2 Save Time(s): Set how often monitor records ETCO2 data (in seconds)

CO2 Range: Choose how high the vertical axis (Y Axis) of the ETCO2 waveform graph will display

ETCO2 Zero: Use this when connecting a new adaptor or resetting a current adaptor. Pressing “OK” while ETCO2 zero is highlighted will start the operation.

3.10 Temperature

Under the setting menu, select the Temperature unit and press the confirm key to enter the Temperature unit interface menu. The menu shown in Figure 3-12 :

Fig. 3-12 TEMP Setting

TEMP unit: Celsius, Fahrenheit

3.11 System Setting

Under the setting menu, select the system setting and press the confirm key to enter the system setting interface menu. The menu shown in Figure 3-13:

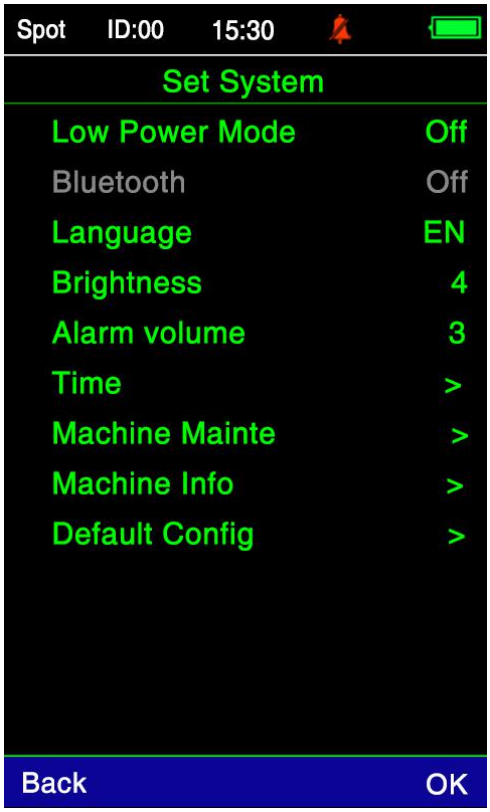


Fig. 3-13 System Setting

System Settings

- "Low Power Mode": On, it will automatically shut down in SPOT mode; Off, it will not shut down automatically in SPOT mode.

Warning

The low power mode has no effect on the monitoring mode.

"Bluetooth": Bluetooth module switch.

Warning

Bluetooth mode is currently not supported.

- "Language" options: Chinese, English.
- "Brightness" options: 1~4 levels, the larger the level, the brighter the screen.
- "Alarm volume" options: 1~3 levels, the greater the level, the louder the sound.
- "Time": Time adjustment.
- "Machine Mainte": maintenance equipment information.
- "Machine Info": The date and version number of the device when it was manufactured.
- "Default Config": Restore the default factory settings.

3.12 Data review

Under the setting menu, select data review and press the confirm key to enter the data review interface menu. The menu shown in Figure 3-14 :

View ID View the list

Fig. 3-14 Data review

If the current working mode is Spot mode, you must select the ID number you want to view before entering the view list. If the current working mode is Monitor mode, directly enter the selection view list, because this mode is single user.

3.12.1 List description

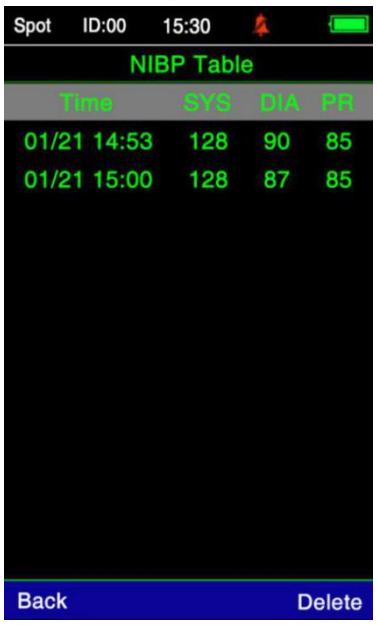


Fig. 3-15 NIBP table

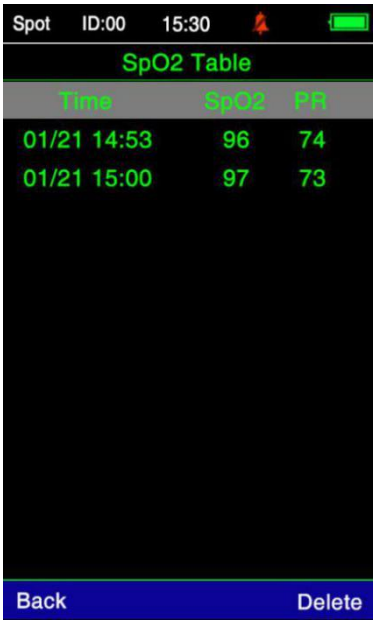


Fig. 3-16 SpO2 table

NIBP table: Time, SYS, DIA, PR. As shown in Figure 3-15.
SpO2 table: Time, SPO2, PR. As shown in Figure 3-16.

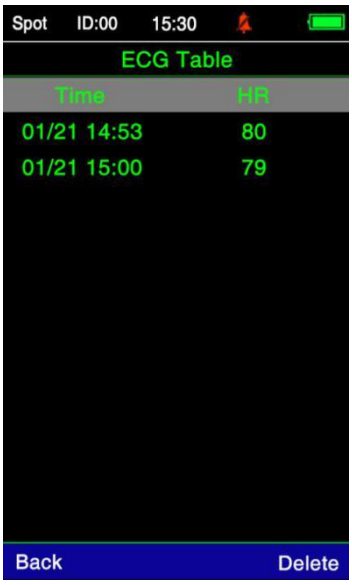


Fig. 3-17 ECG table

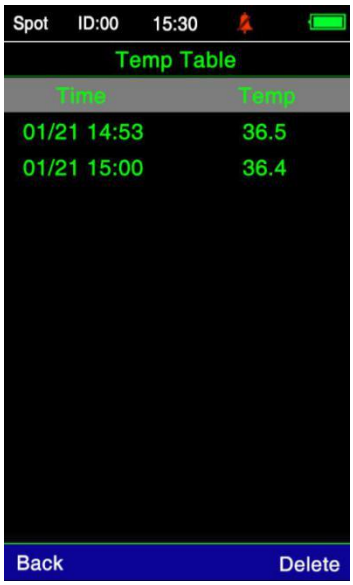


Fig. 3-18 TEMP table

ECG table: Time, HR. As shown in Figure 3-17.
TEMP table: Time, TEMP. As shown in Figure 3-18.

3.12.2 Description of Trend Graph

NIBP trend

The trend graph displays systolic blood pressure, diastolic blood pressure, pulse rate, and different colors. The vertical axis on the left represents pressure, the vertical axis on the right represents pulse rate, and the horizontal axis below shows time. The trend also includes ID, page number, and Date (The time range of the data on this page), preview all data by turning the page. As shown in Figure 3-19.

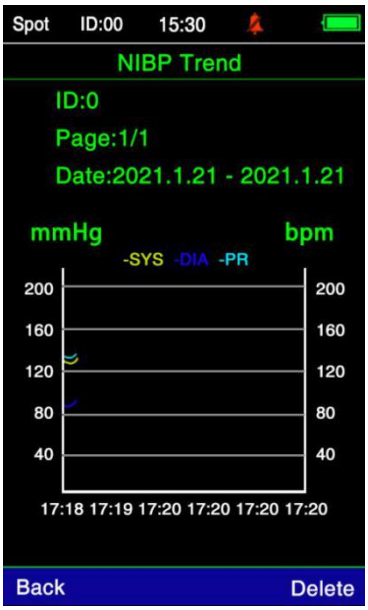


Fig. 3-19 NIBP trend

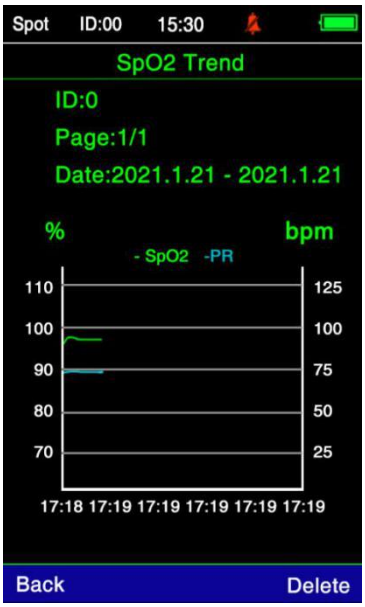


Fig. 3-20 SpO2 trend

SpO2 trend

The trend graph displays blood oxygen and pulse rate. The horizontal axis on the left is in %, the pulse rate is on the right, and the horizontal axis is the measurement time. As shown in Figure 3-20.

