Multi-parameter Veterinary Monitor

User Manual
Copyright

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Preface

The instruction manual detailedly introduces the performance and operation method of the veterinary monitor (hereinafter referred to as monitor or veterinary monitor) as well as other safety information, etc. Here is the best starting point for new users to use the monitor.

Performance, Structure and Composition of the Product

This monitor is mainly comprised of the mainframe and corresponding functional accessories (electrocardiogram cable, noninvasive blood pressure cuff, blood oxygen transducer and body temperature transducer).

Applicable Scope of the Product

The product is applicable for medical units to monitor the sick animals’ electrocardiogram, body temperature, respiration, pulse oxygen saturation, noninvasive blood pressure, pulse rate and end-tidal carbon dioxide, and also has an arrhythmia analysis function.

Applicable Objects of the Product

This instruction manual is applicable to the professional clinical medical staff or the persons who are experienced in using the monitoring equipment for reading. The readers shall have the knowledge and working experience in medical procedure, practice and terms necessary for monitoring the sick animals.

Figures

All the figures provided in this instruction manual shall be for your reference only. The menus, settings and parameters in the figures may be not entirely consistent with what you see from the monitor.
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## 1.1 Safety Information

**Warning**

- To warn you of the conditions where serious consequence, disadvantageous matters or danger may occur. Failure to comply with the warning will result in severe personal injury or death of the user.

**CAUTION**

- To indicate potential danger or unsafe operation. If not avoided, it may lead to mild personal injury, product malfunction, damages or property loss. It may also give rise to more severe harm.

**Attention**

- It emphasizes primary warnings or provides descriptions or explanations so that this product can be used in a better way.

**Warning**

- This monitor is used for monitoring the clinical sick animals, so only the doctors and nurses who are qualified through training can use this monitor.
- Before use, the user shall check whether this instrument and its accessories can work normally and safely.
- The alarm volume and upper and lower limits for alarm shall be set for different sick animals. When a sick animal is monitored, the audible alarm system cannot be merely depended on. If the alarm volume is set too low or is completely turned off, the alarm will fail and the sick animal safety will be endangered. The most reliable sick animal monitoring method shall be to closely monitor the actual clinical situation of the sick
animal.

- This instrument can only be connected to a power socket with protective grounding. If the power socket isn’t connected to a grounding conductor, please don’t use this socket, but use the rechargeable batteries for power supply.
- Don’t open the shell of this instrument to avoid the possible electric shock hazard. The maintenance and upgrading of this monitor must be conducted by the service personnel trained and authorized by Our Company.
- The disposal of packaging materials shall comply with the local laws and regulations or the waste disposal rules and regulations of the hospital. The packaging materials must be placed away from the children.
- Don’t use this instrument at the place where there are flammable articles such as anesthetic to prevent explosion or fire from happening.
- Please carefully install the power lines and the cables for various accessories to avoid the sick animal from being constricted or suffocated or the cables from getting entangled and keep the sick animal free from electrical interference.
- Don’t use mobile phone near the monitor, because the mobile phone will generate a very strong radiation field and disturb the functions of the monitor.
- As for the sick animal with pace maker, the heart rate meter may make the pace maker pulse him in case of cardiac arrest or arrhythmia. Closely monitor the sick animals with pace-making. See the instruction manual for the inhibition capability of related equipment for pace maker.
- The operators shall not touch the sick animals, tables and instruments during the defibrillation period.
- The equipment connected with the monitor shall form an equipotential body (the protective grounding wire is effectively connected).
- When the monitor is shared with the electrosurgery unit, the user (doctor or nurse) shall ensure the sick animals safety.
- The physiological waveforms, physiological parameters and alarm information, etc. displayed by this monitor shall be for the doctors’ reference only and cannot be directly used as the clinical treatment basis.
- The electromagnetic field will affect the performance of this instrument, so the use of the other equipment near this instrument must meet corresponding EMC requirements. For example: Mobile phone, X-ray or MRI equipment may be an interference source, because they will transmit high-strength electromagnetic radiation.
- This is not a treatment device.
To avoid damage to this instrument and guarantee sick animal safety, please use the accessories designated in this instruction manual.

Please properly install or move this instrument and prevent the instrument from being damaged due to fall, collision, strong vibration or other external mechanical forces.

Before the instrument is switched on, please confirm whether the power supply used meets the requirements for power supply voltage and frequency designated in the nameplate label or in the instruction manual of this instrument.

When this instrument and its accessories are about to exceed the service life, they must be disposed of according to local relevant laws and regulations or the rules and regulations of the hospital.

Please install the equipment in a place that is convenient for observation, operation and maintenance.

This instruction manual introduces the product according to the most complete configurations. The product you have purchased may not possess some configurations or functions.

Please place this instruction manual near the instrument for easy and timely access if necessary.

This instrument cannot be used at home.

1.2 Overview of the Monitor

This monitor (shown as follows) can be used for the bedside monitoring of Veterinary, such as cat, dog, etc. This monitor can monitor electrocardiogram (ECG), respiration (RESP), blood oxygen saturation (SpO₂), noninvasive blood pressure (NIBP), two-channel body temperature (TEMP) and carbon dioxide (CO₂) or one of the main parameters.

The screen of this instrument adopts the 4.3” color LCD screen, and simultaneously supports two operation modes, i.e. key mode and touch mode. Next, we will introduce the basic functions of the monitor, shown as Fig. 1-1:
Fig. 1-1 Monitor

<p>| | |</p>
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<td>①</td>
<td>Product Model</td>
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<tr>
<td>②</td>
<td>Key</td>
</tr>
<tr>
<td>③</td>
<td>Power Switch</td>
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<tr>
<td>④</td>
<td>Battery working indicator lamp, battery charging indicator lamp and power supply indicator lamp</td>
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<td>Display screen</td>
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<td>Alarm indicator lamp</td>
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⚠️ **Attention**

- This monitor doesn’t have logging function.

The veterinary monitor has the following monitoring functions, shown as the following table:

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<td>One-channel ECG waveform</td>
</tr>
<tr>
<td></td>
<td>Analysis of arrhythmia and S-T section and pace-making analysis (PACE)</td>
</tr>
<tr>
<td>NIBP</td>
<td>Systolic pressure (NS), diastolic pressure (ND), mean pressure (NM), unit: mmHg or kPa</td>
</tr>
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General

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
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<tbody>
<tr>
<td>SpO₂</td>
<td>Blood oxygen saturation (SpO₂, unit: %), pulse rate (PR, unit: beat per minute or bpm)</td>
</tr>
<tr>
<td>SpO₂ Pleth Plethysmogram</td>
<td></td>
</tr>
<tr>
<td>TEMP</td>
<td>Temperature data TEMP(unit: ℃ or °F)</td>
</tr>
<tr>
<td>RESP</td>
<td>Respiration rate (RR)(unit: times per minute)</td>
</tr>
<tr>
<td></td>
<td>Waveform of respiration rate</td>
</tr>
<tr>
<td>carbon dioxide (CO₂)</td>
<td>End-tidal carbon dioxide EtCO₂ (unit: mmHg or kPa)</td>
</tr>
<tr>
<td></td>
<td>Minimum carbon dioxide in inbound gas INS (unit: mmHg or kPa)</td>
</tr>
<tr>
<td></td>
<td>Air Passage Respiration Rate AwRR (times per minute)</td>
</tr>
</tbody>
</table>

1.3 Screen Display

The screen of this monitor adopts the touch color LCD screen and simultaneously displays the collected sick animal parameters, waveforms, alarm information of the monitor, clock, network connection state, bed number, battery and other prompt messages, etc.

The main screen is divided into three areas: 1. information prompt area or upper menu bar area ①; 2. parameter area ②; 3. lower menu bar area ③; 4. waveform area ④, which are shown as follows:

Fig. 1-2 Standard Interface

**Introduction to Information Prompt Area (①):**

The information prompt area is divided into three parts, which are respectively as follows from left to right:

1-5
(a) Information prompt of veterinary type (Big or small). Click here to rapidly enter into the menu of “Vet Info” and set the detailed information about the sick animal. See the content of “3.2.1 Veterinary Information” for more details.

(b) Information prompt of technological alarm, e.g. ECG lead off and SpO\textsubscript{2} NO SENSOR. Click here to rapidly enter into the window “Alarm recall” of technological alarm and then set the starting time of alarm in the window, and check the alarm information by pulling up or down the menu.

(c) Information prompt or mute prompt of physiological alarm

Information prompt of physiological alarm, e.g. ***RR too high and ***HR too low. Click here to rapidly enter into the window “Alarm recall” of physiological alarm and then set the starting time of alarm and the alarm event to be displayed in the window. For example, the events which can be selected include: All, ECG, SpO\textsubscript{2}, NIBP, CO\textsubscript{2}, RESP or TEMP, etc. Check the alarm information by pulling up or down the menu.

Mute prompt. If the mute key is pressed down now, the prompt is usually: permanent mute or alarm Suspending for 119s. The prompted content shall be determined by the setting of “Alarm Pause Time” in the “Alarm Setup”.

**Introduction to Parameter Area (②):**

Usually, the display locations of TEMP, NIBP and ECG parameters are fixed, but the display locations of RESP, SpO\textsubscript{2} and CO\textsubscript{2} parameters are determined by the parameter displayed by the waveform in the second channel. When SpO\textsubscript{2} is selected as the waveform displayed in the second channel, the first parameter displayed above is RESP and then the parameter displayed below is SpO\textsubscript{2}, but the CO\textsubscript{2} parameter is hidden. The display mode of the other two parameters is deduced by analogy, as follows:

![Fig. 1-3 Parameter Display at the Standard Interface](image-url)
Respiration (RESP):
   — Respiration rate (Unit: times per minute)

Body temperature (TEMP):
   — Temperature (Unit: °C or °F)

Noninvasive blood pressure (NIBP):
   — From left to right, respectively systolic pressure, mean pressure and diastolic pressure (Unit: mmHg or kPa)

Electrocardiogram (ECG):
Analysis results ST1 and ST2 of ST section in the first channel and the second channel (Unit: mV) and Number of ventricular premature beats (Unit: times per minute)
   — Heart rate or pulse rate (Unit: beat per minute)

Blood oxygen saturation (SpO2):
   — Pulse rate (Unit: beat per minute)
   — Blood oxygen saturation (SpO2) (Unit: %)

The above monitoring results are displayed in the parameter area. The parameter values are refreshed once a second, but the NIBP value is refreshed once per measurement.

Introduction to Lower Menu Bar Area (③):
The lower menu bar area is respectively from left to right: clock, demonstration prompt, network connection state, network bed number, battery status, alarm volume off prompt, system menu or screen locking/unlocking key, which are shown as follows:

![Fig.1-4 Lower Menu Bar](image)

(a) Clock: display the current system time of the monitor. Click here to rapidly enter into the menu “System Time Setting” and then reset the system time of the monitor according to the local time zone.

(b) Demonstration: When the working mode of the monitor is at the demonstration state, here “Demonstration” will be prompted; When the monitor is ECG calibrating, Here tips “CAL, can’t monitor!”; When the monitor is measuring blood pressure, here oxygen status will be prompted. Such as: “manual measurement”, “automatic measurement”, “please press “start” key”, “measuring termination”. Tip the contents, and vary according to the monitor in different states.

(c) Network connection state and network bed number: connection state of central monitoring
system: when the symbol “ ” is displayed, it indicates that the central monitoring system is not connected; when the symbol “ ” is displayed, it indicates that the central monitoring system has been successfully connected and the figure next to it is network bed number. Click here to rapidly enter into the menu “Network Bed Number”.

(d) Battery status: display the current battery charge status or damage status. See the content of “Battery” for more details.

(e) Alarm volume off prompt: when the alarm volume is set as “OFF”, the symbol “ ” will be displayed; when the “alarm volume” is set as Level 1 to Level 4, here there isn’t any information.

(f) System menu or screen locking/unlocking key.

Lightly click here to directly enter into the menu “Shortcut Key”.

When here is clicked and held for more than three seconds and then the screen changes from “ ” to “ ”, it indicates that the screen has been locked. In case of unlocking, continuously click the symbol “ ” for more than three seconds or press any key to unlock the locked screen.

**Introduction to Waveform Area (④):**

The waveform area displays the waveforms in two channels, respectively from up to down: the first channel is fixed as ECG waveform, and the second channel can display any of three waveforms, i.e. RESP (possibly from the ECG module), SpO₂, CO₂ except the ECG waveform.

The name of waveform can be displayed in the upper left of the waveform in each channel. The ECG waveform can be selected as required. Please see the chapters and sections about ECG monitoring for more details. The ECG waveform also displays the gains of this channel and the filtering method of ECG wave. There is a scale rod at the right side of ECG wave. During the screen operation, the menu can be popped up at a fixed location and the menu will occupy the location of the whole interface and thus all the waveforms can be temporarily invisible. The display of the original picture can be recovered after exiting from the menu.

The waveforms shall be refreshed at a set rate. See the setting content of each parameter for the adjustment of refreshing rate of each waveform.

**1.4 Key Functions and Basic Operations**

**1.4.1 Key Functions**

The operations on this monitor can be finished by keys, shown as the following table:
### 1.4.2 Basic Operations

(a) Display the required waveforms:

As the first channel is fixed as ECG waveform, the second channel can display any of three waveforms, i.e. RESP (possibly from the ECG module), SpO₂, CO₂ except the ECG waveform. Therefore, if the waveform displayed in the second channel needs to be replaced, click the waveform in the second channel of the screen and then enter into the option of “Switch Wave” in the “XX wave setup” popped up to select the waveform to be displayed.

(b) Adjust the waveform speed:

ECG: click the “ECG” hot key in the waveform area and set the “sweep” through the menu “ECG Wave Setup”.

Click the waveform in the second channel to set the speed of such waveforms as SpO₂, RESP, CO₂, and switch the option “sweep” through the “XX wave setup”.

---

<table>
<thead>
<tr>
<th>Key symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Mute/reset key" /></td>
<td>(Mute/reset key) Alarm suspending for 10 minutes or “permanent mute” (this option can be set in the menu “Alarm Setting” in the main menu). Press down this key for more than one second to shield or turn off all alarm sounds, including the technological alarm, and display “Alarm Suspending for xxs” or “Permanent Mute” in the information area. Under the state of “Alarm Suspending” or “Permanent Mute”, if a new technological alarm occurs, the current state of alarm suspending or permanent mute will end and the alarm will be recovered. After the alarm is recovered, the instruct will immediately respond to the alarm and the response time will not exceed 3s.</td>
</tr>
<tr>
<td><img src="image" alt="Freezing/unfreezing key" /></td>
<td>(Freezing/unfreezing key) In normal mode, press down this key to freeze all the waveforms on the screen. Press down this key again to release the frozen waveforms. After pressing down the freezing key, click the screen to review the ECG waveforms stored within five minutes.</td>
</tr>
<tr>
<td><img src="image" alt="Start/Stop Key for NIBP Measurement" /></td>
<td>(Start/Stop Key for NIBP Measurement) At the non-blood pressure measurement state, press this key to aerate the cuff and then start one blood pressure measurement; at the measurement state, if you want to quit such measurement, press this key to stop measurement and then deflate.</td>
</tr>
<tr>
<td><img src="image" alt="Pop up/exit the main menu" /></td>
<td>(Pop up/exit the main menu) In any interface mode, press this key to pop up the main menu.</td>
</tr>
<tr>
<td><img src="image" alt="ON/OFF Key" /></td>
<td>(ON/OFF Key) Press this key to execute on-off control for the instrument.</td>
</tr>
</tbody>
</table>
(c) Change the alarm limit:
ECG, NIBP, TEMP, SpO₂ (including PR), RESP, CO₂: enter into “XX Setup” to select “XX Alarm Limit setup”.

(d) Adjust the volume:
Alarm volume: Enter into the window “Shortcut Key” by pressing the key “ ” and then select the “Alarm Volume” in this window for setting.
Heartbeat volume: Enter into the window “Shortcut Key” by pressing the key “ ” and then select the “Heartbeat Volume” in this window for setting.
Touch screen volume: Enter into the window “Shortcut Key” by pressing the key “ ”, select the “Main Menu” in this window, enter into the menu “Monitor Setting” and then select the “Touch Screen Volume” in this window for setting.

(e) Set the system time:
Click the clock area in the menu bar below the screen, and then set the time in the menu “System Time Setting” popped up.