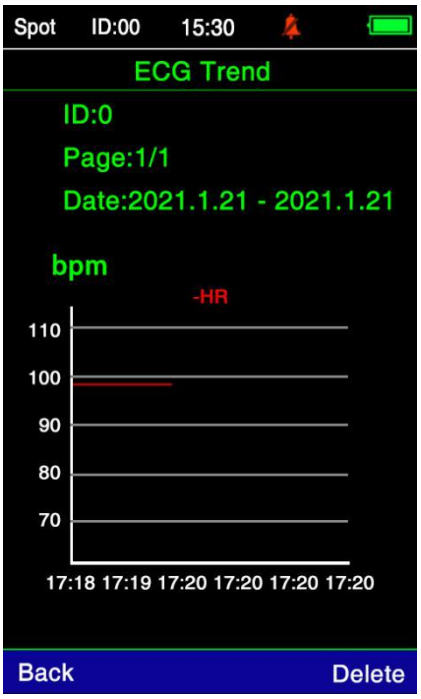


Fig. 3-21 ECG trend

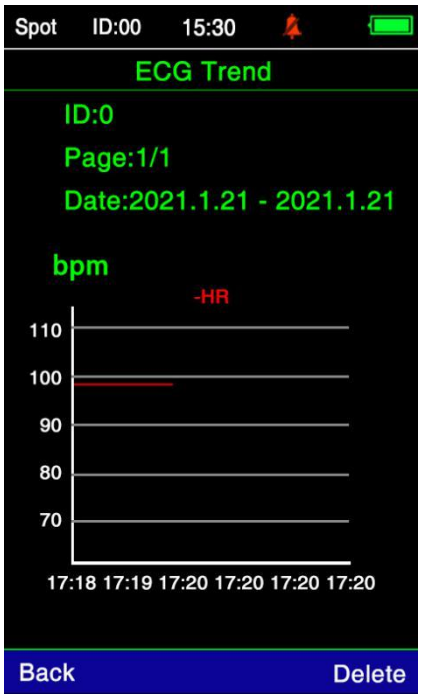


Fig. 3-22 TEMP trend

ECG trend

The heart rate is displayed in the trend graph, the unit of the horizontal axis on the left is bpm, and the horizontal axis is the measurement time. As shown in Figure 3-21.

Temp trend

The trend graph displays Temperature, the horizontal axis on the left is in Celsius or Fahrenheit, and the horizontal axis is the measurement time. As shown in Figure 3-22.

Warning

11 groups of data are displayed on each page, and all the data can be viewed by turning pages.

Chapter IV Maintenance and Cleaning

4.1 Maintenance and inspection

Before using this equipment, the following checks must be carried out:
● Check for any mechanical damage.
● Check all exposed wires, inserts and accessories.
● Check the function of all instruments that may be used to monitor animals, and ensure that the instruments are in good working condition.
If you find any signs that may prove that the function of the device is damaged, you should stop using this monitor to measure the animals. Please contact the seller or our company.

4.2 Normal Cleaning

Warning: Do turn off the power supply and disconnect the AC power supply before cleaning the equipment and sensor.

- The device should be placed in a dust-free environment.
- It is recommended to clean the outer surface of the housing and the display screen. Clean the case with non etching detergent, such as soap and water. Do not use strong solvents such as acetone. Be careful not to damage the monitor.
- Most detergents must be diluted before using.
- Dilute according to the manufacturer's instructions and never use abrasive materials (such as steel velvet or silver polish). Solvents, such as acetone. Be careful not to damage the monitor.
- Do not allow any liquid to immerse the casing. Do not immerse any part of the system with liquid.
- Do not leave any cleaning solution on any part of the surface of the device.

4.3 Cleaning Solution Guidance

Except for the solutions listed in the ‘caution’ section, any solution that can be classified as the following properties can be used as a detergent:

- Dilute ammonia
- Diluted sodium hypochlorite (washing bleach)
- Sodium hypochlorite in the concentration range of about 500ppm (1:100 diluted household bleach) to 5000ppm (1:10 diluted household bleach) is very effective. The amount of ppm depends on how much organic matter (blood, animal and plant mucus) is present on the clean and disinfected surface.
- Diluted formaldehyde 35-37%
- Hydrogen peroxide 3%

- Ethanol
- Isopropanol
- The surface of the monitor and its sensor can be wiped with medical alcohol, dried naturally or cleaned with clean and dry cloth.
- We are not responsible for the effectiveness of these chemicals as a means of infectious disease control.

Please consult with the relevant person in charge of infection control or infectious disease experts.

4.4 Sterilization

In order to avoid long-term damage to the device, we recommend sterilizing the product only when it is considered necessary. We also suggest that sterilized products should be cleaned first.
Recommended sterilization materials: ethanol based, acetaldehyde based.

Caution

- Dilute or use as low a concentration as possible according to the manufacturer's instructions.
- Do not allow fluid to immerse the housing.
- Never soak any part of the system.
- Do not dump liquid on the system during sterilization.
- Do not let the bactericide remain on any surface of the equipment. If there is any residue, please wipe it immediately with a wet cloth.

4.5 Disinfection

In order to avoid long-term damage to the device, we recommend that the device should be disinfected only when deemed necessary. We also suggest that disinfected device should be cleaned first.
For ECG lead, SpO2 sensor, blood pressure cuff and temperature probe, please refer to relevant chapters.

Caution

To prevent damage to the monitor, do not use gas (ETO) or formaldehyde to disinfect the monitor.

Chapter V Alarm

This chapter introduces the general information about the alarm and the measures to be taken when the alarm occurs. You can get the information of parameter alarm and prompt in the chapter about parameter setting.

5.1 Overview

The so-called alarm refers to the prompt given by the monitor to the user when the animal being monitored has a vital sign change enough to attract the attention of the user or the machine itself fails to make the monitoring of the animal unable to proceed smoothly.

5.2 Alarm properties

5.2.1 Alarm Type

The alarm can be divided into two categories: if the alarm originates from the change of vital signs of animals, that is, the physiological parameters of the monitored animals exceed a specific range or the occurrence of physiological abnormalities that cannot be measured by a single physiological parameter out of bounds, it is called physiological alarm; if the alarm originates from the machine itself, that is, it cannot be detected due to the technical obstacles in the use of the monitor or the failure of the machine itself The alarm occurred in accurate animal monitoring is called technical alarm.

5-1 Examples of Physiological Alarm and Technical Alarm

Animal or machine condition	Type of alarm generated
The heart rate of the animal is 200bpm, which is beyond the alarm range set by the user.	Physiological alarm
Ventricular fibrillation was found	Physiological alarm
ECG measurement module found ECG lead falling off	Technical alarm
SpO2 measurement module failure	Technical alarm

5.2.1.1 Physiological alarm Category

Physiological alarm can be divided into two situations: one is that the physiological parameters of the monitored animal exceed a specific range, and the other is that the animal has physiological abnormalities that cannot be measured by a single physiological parameter.

The latter belongs to the alarm that can temporarily block the former, for example, the following:

ECG signal is too weak;

Cardiac arrest;

Ventricular fibrillation / tachycardia;

No pulse was found;

5.3 Alarm mode

In case of alarm, sound light and text prompt will be given.

5.3.1 Acousto optic properties

5-2 Alarm sound and light characteristics

Alarm sound mode	Alarm light mode
The mode is ‘beepbeepbeep-beepbeep’, every 30 seconds (interval count is from this time to the next time).	The alarm light flashes in red with slow frequency

5.3.2 Content properties

Background color: the alarm background color is red.
Color of string: white.

5.4 Alarm status

5.4.1 Summary

For each alarm, there are two states: trigger state, and clear state. You can only be in one state at a time.

- Trigger state: the state when an alarm exists.
- Clear state: the state in which the alarm does not exist.

At the beginning of the work, all possible alarms are in the clear state. In the following time, when the alarm conditions are met, the alarm will enter the trigger state.

For the whole alarm system (i.e. for all alarms), there are the following states:

- Normal state: refers to the state that the alarm can give all prompts (including sound, light and text) in the triggering state.
- Alarm mute state: refers to the state of light and text prompt but no sound prompt when the alarm is triggered.

Every time, the whole alarm system can only be in one state.

5.4.2 Alarm mute status

Alarm mute state means that any sound prompt (including alarm, pulse, etc.) of the monitor is turned off.

5.5 Parameter alarm

In the alarm setting menu, the alarm parameters can be set independently, and the user can set the upper and lower limits of the alarm. When the value of one or several parameters exceeds the alarm limit, the monitor will alarm automatically and perform the following processing:

1) A prompt appears on the screen in the form described in the alarm prompt form;

2) If the alarm volume is set, the alarm will sound according to the set alarm volume;
3) The alarm light flashes;

5.6 Measures to be taken in case of alarm

Note

When an alarm occurs, the condition of the animal should be checked first.

The alarm information is displayed in the system information area or the system alarm information area. It is necessary to identify the alarm and take corresponding measures according to the alarm reason.

1) Check the condition of the animals.
2) Identify which parameter is alarming or which alarm is occurring.
3) Identify the cause of the alarm.
4) Silence the alarm if necessary.
5) When the alarm condition is removed, check whether the alarm is eliminated.

Alarm information and prompt information about parameters can be found in the chapter of parameter monitoring.

Chapter VI ECG

6.1 Instructions for ECG monitoring

6.1.1 ECG Monitor definition

ECG monitoring generates continuous waveforms of animal ECG activities to accurately evaluate the physiological state of animals at that time. Therefore, we should ensure the normal connection of ECG cable, so as to obtain the correct measurement value. The portable monitor only displays one ECG waveform in three lead state.

■ The parameters of monitoring display include heart rate(HR).

■ The above parameters can be used as alarm parameters.

6.1.2 ECG Monitor Points for Attention

Warning

When using portable monitor to monitor ECG signal, the ECG cable provided by our company must be used.

Warning

When you connect electrodes or animal cables, make sure there is absolutely no contact with any other conductive parts or with the ground.

In particular, make sure that all ECG electrodes, including neutral electrodes, are attached to the animal to prevent contact with conductive parts or ground.\

Warning

Interference from ungrounded instruments near animals and ESU interference may cause waveform problems. It is recommended not to use equipment with electrical radiation near ECG / respiratory measurement.

6.2 ECG monitoring operation method

6.2.1 Preparation

1) Prepare the skin before placing the electrode.

● The skin is a bad conductor, so it is very important to prepare the skin for the good contact between the electrode and the skin.

● If necessary, shave the body hair at the place where the electrode is placed.

● Wash skin thoroughly with soap and water. Do not use hexy lether and pure alcohol as this will increase the skin resistance.

● Dry wipe the skin to increase capillary blood flow in the tissue and remove skin debris and oil.

● Confirm that the power supply of the monitor is normal.

Warning

The electrode should be attached carefully and the contact should be confirmed.

Warning

In order to protect the environment, used electrodes must be recycled or properly

treated.

Warning

Before monitoring, it is necessary to check whether the lead is normal. After pulling out the ECG cable, the screen will display the error message of lead falling off, and trigger the sound alarm at the same time.

6.2.2 Installation of ECG lead

The location of ECG monitoring electrode was determined according to the animal type. As shown in Figure 6-2

Warning

The lead names in European and American standards are listed in the table below. (in European standard, R, I, N, F and C are used for each lead, while in American Standard, RA, La, RL, ll and V are used for each lead.)

American		European	
Lead	Color	Lead	Color
RA	White	R	Red
LA	Black	L	Yellow
LL	Red	F	Green
RL	Green	N	Black
V	Brown	C	White

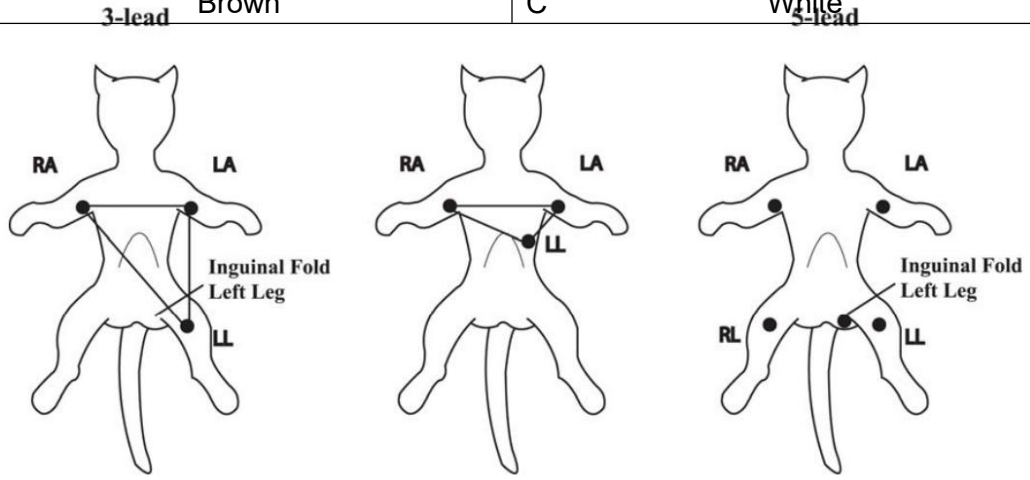


Fig.6-2 Indicative map of the placement of ECG electrodes

ECG lead connection recommended for surgery

Warning

When using the electrosurgical (ES) equipment, the ECG electrode should be placed in the middle between the ES grounding plate and the electrosurgical knife to avoid burns. The cable of electrosurgical equipment should not be entangled with ECG cable.

The placement of ECG leads depends on the type of operation performed.

Warning

When using the electrical surgical (ES) equipment, the electrode must not be placed on the ground plate near the surgical electrical equipment, otherwise there will be a lot of interference in the ECG signal.

Characteristics of a good signal:

- Narrow without notch.
- The R wave is tall and completely above or below the baseline.
- The pacing signal was not greater than the height of R wave.
- The height of T wave is less than 1 / 3 of that of R wave.
- P wave should be much smaller than T wave.
- In order to obtain 1 MV calibrated ECG wave, ECG calibration should be performed. At this time, the screen will prompt that ‘animals cannot be monitored during calibration’.

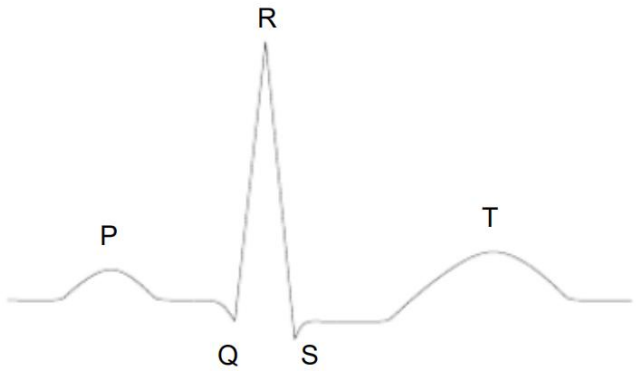


Fig. 6-3 Standard ECG waveform

Using five lead ECG device

Users can arrange the leads on channel 1, channel 2 and channel 3 according to their own needs. The lead labels on the three channels are displayed above the corresponding waveforms, and can be changed in the ECG menu. For channel 1, channel 2 and channel 3, select the appropriate lead from I, II, III, AVR, AVL, AVF and V,

Warning

If the electrode is correct and the ECG waveform is not accurate, replace the lead.

Warning

Interference from ungrounded instruments near animals and ESU interference may cause waveform problems.

6.3 ECG Operation

■ ECG Alarm

The alarm will be given when the caution rate exceeds the upper limit or is lower than the lower limit.

Warning

The upper and lower limits of alarm should be set according to the clinical conditions of animals.

The upper and lower limits of alarm should be set according to the clinical conditions of animals.

■ Lead type

5 lead or 3 lead can be selected

■ Waveform selection

Choose which ECG waveform data to calculate heart rate.

■ Waveform speed

The scanning speed of ECG waveform can be selected as 12.5, 25.0 and 50.0 mm/s.

■ ECG 1，ECG 2，ECG 3

Selective leads are Ⅰ, Ⅱ, Ⅲ, AVR, AVL, AVF, V.