1.5 External Interface of the Monitor

1.5.1 Left Panel of the Monitor

The following interfaces are provided on the left panel of the monitor, shown as follows:
1.5.2 Right Panel of the Monitor

The following interfaces are provided on the right panel of the monitor, shown as follows:

![Fig. 1-6 Right Panel]

**Attention**
- In this monitor, a power adapter shall be used to convert the alternating current into the voltage of DC15V, so as to normally supply the power to the monitor.
- Through the CMIFA socket, this monitor can be connected to the plug-in monitor produced by Our Company for use.

**Warning**
- This network port only can be connected with the central monitoring system of Our Company.
- When the signal interfaces like sick animal cable interface and network interface are simultaneously connected with multiple equipments, the total leakage caused cannot exceed the tolerance.
### General

#### 1.5.3 Back Cover of the Instrument

![Back Cover of the Instrument](image)

#### 1.6 Equipment Symbols

(a) Instrument Symbols

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
<th>Marking</th>
<th>Additional Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Attention icon" /></td>
<td>Attention! please see the accompanying documents</td>
<td><img src="image" alt="Type approval mark" /> 2010R260-44</td>
<td>Type approval mark and number of measuring instrument</td>
</tr>
<tr>
<td><img src="image" alt="Production license mark" /></td>
<td>The application part of Type CF has the anti-defibrillation function</td>
<td><img src="image" alt="Production license mark" /> Y.Z.No.00000700</td>
<td>Production license mark and number of measuring instrument</td>
</tr>
<tr>
<td><img src="image" alt="Mark of Type BF" /></td>
<td>Mark of Type BF</td>
<td><img src="image" alt="Production Date Mark" /></td>
<td>Production Date Mark</td>
</tr>
<tr>
<td><img src="image" alt="Start/Stop Key" /></td>
<td>Start/Stop Key</td>
<td><img src="image" alt="Serial number mark" /></td>
<td>Serial number mark</td>
</tr>
<tr>
<td><img src="image" alt="Battery working state indicator lamp" /></td>
<td>Battery working state indicator lamp</td>
<td><img src="image" alt="Equipotential symbol" /></td>
<td>Equipotential symbol</td>
</tr>
<tr>
<td><img src="image" alt="Battery charging indicator lamp" /></td>
<td>Battery charging indicator lamp</td>
<td><img src="image" alt="Network connection symbol" /></td>
<td>Network connection symbol</td>
</tr>
<tr>
<td><img src="image" alt="AC working indicator lamp" /></td>
<td>AC working indicator lamp</td>
<td><img src="image" alt="Alarm light" /></td>
<td>Alarm light</td>
</tr>
</tbody>
</table>
Note: Please see the content of “1.4 Key Function and Basic Operation” for the key symbols and their functions of the monitor.

(b) Packaging Symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Up Arrow" /></td>
<td>Up</td>
<td><img src="image" alt="Stack Limit" /></td>
<td>Limit of stacking layers</td>
</tr>
<tr>
<td><img src="image" alt="Fragile" /></td>
<td>Fragile</td>
<td><img src="image" alt="Rainproof" /></td>
<td>Rainproof</td>
</tr>
</tbody>
</table>
Chapter 2  Installation of the Monitor

⚠️ **Attention**

- To ensure that the monitor works properly, please read the information in this chapter, security information and sick animal safety chapters before using, and install monitor as required.

### 2.1 Unpacking and Examination

Carefully unload monitor and accessories from the box, and save the packaging materials for later transport or storage. Please compare the accessories according to the packing list. Check to see if there is any mechanical damage. Check all the external wires, insert any accessories needed. If there are any questions, please contact our sales department or agency immediately.

### 2.2 Connect the AC power cord

Steps of connection:

Confirm that the AC power supply meets the following specifications: a.c.100V ~ 250V, 50Hz/60Hz.

Using the monitor power cord and power adapter, plug the power cord into the power adapter plug, and the other end to the DC15V (the monitor). Plug the power adapter into a grounded three-phase power outlet.

⚠️ **Attention**

- Plug the power cord to the dedicated hospital outlet.
- If configured with a battery, you must charge the battery. If you do not connect the AC power and directly turn on the monitor, it will probably not work because of insufficient battery power. Connect to an AC power supply and you can charge the battery, regardless of whether the monitor is turned on or not.

Please connect the grounding cables as necessary. See in the chapter on sick animal safety for grounding section contents

### 2.3 start

After you turn on the power switch, the screen will display "system is loading …", then it will display the company's LOGO, perhaps for 1-5 seconds, After the systems self-test has succeeded
and entered the main screen. User can operate at this time.

⚠️ Attention

- If there are significant errors in the self-test process, the system will alert.
- Check all monitoring functions that can be used to ensure that the monitor is functional.
- If configured with a battery, then you must charge the battery after each use to ensure that there is a sufficient power reserve.
- After a shutdown, you can restart after one minute.

⚠️ Warning

- If you find signs of damage to monitor functions, or an error message, do not use this monitor for sick animal monitoring. Please contact with the biomedical engineers of your hospital or maintenance engineer of the company.

2.4 Connecting the Sensor

Connect the sensor for the function you want to monitor to the appropriate body part.

⚠️ Attention

- For the correct connection methods for sensors and related requests, please see chapter 10-15.
Chapter 3 Shortcut Keys and Main Menu

3.1 Shortcut Keys

The system settings for this monitor are flexible. Push " " key to enter the “shortcut key” window, from which you can quickly activate some shortcut keys and menus, as shown in the following figure:

![Shortcut Keys](image)

Fig. 3-1 Shortcut Keys

Identify shortcuts and menu functions:

<table>
<thead>
<tr>
<th>START/STOP</th>
<th>Under static conditions: start a manual NIBP measurement. Under Measuring conditions: stop the NIBP measurement. Under static conditions after the first set up of the automatic measurement: Starting automatic NIBP measurement.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEAT VOL</td>
<td>set the heartbeat volume</td>
</tr>
</tbody>
</table>
### Shortcut Keys and Main Menu

<table>
<thead>
<tr>
<th>Shortcut Key</th>
<th>Description</th>
<th>Action</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vet Info</td>
<td>set veterinary information</td>
<td>CONTINUAL</td>
<td>Start a NIBP continuous measurement, the process will last 5 minutes</td>
</tr>
<tr>
<td>TREND GRAPH</td>
<td>Review trend chart</td>
<td>MONITOR SETUP</td>
<td>Enter the monitor settings window</td>
</tr>
<tr>
<td>TREND TABLE</td>
<td>Review trend tables</td>
<td>MAIN MENU</td>
<td>Enter the main menu setup window</td>
</tr>
<tr>
<td>ALARM VOLUME</td>
<td>set the Alarm volume</td>
<td></td>
<td>Exit button</td>
</tr>
</tbody>
</table>

#### 3.2 Main Menu

Push "貘" key to enter the “Shortcut Key” window, select "MAIN MENU" in this window. Main menu includes: Vet Info, SURVEY SETUP, ALARM SETUP, MONITOR SETUP, DATA REVIEW, TIME SETUP, NET BED, MAINTAIN. as shown in the following figure:
3.2.1 Veterinary information (Vet Info)

**Attention**

- When updating sick animal information, please verify the accuracy of it and determine whether the sick animal has been discharged or transported to other sections.

Push " homeowners/" key to enter the "shortcut key" window, select "main menu" in this window and enter "Vet Info" menu, as shown in the following figure:

![Fig. 3-3 Vet Info](image-url)
## Shortcut Keys and Main Menu

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAT NO</td>
<td>Enter the sick animal's medical record number, supporting up to 10 digital characters.</td>
</tr>
<tr>
<td>BED NO</td>
<td>Select sick animals’ beds number, you can select 1-999 bed.</td>
</tr>
<tr>
<td>NAME:</td>
<td>Enter sick animals' names, supporting up to a maximum of 7 chinese characters.</td>
</tr>
<tr>
<td>SEX</td>
<td>Sick animal gender (Female, Male).</td>
</tr>
<tr>
<td>Vet type</td>
<td>Select the type of veterinary (big small).</td>
</tr>
<tr>
<td>WEIGHT[kg]</td>
<td>Enter the sick animal's weight.</td>
</tr>
</tbody>
</table>

### Warning

- When sick animal type changes, the alarm upper/lower limit value of HR, RESP, NIBP, SpO2, CO2 and other parameters correspondingly change. In General, you have to verify alarm limits prior to the sick animals monitoring to ensure that these settings are appropriate for your sick animal.

### 3.2.2 SURVEY SETUP

Push " " key to enter the "shortcut key" window, select "MAIN MENU" in this window and enter "SURVEY SETUP" menu. "SURVEY SETUP" is an important part of our system. “Measure Settings” and “Parameter Settings” are coordinated. If either of these are set, it will set the other and monitor appropriately. This content includes: ECG settings, SpO2 settings, RESP settings, TEMP setting, NIBP settings and CO2 settings. For more information, please see the parameters section of "setting" section.
3.2.3 **ALARM SETUP**

Push " " key to enter the "shortcut key" window, select "main menu" in this window and enter "alarm setup" menu to set the alarm. For more information on alarm settings, please refer to "alarm" chapter.

3.2.4 **MONITOR SETUP**

Push " " key to enter the "shortcut key" window, select "main menu" in this window and enter "monitor setup" menu.

The "monitor setup" menu includes: face select, beat vol., touch volume, demo. Touch screen volume and presentation functions, " face select " and " beat vol " sections are not introduced here. For details, please see the relevant sections.

3.2.4.1 **Touch Screen Volume**

There are five levels of touch screen volume in the system, they are "off" and "1~4" levels. By selecting the "1~4" level system, the system will demonstrate in the touch screen volume selected; Selecting "off" means touch screen volume is turned off.

3.2.4.2 **Demo**

Select "Demo" in the “monitor setup” menu and a pop-up window "Input demo key" dialog box will appear. After entering the correct password, select "on", then the monitor enters presentation State.

⚠️ **Warning**

- Demo waveform is a kind of simulation of waveforms, which is made by the manufacturer only to demonstrate the machine performance, and help users to set up training. In actual clinical use, the presentation is forbidden. Because it may make the
3.2.5 DATA REVIEW

Push " " key to enter the "shortcut key" window, select "main menu" in this window, and enter "data review" menu. “For more information about "DATA REVIEW" please see the “reviews "section.

3.2.6 TIME SETUP

Push" " key to enter "shortcut key" window, select "main menu" in this window and enter "time setup" menu or click the clock area in the menu bar below the screen in the interface. In the pop-up" time setup" menu, set system time in accordance with the local time zone. The time settings include: year, month, day, hour, minute and second.

3.2.7 Network Bed Number (NET BED)

Push " " key to enter the "shortcut key" window, select "main menu" in this window and enter "net bed" menu. From this menu, you can set up network bed number, IP address, MAC address, subnet mask, server IP, etc, which is connected to the central monitoring system of the company. In General, we only need to set the network number, and other settings are in the default state.

- NET BED: bed number of monitors connected to the central monitoring system network.
- IP address: 200.200.200.X, (x, refers to the network bed number, 1~128 beds are optional).

How to know the network is connected successfully? There is a central monitoring system icon below the interface area. When it appears "", it indicates that the central monitoring system has not connected successfully. When it displays "", it indicates that the central system has connected
successfully, next to the icon is the network number.

⚠️ Attention

- The Network bed number must be unique, and cannot be conflicting with bed numbers of any other instruments connected to the central monitoring system, otherwise it will cause instrument signal deadlock because of the preemption of the central monitoring system channel.
- If any instrument freezes due to network bed number conflicts, remove the network cable, turn off the monitor and restart. Reset the networks and then reconnect to the network connector.

3.2.8 Monitor Maintenance (MAINTAIN)

Push " " key to enter the "shortcut key" window, select "main menu" and enter the maintenance menu interface. In the "maintain" menus, enter the correct password: 5188, press "Enter" button, enter the maintenance menu interface.

- LANGUAGE: Chinese/English and so on.
- SCREEN ADJUST: select "screen adjust" menu. The screen calibration interface appears. According to the screen calibration point that pops up "  ", as the confirmation that five calibration points "  ", have been clicked. Calibration ends and the screen automatically returns to the main interface.
- FACTORY DEFAULT: select this item and enter "factory defaults" dialog box. Selecting "no" means the current operation is aborted and the original configuration of the system is restored. Selecting "Yes" means the factory default settings of adult configuration is to be used and the
original configuration will be overwritten.

- In order to facilitate maintenance and back-up, system software version and compile time is in default -nonoptional status.

⚠️ Attention

- **Default configuration means that if you choose "default configuration", the system will override the current parameter with the default parameters provided by manufacturers.**

### 3.2.9 Autostorage after power failure

This monitor supports auto storage after power failure, i.e., current sick animal’s information and parameter measurement like alarm messages, trend graph, trend chart, arrhythmia record and NIBP data will automatically saved in the NandFlash of the monitor in case of power failure. Only the sick animal information before power failure can be saved, which can be uploaded to the big host and can be restored if needed.

⚠️ Attention

- **Information saved after power failure in small host can only be read in big host.**
- **Please refer to the instruction of big host for how to restore saved data after power failure.**
Chapter 4  System Work Interface

4.1 Work Interface

Two work interfaces are available with the medical monitor, a standard interface and a large font interface. The user can get different screen messages by choosing a different work interface based on different requirements. The work interfaces will be introduced in the following.

4.1.1 Standard Interface

The standard interface can only display 2-channel effective waveform, but the parameters will be displayed at another area of the screen. Channel One is fixed only for ECG waveform while Channel Two can display any other function from RESP (originating from ECG module), SpO₂ and CO₂ waveforms except the ECG waveform itself. On the second channel other waveforms can be displayed by touching the second channel waveform display area and go to the menu to switch over to the waveform desired.

Fig. 4-1 Standard Interface
4.1.2 Large Font Interface

The large font interface is used to display data with large fonts, which is set to display ECG, SpO₂, NIBP and RESP (when the second channel waveform of the main interface is set for CO₂, it will display CO₂ waveform) as shown in the following figure:

Fig. 4-2 Large Font Interface
Chapter 5  Alarm

5.1  Alarm Type

The monitor can give an alarm of three types: physiological alarm, technical alarm and a prompting message.

a)  Biological alarm

Physiological alarm is generally prompted when a sick animal’s physiological parameter exceeds the higher or lower limits set for giving an alarm or when a sick animal shows a physical disorder. The alarm message will appear at a physiological alarm area on the upper side of the screen.

b)  Technical Alarm

The technical alarm is also referred to as a system error message, indicating the alarm is caused by a misoperation or system malfunction thereby causing improper operation of a system function or distortion of monitored results. The alarm message of the technical alarm will appear on the upper side of the screen in the technical alarm area.

c)  Prompting message

Strictly speaking, the prompting message does not belong to the domain of alarm. It is to display the information relative to the system conditions themselves, which have nothing to do with the sick animal’s vital sign, the prompting message area.

5.2  Alarm level

The monitor can give an alarm in three volume levels: high, medium and low alarm, respectively, in terms of the severity of the sick animal.

a)  High alarm
The sick animal is in a critical condition, endangering the sick animal’s life, emergent attention required.

b) Medium alarm

The sick animal’s vital signs are abnormal, relevant measures and treatment are immediately required.

c) Low alarm

The sick animal’s vital signs are abnormal, and relevant measures and treatment may be required.

All alarm levels for technical alarms and some physiological alarms have be set before the monitors are delivered, the users are not allowed to change them, but a certain degree of physiological alarm can be modified.

5.3 Alarm Mode

When giving an alarm, the monitor will prompt the users in both sound and visual modes: light signal

- light signal
- sound signal
- Message
- parameter’s flashing

in which light signal, sound signal and prompting message are differentiated with different alarm levels.

5.4 Lighting Alarm

When giving an alarm, the alarm indicating lamp will show alarms in different levels with color and flashing frequency.
5.5 **Sound Alarm**

The sound alarm is set to prompt the alarm in different levels of severity with different sounds.

- Low level alarm: du.

---

**Warning**

- Both bedside machines and central monitoring systems have sound alarming function.
- Once the bedside machine is connected to a central monitoring system, although both the bedside machine and central monitoring system can coordinate the alarm level as well as the upper and lower limits of the alarm, the bedside machine may not give an alarm simultaneously when the central monitoring system is prompting an alarm due to the delaying function of the bedside machine.

5.6 **Prompting Message**

Prompting message means the related information will appear on the physiological alarm area or technical alarm area of the monitor when the alarm is active. The system will show different alarm levels in different background colors:

- High level alarm: Red
- Medium level alarm: yellow
■ Low level alarm: yellow

Levels of the prompting message in the front of the alarm will be distinguished with the following symbols:

■ High level alarm: ***
■ Medium level alarm: **
■ Low level alarm: *

5.7 Parameter in alarm flashing

When a parameter is alarming, the parameter will flash once every second.

5.8 Icon of alarm status

Besides the alarm modes mentioned above, the following alarm icons will appear on the screen to indicate different alarm conditions.

■ Alarm muted ✗:
■ indicating shut off of a parameter alarm. 🚨:

5.9 Setting of Alarm(ALARM SETUP)

Press “←” key to go to the “shortcut key” window to choose the main menu, then go to the “ALARM SETUP” menu as shown below:
ALARM VOL: five alarming volumes are available in the system: “off”, and 1-4 levels. Once the 1-4 levels selected the system will prompt the alarm at a certain alarm volume, Accordingly; while “turn off” is selected will shut off the alarm sound.

ALM PAUSE TIME”, there are: six different timeouts provided with the system: “forever”, “one minute”, “two minutes”, “three minutes”, “five minutes” and “ten minutes”. This function is effective only when the system is giving an alarm, but when a new technical alarm is given the instrument will immediately prompt with an alarm, as if the “silence forever” is disfunctional. When the “forever” is selected, when the “sound off” key is pressed, it prompts the permanent sound off. When the “one minute” time-out key is selected, press the sound off key to prompt a 59 second time-out for alarm, and make a countdown. and so on.

ALM LATER: time-out period for delaying parameter alarm provided in the system for selection are: “disabled”, “5 sec.”, “10 sec.”, “15 sec.”, and “20 sec”. Once the “disable” is selected for delaying the alarm, when the measured parameter exceeds the delayed time-out limit the unit will alarm immediately. ie; when the “5 sec.” is selected for delaying alarm, the unit will alert when time exceeds the delayed time-out limit of 5 seconds. and so on.
Warning

When the system is set in shut off sound, the monitor will not make any alarm sound if an alarm event happens. So, the operator should use the function carefully.

5.10 Upper and lower limits of alarm settings

For example:

a) Go to ECG setting from the standard interface to set the alarm levels to high, medium or low level.

b) Select “Alarm limit setup” : set the high limit of alarm at 100bpm; and the lower limit of alarm in 40bpm

c) Once the setting is finished, press “Esc” key.

Warning

When setting the upper and lower limits of alarm, Decide if the sick animal you are monitoring is an big or small veterinary, and the limit should be set according to clinical requirements.

5.11 Verifying the Alarm System

Whether or not the alarm system is working, can be detected through the light and sound alarm status indicator., For instance:

a) Connecting a cable for blood oxygen measurement to the monitor;

b) Go to “spo2 setup” to set the blood oxygen alarm in an “on” position;

c) Setting “spo2 alm limit” in 90% and 60%, respectively;

d) Go to “main menu” to select “ alarm setup” in which the alarm volume” is set at one of the
levels of “1-4”;

e) When the measured value exceeds the high or low limits, the alarm level will be set at “high, medium and low”, To observe the light, sound and parameter flashing changes, refer to “sound alarm, light alarm, prompting message and parameter flashing of the chapter.

### 5.12 Time-out or Disenabled Alarm

When alarm is given, an operator can press the “key to suspend or shut off the alarming sound and suspending the alarm sound for all parameters being monitored and shut off technical alarms. The time-out will display on the upper-right corner of the screen, such as: “Alm pause : XXs”. The “Alarm setup” on main menu can be set, accordingly.

⚠️ **Warning**

- When the system is set in shut off sound, the monitor will not make any alarm sound if an alarm event happens. So, the operator should use the function carefully.
Chapter 6 Battery

6.1 General

A built-in rechargeable battery is installed in the medical monitor. When connected to the AC power supply, the battery will be automatically recharged, whether the unit is in an ON or OFF position, until the battery is fully charged. In case the power suddenly turns off, the system will be automatically powered on by the built-in battery thereby not interrupting the unit while working, and the indicator light for the battery will be lit after the power supply has been shut off for over 30 seconds.

The symbol “” will be shown at the bottom right corner indicating the power condition of the battery: the green indicates the power is still full or medium level, while yellow shows a low level; and red an extremely low level, alerting the user of the condition.

Battery icon shown on the screen indicates the current battery level:

- Indicating fully charged battery.
- Indicating the is battery charged, but not at a full level.
- Indicating the battery is at a low level, requiring recharging the battery.
- Indicating the battery is unavailable or malfunctioning.

Attention

- Please remove the battery if unit will be out of service for a long time and store properly.
- If a built-in battery is inside the unit, the battery must be recharged after each use to ensure enough energy in the battery.

Warning

- The battery liquid is harmful, In case the liquid contacts your skin or eye, wash it immediately with large amounts of clean water or seek medical advise.
- Keep the battery out of reach of children.
- The monitor is working it will automatically turn off power when power is too low. If the energy in the battery has nearly run out, the monitor will give a high level alarm with a continuous sound of “duuuuuuuu”. If the battery is at a low level and prompts a message
6.2 Installing Battery

Procedure of changing or installing the battery:
(a) Turn off the monitor, and disconnect the power cord and other connection lines.
(b) Place the monitor with the back up.
(c) Unscrew the battery cover.
(e) Take out the used battery and put the new one into the battery holder making sure the positive and negative poles match what is indicated on its shell.
(f) Replace the holder and screw it on, and turn the monitor upright.

⚠️ Warning
- Use only the supplier’s designated battery.
- Don’t dismantle the battery while the monitor is turned on.

6.3 Optimization and check of battery performance

(1) Optimization of battery performance

When the battery is used for the first time at least two complete cycles of optimization of the battery should be carried out. A complete optimization cycle should be: uninterrupted charging battery until the power is full, followed by use until the battery is fully discharged and monitor is automatically shut off.

This will ensure the battery is in optimization process:
(a) Disconnecting the monitor from the sick animal suspends all monitoring and measuring procedures.
(b) The optimized battery should be kept in the battery holder of the unit.
(c) When charging the battery, at least six hours of charging should be ensured until it is fully charged.
(d) Disconnect the AC power supply, the monitor is powered with the battery until the battery runs out and the monitor automatically shuts off.
(e) This completes the battery optimization process.
Battery

(2) Check of Battery Performance

The service life of battery is changeable along with its storage, working environment charge cycles and service time. Even though battery is out of service its performance will gradually deteriorate.

Procedure for checking the battery is as follows:

a) Confirming whether or not the battery is damage. When the battery shows the symbol “⬛”, it indicates the battery is damaged or not in the battery holder.

b) Check if the battery is in a normal charging condition and if the battery is connected to the AC power supply.

c) Disconnecting the monitor from the sick animal suspends all monitoring and measuring procedures.

d) When charging the battery, at least six hours of charging should be ensured until it is fully charged.

e) Disconnect the AC power supply, power on the monitor with the battery until it is fully discharged and the monitor shuts off automatically Record the start and stop time.

f) The period of battery discharge will reflect the battery performance.

g) Once the discharge period is down to 50% of the original time, it requires changing the battery.

⚠️ **Attention**

- In order to extend the service life of the battery it is recommended to charge it every three months after a long dormant period so as to prevent overdischarge.

- Battery power supply loss depends on the configuration and operation of the monitor; for example, the unit will have a big loss of battery power if it is used to measure NIBP parameter often.

6.4 Battery Recovery

If the battery shows apparent damage or is at an energy exhaustion condition, it should be exchanged immediately, and the old battery should be recovered and properly disposed of in accordance with relevant laws or rules and regulations for hospitals.

⚠️ **Warning**

- Do not dismantle or short circuit the battery, and not put it in a fire. There is a risk of explosion, or leakage of harmful gases or other risks of harm.
Chapter 7 Data Review

Data review includes: NIBP RECALL, ALARM RECALL, ARR RECALL, TREND GRAPH, TREND TABLE and WAVE RECALL.

The monitor provides 48-hour tendency data for all monitoring parameters, 1000 sets of NIBP measurement data, storage of 100 parameter warning events, 100-events of arrhythmia review and 5-minutes of waveform holographic review. Methods for observing these stored data are to be explained in this chapter.

7.1 NIBP Measurement Review (NIBP RECALL)

This monitor displays 1000 sets of NIBP measurement data during NIBP measurement review. Press Button " " to enter "Shortcut Key" window and select "Main Menu" in this window to enter the menu "NIBP RECALL". The latest 5 sets of NIBP measurement results and time are displayed in this window, specifically as shown in Figure below:

![Figure 7-1 NIBP RECALL](image)

Data is displayed chronologically from earlier to later. Five sets of measurement data can be displayed on each screen, and users can select " " and " " to review earlier or later data. A maximum of 1000 sets of measurement results can be displayed. When the measurement results exceed 1000, only the latest 1000 sets of data are on display and the earlier data are to be overwritten.

Blood oxygen and pulse rate data can be reviewed in this window.

7.2 Warning Event Review (ALARM RECALL)

This monitor displays the latest 100 warning events in warning event review. Press Button " " to enter "Shortcut Key" window, select "Main Menu" in this window to enter the menu "Data Review", and then select "Alarm recall", specifically as shown in Figure below:

![Figure](image)
Users can define conditions for warning events review in this menu, which includes:

(a) Starting Time for Warning Review
Users can define the "start time" of warning reviews in this option; this defined time is limited by the system if there is data beyond the defined starting time.

(b) Event Selection of Warning Review
Users can select the parameters they want to review in the pull-down list of Warning Review "Event". Options available include "all" (warning events of all parameters, or any parameter(s) selected from ECG, SpO2, NIBP, CO2, RESP and TEM).

(c) Warning Event Review
Displayed in the menu Warning Event Review is the information as follows:

   - Warning Occurrence Time (Format: Year-Month-Day Hour: Minute);
   - Event Types (Warning Level included);
   - Sequence No. (Format: x in y).

7.3 Arrhythmia Review (ARR RECALL)

This monitor displays the 100 latest ARR reviews during arrhythmia review. Press "Shortcut Key" to enter "Shortcut Key" window, select "Main Menu" in this window to enter the "Data Review" Menu, and then select "ARR Recall", specifically as shown in Figure below:
Users can define conditions for arrhythmia reviews in this menu, which include:

(a) Starting Time for Arrhythmia Review
Users can define the "start time" of ARR reviews in this option; and this defined time is limited by the system if there is data beyond the defined starting time.

(b) Arrhythmia Review
Displayed in the menu Arrhythmia Review shows the information as follows:

Arrhythmia Occurrence Time (Format: Year-Month-Day Hour: Minute);
Event Types (Warning Levels Included);
Sequence No. (Format: x in y).
Arrhythmia events before or after are displayed on other pages and can be reviewed by pressing the button PageDown or PageUp.

⚠️ Attention

- In case that the arrhythmia events exceed 100, the monitor will only save the latest 100 events and the earlier ones will be discarded. A monitor with power-failure storage functions can store the latest 100 arrhythmia events in case of a power failure.

7.4 Tendency Diagram Review (TREND GRAPH)

The tendency diagram in the latest hour can be displayed with the resolution of one event every second or every 5 seconds; and the tendency diagram in the latest 48 hours can be displayed with the resolution of one event in every minute, or every 5 or 10 minutes. Press button " " to enter the "Shortcut Key" window, select "Main Menu" in this window to enter the menu "Data Review", and then select "trend graph", specifically as shown in Figure below:
The vertical axis represents measured value and the horizontal axis represents measured time. Described as follows are the displayed symbols used:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>↑ ↓</td>
<td>Page up or down to review the tendency diagram of other parameters not displayed on the current view.</td>
</tr>
<tr>
<td>↑</td>
<td>View control switches on next page.</td>
</tr>
<tr>
<td>← →</td>
<td>Move the cursor one step left or right to review a tendency diagram by the time line of tendency database.</td>
</tr>
<tr>
<td>↑ ↓</td>
<td>Move the cursor one page left or right to review a tendency diagram by the time line of tendency database.</td>
</tr>
<tr>
<td>◀▶</td>
<td>Skip to the starting or ending point of a tendency database to review the furthest (earliest) or the nearest (latest) stored tendency information.</td>
</tr>
</tbody>
</table>

(a) **Select and Display Tendency Diagrams of Different Parameters:**
Click on the option "Parameter Selection" to refill displayed parameter. When a desired parameter is selected, its tendency diagram will be displayed within the window. Parameters can also be selected by pressing button "↑" or "↓".

(b) **Select 1h or 48h Tendency Diagram:**
Click on the option "Resolution", and select 1 or 5 sec. to review a tendency diagram for the last hour and 1, 5 or 10 min. to review a tendency diagram in the last 48 hours.

(c) **Review Previous or Nearer Tendency Curves:**
Press "◀" to enter the window on next page, then press left to review tendency curves on earlier time points or right button "▶" or "◀" to review tendency curves on nearer time points.

(d) **Obtain Tendency Data on a Given Moment from Current Diagram**
Press "▶" to enter the window on next page, and then press left or right button "◀" to move
cursor, and the selected moment will change when the cursor moves, and the values corresponding to the parameters at the selected moment will be displayed on the horizontal axis.

(e) Operation Examples

Review NIBP Tendency Diagram in the Last Hour:

1. Press button " " to enter the "Shortcut Key" Window, select "Main Menu" in this page to enter the menu "Data Review", and then select "Tendency Diagram review".

2. Then select the option "Parameter Selection" in the window "Tendency Diagram Review" to click on "NIBP".

3. Select "1 sec." or "5 sec." in the "Resolution" Option.

4. Press " " to enter window on next page, and then press " " or " " buttons to review changes on a tendency diagram with time, as well as changes of the tendency curves and values.

5. Press button " " to exit Tendency Diagram Review.

7.5 Tendency Chart Review (TREND TABLE)

The tendency chart data in the latest 48 hours can be displayed with resolutions as follows: 1min, 5min, 10min, 30min or 60min.

Press button " " to enter the "Shortcut Key" window, select "Main Menu" in this window to enter "Data Review" menu, and select "Trend table", specifically as shown in Figure below:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>❧ ❧</td>
<td>Page up or down to review the tendency diagram of other parameters not displayed on the current view.</td>
</tr>
<tr>
<td>❧ ❧</td>
<td>Page left or right to display data in previous or next time slot.</td>
</tr>
</tbody>
</table>
Data Review

(a) Tendency Chart Review:
Date is displayed below the measuring parameters and the time corresponding to each set of tendency data is displayed on the right side of the displayed data. Parameters listed in a tendency chart are divided into 8 categories, and their units are displayed depending on the setting of the menus:

HR (bpm),
RR (rpm),
SpO₂ (%),
PR (bpm),
T1 (℃),
T2 (℃),
NIBP (NS/ND/NM) (mmHg),
CO₂ (mmHg),
AwRR (rpm).

(b) Select Tendency Charts of Different Resolutions
Select "Resolution" to enter the menu and then select time interval for tendency data.

(c) Review Tendency Data of Different Parameters
Press PageUp or PageDown button " " " " to select and review other parameters not displayed on current views.

(d) Review Previous or Nearer Tendency Curves
Select PageLeft or PageRight button " " " " to review previous or nearer tendency data.

(e) Operation Example
Review NIBP Tendency Chart:

(1) Press button " " to enter the window "Shortcut Key", and select "Main Menu" in this window to enter the menu "Data Review", and then select "Trend table".
(2) Select the option "Resolution" in the window " Trend table ", and pick "1min.".
(3) Select PageDown " " until NIBP tendency data is displayed on the screen.
(4) Select PageLeft or PageRight button " " " " to review previous or nearer tendency data.
(5) Press button "Exit" to exit Tendency Chart Review.
7.6 Waveform Review (WAVE RECALL)

This monitor can display waveform holographic replay within 5 minutes in a Waveform Holographic Review window. The parameters to be viewed includes: ECG, SpO₂, RESP and CO₂, specifically as shown in Figure below:

![Waveform Recall Diagram]

Please refer to Section 7.5 "Tendency Chart Review" to learn how to use symbols.
Chapter 8 Maintenance, Cleaning and Care

Use only materials and methods that are approved by our company and listed in this chapter for cleaning or disinfecting the device. Our company does not provide any guarantee for the damage caused by unauthorized materials or methods.

Our company has no responsibility for the effectiveness of controlling infectious diseases using these chemical agents. Please contact the infectious or epidemic disease experts in your hospital for details. Also please see all policies which are suitable for your hospital and locality.