■ Gain setting

When the input signal is too large, the peak may be truncated. At this time, the user can refer to the actual waveform to manually change the ECG waveform gain file to avoid incomplete waveform display.

The gain of each calculation channel can be selected. There are four levels of gain: x0.25, x0.5, X1 and x2. The scale of 1mV is given on the left side of each ECG waveform. The height of a 1 MV scale is proportional to the amplitude of the wave.

■ Filter settings

1. Diagnosis mode，Monitor mode, Surgery mode,Strong mode.
2. Only in the diagnosis mode can the system provide the real signal without processing.
3. In the ‘monitoring’ and ‘operation’ filtering mode, ECG waveform will have varying degrees of distortion. At this time, the system can only provide the basic condition of ECG, which will have a great impact on the results of ST segment analysis.
4. In the operation mode, the analysis results of arr may also have some influence. Therefore, it is suggested that when the interference is small, the diagnosis mode should be used for animal monitoring as far as possible. More clean or accurate waveforms can be obtained by filtering.
5. In the diagnosis mode, the ECG wave without filtering is displayed; in the monitoring mode, the false alarm may be filtered; in the operating room, the operation mode can reduce the false error and interference from the electrosurgical equipment.

6.4 ECG alarm information and prompt information

Alarm information

There are two kinds of alarms in ECG measurement: physiological alarm and technical alarm. At the same time, various prompt messages may be generated in the process of ECG measurement. When these alarms or prompts appear, the visual and auditory representations of the monitor can refer to the relevant description in the chapter of alarm settings. On the display screen, physiological alarm and general prompt information (general alarm) are displayed in the alarm area of the monitor, while technical alarm is displayed in the information area of the monitor.

The following classification list describes some alarms that may be generated by this measurement.

Physiological alarm ：

Notification	Reason
HR High	HR measured value is higher than the set alarm upper limit
HR Low	HR measured value is higher than the set alarm bottom limit
PVC High	PVCHR measured value is higher than the set alarm upper limit

Technical alarm ：

Notification	Reason	Solution
RA shedding	The electrocardiograph electrode falls off from the animal or the electrocardiograph cable falls off from the monitor.	Ensure that all electrodes, leads and cables are connected properly.
LA shedding		
LL shedding		
V1 shedding		

6.5 Maintenance and cleaning

Maintenance and cleaning

Warning

Turn off the power and disconnect the AC power before cleaning the monitor or sensor.

If ECG cable is damaged or aging, replace it with a new one.

Cleaning

The surface of the monitor and its sensor can be wiped with medical alcohol, dried naturally or cleaned with clean and dry cloth.

Sterilization

In order to avoid long-term damage to the product, we recommend sterilizing the product only when it is considered necessary.

We also suggest that sterilized products should be cleaned first.

Recommended sterilization materials for monitor:

Ethoxyl: 70% whey, 70% ethylpropyl.

Acetaldehyde group

Disinfect

In order to avoid long-term damage to the product, we recommend that the product be disinfected only when deemed necessary.

We also suggest that disinfected products should be cleaned first.

Chapter VII SpO2 Measurement

7.1 SpO2 Monitor instruction

7.1.1 SpO2 Definition

SpO2 plethysmography parameters measure arterial oxygen saturation, which is the percentage of total oxygenated hemoglobin. For example, if 97% of the total hemoglobin molecules in the red blood cells of arterial blood are combined with oxygen, the blood will have 97% SpO2 oxygen saturation, and the SpO2 value reading on the monitor should be 97%. The SpO2 value shows the percentage of oxygen carrying hemoglobin molecules forming oxyhemoglobin. SpO2 plethysmography parameters can also provide pulse rate signal and plethysmography wave.

7.1.2 Measurement principle of SpO2 plethysmography parameters

Blood oxygen saturation was measured by pulse oximetry. This is a continuous and noninvasive method for measuring hemoglobin oxygenation saturation.
It measures how much light emitted from one side of the sensor light source passes through animal tissues (such as ears, tongue, etc.) and reaches the receiver of the other side.
The wavelength that the sensor can measure is usually 660nm for red LED and 940nm for infrared LED. The maximum optional output power of LED is 4MW.
The amount of light passing through depends on a number of factors, most of which are constant. But one of these factors, arterial blood flow, changes over time because it's pulsating. By measuring the light absorbed during pulsation, it is possible to obtain arterial blood oxygen saturation. The detection of pulse itself can give a plethysmography waveform and pulse rate signal.
The SpO2 value and plethysmography waveform can be displayed on the main screen.

Warning

If carboxyhemoglobin, methemoglobin or dye dilution chemicals are present, the SpO2 value will deviate.

7.1.3 Measurement of sp02 plethysmography parameters

The ‘sp02’ value and waveform can be displayed on the main screen.

Warning

If carboxyhemoglobin, methemoglobin or dye dilution chemicals are present, the sp02 value will deviate. Oxygen saturation / pulse monitoring.

Warning

The cable of the electrosurgical equipment should not be entangled with the sensor cable.

Warning

■ Make sure the blood oxygen probe is out of the light.

Warning

■ The Sp02 value is always displayed in a fixed place.

Warning

The Sp02 waveform is not proportional to the pulse volume.

Warning

Before monitoring, check whether the sensor cable is normal. When the sp02 sensor cable is removed from the socket, the screen will display the error message of "probe falling off" and trigger the sound alarm at the same time

Warning

If the sensor packaging or sensor has signs of damage, do not use this Sp02 sensor, should contact the seller to deal with.

Warning

Continuous and prolonged monitoring may increase the risk of unwanted changes in skin characteristics, such as hypersensitivity, redness, blistering or compressive necrosis, especially in small animal tongues or animals with perfusion disorders and altered or immature skin patterns.

Pay special attention to check the position of the sensor according to the quality change of the skin and the correct light path alignment and attachment method. Regularly check the sensor attachment position and change the attachment position when the skin quality decreases. Due to the different status of individual animals, more frequent examinations may be required.

7.2 SpO2 Measurement Operation

7.2.1 Sp02 plethysmography

1) Turn on the monitor;
2) Stick the sensor on the animal's tongue or ear at the appropriate position. If the hair is over, remove the hair before use.
3) Plug the connector at one end of the sensor cable into the sp02 connector of the branch line.

Warning

If the test position and probe can not be accurately located, it may lead to inaccurate reading of blood oxygen saturation, or even unable to search for pulse wave and unable to conduct blood oxygen monitoring, it should be relocated at this time.

Warning

In the long-term continuous monitoring process, check the peripheral circulation and skin condition of the measuring part every 2 hours or so. If adverse changes are found, the measuring part should be changed in time.

In the process of long-term continuous monitoring, the positioning of the probe should be checked periodically to avoid the change of the probe positioning caused by moving and other factors, which will affect the accuracy of measurement.

7.3 SpO2 Monitoring measurement limit

During the operation, the following factors can affect the accuracy of blood oxygen saturation measurement:

- High frequency electrical interference, such as the interference generated by the host system itself or the interference from the electrical instruments connected to the system.
- Do not use photoelectric oximeter and oxygen sensor during MRI scanning. Induced current may cause burns.
- Intravenous dye.
- Animals move too often.
- External light radiation.
- Improper installation of sensor or improper contact with object.
- Sensor temperature (the best temperature should be in the range of 28 ℃ ~ 42 ℃).
- Place the sensor on the limb with blood pressure cuff, arterial catheter or endovascular tube.
- The concentration of nonfunctional hemoglobin such as carboxyhemoglobin (COHb) and MetHb.
- Low oxygen saturation.
- The circulation perfusion of the test site was poor.
- Shock, anemia, hypothermia and vasoconstrictor drugs may reduce the arterial blood flow to an unmeasurable level.
- The measurement also depends on the absorption of specific wavelengths of light by oxyhemoglobin and reduced hemoglobin.
- If there are other substances absorbing the same wavelength, they will lead to false or low sp02 values. Such as: carbohemoglobin, methemoglobin, methylene blue, indigo carmine.
- It is recommended to use the SpO2 sensor described in the attachment.

7.4 SpO2 Alarm Information

SpO2 alarm information

SpO2 Some physiological alarm, technical alarm and prompt information that may occur in module measurement are listed in the table below.