8.1 General

The monitor must be kept dust-free. After monitor cleaning and disinfection, please carefully check the monitor. If you find any signs of damage or ware on the monitor, stop using the monitor. If necessary, please clean it at first and return it to Our Company. Please pay special attention to the following items:

- Follow the manufacturer’s instructions to dilute the solution, or adopt the lowest possible concentration.
- Do not let liquid enter the monitor.
- Do not pour liquid onto the monitor.
- No part of this monitor can be subjected to immersion in liquid.
- Don’t use abrasive material (such as steel wool or silver polish etc) or bleaching powder, avoid using acetone-based cleaners such as acetone.

⚠️ Warning

- Before cleaning the monitor or accessories, Make sure that the equipment is switched off and disconnected fro AC power.
- If any ECG cable is damaged or aging, the cable should be replaced with a new one.

⚠️ CAUTION

- If you accidently pour liquid onto the monitor or accessories, please contact our customer service immediately.
8.2 Maintenance and check

The overall check of the monitor, including a safety check, should be performed only by qualified personnel before first use, every 6 to 12 months, and each time after repair.

Before using the monitor, do the following:

(a) Check the work environment and if the power supply meets the requirement.
(b) Check if there is any mechanical damage.
(c) Check if the cables are worn and ensure insulation is in good condition.
(d) Check all the functions of the monitor to make sure that the monitor is in good condition.
(e) Check if the accessories used are specified by the manufacturers.
(f) Check the battery.
(g) If the monitor is equipped with a recorder, please check if the recorder is normal and recording paper meets the specified requirement.
(h) Check if the wiring resistance and leakage current meet the requirement.

If you find any damage on the monitor, stop using the monitor on sick animals, and contact the biomedical engineer of the hospital or our Customer Service immediately.

All the safety and maintenance checks that need to start the monitor should be performed by a qualified customer service technician. Non-professional operation can cause the monitor damage or cause a security risk, and human health may be endangered.

The circuit diagrams of the monitor can be provided by the manufacture, Shenzhen Our Medical Instruments Co., Ltd as per customers demand. Qualified technicians can use it to help the user repair some apparatus that Shenzhen Our Medical Instruments Co.,Ltd classifies as “can be maintained by the user”.

Warning

- If the hospital or agency that is responsible for using the monitor does not follow a satisfactory maintenance schedule, the monitor may become damaged, and human health may be endangered.
8.3 Maintenance schedule

The following safety and maintenance check can be conducted by professional persons from our company. You can contact with our customer service technicians if you need the following maintenance check. Before the inspection or maintenance, the facilities should be cleaned and disinfected.

<table>
<thead>
<tr>
<th>check and maintenance</th>
<th>Frequency:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The ECG synchronism of the monitor and defibrillator</td>
<td>Check can be conducted at least every 2 years or when needed by customers.</td>
</tr>
<tr>
<td>NIBP air leakage check</td>
<td>Check can be conducted at least every 2 years or when needed by customers.</td>
</tr>
<tr>
<td>NIBP adjusting</td>
<td>Check can be conducted at least every 2 years or when needed by customers.</td>
</tr>
<tr>
<td>NIBP pressure calibration</td>
<td>Check can be conducted at least every 2 years or when needed by customers.</td>
</tr>
<tr>
<td>Mainstream and Side stream CO₂ calibration and performance inspection</td>
<td>Check can be conducted at least every 2 years or when the measured value is in question.</td>
</tr>
<tr>
<td>Battery</td>
<td>See the section on battery for reference</td>
</tr>
</tbody>
</table>

8.4 Cleaning and Sterilization

8.4.1 Note

⚠️ Attention

- The monitor and accessory surface can be cleaned with hospital-grade ethanol and dried in air or with soft, clean cloth.
- For protecting the environment, disposable accessories should be recycled or disposed of properly.

⚠️ CAUTION

- Do not use high pressure gas to disinfect the sensor.
- No sensors can be subjected to immersion in liquid.
- Don’t use any broken sensor or cable.
8.4.2 Cleaning

The Monitor must be kept dust-free. Regular cleaning of the monitor shell and screen is strongly recommended. More cleaning is needed in the environmental polluted or sandstorm areas. Before cleaning the monitor or the sensor, please consult with customer service or understand the hospital equipment cleaning regulation.

1) Cleaning agents are listed below:
   - Diluted Ammonia Water
   - Diluted Sodium Hypochlorite (Bleaching agent)
   - Diluted Soapy Water
   - Hydrogen Peroxide 3%
   - Alcohol 70%
   - Isopropanol 70%

2) Before cleaning the monitor:
   - Make sure that the equipment is switched off and disconnected from the power line.
   - Use soft cotton ball to adsorb a small amount of cleaning agents and clean the screen.
   - Use soft cloth to adsorb a small amount of cleaning agents and clean the monitor shell.
   - If necessary, please use a soft dry cloth to wipe away the excess cleaning agents.
   - Dry the monitor in air.

8.4.3 Sterilization

To avoid extended damage to the equipment, Sterilization is only recommended when stipulated as necessary in the Hospital Maintenance Schedule. Monitor facilities should be washed first.

Recommended sterilization material: Ethyl alcohol 70%, Isopropanol 70%, Glutaraldehyde 2%.

⚠️ CAUTION

- Do not use ETO gas to disinfect the monitor.
- Use a moistened cloth to wipe up any agent remaining on the monitor.
Chapter 9  Sick animal Safety

9.1  Safety Instruction

The design of the multi-parameter veterinary monitor is compliant with the relevant international safety standards for medical electrical equipment. This instrument is protective of anti-defibrillation and surgical electrotome of floating inputs; it is installed by applying appropriate electrodes (referred to the chapter of ECG Monitoring) and under the guidance of the manufacturers; and the screen display can be restored within 10 seconds following defibrillation operations.

9.2  Environment

The following guidance should be observed in the interest of absolute safety of electrical installations.

Vibration, dust, corrosives or explosive gas, extreme temperature and humidity should be avoided in the environment where the multi-parameter monitor is used.

Ventilation inside the instrument case where the monitor is installed should be guaranteed in such a manner that enough space is reserved in both the front to facilitate operations and the rear so that, when the case door is open, facilitate maintenance. A void space of at least 2 inches or 5 centimeters should be cleared around the instrument for air ventilation.

The monitor system should be placed under an ambient temperature of 0℃ ~ 40℃ in order to meet its working requirements. An ambient environment out of this range may impair the instruments accuracy and cause damages to its components and circuits.

9.3  Power Requirement

Please refer to the chapter of General Description or the chapter of Monitor Performance Indexes.

9.4  Protective Grounding

The housing of this multi-paramter veterinary monitor should be grounded for the sake of the safety of sick animals and operators. Therefore, it should be equipped with dismountable triaxial cables to ensure its grounding through the grounding leads (protective grounding) of the power cables when it is inserted into an assorted three-plug connector. In case a three-plug connector is not available, the electrical operating staff should be consulted.
9.5 Equipotential Grounding

The primary protection of the instrument is embodied in the building protective grounding (protective ground) system by means of power plugs grounding. The multi-parameter monitor should be separately connected with the equipotential grounding system for examinations of hearts or skulls. One end of the equipotential grounding leads (potential equilizing leads) should be connected onto the equipotential grounding terminals on the rear panel of the instrument and the other should be connected onto one connector of the equipotential system. The equipotential grounding system should be in place for safety functions of the protective grounding leads in case of any damage to the protective grounding system. Cardiac or brain examinations should be conducted only in the rooms equipped with protective grounding systems. A check of the instruments should be conducted to guarantee the instruments are in good repair before each examination. The cables connecting with sick animals and instruments should be guaranteed not having been subjected to electrolytic pollution.

9.6 Condensation

The working instruments should be guaranteed not to form any condensation. Transferring of the instrument from one room to another may cause condensation on the instrument. This is attributed to its exposure to humid air at different temperatures. Unnecessary problems can be avoided by placing the instrument in a dry place before putting it into use.

Note: Condensation is defined as coagulation of gases or liquids when cooled, e.g. water vapor when cooled is transformed into water and water when cooled into ice. The lower the temperature is, the faster condensation is formed.

Warning

- Replacement of the three-plug connector with a two-plug connector is strictly prohibited.

Warning

- Battery power should be used to power the monitor against unstable protective grounding (protective earth) system.
Warning

- Use in the presence of combustible anesthetics is prohibited to avoid any risk of explosions.

9.7 Description of Symbols on Instrument

Please refer to Section 1-1.6: Instrument and Symbols.
10.1 Definition of ECG monitoring

ECG produces a continuous record of electrical activity of the sick animals’ heart and displays the activity on the monitor in the form of waves and values, so as to accurately assess the physiological status of the sick animal at that time. So, the connection of ECG cables should be assured to be accurate to obtain the correct measurements. In normal use, the instrument can only display one ECG waveform.

Sick animal cable consists of two parts:
- Trunk for connecting to monitor
- Lead device for connecting to sick animal

On the screen, you can choose the ECG waveform you want to monitor. Enter the "ECG waveform settings" menu and set the lead name to display.

Displayed parameters include heart rate (HR), ST segment measured value and arrhythmia.

The instrument has alarm functions for all of the above parameters.

⚠️ Attention

- Under factory settings in the instrument, the ECG waveforms are displayed in the top-two waveform positions.

10.2 Precautions for ECG Monitoring

⚠️ Warning

- The operator should not touch the sick animal, table or instrument during defibrillation.
- ECG lead wire provided by the Our Company should be used when monitoring the ECG signal by this instrument.
- When connecting the electrode or sick animal cable, you should insure that the sick animal is absolutely not in contact with any other conductive instrument or with the ground. In particular, you should make sure that all ECG electrodes, including the neutral electrodes, are connected to the sick animal, to prevent them contacting the ground or each other.
Attention

- Interference from ungrounded equipment near the sick animal and ESU interference may cause waveform problems. If you operate under the conditions regulated by EN60601-1-2 (with the anti-radiation capacity of 3 V / m), the electric field strength more than 1 V / m may cause measurement errors at various frequencies. Therefore, it is recommended not to use electrical radiation equipment near the ECG / respiration monitoring devices.

10.3 Procedures of ECG Monitoring

10.3.1 Preparation

Ask the sick animal to remove outer clothing on upper body.

(a) As skin is poor conductor of electricity, to get a good contact of the electrode and the skin, it is important to make preparation of the sick animal’s skin.

(b) If necessary, shave the area for the electrode.

(c) Thoroughly clean the skin with soap and water. (Do not use ether or pure alcohol, because they will increase the resistance of the skin).

(d) Dry and rub the skin in order to increase the capillary blood flow and remove skin debris and oil.

(e) Attach the alligator clip prior to placement of the electrode.

(f) Placing electrodes on the sick animal. If the electrodes used do not have conductive gel, apply the conductive gel before placement.

(g) Connect the electrode lead and the sick animal cable.

(h) Check that the monitor power is on.

Warning

- ECG contact area should be checked daily for irritation. If there are signs of allergy, you should replace the electrode or change the position every 24 hours.

- Before ECG monitoring you should check whether the connections are normal or not. After unplugging the ECG cable, the screen will display the prompt message of sensor disconnected and start an audible alarm.
10.3.2 Installing ECG lead

10.3.2.1 Identification and color code of electrodes

The table below shows the lead names in the European and American standards. (The leads are represented by RA, LA, RL, LL, and V in the American standard, while by R, L, N, F, and C in the European standard): 

Identification and color code of three-lead and five-lead electrodes are as follows:

<table>
<thead>
<tr>
<th>the American standard</th>
<th>Color</th>
<th>the European standard</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>name of lead</td>
<td></td>
<td>name of lead</td>
<td></td>
</tr>
<tr>
<td>RA</td>
<td>White</td>
<td>R</td>
<td>Red</td>
</tr>
<tr>
<td>LA</td>
<td>black</td>
<td>L</td>
<td>yellow</td>
</tr>
<tr>
<td>LL</td>
<td>Red</td>
<td>F</td>
<td>Green</td>
</tr>
<tr>
<td>RL</td>
<td>Green</td>
<td>N</td>
<td>black</td>
</tr>
<tr>
<td>V</td>
<td>brown</td>
<td>C:</td>
<td>White</td>
</tr>
</tbody>
</table>

10.3.2.2 Installation position of three-lead ECG monitoring electrodes

Installations of three-lead ECG monitoring electrodes, according to the American and European standards respectively (see Fig. 10-1):

White / red (RA) electrodes - placed in the right foreleg.
Black / yellow (LA) electrodes - placed in the left foreleg.
Red / green (LL) electrodes - placed in the left hind leg.
10.3.2.3 Installation position of five-lead ECG monitoring electrodes

Installation of five-lead ECG monitoring electrodes, according to the American and European standards respectively (see Fig. 10-2):

White / red (RA) electrodes - placed in the right foreleg.
Black / yellow (LA) electrodes - placed in the left foreleg.
Green / black (RL) electrodes – placed at the right hind leg.
Red / green (LL) electrodes - placed in the left hind leg.
brown/white(V) electrodes – placed on the Fourth intercostal space as fig. 10-3 shows
ECG Monitoring

**Attention**

- In order to ensure the safety of sick animals, all leads must be connected to the sick animal.

**10.3.2.4 ECG leads configuration recommended for surgical sick animals**

**Warning**

- When using electrical surgery unit (ESU), you should put the ECG electrodes in the middle position between the ESU grounding-plate and electrosurgical scalpel to avoid burns. Cable of ESU can not be wound around the ECG cables.
- When using electrical surgery unit (ESU), do not put the ECG electrodes onto the ESU grounding-plate, or there will be a lot of interference with the ECG signal.

Placement of ECG leads depends on the type of surgery. For instance, for open heart surgery, electrodes can be placed on the side of the chest or on the back. In the operating room, as the use of electrosurgical scalpel, sometimes will create an artifact and may affect the ECG waveform, so you should put the electrodes on the left and right shoulder near the left and right side of abdomen and put the chest leads at the left side of the middle chest, which will be conducive to the decrease of artifacts. You should avoid putting the electrode on the upper arm, or the ECG wave may become very small.

**10.3.2.5 Waveform Quality**

Users can arrange leads according to their own needs. Lead name of the channel is displayed on the left of the corresponding waveform, you can select the one you want directly and make changes. For the two waveform channels, only Channel 1 can display the ECG waveform, and you can click the screen at the position of ECG waveform to enter the "ECG waveform settings", then chose the appropriate lead name from “I, II, III, AVR, AVL, AVF and V” and chose the gain and filtering methods basing on your requirement.

Characteristics of a good signal are as follows:

- Tall and narrow with no notch.
- Having a tall R-wave that is completely above or below the baseline.
- T-wave is less than 1/3 height of the R-wave.
- P wave should be much smaller than the T wave.

In order to obtain the 1 mV calibration (1 mV ECG waves), ECG should be calibrated, and then the
screen would prompt. The equipment can not monitor the sick animal during calibration.

![Standard ECG waveform](image)

**Fig. 10-6 Standard ECG waveform**

**Attention**

- If the electrode adhesive is correct, but the ECG waveform is not accurate, then the lead should be replaced.
- Interference from ungrounded equipment near the sick animal or electrical surgical unit (ESU) may cause waveform problems.

### 10.4 ECG display and screen hot keys

1. **ECG lead name:**
   By using three-lead ECG, five-lead ECG, the corresponding lead names displayed are different, and you can find the details in the menu: "ECG waveform settings".

2. **Heart Wave Gain:**
   Heart wave gain is used to adjust the size of the wave amplitude. You can choose gain on every calculation channel, and there are gains of $\times 0.25, \times 0.5, \times 1, \times 2$ levels and an automatic mode. The automatic mode refers to the gain being chosen automatically; adjusted by the monitor itself. The 1mv benchmark is displayed on the left side of each waveform. The height of the 1mv benchmark is...
proportional to the wave amplitude.

⚠️ **Attention**

- When the input signal is too large, the wave crest may be truncated. At that time user can manually change the gain level of the ECG waveform. Watch the actual ECG waveform to avoid incomplete waveform display.

③ Wave Filtering methods:

- Cleaner or more accurate waveforms can be obtained by wave filtering. User can chose four wave filtering methods. Under the diagnostic mode the screen displays the unfiltered ECG wave. Monitoring mode will filter the artifact which may lead to false alarms; the operation mode can reduce artifact and interference from the electrosurgery unit in the operating room. Wave filtering methods act on two channels simultaneously, and are displayed on the top of the first ECG waveform. ST waveform filtering method is to guarantee users’ accurate analysis of ST-segment. In ST mode, it is more accurate to measure subject’s ST-segment. The frequency response range of this mode is from 0.05Hz to 40hz. The low-frequency part is very expansible, ensuring subject’s ECG measurement in ST-segment is not distorted and at the same time effectively filtering high-frequency interference signal over 40hz besides power line interference. In this mode, user can alter the analysis point of ST-segment to acquire subject’s ST-segment values more accurately.

⚠️ **Warning**

- Only under the diagnostic mode can the system provide a true signal which is not processed. Under the monitoring and operation filter mode, there are deformations to different degrees on the ECG waveforms. At this time the system only provides basic conditions of ECG, which will greatly impact the analytic result of ST segment. Under the operation mode, the analytic result of AWRR may also be partly impacted. Therefore, it is recommended that diagnostic mode should be used as much as possible when interference is small.

④ 1 millivolt scale bar

Showing the height of the gain

⑤ upper and lower limits of the ECG alarm:

Displaying current upper and lower limits of the ECG alarm

⑥ PVCs (arrhythmia) and ST segment analysis

Displaying the current state of PVCs and ST segment analysis with an alternate view displays at a refresh rate of one second for every parameter.
ECG Monitoring

(a) When using the 3-lead cycle, show the analysis value of PVCs, ST1, ST1 refer to I lead ST segment analysis.

(b) When using the 3-lead, the display loop is the analysis value of PVCs, ST1, ST2, ST3, AVR, AVL, AVF, STV w, AVR, AVL, AVF, STV is the analysis of aVR, aVL, aVF’s ST segment.

When PVCs is turned on, you can monitor arrhythmias.

When ST segment analysis is turned on, you can monitor the ST segment.

When using the 3-lead, you can monitor arrhythmias.

7. ECG values:

When ST segment analysis is turned on, you can monitor the ST segment.

8. ECG waveform:

When ST segment analysis is turned on, you can monitor the ST segment.

10.5 ECG Setup

10.5.1 ECG wave setup

Click the screen at the ECG waveform to enter the "ECG wave setup", which is shown as below:

<table>
<thead>
<tr>
<th>LEAD NAME</th>
<th>GAIN</th>
<th>SWEEP</th>
<th>WAVE MODE</th>
<th>FILTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>x1</td>
<td>25.0</td>
<td>MONO</td>
<td>DIA</td>
</tr>
</tbody>
</table>

Fig. 10-7 ECG wave setup

- LEAD NAME: by using three-lead ECG, five-lead ECG, the corresponding lead names displayed are different.

When using five-lead, the optional leads are I, II, III, aVR, aVL, aVF and V.

When using three-lead, the optional leads are I, II and III.

- GAIN: is used to adjust the size of the wave amplitude. You can choose × 0.25, × 0.5, × 1, × 2 levels and an automatic mode. The automatic mode refers to the gain is automatically adjusted by the monitor itself. The 1mv benchmark is provided at the right side of each waveform. The
height of the 1mv benchmark is proportional to the wave amplitude.
When the ECG waveform gain is selected as “×2”, the second channel of the waveform will be hidden temporarily, and the second channel of the waveform will be re-displayed when the ECG waveform gain is selected at other levels.

⚠️ **Attention**

**When the input signal is too large, the wave crest may be truncated. At that time user can manually change the gain level of the ECG waveform. Watch the actual ECG waveform to avoid incomplete waveform display.**

- Wave speed (SWEEP): there are three levels of ECG wave sweep speed as 12.5, 25.0 and 50.0mm/s that can be chosen.
- Waveform description (WAVE MODE): Color-order method and ladder method, and the acquiescence of the instrument is ladder method.
- Filtering methods (FILTER): there are three filtering methods, namely: the diagnostic, monitoring and operation. You can find more details in the content of “10.4 ECG display and screen hotkeys”
- Lead Type: you should choose the type that match the number of lead wires you use, and the option are three-lead, five-lead.
- HR Channel: select the heart rate channel, “channel 1” represent the data of the first ECG waveform calculate heart rate. (no optional)

### 10.5.2 ECG setup

There are three ways to enter "ECG setup": First, click at the ECG waveform to enter the "ECG wave setup" and find the "ECG Setup" menu. Second, click on ECG parameters area, you can directly enter the "ECG Setup" menu. Third, by pressing the “” key to enter the "Shortcut" window and select "main Menu" in this window to enter the "survey setup" menu, and then select the "ECG Setup" menu, which are shown as the figure below:
ECG Monitoring

Fig. 10-8 ECG setup

(a) Heart rate alarm (HR ALM): if select "On", the instrument will alarm and store when heart rate alarm happens; if select "Off", the instrument will not alarm and will prompt " htmlForSign" beside the ECG waves.

(b) Alarm levels (ALM LEV): there are three optional values as "high", "medium" and "low". The "High" value represents the most serious alarm.

(c) ALM LIMIT SETUP: is used to set the high limit and low limit of the heart rate alarm. It will warn when the heart rate exceeds the high limit or the low limit. Please see the content of "Product Specifications" section to find details about the high and low scope of heart rate alarm.

Attention

- You should set the high and low limit of alarm basing on the clinical needs of different sick animals.
- High heart rate alarm limit setting is particularly significant in ECG monitoring. The high limit should not be set too high; taking the factors of change into account, the high limit should not be set more than 20bpm higher than the heart rate of the sick animals.

(d) NOTCH: 50Hz or 60Hz parts of the signals will be suppressed. When it is set 50Hz or 60Hz, NOTCH will be used when waveforms jitter frequently (e.g. Waveform has burrs). Waveforms will be filtered at the power supply frequency.

(e) HR FROM: ECG, SPO2, Manual. ECG or SpO2 can be chosen to test HR; if Manual is selected, monitor will decide which test result to use according to the quality of signals; if HR is tested through SpO2, point out pulse and there is pulse sound. When SpO2 is chosen, disable
ECG Monitoring

HR alarm and enable PR alarm.

(f) Wave color: green, blue, red, yellow, white, blue and purple.

(g) If the monitor has the function of ST segment analysis and arrhythmia analysis, you can see “ST segment monitoring analysis” and “arrhythmia analysis” content to find the methods to use.

(h) ECG CAL: When the ECG is in calibration, you can not monitor the sick animal. And it will prompt at the middle of the screen as: “CAL, can’t monitor!” You should go back to the “ECG Setup” to choose "Stop ECG cal" menu to stop the calibration.

(i) Default: by selecting the "default " dialog box, user may respectively select "No" or "Yes" to exit or choose “Will adopt the default config!The previous configure will be lost!”.

10.6 ST segment analysis

10.6.1 About ST segment analysis

Normal cardiac and atrial cardiac pacing are used for ST segment analysis. The monitor analyzes these cardiac pacings and calculates the elevation and depression of the ST segment. On the monitor, the information can be displayed in the form of ST value. The instrument can continue to monitor all available leads. ECG waveforms need not be displayed on the monitor for the ST segment analysis. Dedicated filters which could ensure the diagnostic quality need to be used during the implementation of the ST segment analysis. If you choose any filtering mode except the "diagnosis" filtering mode for monitoring ECG, the ST segment appearance of the ECG waveform may be slightly different from that of the same fragment in the ST waveform. In order to make diagnostic assess of the ST segment, please always switch to the "diagnosis" filter mode. You can also select "monitoring" or "operation" mode, but the ST segment data will be very fuzzy.

ST segment analysis can measure the elevation or depression of ST-segment for the specified lead.

Understanding the ST-segment measurements: A positive number indicates elevation, and a negative number indicates depression.

ST-segment measurement range: -2.0 ~ +2.0 mV.

10.6.2 The impact on ST-segment

Some clinical situations make it difficult to get reliable ST monitoring, such as:

- Inability to obtain low noise lead;

10-11
ECG Monitoring

- there are arrhythmias causing an irregular baseline, such as atrial fibrillation or atrial flutter;
- the sick animal is receiving continuous cardioventricular pacing;
- the sick animal has left bundle branch block.

When these situations occur, you should consider stopping ST monitoring.

⚠️ Warning

The clinical significance of ST level change information provided by this monitor should be decided by doctors.

10.6.3 Setting ST-segment analysis

You should enter "ECG Settings" to choose "ST analysis", as shown below:

![ST analysis settings](image)

- **ST ANALYSIS**: This switch is used to set the state of ST-segment analysis, ST segment analysis can only be carried out when the switch is turned on.
- **ALM ON/OFF**: If select Off, the instrument will alarm and store when ST segment analysis alarm happens. If you select Off, the instrument will not alarm, and will prompt beside the ST segment. The ST alarm will be triggered only when its measured value exceeds the high ST alarm limit or the low ST alarm limit.
- **ALM LEV**: used to set the ST alarm level. There are three optional values as high, med and low.
- **ST ALM LIMIT**: to set the high and low alarm limits of the ST segment alarm.
  - High limit: maximum ceiling value is 2.0; the minimum value must be set higher than -1.9 of the lower limit.
  - Low limit: maximum value is 1.9; the minimum must be set higher than -2.0 of the lower limit.
For the range of high and low ST alarm limit, please see the content of "Product Specifications" section.

⚠️ Attention

- ST segment analysis does not consider abnormal QRS complex.
- The alarm limit of the two ST segment measured values are the same, and the alarm limit for each channel can not be set separately.

Determine the ST Segment (DEF POINT): Select this option to enter the “Determine the ST Segment AP” window and set the values at ISO and ST.

ISO and ST are two measuring points of ST Segment, which are adjustable. R wave crest point is the reference point in setting of ST measuring point (as shown in the following figure):
ST measured value of each HB composite waveform is the vertical distance between this waveform and the crossing of two measuring points.

![Attention]

- Where obvious changes happen to the sick animal’s HR or ECG Waveform, it is necessary to adjust the ST measuring point in the following methods.

Method of Adjusting ISO and ST

Adjust the values by selecting “ ” or “ ”.

Setting the measuring point of ST Segment, please open the “Determine Analysis Point” window and the window will show QRS wave-group module (if the channel is not opened, “ST Analysis Switch OFF” will be prompted). The location for high-brightness line in the window can be adjusted. Select the ISO or ST first, and then turn the knob both leftward and rightward to move such a line in parallel so as to determine the reference point or measuring point.

![Attention]

- The abnormal QRS wave group will not be taken into consideration when ST segment is analyzed.

(1) Alarms & Reminders used in ST Segment Analysis.

![Attention]

- The alarm limits for two measured values of ST SEGMENT are coincident. The alarm limit of each channel can’t be set alone.

### 10.7 Arrhythmia Analysis(ARR ANALYSIS)

Arrhythmia analysis is used for monitoring ECG of sick animals clinically, detection of heart rate change and premature ventricular contraction, storing arrhythmic events and generating alarm information. Arrhythmia analysis can be used for monitoring both pacemaker and non-pacemaker sick animals. According to the arrhythmia analysis, doctors can evaluate the sick animal's condition (such as heart rate, frequency and rhythm of PVCS (premature ventricular contractions) and abnormal heartbeats and thus give appropriate treatment. In addition to detection of the ECG changes, arrhythmia analysis can also monitor the sick animal and give the appropriate alarm.

The arrhythmia monitoring function of the monitor is turned off by default. Users can turn on this feature if they desire.

Through test and classification of arrhythmia and abnormal heartbeat, arrhythmia monitoring function can draw the attention of doctors to cardiac arrhythmias of sick animals and alarms.
The monitor can detect 14 kinds of arrhythmias for analysis. During arrhythmia analysis, the system will store the last 100 alarm events, and the operator can edit the arrhythmic events from menu of this function.

10.7.1 Setting Arrhythmia Analysis

Enter "ECG Setup" and select "arr analysis", as shown below:

![Fig. 10-10 Arrhythmia Analysis]

- **ARR ANALYSIS**: select "On", when you want monitoring. The default is "Off".
- **Alm on/off**: select "On" for alarm and storage, and select "Off" to stop PVC alarm, and the instrument will prompt "\n" in the parameters area of the screen beside the PVCs;
- **Alm lev**: there are three optional values as high, med and low. The High value represents the most serious PVCs alarm.
- **PVCs alm HI**: the PVCs alarm is based on the high limit, and the alarm will activated when PVCs exceeds the high limit.

Adjustment ranges of high alarm limit are as follows:

<table>
<thead>
<tr>
<th>PVCs</th>
<th>Highest</th>
<th>Lowest</th>
<th>Single adjust volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVCs</td>
<td>31</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

- **Tachycardia**: setup the tachycardia. It will trigger the alarm when the value of HR exceed the threshold. Setup range of 100-350bpm.
- **ARR RELEARN**: The user may need to start the self-study when the ECG template has great changes in the process of ECG monitoring. The ARR self-study can let the monitoring learn the new ECG template to correct the value of arrhythmia alarm and the heart rate.
- **ARR ALARM**: set the arrhythmia alarm.

❖ Arrhythmia options(ARR TYPE): in this menu, you can set the options as follows: all,
ECG Monitoring

ASYSTOLE, VFIB / VTAC, R ON T, VT> 2, COUPLE, PVC, BIGEMINY, TRIGEMINY, TACHY, BRADY, PNG, PNP, MISSED and BEATS.

✧ ALM ON/OFF: On, Off.
✧ Alarm levels(ALM LEV): high, med and low.
11.1 RESP (Breathing) Measurement

11.1.1 The Generation of Breath

The monitor measures breath according to the thoracic impedance values of the two electrodes. The impedance variations between the two electrodes (because of the thoracic activities) produce a breathing wave on the screen.

11.1.2 The Settings of Breathing Monitor

To monitor respiration, we don’t need additional electrodes, but the position of the electrodes is quite important. Because of the clinical situation, some sick animals’ thoraxes are transversely expanded which leads to a negative thoracic internal pressure. In this case, it is better to have two respiratory electrodes placed in the right midaxillary line and the left thorax, which have the greatest activity when breathing, to get the best breathing wave.

⚠️ Attention

- Breathing monitor can not be applied to the sick animal who moves frequently, because it may lead a wrong alarms.

RESP monitoring inspection

Before setting the electrode, make the sick animal’s skin ready

Load spring clips to the electrodes and put them onto the sick animal as the following:

Connect the monitoring system power.

11.1.3 Place Electrodes for the Breathing Measurement

For example, if the five leads are applied, the connecting methods are shown on the charts below (for the connecting methods of other leads, please refer to the related sections of Chapter 10)
Fig. 11-1 The Settings of the Five Lead Electrodes

- white electrode (RA) — Right foreleg
- black electrode (LA) — Left foreleg
- green electrode (RL) — Right hind leg.
- red electrode (LL) — Left hind leg.
- brown electrode (V) — Fourth intercostal space.

⚠️ Attention

- Put the green and the red electrodes at opposing angles so as to get the best breathing wave. You should avoid putting the electrodes over the liver area and the left ventricle on the line of the respiratory electrodes, which can help to avoid slight errors made from cardiac overlap or the pulsing blood flow. This is particularly important for small vets.

11.2 RESP Settings

11.2.1 RESP Wave Settings

Click on the wave of the second channel on the screen. If it is the RESP wave, just enter the menu directly. If it is the SpO₂ or the CO₂ wave, after entering the menu, select “RESP” from “switch
waves”, and then enter the menu again. As follow:

<table>
<thead>
<tr>
<th>Wave Type</th>
<th>RESP Wave Setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWEEP</td>
<td>: 12.5</td>
</tr>
<tr>
<td>RESP LEAD</td>
<td>: RA-LA[I]</td>
</tr>
<tr>
<td>ENHANCE FILTER</td>
<td>: OFF</td>
</tr>
<tr>
<td>GAIN</td>
<td>: ×1</td>
</tr>
<tr>
<td>WAVE TYPE</td>
<td>: LINE</td>
</tr>
</tbody>
</table>

Fig. 11-2 RESP Wave Setup

- Wave speed(SWEEP): optional breathing wave speed has 6.25mm/s, 12.5mm/s and 25.0mm/s three options.
- RESP LEAD:RA-LA[I],RA-LL[II]. Breathing leads refers to the place where the respiratory waveform monitored currently comes from. RA-LA（I）or RA-LL（II）.
- ENHANCE FILTER:OFF,ON. Interference filter is to filter the heart, the boot default is "on."
- GAIN: user can install the gain of RESP wave to amplify or narrow the amplitude shown by the wave. Optional waves are ×0.25, ×0.5, ×1 and×2.
- WAVE STYPE: fill and line.
- SWITCH WAVE: when this monitor has SpO₂, CO₂ and
- RESP monitoring functions at the same time, we can switch the wave shown on the second channel with this menu.