Physiological alarm：

Notification	Reason
SpO2 too high	SpO2 measured value is higher than the upper alarm limit
SpO2 too low	SpO2measured value is below the lower alarm limit
PR too high	PR measured value is higher than the upper alarm limit
PR too low	PR measured value is below the lower alarm limit

Technical alarm：

Notification	Reason	Solution
System Error3/SysErr3	Self test failure of blood oxygen module	Contact the seller or manufacturer
System Erro4/SysErr4	Blood oxygen module communication error	Contact the seller or manufacturer
No Sensor	Sensor not connected	Make sure that the sensor is placed on the animal's tongue or ear or other parts, and that the monitor is connected to the cable properly.
Sensor off	Sensor shed off	

Tips (including general warnings) ：

Notification	Reason
No pulse	No pulse was found
Searching	Search for pulse

7.5 Maintenance and cleaning

Maintenance and cleaning

Warning

Before cleaning the monitor or sensor, turn off the power and disconnect the AC power.

Warning

Do not autoclave the sensor.

Do not immerse the sensor in liquid,

If the sensor or cable has signs of damage or deterioration, it is forbidden to use again.

Cleaning:

The surface of the sensor can be wiped with cotton ball or soft cloth dipped with medical alcohol, and then dried with dry cloth. The light emitting tube and the receiver part of the sensor can be cleaned in the same way.

The cable can be cleaned and disinfected with 3% hydrogen peroxide or 70% isopropanol, the active reagent is also effective, and the connector cannot be immersed in the above solution.

Chapter VIII Temperature Measurement

8.1 Temperature monitor instruction

The portable monitor can use the temperature probe to measure the Temperature data.

Temperature measurement setting

- If you are using a disposable temperature probe, insert the temperature cable into the socket, and then connect the probe with the cable. For a reusable temperature probe, you can insert it directly into the socket.
- The temperature probe was inserted from the anus of the animal, and the insertion depth was determined according to the size characteristics of the animal.

Warning

Before monitoring, check whether the probe cable is normal.

Warning

The disposable temperature probe can only be used once.

Warning

Handle the temperature probe and cable carefully. When not in use, the probe and cable should be pulled into a loose ring. If the wire inside is too tight, it will cause mechanical damage.

8.2 Temperature alarm information and prompt information

Physiological alarm, technical alarm and prompt information that may occur in TEM measurement are listed in the table below.

Physiological alarm：

Notification	Reason
TEMP TOO HIGH	TEMP measured value is higher than the upper alarm limit.
TEMP TOO LOW	TEMP measured value is below than the lower alarm limit.

Technical alarm：

Notification	Reason
System Error 5/SysErr5	Temperature module self check error / communication error

Prompt and alarm：

Notification	Reason
Overrange	Out of range

8.3 Maintenance and cleaning

Warning

Turn off the power and disconnect the AC power before cleaning the monitor or the sensor connected to it.

Reusable temperature probe:

1) The heating of the temperature probe shall not exceed 100 ℃ (212 ℃). It can only withstand the temperature of 80 ℃ (176 ℃) - 100 ℃ (212 ℃) for a short time.
2) Do not steam sterilize the probe.
3) Only use alcohol detergent to disinfect.
4) When using the straight probe, it should be possible to cover it with protective glue.
5) When cleaning the probe, hold the head end in one hand, and scrub the probe downward toward the coupling with a wet, lint free cloth in the other hand.

Warning

If you are using disposable temperature probe, it is not allowed to re disinfect or re-use.

Warning

In order to protect the environment, the disposable temperature probe should be recycled or properly treated.

Chapter IX NIBP Measurement

9.1 NIBP Monitor instruction

Noninvasive blood pressure (NIBP) was measured by oscillatory method;
It can be used for animal measurement.

- Measurement Mode：Manual, Auto and Stat.
- Every mode will display SYS,DIA & MAP
- ‘Manual’Mode：Take only one measurement.
- ‘Auto’Mode：The measurement was repeated. The interval can be set as 1 / 2 / 3 / 5 / 10 / 15 / 30 / 60 / 90 minutes.
- ‘Stat’Mode：Continuous measurement for 5 min.

Warning

For animals with severe coagulation disorder, it is necessary to determine whether to take automatic blood pressure measurement according to clinical evaluation, because there is a risk of hematoma at the friction between limb and cuff.
When measuring on a small animal, make sure that the correct mode setting is selected (see cuff type setting).
When measuring on a small animal, make sure that the correct mode setting is selected (see cuff type setting).

9.2 NIBP Monitor Measurement Operation

9.2..1 NIBP Measurement

The inflation tube connecting the blood pressure cuff and the monitor should be unobstructed without entanglement.

1. Turn on the device and insert the inflation tube into the blood pressure cuff interface of the monitor.
2. Measure the circumference of the animal's limbs and choose the appropriate cuff for binding. If the limbs have more hair and need to be tied after removing the hair, please select the upper limb with more limb muscles for measurement.

◆ Make sure the cuff is completely deflated.
◆ Use appropriate size cuff for animals to ensure that the marker towel is just above the appropriate artery. Make sure that the cuff is not too tight around the limb, otherwise it may cause discoloration or even ischemia of the distal limb.

Warning

The length of the inflatable part of the cuff should be enough to surround 50-80% of the limb. The wrong size of the cuff will produce the wrong reading. If there is a problem with the cuff size, use a larger cuff to reduce errors.

◆ Check that the edge of the cuff falls within the range marked < - >. If not, replace it with a more suitable cuff.

- ◆ Connect the cuff with the inflation tube.
- ◆ Confirm whether the measurement mode is correct (the measurement mode is displayed in the information area of the power on Interface).
- ◆ Press the corresponding function button 2 on the front panel to start inflation and pressure measurement.

9.3 Operation Tips

1. Take an automatic measurement

The user can select the time interval value for automatic measurement. After that, the system will automatically inflate and measure according to the set interval.

Caveat

If the non-invasive pressure measurement time in the automatic mode is too long, the limbs rubbing with the cuff may be accompanied by purpura, ischemia, and nerve damage. During monitoring, always check the color, warmth and sensitivity of the distal limbs. Once any abnormality is observed, place the cuff in another place or immediately stop blood pressure measurement.

2. Stop automatic measurement

Pressing the stop button at any time during the automatic measurement will stop this automatic measurement, the interval time will be re-timed, and the measurement will be restarted after the next measurement time is reached.

3. Take a manual measurement

◆ Press the start button to start a manual measurement.

◆ During the idle time of automatic measurement, press the start measurement button to start a manual measurement. If the stop button is pressed again at this time, manual measurement will be stopped and automatic measurement will continue.

Warning

If you are in doubt about the accuracy of the readings, check the animal's vital signs using possible methods before checking the function of the blood pressure monitor.

Caveat

If liquid spills on the equipment or accessories, especially when the liquid may enter the pipeline or monitor, please stop using it and contact the maintenance department.

Limits of measurement

Depending on the condition of the animal, the oscillation method has certain limitations. This measurement looks for regular pulse waves produced by arterial pressure. When animal conditions make this detection method difficult, the measurement value becomes unreliable and the measurement time increases. The user should be aware that the following conditions will interfere with the measurement method, make the measurement unreliable or prolong the measurement time. In this case, the condition of the animal will make the measurement impossible:

■ Mobile

If the animal is moving, shaking or convulsing, the measurement will be unreliable or

even impossible, because these conditions may interfere with the detection of arterial pressure pulsations and the measurement time will be extended.

■ Arrhythmia

If the display shows an arrhythmia that results in an irregular heartbeat, the measurement will be unreliable or even impossible, and the measurement time will be extended.

■ Heart-lung machine

If the animal is connected with an artificial heart-lung machine, the measurement will not be possible.

■ Pressure change

If within a certain period of time, the arterial pressure pulsation is being analyzed to obtain a measurement value, and the blood pressure changes rapidly at this time, the measurement will be unreliable or even impossible.

■ Severe shock

If the animal is in severe shock or hypothermia, the measurement will be unreliable. Because the decrease in blood flow to the periphery will result in a decrease in arterial pulsation.

■ Extreme heart rate

Blood pressure cannot be measured when the heart rate is lower than 40bpm and higher than 254bpm.

■ Animals with many hairs and behind

Thick hair under the limbs will reduce the accuracy of the measurement, because the fat will prevent the concussion from the arteries from reaching the cuff.