### 11.2.2 RESP Setup

Three ways to enter “RESP Setup”

a) If there are no parameters displayed on the interface, click the wave of the second channel and enter the“×× wave setup”. After setting “switch wave” to “RESP”, click the wave of the second channel again and you can find the “RESP Setup” menu.

b) When there are RESP parameters shown on the screen, click RESP parameter area and enter “RESP Setup” directly.

c) Press the “” button for the “shortcut” window, choose “main menu” from this window and enter “survey setup” menu and select “RESP Setup”. Shown in the following charts.
ALM: choose “on”, and there are alarm prompts and record storage when the respiration rate alarms; Choose “off”, and there is no alarm and the signal “!” will show up beside RESP in the parameter areas on the screen.

ALM LEV: optional items are “high”, “med” and “low”.

APNEA ALM: set to judge a sick animal’s suffocation time, between 10-60 seconds; You can choose “no” option.

Alm Limit Setup: used to set the alarm’s upper limit and lower limit. Respiration rate alarm depends on the upper limit and low limit settings. When the respiration rate is more than the upper limit or less than the lower limit, it will alarm. For the range between the upper limit and the lower limit of respiration rate alarm, please refer to the related contents of “product specifications” chapter.

WAVE COLOR: colors shown by the wave: green, cyan, red, yellow, white, blue and purple. The wave fits the measuring parameters’ colors.

Default: choose this item and enter “RESP default config” in the dialog box. User can choose “no” or “yes” to quit or choose “Will adopt the default config!The previous configure will be lost!”.

### 11.3 Maintenance and Cleaning

**Warning**

Before cleaning the monitor or the sensors, you must turn off the power and switch off the AC power.

If any ECG cable is damaged or aging, the cable should be replaced with a new one.
Cleaning
This monitor and the sensor surface can be cleaned with medical alcohol, air dried or dried with a clean and dry cloth.

Disinfectant
In order to avoid long-term damage to the equipment, we advise you sterilize these products only when it is absolutely necessary in your instrument maintenance plan. We also suggest you first wash these sterilization instruments.

Recommended sterilization materials for monitor:
Ethanol base: Ethanol 70% or isopropyl alcohol 70%
Acetaldehyde base

Sterilization
In order to avoid long-term damage to the products, we suggest you sterilize them only when your hospital regulations think it essential to do so. We also advise you first clean the sterilization products.
12.1 Definition of SpO2 Monitoring

SpO2 plethysmography parameters measure blood-oxygen saturation, that is, the percentage of the total oxyhemoglobin. When 97% of the total number of hemoglobin molecules combines with oxygen in the arterial blood’s red blood cells, this blood will have 97% SpO2 oxygen saturation, and at the same time the monitor reads 97% SpO2 value. This value shows the percentage of oxygen-carrying hemoglobin molecules, constituting oxyhemoglobin. Furthermore parameters of the SpO2 can also provide pulse rate signal and plethysmography wave.

12.1.1 Principle of Measuring SpO2 Plethysmography Parameter

Pulse oximetry is a measurement of oxygen saturation. It is a continuous, non-invasive way of determining the hemoglobin oxygenation saturation. It is involved in measuring how much light emitting from the sensor side passes through the sick animal’s tissue (such as a finger or ear) and then reaches the other side of the receiver.

Sensor is usually able to gauge the 660nm wavelength of red LED, and 940nm of infrared LED While LED’s maximum available output power is 4mW.

Though the amount of light passing through depends on many factors, most of them are constant. However, blood flow in the arteries, one of those factors, changes with time since it is pulsatile. It is possible to obtain arterial blood oxygen saturation by measuring the amount of light absorbed during the pulse. And surveying pulse itself can supply a "plethysmography" waveform and pulse rate signal.

The main screen can display "SpO2" value and "plethysmography" waveform.

⚠️ Warning

- If there is carbonyl hemoglobin, methemoglobin, or dye dilution chemical present, the SpO2 value will deviate.

12.1.2 Recognition the type of blood-oxygen

The types of oxygen in the arteries have been configured when the equipment is delivered from the factory, which is recognizable by the socket connected to the oxygen probe:

- Digital SPO2: the blue socket, a circular single-slot one, is set for the blue oxygen sensor, whose color is the same as the socket.
- Nellcor SPO2: the red socket, a circular single-slot one, is set for the red oxygen sensor, whose color is the same as the socket.
### 12.1.3 Monitoring of Blood-Oxygen/ Pulse

**Warning**
- Do not twist the cable of electrical surgical equipment with the sensor’s.
- Do not put a sensor on limbs with an arterial catheter or intravenous tube.

**Attention**
- Do not place the sensor on the body part doing measurements of blood pressure, because the process of measurement during blood pressure measurement may occlude the blood flow, and that will affect readings of oxygen saturation.

### 12.2 Attention on Monitoring of SpO2/ Pulse

**Warning**
- First check whether the sensor cable is normal before the monitor is started. When you unplug the cable of the SpO2 sensor from the jack, the screen will display error message as "sensor off" and simultaneously trigger an audible alarm.
- If the sensor or its packaging has signs of damage, do not use it and return to the factory.
- Continuous and prolonged period of monitoring may increase the risk of undesirable changes in the skin characteristics, such as extremely sensitive, reddening, blistering, or even pressure necrosis etc, especially of the small vet with perfusion disorders and varying or immature forms of skin. Particular attention to checking placement of the sensor according to the changes in the quality of skin, correct optical alignment and attachment methods. Also check, periodically, the location where the sensor is attached and make a change of the position if there is a decline of skin quality. Finally different conditions of individual sick animals may require more frequent inspection.
12.3 Steps of Monitoring

Attention

- Make sure that the nails cover the light inside the probe. Its lines should be placed on the back of hands.
- SpO2 value is always displayed in a fixed place.
- SpO2 waveform and pulse volume are out of proportion.

Warning

- Select the appropriate placement according to the instrument and its supporting oxygen probe, which is fundamentally vital to a small vet.

Fig 12-1 (A,B) placement of sensor

(1) the oxygen probe clip open in the left and right sides of the clip installed infrared LED sensor (see Figure 12-1-A);
(2) open the monitor;
(3) to one end of the sensor cable connector insertion the SpO2 module's SpO2 hole;
(4) the best placement of the probe position is the animal's tongue, the probe can be placed in the intermediate position of the tongue of the animal. Other places, such as the toes and ears are also available for placement. We recommend to the probe clip clamped the animal tongue to oxygen guardianship, (see Figure 12-1-B):

Attention

- When the accurate positioning between the test site and the probe fails, it may result in wrong readings of blood-oxygen saturation, and even stop monitoring.
because of the failure of the search for the pulse wave. In this case you should re-position the two.

- Excessive movement of measured sites may affect the accuracy of the measurement, therefore, you should calm the sick animal or replace sites in order to reduce the impact of excessive movement.

⚠️ **Warning**

- In a long and continuous monitoring process, check the condition of the peripheral circulation and skin under measuring every 2 hours or so, and if negative conditions happen, timely change the site under measurement.
- In a long and continuous monitoring process, it is advisable to check periodically the positioning of the probe to avoid inaccurate measurement due to changing in the positioning from moving or other factors.

### 12.4 Limits in Measurement

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

- High-frequency radio interference, for instance, interference self-generated from the host system or from electrical scientific instruments connected to the system.
- During magnetic resonance imaging scanning (MRI), do not use the photoelectric oximeter and oxygen sensor, since induced currents may cause burning.
- Intravenous dye.
- Sick animal’s excessive movement.
- External radiation.
- Improper installation of sensor or improper contact position with the object.
- Sensor’s temperature (optimal temperature should be among 28 °C - 42 °C).
- The sensor is placed on the limbs with a blood pressure cuff, arterial catheter, or the pipeline of body cavity.
- The concentrations of non-functional hemoglobin such as carboxyhemoglobin (COHb) and methemoglobin (MetHb) etc.
- Extremely low degree of blood-oxygen saturation.
- The measured area has poor circulation.
- Syndromes such as shock, anemia or low temperature etc and application of vasoconstrictor drugs can reduce blood flow to the level
of not being able to be measured.

- Measurement also depends on both the oxyhemoglobin and reduced hemoglobin’s absorption of specific wavelengths of light. If any other factors absorb the same wavelength, they will generate false measurement, lower SpO₂ values. These factors are as follows: carbonization of hemoglobin, methemoglobin, methylene blue, indigo rouge.
- It is recommended to use only the SpO₂ probe described in the accessories.

12.5 SpO₂ settings

12.5.1 SpO₂ Wave Setup

Click the waveform of the second channel on the screen, if SpO₂ waveform is the current one, you can directly enter the menu. If the current waveform is the RESP one or CO₂ one, after entering the menu, select "SpO₂" in the direction of "switch wave", then you can re-enter the menu shown below:

- Waveform Speed(SWEEP): three kinds of respiratory wave speeds available are: 6.25mm/s, 12.5mm/s and 25.0mm/s.
- WAVE TYPE: Filled or Lines.
- SWITCH WAVE: When the monitor has three kinds of monitoring functions, that is, SpO₂, CO₂ and RESP, this menu can switch waveform displayed on the second channel.

12.5.2 Digital, Nellcor SpO₂ Settings

There are three ways of accessing "SpO₂ Setup":

(a) When the interface does not display SpO₂ parameter, click on the position of the second
channel’s waveform in the standard interface, enter "× × wave setup", choose "SpO2" in the setting of " switch wave ", and then re-click on the position, the "SpO2 Setup" menu will be found;

(b) When the interface displays SpO2 parameter, click on the region of the SpO2 parameter, you can directly enter the "SpO2 Setup" menu;

(c) Press the " " key to enter the "Shortcut" window, where you select the “Main Menu” and enter “measurement setup” menu, then choose “SpO2 setup.” It is shown below:

```
<table>
<thead>
<tr>
<th>Big</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpO2 SETUP</td>
</tr>
<tr>
<td>ALM          : ON</td>
</tr>
<tr>
<td>ALM LEV      : MED</td>
</tr>
<tr>
<td>SatSecond    : 50</td>
</tr>
<tr>
<td>SpO2 ALM LIMIT</td>
</tr>
<tr>
<td>PR ALM LIMIT</td>
</tr>
</tbody>
</table>
```

Fig. 12-6 SpO2Setup

---

**Warning**

- To set the SpO2 alarm limit as 100% is equal to turn off the upper limit alarm. High oxygen levels will have premature small in danger of infecting the crystal-like fibrous tissue disease. Therefore, the limit of oxygen saturation alarm must be choosen carefully based on generally accepted clinical practice.

- **Alarm Switch(ALM):** selecting "On" refers to warning and alarm storage during the alarm of the SpO2 (oxygen saturation), whereas selecting "Off" has no warning and has a sign of 🚨 next to the SpO2 of the screen parameter area.

- **Alarm level(ALM LEV):** Alarm level is used to set the alarm level, the choices are "high", "med" and "low". "High" stands for the most serious alarm events.

- **Intelligent Alarm(SatSecond):** Intelligent Alarm has five levels, that is, 10 seconds, 25, 50,100 and shutdown, for example, intelligent alarm range is set to 50 seconds, NELLCOR oxygen alarm limit of 97% and lower limit of 90%, the measured value of blood-oxygen is 80% and maintains 3 seconds, then drops to 78% and stick to 2 seconds, thus we calculate from the moment beyond the alarm limit, after 5 seconds of continuously exceeding the limit of the alarm, the sound and light alarm immediately activates, andat the same time,
circles next to the value of blood-oxygen also goes back to the beginning. Intelligent alarm is designed to reduce false alarms, help the doctor grasp more accurate and timely changes in blood-oxygen. (This function is only effective for NELLCOR blood-oxygen) Its calculation is as follow:

Minus percentage points x seconds = SatSeconds integer

values of the calculated SatSeconds are shown:

<table>
<thead>
<tr>
<th>%SpO2</th>
<th>second</th>
<th>SatSeconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>(90%-80%)</td>
<td>x 3</td>
<td>= 30</td>
</tr>
<tr>
<td>(90%-78%)</td>
<td>x 2</td>
<td>= 24</td>
</tr>
</tbody>
</table>

Total SatSeconds = 54

SatSeconds Sample:

After about 4.9 seconds, the instrument will report SatSeconds alarm, because 54 is beyond the intelligent alarm range 50 SatSeconds.

Within a few seconds, saturation will fluctuate a bit, and not be stable. Generally, the sick animal's SpO2 value may fluctuate between the upper and lower limits of the alarm, and may re-enter to non-alarm range several times. In this volatile period, the system will store the positive and negative points of the SpO2, till it reaches the SatSeconds limit or sick animal's SpO2 values returned to and remains in the non-alarm range.

- SpO2 ALM LIMIT: According to the setting of high and low limits, the equipment begins to alarm when the SpO2 is beyond the upper limit or below the lower limit.
- PR (pulse rate) ALM LIMIT: According to the setting of high and low limits, the equipment begins to alarm when the PR exceeds the upper limit or is below the lower limit.

Please look at the content of "Product Specifications" section to set the SpO2 alarm and PR alarm's high and low limit range,

- WAVE COLOUR: waveform display colour: Green, Cyan, Red, Yellow, White, Blue and Purple. Waveform is consistent with measured parameters in colour.

- Default: Select it to enter the dialog of the SpO2 default configuration, the user can select "No" to exit or "Yes" to choose "Will adopt the default config! The previous configure will be lost!."
12.6 Maintenance and Cleaning

⚠️ CAUTION

- Do not autoclave the sensor.
- Do not soak the sensor in liquids.
- If the sensor or cable is damaged or has signs of deterioration, do not use again.

⚠️ Warning

- Before cleaning monitors or sensors, you must switch off and disconnect the AC power.

Cleaning:

Wipe the sensor’s surface first with a cotton ball dipped alcohol or a soft cloth, then thoroughly dry cloth. The same method could be applied to the cleaning of the LED sensor and receiver devices.

Disinfect the cable with 3% hydrogen peroxide or 70% isopropyl alcohol, and other active agents are equally effective, the joint can not be immersed in the above solution.
13.1 General

Uses oscillation method for Non-invasive blood pressure (NIBP) measurement. It can be used in big cuff and small cuff decided to use based on the animal's limbs cuff type; Measurement mode: manual, automatic and continuous measurement. Each of these modes display systolic pressure, average pressure and diastolic pressure.

- Use “manual” mode to conduct only one measurement.
- Automatic "mode, the measurement is repeated at intervals. Intervals can be set to 1, 2, 3, 4, 5, 10, 15, 30, 60, 90, 120, 180, 240 and 480 minutes.
- In Continuous "mode, continuously measures at five-minute intervals.

⚠️ Warning

- No-invasive blood pressure measurement cannot be run in sick animals suffering from sickle-cell disease or skin damage or any time there may be anticipated damage.
- For a sick animals suffering from serious disturbance of blood coagulation mechanism, the decision to operat automatic blood pressure measurement must be made according to the clinical evaluation, because the friction area between body and sleeves has the risk of hematoma.

When measuring in small cuff, you must ensure that the correct mode is selected (see menu settings of veterinary information). Wrong veterinary mode could jeopardize veterinary safety, because high blood pressure of big does not apply to small veterinary.

13.2 NIBP Monitoring

13.2.1 NIBP measurement

⚠️ Warning

- Before starting the measurements, make sure the selected criteria applies to your veterinary(big ,small).
- Do not install cuff on a limb with intravenous infusion or inserted catheter. During the period of cuff inflation, the slowing down or blocking of infusion may result in
NIBP Monitoring

- **Ensure that inflatable tubes that attached blood pressure cuff and monitor are smooth and with no tangles.**

  a) Insert the inflatable tubes in the blood pressure cuff on monitor interface, turn on instrument power supply.

  b) Attach a blood pressure cuff to the veterinary's upper arm or thigh in the following ways, (Fig. 13-1).

    - Verify that the cuff is completely deflated.
    - Use dimension appropriate cuff to the sick animal, ensure the cuff catheter exit is located just above the appropriate artery. Ensure cuff is not too tight, as it may cause discoloration even ischemia of distal limb.