9.4 NIBP alarm information

The following situations may cause a longer measurement time or unreliable values:

• Animal Movement
• Severe Shock
• Low Heart Rate
• Arrhythmia
• Rapid Pressure Changes
• Extremely Large Animals

Error	Cause
SysErr	Self-test fail
SysErr2	NIBP module system error
CuffLoose	Cuff is too loose or cuff not connected

CuffErr	Using small cuff in big cuff mode
Leakage	Valve or gas circuit leak
PressErr	NIBP Valve is not working appropriately
Weak	Animal’s pulse is too weak or cuff is loose
OveRange	Animal’s blood pressure exceeds the measurement range
Motion	During measurement, motion artifact in signal or too much interference
Protect0	Cuff pressure exceeds the range 300mmHg
Saturate	Too large signal amplitude caused by motion or other reasons
TimeOut	Big Cuff: cuff pressure over 2kPa(15mmHg) lasting for more than 3 minutes. Small Cuff: cuff pressure over 0.67kPa (5mmHg) lasting for more than 90s
Reset	NIBP module reset

9.5 Maintenance and cleaning

- Don’t constrict or kink the rubber hose
- Don’t allow liquid to come in contact with the vital signs monitor or charging dock
- When cleaning the monitor, only wipe the case
- Don’t submerge or place in any type of gas or steam sterilizer

Disposable NIBP Cuff

Disposable NIBP cuff should be used for only one animal, it cannot be disinfected or be sterilized under high pressure steam.

Warning

To protect the environment, single-use blood pressure cuffs must be recycled or properly disposed of.

Chapter X Mainstream CO2 Module

10.1 Hardware Interface

10.1.1 Mainstream CO2 Module:

Fig. 10.1.1 Mainstream CO2 Probe

10.1.2 Points for Attention:

10.1.2.1 Zero Operation

It is recommended that users ensure each module goes down to zero before use to ensure the best measurement accuracy. This operation is not necessary but is recommended. During the zero calibration operation, ensure that the gas sampled by the module is room air. If the module is in use and zero calibration must be performed, the module must alarm “apnea” first and the user must disconnect the module from the patient, ensuring that none of the gas sampled is from the patient. If the probe needs to return to zero, just unplug the adaptor and re-insert it. The probe will automatically return to zero without having to enter the monitor set-up software (see section 3.5.4).

10.1.2.2 Check Adaptor

When “check adapter” warning appears, check to see if the adapter is connected and that the optical analysis window is clean.

Clean probe with alcohol or install a new probe if needed.

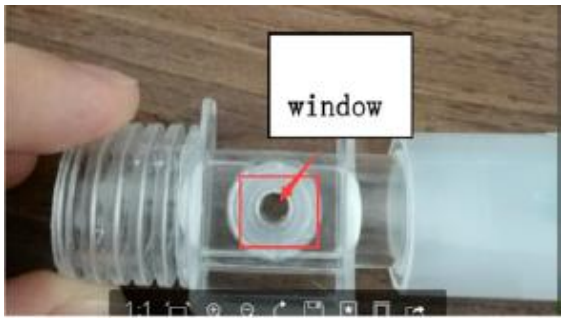


Fig 10.1.2.2 Adult Airway Adapter

10.1.2.3

The monitor may report “compensation not set” after power failure or device reset. If this warning occurs, enter the Set ETCO2 menu to adjust the compensation settings.

10.1.2.4

Upon initial power up and after connecting a new probe to the monitor, a solid red light will illuminate on the module itself. This means the module is in a pre-heated state. When the red light goes out, the probe is preheated. When the probe is pre-heated and in a normal measurement state, a green light will illuminate during exhalation and

will turn off during inhalation. If the red light is slowly blinking, that indicates a “check adaptor” alarm. A fast blinking red light indicates he adapter needs to return to zero (see section 10.1.2.1).
Note: The adapter needs to be preheated for 2-3 minutes (until the red light extinguishes) to prevent condensation on the optical analysis window from affecting the measurement results.

10.2 Proper Connection

For the mainstream module, the adaptor should always be kept in the correct position, as follows:

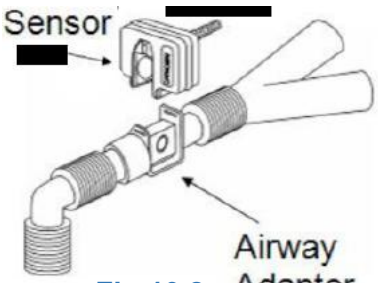


Fig 10.2

Fig 10.2.1

10.3 Troubleshooting of mainstream CO2 module

10.3.1 The mainstream ETCO2 module needs to be pre-heated before use. Preheating time takes about 3 minutes, depending on the ambient temperature. For example, the preheating time in a colder room will take about 3 minutes where as a warmer room may take as little as 1 minute. The purpose of preheating is to prevent condensation from building up in the adapter. The optical analysis window can get covered and affect the measurement. When condensation occurs, the monitor will prompt the “check adaptor” alarm. When a new probe is connected to the monitor, the red light will always be on, which means the module is in a preheated state. When the red light goes out, the module is preheated and no lights will be on. When the probe is in a normal measurement state, the green light will turn on when exhalation is detected and will turn off when inhalation is detected. If the module has a slow flashing red light, it is in a “check adapter” state. The user should check to ensure the adapter is connected properly and the optical analysis window is clear. If the module has a fast flashing red light, it is indicating “return to zero”. Disconnect the module from the patient, ensure no respiratory gases are in the adapter, then disconnect and reconnect the adapter to the module. The module will automatically return to zero without entering the monitor set up software.

10.3.2 When the mainstream ETCO2 module is being used for a long period of time, it is recommended to periodically check to whether the optical analysis window is

contaminated by respiratory secretions. If the optical analysis window is found to be dirty, it is necessary to clean the adapter window or replace with a new adapter. If the optical analysis window is dirty, the monitor will display the “check adapter” alarm. If the user attempts to zero the module, the procedure will cause an error. At this point, the module will not work properly and will continue to prompt the “check adapter” or “adapter need replace” warnings. If the user attempts to clean the module but the warning and alarms persist, a new adapter should be connected. Baseline elevation will cause the ETCO2 readings to be high. When a new adapter is connected, the module will automatically carry out a return to zero operation. This process can last about 15 seconds and the user should ensure that no respiratory gases enter the adapter during this time.

10.4 CO2 Compensations

The measurement of CO2 is affected by temperature, pressure and gas compensations. The barometric pressure, as well as the presence of O2, N2O, Helium, and anesthetic agents in the gas mixture need to be compensated for by the device in order to achieve it’s stated accuracy. The device provides instrument settings to allow the user to communicate these operating conditions. Please set the correct set-tings according to your operation environment the first time you use this monitor. This is only necessary if using the monitor in extreme conditions, 99% of users will not need to adjust these settings. The settings can be found in the ETCO2 set up menu.

10.5 Apnea Alarm

The “Apnea Time(s)” is the maximum time allowed from the detec-tion of one breath to the next breath. Therefore, if the time between breaths exceeds the time out period, the alarm “Apnea” will be trig-gered.
At start-up, or following a zero operation, three breaths need to be de-tected before this timer is activated. To clear the “Apnea” alarm, three breaths are required, or a zero operation must be carried out.

NOTE	The Capnostat monitor is not an apnea monitor. The software cannot discriminate between the patient no longer breathing and a sensor that has been disconnected from the patient circuit.

10.6 Sidestream CO2 Module

10.6.1 Using the Sidestream CO2 Module

This section provides information regarding the CO2 Module and its use with the CO2 cannula kits and the on-airway adapter kits. The BA220 CO2 Module is a rugged, solid-state, sidestream sensor. It is factory calibrated and does not require further calibration.

CAUTION: Do not use on patients that cannot tolerate the removal of 50ml/min from their total minute ventilation.

10.6.1.2 Module Mounting

A clip mounting bracket is available for the BA220 CO2 Module. Different mounting adapters can be designed based on customer application requirements.

10.6.1.3 Module Exhaust

The exhaust port on the rear of the module contains a barb for attaching scavenging tubing. The ID of the tubing is from 1.5mm to 2.0 mm and the OD of the tubing is from 3.2mm to 5mm.

CAUTION: When used with Anesthetic gas, connect module exhaust port to waste gas treatment system.

10.6.2 Connect with Sample Kit

BA220 module need to use with water filter and sample kit.

- Water Filter：Prevent liquid water and patient secretions into the CO2 module.
- Cannula sampling kits：These kits are used to sampling from Nasal or Oral/Nasal of non-intubated patients.
- On-airway adapter kits：These kits are used to sampling from mechanical ventilation circuit of intubated patients.