![Fig. 13-1 Using Cuff](image)

### Attention

- **Sleeve bandwidth should be 40% of the limb diameter, or two-thirds of upper arm length.**

- **The length of the inflatable part of cuff should be able to surround 50~80% of the limb, cuff with improper size will generate an erroneous reading. If the cuff size is improper, you should use larger or smaller cuffs to reduce errors.**

Cuff type:

<table>
<thead>
<tr>
<th>Animal type</th>
<th>Use standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>elephant</td>
<td>Neo #5</td>
</tr>
<tr>
<td>horse</td>
<td>Neo #4</td>
</tr>
<tr>
<td>dog</td>
<td>Neo #3</td>
</tr>
<tr>
<td>cat</td>
<td>Neo #2</td>
</tr>
<tr>
<td>mouse</td>
<td>Neo #1</td>
</tr>
</tbody>
</table>
NIBP Monitoring

Animal cuff size:

<table>
<thead>
<tr>
<th>Cuff name</th>
<th>Arm circumference measurements</th>
<th>Cuff length</th>
<th>Cuff width</th>
<th>Tube length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pet blood pressure cuff 1#</td>
<td>3 ~ 5.5 cm</td>
<td>12.2 cm</td>
<td>2.6 cm</td>
<td></td>
</tr>
<tr>
<td>Pet blood pressure cuff 2#</td>
<td>4 ~ 8 cm</td>
<td>15.4 cm</td>
<td>3.2 cm</td>
<td></td>
</tr>
<tr>
<td>Pet blood pressure cuff 3#</td>
<td>6 ~ 11 cm</td>
<td>18.7 cm</td>
<td>4.2 cm</td>
<td>2m</td>
</tr>
<tr>
<td>Pet blood pressure cuff 4#</td>
<td>18 ~ 26 cm</td>
<td>10.6 cm</td>
<td>10.6 cm</td>
<td></td>
</tr>
<tr>
<td>Pet blood pressure cuff 5#</td>
<td>46 ~ 66 cm</td>
<td>21 cm</td>
<td>21 cm</td>
<td></td>
</tr>
</tbody>
</table>

- Check whether the cuff edge falls in the range <->. If not, change with a more appropriate cuff.

Connect the cuff and inflatable tube. Body parts used for pressure-measuring should be in the same horizontal location with sick animal's heart. If unable to do so, it is necessary to use the following correction method to modify the measurement results:

- If cuff is above the heart level location, 0.75mmHg (0.10kPa) should be added to the displayed value for per centimeter gap.
- If cuff is below the heart level location, the displayed value should minus 0.75mmHg (0.10kPa) for per centimeter gap.

1) Confirm that the monitor method is correct (monitor method displays on the upper right corner of monitor information area), if you need to change the monitor method, please enter "NIBP setting" and change "measurement model".

2) Press the " " button in the front panel and start pressure inflation.

13.2.2 Action Prompt

1) One automatic measurement

Enter "NIBP setup" menu, select the "interval", then user can choose automatic measurement interval value. Then press the " " button in the Control Panel, the system will automatically conduct measurement in accordance with set interval time.
NIBP Monitoring

⚠️ Warning

- If the time of non-invasive blood pressure in automatic pattern lasts too long, the limb that is in contact with the cuff may develop Purpura, ischemia and nerve injuries. When monitoring sick animals, you have to regularly check the color, warmth and sensitivity of distal limb. If you observe any exceptions, you have to put the cuff in another place or immediately stop blood pressure measurement.

2) Stop automatic measurement

At any point of the automatic measuring process, automatic measurement can be stopped by pressing the "\[\]" button.

3) Carry out a manual measurement

- Enter "NIBP settings" menu, choose "interval", select "manual", and then press the "\[\]" button on the Control Panel and a manual measurement will begin.
- After automatic measurement stops, press the "\[\]" button and you'll start a manual measurement. If you press the "\[\]" button again, the manual measurement will stop and continue with the automatic measurement.

4) Conduct a manual measurement in automatic measurement process

Press the "\[\]" button on the control panel to conduct a manual measurement.

5) Stop manual measurement during measurement.

Press "\[\]" button on the control panel again, to stop a manual measurement.

6) For continuous measurement

Enter "NIBP setup" menu, select "continuous " to start continuous measurement. This process will last 5 minutes.

⚠️ Warning

- If the time of non-invasive blood pressure in continuous measurement pattern lasts too long, the limb that is in contact with the cuff may develop Purpura, ischemia and nerve injuries. When monitoring sick animals, you have to regularly check the color, warmth and sensitivity of distal limb. If you observe any exceptions, you have to put the cuff in another place or immediately stop blood pressure measurement.

7) Pause in continuous measurement

At any point of the continuous measurement process, continuous measurement will be stopped by pressing the "\[\]" button.

13-4
Attention

- If you doubt reading accuracy, use the same method to check sick animal vital signs before checking the monitor function.

Warning

- If liquid splashes on the devices or accessories, especially when the liquid is likely to enter into channels or monitor, please contact the hospital's maintenance department.

13.2.3 Measurement Restrictions

According to the sick animal's condition, oscillatory measurement has some restrictions. Such measurements are looking for regular impulse waves produced by arterial pressure. In the case the sick animals’ condition makes this kind of detection difficult, measurement values become unreliable and load time increases. Users should be aware that the following conditions will interfere with the measurement method, so that pressure is not reliable or load time increases. In this case, the sick animal's condition will make measurement impossible.

1) Sick animal mobility

If sick animal is moving, shaking or in spasms, measurement will be unreliable even impossible, as these may interfere with the detection of the arterial pressure pulse and load time will be extended.

2) Arrhythmia

If sick animal has shown arrhythmia caused by irregular heart beats, measurements are unreliable or even impossible and load time will be extended.

3) Heart-Lung machine

If sick animal is connected to an artificial heart-lung machine, measure cannot be conducted.

4) Pressure Change

If within a certain time, arterial pulse pressure is being analyzed to get the measurements, when blood pressure in sick animals is rapidly changing, measurement will be unreliable or even impossible.

5) Severe Shock

If a sick animal is in serious shock or hypothermia, the pressure will be unreliable. Causes that reduce blood flowing to periphery would cause a decline in arterial pulse.

6) Limit Heart Rate

Blood pressure measurement cannot be performed when heart rate is lower than 40bpm (beats per
minute) or higher than 240bpm (beats per minute).

7) **Obese Sick animals**

A thick fat layer around a limb makes the oscillations from artery obstructed so that they cannot arrive at the cuff. Accuracy is lower than normal.

13.2.4 **NIBP parameter settings and adjustment**

Results of NIBP measurements and the corresponding information is displayed on the screen as the following layout:

![NIBP setup diagram](image)

**13.3 NIBP Settings**

There are two ways to enter "NIBP setup":

1) Click NIBP parameter area, directly enter "NIBP setup" menu;

2) Press the " " key to enter the "shortcut" window, select "main menu" in this window and enter "survey setup" menu, then select "NIBP setup". As shown in the following figure:

![NIBP setup window](image)

- **ALM**: Select "on", alarm prompt and storage are made when a pressure warning occurs. Select "off", no alert, and there is a " " prompt besides the NIBP in the parameters area of the screen.
NIBP Monitoring

- ALM LEV: "high", "med" and "low" three options. "High," is the most serious alarm.
- Sys alarm limit are based on set high common low relay and low limit, when pressure exceeds the high common low relay or below the low limit values, alarm activates.
  
  Sys alm limit, dia alm limit, map alm limit can be alarmed independently.
  
  For the high and low limits of alarm scope of NIBP Sys alm limit, dia alm limit, map alm limit, please refer to "product specifications" section.

- MEASURE MODE: big or small.
  
  Select appropriate blood pressure measurement modes: big, small.

- Pressure units (Unit): optional mmHg or kPa.

- INTERVAL:
  
  Automatic measurement time interval (in minutes). Can be 1, 2, 3, 4, 5, 10, 15, 30, 60, 90, 120, 180, 240, 480 minutes for selection. After selecting the time interval, press NIBP key to begin inflation for the first automatic measurement. If you want to stop automatic measurement, select "manual" to go back to manual mode during the measurement interval.

- Pre-inflated value (INFLATION): settable range: big vet: 200 mmHg, small vet: 100 mmHg.

- DISP COLOR: colors for parameters: green, cyan, red, yellow, white, blue, purple.

- RESET: reset of measuring status of blood pressure pump.
  
  Press the reset button, the inflated value of blood pressure pump will recover the initial settings.
  
  When blood pressure pump is not working properly but the monitor does not question why, this is the recommended key. Because it allows self checking of blood pressure pumps, allowing automatic recovery of pump exception due to some accident.

- CONTINUAL
  
  After select continuous measurement, the menu will disappear automatically and continuous measurement starts immediately; If you want to stop it, press the key of blood pressure measurement on the shell.

- CALIBRATE (pressure calibration)
  
  For calibration of NIBP pressure, it should be carried out at least every two years or when do you think the value is not accurate.

- Leak detection (pneumatic)
  
  For detecting the closed conditions of NIBP gas path.

- Default Select this item to enter "NIBP default config" dialog box, the user can choose "no" or "Yes" to exit or select "Will adopt the default config! The previous configure will be lost! ."
13.4 NIBP Pressure Calibration

Manufacturers recommend a calibrated pressure gauge (or mercury sphygmomanometers) with a precision more than 1mmHg to be used for calibration. Select "calibrate" to begin calibration and this item becomes "stop cal", if you press the knob right now, the system will stop the calibration.

⚠️ Warning

- Calibration of NIBP measurements should be carried out once every two years (or by your hospital's maintenance of Constitution). Machine performance should be checked as following details.

◇ Pressure sensor calibration steps:

Metal containers with a volume of 500ml+5% instead of cuffs. Connect a calibrated standard gauge with measurement error of less than 0.8mmHg, a spherical air pumps with a t-interface and inflatable tubes attached to NIBP jack on the module. Set the monitor to "calibration" mode, and then inflate the metal containers with ball type air pump to pressure of 0,50 and 200 mmHg respectively. The difference of pressure value between standard pressure gauge and monitor should be within the 3mmHg. Otherwise, please contact the Our company maintenance engineers.

![Fig. 13-3 calibration of NIBP connection diagram](image)

13.5 NIBP Leak detection

Used to detect whether the NIBP measurement pump leaks, when switch in NIBP cuffs, it can be used to start the NIBP inflation process to find out if the closed conditions of NIBP gas does well. If air leakage test is passed, the system does not make any messages; Otherwise there is a corresponding error message in NIBP information area.
NIBP Monitoring

Leak detection process:

a) Connect the cuff and NIBP to the opening of the monitor.
b) Wrap the cuff around a cylinder with proper size.
c) Enter "NIBP settings" menu.
d) Turn the knob, move the cursor to "leak testing", press the knob. "Leak detection …" will display beneath the NIBP parameters area on the screen. The system has began to perform leak detection.
e) System automatically inflated to the pressure of 180mmHg.
f) After about 20 seconds, the system will automatically open the valve, which means leakage measurement is complete.

If there are no message in NIBP parameter area, it means the system leakage phenomenon does not exist. If "pump leak …" appears, it means that gas leakage may exist. Operators should check whether the entire connection is loose. After confirming the connection, then conduct a leak detection again. If there is still a fault prompt, please contact the manufacturer for maintenance.

Fig. 13-4  NIBP leak detection connection diagram

Warning

This leak detection is different from those described in the standard EN 1060-1, which is for users to simply test air leakage in NIBP inflation. If the system displays the NIBP leaks at the end of testing, please contact the Our company maintenance engineers.

13.6 Maintenance and Cleaning

1) The maintenance and cleaning of reusable blood pressure cuffs.

Cuffs can be disinfected through regular high pressure sterilization in a hot air oven, gas or radiation sterilization, or immersion in decontamination solution. But keep in mind you want to remove the rubber bag when using this method. Cuff can not be dry cleaned. Cuff can be machine washed or
NIBP Monitoring

hand washed. Hand washing can prolong life. Before cleaning, remove the latex rubber bag. After cleaned cuffs dry, put the bag into it again. To mount the rubber bag back into the cuff, put the bag on the head-end of the cuff, so that the rubber hose and the large opening on the long side of the cuff line up, then roll up the bag longitudinally and insert into the large opening, hold the leather hose and cuffs, shake the entire cuff until the rubber bag is in place. Put the hose into cuff and put it through small holes line. See the following figure:

Fig. 13-5 Replace the cuff tape

2) Disposable blood pressure cuffs

Disposable blood pressure cuff can only be used for a specific sick animal. Do not use the same cuff for different sick animals.

Disposable cuffs may not be disinfected or given high pressure steam sterilization. Disposable cuffs can be cleaned with SOAP to control infection.
14.1 Temperature Monitoring

This monitor has two temperature measurement channels. With the temperature probe you can measure the body temperature data.

14.1.1 Temperature Measuring Set

If you are using a disposable temperature probe, the temperature probe should be inserted into the socket, then connect the probe to the cable. For reusable temperature probe, it can be directly inserted into the socket.

The temperature probe should be applied to the sick animal firmly.

Power up the system

⚠️ Warning

- At the beginning of monitoring, you should check that the probe cable is normal. Then unplug the temperature probe cable from the jack, the screen will display the message "temperature sensor is off" and sound the alarm.
- Be careful in handling the temperature probe and cable, when not in use, the probe and cable should be pulled into the loose ring. If the wire is pulled too tight, it will lead to mechanical damage.
- Calibrate the temperature measuring instrument at least once every two years (or according to the required time in the hospital directive rules). Please contact the manufacturer when calibration is needed.

⚠️ Attention

- Disposable temperature probe can only be used once.
- During the monitoring process, the temperature measuring instrument will automatically check itself once per hour. Self-checking will last 2 seconds, and will not affect the normal working of the temperature monitor.

14.2 TEMP Settings

Enter "TEMP Setup" in two ways

a) Click the TEMP parameter region and you can directly enter the "TEMP setup" menu;
b) By pressing the " " key to enter the window of "shortcut" , select "main menu", enter "survey setup " menu, then choose" TEMP Setup". As shown in the following illustration:

14-1 TEMP setup

- **Alarm switch (ALM):** If selecting "on" it will alarm and store when TEMP (body temperature) alarm is activated. If selecting "off" it will not alarm, and there would be reminder " 🚨 " near "TEMP" on the screen parameter area.

- **ALM LEV:** For setting an alarm level, available options are " high"," medium"," low".

- **Body temperature alarm limit (TEMP ALM LIMIT):** Temperature alarm is set according to the high limit and low limit, it will alarm when the temperature exceeds the high limit or low limit.

- **TD ALM HI:** When the two temperature difference TD exceeds the alarm limit, TD alarms.
  
  For temperature and TD alarm range please refer to the "product standard" chapter.

- **Temperature unit:** To choose Celsius degree or Fahrenheit degree.

- **TEMP UNIT:** Choose ℃ or ℉.

- **Disp color:** colors for parameters: green, cyan, red, yellow, white, blue, purple.

- **Default**
  Select the "TEMP default config" dialog box, and users can separately select "Yes" or "No" to exit or select "Will adopt the default config ! The previous configure will be lost !".

### 14.3 Maintenance and Cleaning

**Warning**

- Turn off the power and disconnect the AC power supply before cleaning monitor or the connected sensor.
Maintenance and cleaning of the reusable temperature probe:

- It can only tolerate the temperature from 80 degrees Celsius (176 degrees Fahrenheit) to 100 degrees Celsius (212 degrees Fahrenheit) for a short time.
- Probe cannot be disinfected by steam. It can only be disinfected by alcohol-containing detergent.
- When using straight beam probe, please use a protective cover to shield it.
- When cleaning the probe, one hand holds the head end, another hand with a damp lint free cloth scrubs the probe in the direction of the probe connector.

⚠️ Attention

- If you are using a disposable temperature probe, do not clean and reuse.
- In order to protect the environment, disposable temperature probes should be recycled or disposed of properly.
15.1 General

This instrument measures sick animal airway CO₂ pressure, allows acquisitions of end-tidal CO₂ (EtCO₂), inspiratory CO₂ (Ins CO₂) and airway respiration rate (AWRR) and displays CO₂ pressure waveform.

This monitor employs side-stream and mainstream measurement modes for the measurement of CO₂.

- In the side-stream measurement mode, the respiratory gases through sick animal airways are sampled with a constant sampling flows and analyzed by remote CO₂ sensors built in the measurement system.
- In the mainstream measurement mode, CO₂ sensors are mounted on an airway joint that is directly inserted into the respiratory system of a sick animal.

CO₂ is measured to provide (with CO₂ as option):

- CO₂ Waveform.
- End-tidal CO₂ (EtCO₂): CO₂ measured at the end-tidal moment.
- Minimal inspiratory CO₂ (Ins CO₂): the minimal value measured during intake period.
- Airway Respiration Rate (AWRR): respiration rate per minute derived from CO₂ waveform.