10.6.2.1 Connecting the Sample Kit

1. Connect the water filter with the on-airway adapter kit or cannula sampling kit.
2. Insert the water filter into the receptacle as shown in Fig 10.6.2.1, rotating the filter clockwise 45 degree.
3. After using, remove the sampling kit. Rotating the filter anticlockwise 45 degree and pull off the filter from the receptacle.

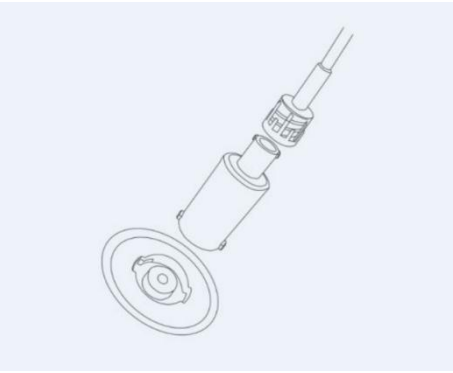


Fig 10.6.2.1

10.6.3 Zeroing the Module

The zero allows the CO2 module to adjust to the optical characteristics of the sample cell, to reduce the measurement error. A Zero is necessary only when requested. The following conditions, the system can prevent zero, in order to avoid error correction.

- Breath is detected in last 20 seconds.
- If the temperature is not stable.

10.6.3.1 To perform a Sample Cell Zero

1. Connect the CO2 Module and, 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. Set the Host to the zeroing function.
4. Query the status of the CO2 Module to check that the status bit "CO2 Sensor not ready to zero," is not set.
5. Start the Zero. The maximum time for a module zero is 40 seconds. The typical time for a zero is 15-20 seconds.

Note：For best results, wait 5 minutes to allow the CO2 Module to warm up before performing the Zero procedure.

10.6.4 Single Patient Use Sidestream

10.6.4.1 Single Patient Use Sidestream Cannula Sampling Kits

These Cannula kits were used to monitor CO2 of non-intubated patients. Select a sidestream cannula kit that is appropriate for the patient size and application.

Nasal CO2 Sampling Cannula	Big animal Intendedfor use when monitoring non-intubated big animal
Nasal CO2 Sampling Cannula	Small animal Intended for use when monitoring non-intubated small animal
Oral/Nasal CO2 Sampling Cannula	Big animal Intendedfor use when monitoring non-intubated big animal
Oral/Nasal CO2 Sampling Cannula	Small animal Intended for use when monitoring non-intubated small animal
Nasal CO2 Sampling Cannula w/ O2 Delivery	Big animal Intendedfor use when monitoring non-intubated big animal
Oral/Nasal CO2 Sampling Cannula w/ O2 Delivery	Small animal Intended for use when monitoring non-intubated small animal
Oral/Nasal CO2 Sampling Cannula w/ O2 Delivery	Big animal Intended for use when monitoring non-intubated big animal

10.6.4.2 Directions for Use of SINGLE PATIENT USE Nasal And Nasal/Oral Sidestream Kits

CAUTION: The Nasal and Nasal/Oral Cannula kits are intended for single patient use. Do not reuse or sterilize the cannula kit as system performance will be compromised.

1) Verify that the cannula kit is clean, dry and undamaged. Replace the cannula kit if necessary.
2) Connect the filter with cannula sampling kit.
3) Insert the Filter into the receptacle as shown in Figure 1, rotating the filter clockwise 30 degree.
4) Perform an sample cell zero if prompted by the host system.
5) Place the nasal cannula kits onto the patient as shown in Figure 1.
6) 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 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.
7) When using the Nasal or Oral/Nasal CO2 sampling kits with oxygen delivery, place the cannula on the patient as shown in Figure 3 and then attach the oxygen supply tubing to the oxygen delivery system and set the prescribed oxygen flow.
8) If the oral/nasal cannula is used, the oral sampling tip may need to be trimmed to adequately fit the patient (see Figure 4). Place the cannula onto the patient as shown in Figure 3. 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.

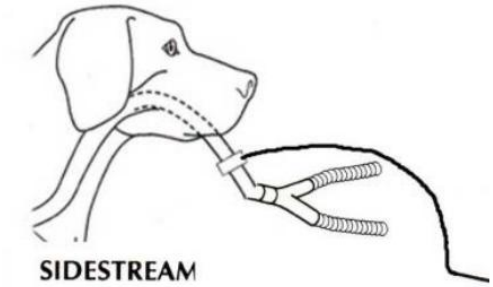


Fig. 1

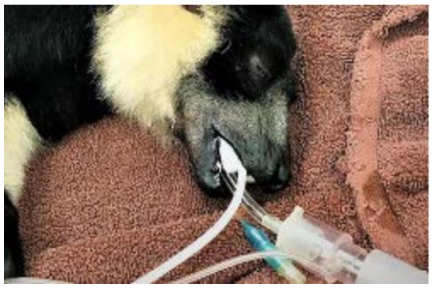


Fig. 2

Fig. 3

CAUTION: Do NOT cut the oral cannula tip when the cannula is on the patient.
CAUTION: Remove the sampling kit from the CO2 Module Inlet Port when not in use.

10.6.4.3 Single Patient Use Side stream On-Airway Adapter Kits

The side steam on-airway adapter kits are used when monitoring intubated patients. Select an side stream on-airway adapter kit that is appropriate for the patient size and application.

Airway Adapter Kit	Adult/Small animalfor use
Airway Adapter Kit	Small animal for use
Sample Line	Intended for use with the module with ventilator and anesthesia circuits that have an integrated airway adapter

10.6.4.4 Directions for Use of SINGLE PATIENT USE Side stream Adult/Small animal and Small animal/Infant On-Airway Adapter Kits

The Adult/Small animal sidestream on-airway adapter kits should be used when monitoring intubated patients with Endotracheal Tube diameters greater than 4.0 mm. Use the Small animal/Infant on airway adapter kits when monitoring intubated patients with Endotracheal Tube diameters less than or equal to 4.0mm

CAUTION: The Adult/Small animal and the Small animal/Infant on-airway adapters are intended for single patient use. Do NOT reuse or sterilize the adapter kit as system performance will be compromised.

1. Verify that the on-airway adapter is clean, dry and undamaged. Replace the on-airway adapter kit if necessary.
2. Connect the sampling line of the on-airway adapter kit with the Filter.
3. Insert the Filter into the receptacle as shown in Figure 1, tighten.
4. Perform an sample cell zero if prompted by the host system.
5. Place the on-airway adapter at the proximal end of the airway circuit between the elbow and the ventilator circuit wye.
6. Check that connections have been made correctly by verifying the presence of a proper capnogram on the Patient Monitor.

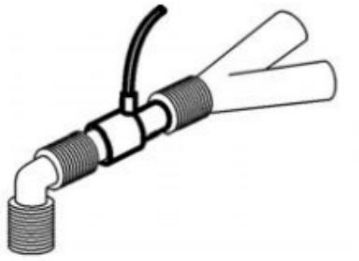


Fig. 4

10.6.4.5 Directions for Use of Sampling Line Kits

The sampling line kits are intended for use when using the CO2 module with ventilator and anesthesia circuits that have an integrated airway adapter. Connect sampling line to the port on the airway adapter (see Figure 5).

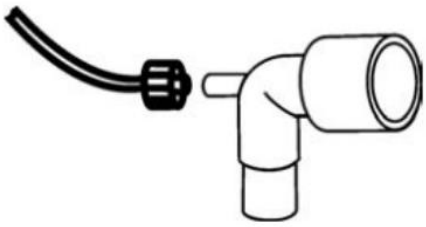


Figure. 5

Do not connect any non-approved extension tubing or nasal cannula to this sample line kit as device performance will be affected.

10.6.5 Check and Clean Sample Line Message

The sample flow rate of the BA220 is continually monitored. If the flow rate falls outside the nominal operating range “Check Sample Line” will be sent to the host monitor. If the Gas road blocked, the pump will be suspended.

10.6.5.1 Conditions that Can Cause a Change in Flow Rate

- Water, mucous or other patient contaminate has entered the sample tubing.
- The sample tubing is crimped or pinched so that the sample flow rate has decreased.
- The exhaust port of the BA220 is obstructed.
- The sample line is damaged.
- Sample line is not connected.

10.6.5.2 Clearing the "Check Sample Line" Message

- When the "Check Sample Line" message is displayed, the user should inspect the sample line kit to verify that none of the conditions described above are present. Replace with a new sample kit if needed.
- The user should verify that the exhaust port is not obstructed or blocked. If tubing is connected to the exhaust port, the user should also inspect the tubing for any crimping or pinching.
- The "Check Sample Line" message will clear if the condition that caused the flow rate change is corrected.

10.6.6 Maintenance

10.6.6.1 Sample Flow Rate Accuracy Check

The Module flow rate accuracy should be verified by direct measurement using a calibrated flow meter every 12 months.

NOTE: The test must be performed under load. Use the Adult On-Airway Adapter Kit for proper test verification.

1. Connect the CO2 Module connector to the power supply or host monitor.
2. Attach the water filter to the sample receptacle of the CO2Module.
3. Connect the water filter with the Adult On-Airway Adapter Kit.
4. Wait for the CO2 Module to warm up to its operating temperature.
5. Connect the calibrated flow meter to the exhaust port of the module.
6. Verify that the flow rate is 75 ml/min ± 15 ml. If the measured flow rate is outside of the specified limits, remove the CO2 Module from use and contact the Manufacturer.

10.6.6.2 CO2 Accuracy Check

The following procedure should be performed to check the CO2 accuracy of the CO2 Module. It is recommended that this procedure be performed every 12 months.

1) Attach the CO2 Module to the Host monitor. Attach a CO2 airway adapter to the CO2 Module.
2) Turn on the Host monitor.
3) On the Host monitor, change to the CO2 Accuracy Mode. This mode will need to display the CO2 waveform value as a numeric instantaneous value.
4) Wait for the CO2 Module to warm up to its operating temperature.

5) Set the CO2 Units setting of the CO2 Module to percent.
6) Set the gas compensation settings of the CO2 Module to the verification gas mixture.
7) Zero the CO2 Module.
8) Attach a regulated flowing gas mixture of 5% CO2, balance N2 to the airway adapter. Set the flow rate of the gas to 2 liters per minute.
9) Allow 30 seconds for the gas mixture to stabilize and observe the CO2 value. The expected value is 5% ± 0.26%.
10) If a waveform is present, verify that it appears as a straight line at approximately 5 percent.
11) The accuracy check is now complete. Remember to set the CO2 Module settings for units and gas composition back to their previous settings.

10.6.7 Cleaning

Cleaning the CO2Module case, Cable and connector:

1. Use a cloth dampened with isopropyl alcohol 70%, a 10% aqueous solution of sodium hypochlorite (bleach), a 2% gluteraldehyde solution, ammonia, mild soap or disinfectant spray cleaner.
2. Wipe down with a clean water-dampened cloth to rinse and dry before use.

NOTE: Do not immerse or sterilize the Module.
NOTE: The Side stream on-airway adapters and side stream sampling kits are single patient use. Treat in accordance with hospital protocols for handling single patient use devices.

Appendix I Accessories Specifications

Warning

The accessory models specified by the manufacturer are listed below. The use of other types of accessories may damage the monitor

1. ECG accessories

Name	Specification
One-piece 3-lead cable	Plug: LEMO type 6PIN plug
	Cable: shielded wire
	Lead wire: single core double shielded wire
	Electrode connector: clip

2. SpO2 accessories

Name	Specification
SpO2 sensor	Adopt imported special Nellcor sensor. Equipped with a large clip and a small clip. Probe: tongue or ear

3. TEMP (temperature) accessories

Name	Specification
Body cavity probe	Plug: audio plug
	Probe: 2.25mm
	Accuracy: 30~45 ℃± 0.1℃

4. NIBP (blood pressure) accessories

Disposable NIBP cuff

Cuff size	limb circumference	Inflatable tube length
#1	3～6cm	1.5m～3m
#2	4～8cm	
#3	6～11cm	
#4	7～13cm	
#5	8～15cm	

5. EtCO2(End-tidal carbon dioxide) accessories

Name	Specification
Mainstream	Disposable adapter with big size and small size
Sidestream	Sample line, three way trap, nasal tube, water filter

Appendix II Product Specifications

1. Types of monitors

Degree of anti-liquid entry	Ordinary sealed instrument does not have the function of preventing liquid from entering
Disinfection / sterilization method	Please refer to Chapter 6 for details.
Working method	Continuous work

2. Monitor Specifications

2.1 Monitor size and weight

Size	146mm x 67mm x 30mm
Weight	250g

2.2 Working Environment

Temperature
Operating: 0° ~ 40° C
Storage/Transportation: -20° ~+60° C
Humidity
Operating:≤80%
Storage/Transportation:≤ 93%
Altitude range
Working: -500-4,600 meters (-1,600-15,000 feet)
Transportation and storage altitude: -500-13,100 meters (-1,600-43,000 feet)

2.3 Display information

Up to 3 waveform displays
An alarm indicator (red)
A battery charging status indicator (red/green)

2.4 Power

Input: 100～240 V AC, 50/60 Hz,
Output: DC: 5V, 2A
3.7V-2000mAh lithium rechargeable battery

3. ECG Specifications

3.1 Lead configuration

Standard 3-lead or 5-lead cable

3 lead	RA, LA, LL, lead mode: I, II, III
5 lead	RA, LA, LL, RL, V, lead mode: I, II, III, aVR, aVL, aVF, V

3.2 Gain
250, 500, 1000, 2000

3.3 Heart rate
Heart rate range: 15 ~ 350bpm (beat/min)
Accuracy: ±1% or ±1bpm, whichever is greater
Resolution: 1 bpm (beats/min)

3.4 Sensitivity
> 200 uV (peak-to-peak)

3.5 Input impedance
> 5 (Megaohm)

3.6 Bandwidth
Diagnosis mode: 0.05 ~ 130Hz
Monitoring mode: 0.5 ～ 40Hz
Operation mode: 1 ～ 20Hz

3.7 Electrode polarization voltage range
300mV

3.8 Pacing pulse detection
For pacing pulses that meet the following conditions, it can be detected:
Amplitude: ±2mV ～ ±700mV
Width: 0.1ms ～ 2ms
Rise time: 10us ～ 100μs

3.9 Pacing pulse suppression
When the pacing analysis switch is turned on, the pacing pulses that meet the following conditions can be suppressed without affecting the heart rate calculation:
Amplitude: ±2mV ～ ±700mV
Width: 0.1ms ～ 2ms
Rise time: 10us ～ 100μs

3.10 Baseline recovery time
<3 seconds after defibrillation

3.11 Signal range
8mV (peak-to-peak value)

3.12 Calibration signal
1mV (peak-to-peak value), accuracy 5%

4. SpO2 specifications

4.1 Measuring range:

SpO2: 0-100%
PR: 0-500bpm
PI: 0.05%-20%

4.2 Accuracy range

SpO2: 70%-100%
PR: 30-500bpm
PI: 0.05%-20%

4.3 Accuracy

SpO2: ±3(70%-100%)
PR: ±3bpm (under exercise conditions: ±5bpm)

5.TEMP specifications

5.1 Applicable temperature sensor

YSI series, CYF series

5.2 Measurement

Range 25 ～ 45 ℃
Resolution 0.1 ℃
Accuracy 0.1 ℃ (not including sensor error)

6. NIBP specifications

6.1 Measurement method

Pulse wave oscillation

6.2 Working mode

Manual / automatic / continuous measurement

6.3 Measurement interval time in automatic measurement mode

1,2,3,5,10,15,30,60,90

6.4 Pulse rate range

40 – 240 bpm

6.4 Range

Systolic blood pressure: 40 ~ 270 mmHg

Diastolic blood pressure: 10 ～ 230 mmHg
Average pressure: 20 ～ 210 mmHg
Static pressure range: 0 ~ 300 mmHg
Static pressure accuracy: ±3 mmHg

6.5 Pulse rate range
40 – 240 bpm

6.6 Overvoltage protection
300mmHg

7. ETO2 specifications

7.1 Measuring range:
0-150mmhg
0-19.7%
0-20 kpa

7.2 Accuracy range:

ETCO2 Concentration	Accuracy
0-40mmHg	±2 mmHg
41- 70 mmHg	±5% of reading
71 – 100mmHg	±8% of reading
101-150mmHg	±10% of reading

7.3 Accuracy
CO2 concentration measurement resolution: 0.1mmHg

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