⚠️ Warning

● Impact or vibration of CO₂ should be avoided whenever possible.

⚠️ Attention

● Don't use this instrument where combustible anesthetic gases are present in the environment.
● This instrument can be operated only by well-trained staff who are familiar with this operation manual.

The CO₂ switch is set to on in the option "XX wave setup", and the figure (in Demonstration Mode) as below will be obtained:
15.2 Measuring Principle and Working Process

The CO₂ measuring principle is mainly based on the characteristic that CO₂ can absorb the infrared rays having a wavelength of 4.3µm. The measuring method works as follows: Gaseous CO₂ is introduced to a measuring chamber of which one side is irradiated by infrared rays, and sensors are employed to measure the attenuation degrees of received infrared rays at the other side of the measuring chamber, and the attenuation degree is directly proportional to the CO₂ concentrations. The comparison expression for the conversion between CO₂ partial pressure and CO₂ concentration is:

\[
\text{CO}_2 \text{ Partial Pressure (mmHg)} = \text{CO}_2 \text{ Concentration (％)} \times \text{Pamp (Ambient Pressure)}
\]

CO₂ Module: adopting Autorun instruction measurement mode, and the waveform is sampled once in every 31 milliseconds.

15.3 CO₂ Operation Instruction

(1) The schematic of connection of the mainstream module produced by the RESPIRONICS company is shown in the figure below:
(2) The schematic of connection of the sidestream module produced by the RESPIRONICS company is shown in the figure below:

Fig. 15-3 (A,B,C) Sidestream CO₂ Connection Diagram

(3) The schematic of connection of the ISA™ sidestream analyzer produced by the PHASEIN company is shown in the figure below:

Figure 15-4 ISA™ Sidestream Analyzer (ISA CO₂) CO₂ Connection Schematic

(4) The schematic of connection of the IRMA™ mainstream analyzer produced by the PHASEIN company is shown in the figure below:
The monitoring equipment produced by this company supports CO₂ measurement by using a sidestream or mainstream module produced by the IRONICES company, or an ISA™ sidestream analyzer (ISA CO₂ (CO₂) CAT. NO. 800101) produced by the PHASEIN company.

**Attention**

- When an ISA™ sidestream analyzer (ISA CO₂ (CO₂) CAT. NO. 800101) produced by the PHASEIN company is used for monitoring CO₂, please refer to the contents of the section titled “17.6 Measuring Procedure and Before-Using Checking” for the measuring procedure, and change the procedure for setting the AG module menu to CO₂ menu setting.

**Warning**

- CO₂ should be closed when not used, otherwise, the service life of the CO₂ modules will be reduced due to their long-time non-stop operations.
- Before use, please check airway joints. Don't use when visible damage or breaks are found on the airway adapter.

### 15.4 CO₂ Measurement Procedures

Based on different CO₂ modules used, determine if it is necessary to set such menu items as “O₂ Compen”, “Balan Gas”, “Altitude(m)” and “baro pre” etc for the instrument. When an ISA™ sidestream analyzer (ISA CO₂ (CO₂) CAT. NO. 800101) produced by the PHASEIN company is used, if there are no such settings as altitude and atmospheric pressure etc, it means that such functions have been carried by the module itself, need not to be set manually. Please refer to the instruction manual coming with the module.

If you need the CO₂ alarm message function, you can set this function in “CO₂ Setup”.

15-4
15.5 Measuring Procedure of RESPIRONICS Branded Mainstream and Sidestream Modules

a) Start the monitor, and click the waveforms of Channel II on the screen if RESP waveform or SpO₂ waveforms are displayed on the Channel II on the standard interface; after entering the Menu, select "CO₂" in the option "Switch Wave", and then return to the standard interface, and CO₂ monitoring will be displayed on the interface. (The operations following Step I can be skipped when CO₂ waveforms are already displayed on Channel II on the standard interface.)

b) Then the CO₂ module is connected with the monitor (by referring to Fig. 15-2 or Fig. 15-3 depending on the types of CO₂ modules).

c) Click CO₂ within parameter region, oxygen compensation is set in the menu "CO₂ Setup"; when at the sea level, 16 is recommended;

d) Select proper equilibrium gases in the menu "CO₂ Setup": room air, N₂O or helium (It is generally OK to select room air when no N₂O gas or helium is used indoors);

e) Readjust accurate atmospheric pressure by setting “altitude[m]” in the menu "CO₂ Setup": 0 ~ 5029.2m, with an instrument default of 0 m; when CO₂ values are on the high or low side, please select appropriate atmospheric pressure by referring to the following table;

<table>
<thead>
<tr>
<th>Sea-Level Elevation</th>
<th>Atmospheric Pressure</th>
<th>5%CO₂ ETCO₂ mmHg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inch</td>
<td>m</td>
<td>mmHg</td>
</tr>
<tr>
<td>Sea Level (0)</td>
<td>Sea Level (0)</td>
<td>760</td>
</tr>
<tr>
<td>500</td>
<td>152.4</td>
<td>745</td>
</tr>
<tr>
<td>750</td>
<td>228.6</td>
<td>738</td>
</tr>
<tr>
<td>1,000</td>
<td>304.8</td>
<td>731</td>
</tr>
<tr>
<td>1,500</td>
<td>457.2</td>
<td>717</td>
</tr>
<tr>
<td>2,000</td>
<td>609.6</td>
<td>704</td>
</tr>
<tr>
<td>2,500</td>
<td>762</td>
<td>690</td>
</tr>
<tr>
<td>3,000</td>
<td>914.9</td>
<td>677</td>
</tr>
<tr>
<td>3,500</td>
<td>1066.8</td>
<td>665</td>
</tr>
<tr>
<td>4,000</td>
<td>1219.2</td>
<td>652</td>
</tr>
<tr>
<td>Value</td>
<td>CO2</td>
<td>Temp</td>
</tr>
<tr>
<td>--------</td>
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<tr>
<td>16,500</td>
<td>5029.2</td>
<td>405</td>
</tr>
<tr>
<td>16,800</td>
<td>5120.6</td>
<td>400</td>
</tr>
</tbody>
</table>

Note: 760mmHg is assumed at the sea level, at 0°C. Calculation of Atmospheric Pressure: the sea-level based ambient temperature is assumed as 0°C. Refer to the above Table.

⚠️ **Warning**

By setting sea-level elevation, the monitor is not automatically changed with air pressure compensations. Correct sea-level elevation must be set before the first use of CO2.
Measurement Program. Improper setting of sea-level elevation will result in incorrect CO2 readings. A 5% CO2 deviation is generally generated corresponding to difference of each 1000m height.

f) Select calibration in the menu"CO2 Setup" and a hint will appear in the lower right corner on the interface when the calibration is finished: In calibration, please wait for 30s, and then CO2 measurement can be commenced when the hint disappears.

15.6 Measuring Procedure of PHASEIN Branded Sidestream and Mainstream Analyzers

The PHASEIN branded sidestream analyzer operating procedure is roughly the same as the mainstream analyzer operating procedure; please refer to the sidestream analyzer operating procedure for the mainstream analyzer operating procedure.

15.6.1 Measurement Steps

If you want to set the host monitoring equipment in order to start gas analysis, please execute the following procedure:

a) Start the host monitoring equipment (if a minihost is used, please start the minihost monitoring equipment at the same time).

b) Or insert the CO2 plug-in module into the host monitoring equipment; the indicator of the CO2 plug-in module will illuminate, which means that the module has been successfully connected to the host monitoring equipment; otherwise, please reinsert the CO2 plug-in module.

c) Connect the Nomoline sampling tube to the input interface of the ISA analyzer (CO2 module)

d) Connect the interface cable of the ISA analyzer to the CO2 interface of the host.

e) Enter into the conventional screen of the host monitoring equipment, select [Switch Wave] to call out the “CO2” waveform and parameters which you want to monitor, such as [CO2] (this step can be skipped if the screen has already displayed the “CO2” waveform and parameters).

f) When the CO2 module is connected to the monitor, its module working mode is in the “On” state; however, in order to make sure that it is in the correct working state, please do enter into the [CO2 Setup] menu to set its “CO2 On” to the [On] mode.

g) Set appropriate [O2 Compen], [Laughing Gas Compensation].

h) To connect the outlet of the sample gas to the discharge system, or to make the gas to flow back to the sick animal’s circuit.

i) If it is green LED indication, ISA Analyzer is available.
j) To carry out inspection before use according to the statement in the “check before use”.

k) If the inspection is normal, start to monitor the CO2 Gas.

### 15.6.2 Check before use

Before connecting the Nomoline sampling pipe to the breathing circuit, carry out the following steps:

a) Connect the sampling tube to the gas entrance interface (LEGI) of the ISA CO2 module.

b) Check whether the green light of LEGI is steadily on or not (The indication system is normal).

c) Exhale to the sampling tube, check if a valid CO2 waveform and value are displayed on the host monitoring equipment.

d) Use the finger tip to block up the sampling pipe, and hold on for 10 seconds.

e) Examine whether there is obstruction warning and if the LEGI shows a red flashing light.

f) Under proper circumstances: Carry out enclosure check on the sick animal’s circuit that is linked with the sampling pipe.

---

**Attention**

- If the interface shows the prompt of ‘no connection to the oxygen sensor’, please reinstall the oxygen sensor.

- The end of the gas circuit adapter which connects the gas sampling pipe should point upward so as to prevent the condensing water drops entering the gas sampling pipe and blocking it up.

---

**Warning**

- Hang the external CO2 analyzer onto the CO2 bracket on the rear casing of the instrument; prevent the dropping damage of the CO2 module.

- Unless HME is used to protect the IRMA probe, the state indicating LED should face upward all the time during IRMA probe placement.

- Do not pull the cable of ISA By-flow Gas Analyzer.

- Do not operate the ISA By-flow Gas Analyzer in the environment beyond the designated...
CO₂ Monitoring

- Make sure all connections are firm and reliable. Any leakage will result in the inclusion of ambient air in the sick animals respiratory gas, which leads to a wrong reading.

15.7 CO₂ Setting

15.7.1 CO₂ Wave Setup

Click the waveforms on Channel II displayed on the screen; when the current waveform is CO₂ waveform, directly enter the menu. When the current waveform is RESP waveform or SpO₂ Waveform, select “CO₂” in the "Switch wave" after entering the menu, and then reenter the menu, specifically as shown in Figure as below:

![Fig.15-4 CO₂ Wave Setup](image)

- Waveform Speed(sweep): three kinds of respiratory wave speeds available are: 6.25mm/s, 12.5mm/s and 25.0mm/s.
- Wave type: Fill or Line.
- Switch wave: Waveforms displayed on Channel II can be switched via this menu when this monitor simultaneously provides monitoring of SpO₂, CO₂ and RESP.

15.7.2 CO₂ Setting

Enter "CO₂ Setup" and three modes via the following three methods:

a) In case that no CO₂ parameters are displayed, click the waveforms on Channel II and enter "×× Wave Setup", and set the "Switch wave" as "CO₂", and click again the waveforms on Channel II, then the menu "CO₂ Setup" can be traced;

b) In case there are CO₂ parameters displayed, just click CO₂ parameter region and directly enter the menu "CO₂ Setup".
c) Enter the window "Shortcut" by pressing the button " " and select "Main Menu" in this window to enter the menu "Survey setup", and select "CO2 Setup", as shown in Figure below:

Fig.15-5 CO2 Setup

- Warning Switch (ALM): Select "On", then alarming hints are given when CO2 alarming is triggered, while select "off", alarming hints will not be given and an icon prompt " " will appear beside the parameter region on the screen.

- Warning Levels(ALM LEV): Three Options: "High", "Med" and "Low". "High" indicates the most critical warning.

- DISPLAY PARAMETER: CO2, INS and AwRR, which can be selected in the parameter display region as the one to be displayed.

- UNIT: mmHg and kPa.

- O2 COMPEN: Adjustable Range: 0~100.(RESPIRONICS); HIGH,MED LOW(PHASEIN)

- BALAN GAS: room air, N2O, helium. (PHASEIN have not the option)

- Sea-Level Elevation(altitude): 0~5029.2 mmHg (It can be properly conditioned in different localities and the atmospheric pressure varies with the regulations of sea-level elevations.) (PHASEIN have not the option)

- Atmospheric Pressure (BARO PRE): 400~850 mmHg, Defaulted at 760 mmHg, Displayed grey and Non-adjustable. (PHASEIN have not the option)

- CO2 ALM LIMIT: Operable to re-setting of CO2 warning upper and lower limits. Warning prompts are given when CO2 measured values are running either above its upper limits or below its lower limits.

- INS Warning Upper Limit (INS ALM HI ): Operable to re-setting of INS warning upper limits.
CO₂ Monitoring

Warning prompts are given when the INS measured value runs above its upper limits.

- AWRR Warning Limit (AwRR ALM LIMIT): Operable to re-setting of AWRR warning upper and lower limits. Warning prompts are given when the INS measured value runs either above its upper limits or below its lower limits.

- Suffocation Warning (APNEA ALM): Adjustable Range: No, 10s, 15s, 20s, 25s, 30s, 35s and 40s. This function is deactivated when the option None is selected. When "10 s" is selected, the monitor will give warning prompts when the suffocation lasts for 10 seconds without an interruption. Warning is given similarly when other options are selected.

- Wave Colour: waveform display colour: Green, Cyan, Red, Yellow, White, Blue and Purple. Waveform is consistent with measured parameters in colour.

- Calibration (ZERO CAL): It is suggested that calibration be conducted before CO₂ monitoring in the interest of measured data of higher precisions.

- CO₂ Default Configuration (Default): Original setting will be overwritten.

15.8 Discharging Waste Gases

When nitrous oxide and/or an anesthetic gas is used, you should prevent these gases from polluting the operating room. Usually the gas discharging outlet should be connected to (via the gas discharging pipe connected to the sample gas outlet of the host equipment):

A discharging system (used for discharging collected gases) or the sick animal circuit (used for the back flowing of collected gases).

⚠️ Warning

- Anesthetics: When an anesthetic which is being used or a sick animal who recently used an anesthetic is measured, the gas discharging hole on the module must be connected to a waste gas processing system or the sick animal circuit (on the anesthesia machine or the respirator), so as to prevent medical personnel from inhaling the anesthetic.

15.9 Maintenance and Cleaning of RESPIRONICS Branded Mainstream and Sdestream Modules

15.9.1 Common Cleaning

Clean with cloth, optionally dipped with 70% isopropanol, aqueous solution containing 10% sodium hypochlorite (bleacher), sterilizing spray cleaner (such as Steris Coverage Spray HB), ammonia
water or mild soap water. Before cleaning, wash the cloth with rinse water and then wring out and air-dry the washed cloth. Make sure that sensor windows are clean and are air-dried before being used repeatedly.

15.9.2 Airway Adapter for Cleaning Reusable Mainstream Sensor

Rinse it with warm soapy water first and soak it in liquid sterilizing fluid, such as 70% isopropanol, aqueous solution containing 10% sodium hypochlorite (bleacher), 2.4% glutaraldehyde solvent, e.g. Cidex Plus or Steris System 1 or ammonia water. Wash it with clean water completely.

15.9.3 Method for Sterilizing Reusable Adapter

Autoclave Sterilizer-operable only to big-used adapters.

Ethylene oxide (ETO)- Sterilizing for 1.5h.

Soaking in Cidex Plus for 10h.

Soaking in Perasafe for 10h.

U.S. Steris System 1 pasteurizer.

Before adapters are reused, please make sure that the windows are dried without any residuals and that adapters stand intact during operation or cleaning/sterilization.

15.9.4 Sterilization Times for Reusable Airway Adapter

The reusable airway adapters can be reused 100 times if the above sterilization method is used.

15.9.5 Zeroing

Please zero before monitoring CO₂; zeroing is to eliminate the effect of baseline drifting on the results during measurement, thus ensuring the correctness of measured results.

Usually, the module will zero itself automatically when necessary. The user can zero the module manually when the user considers it necessary: Select [CO₂] in the parameter area, in the [CO₂ Setup] menu popping up, select [Zero cal] to zero the CO₂ module. During zeroing, make sure that the sick animal circuit is exposed to the ambient air (21% oxygen and 0% CO₂) for approximately 30 seconds; when the 30s zeroing prompt on the screen ends, it means zeroing is completed.
15.10 PHASEIN Branded Mainstream and Sidestream Analyzer

Related Information

15.10.1 Safety Alarm Information

15.10.1.1 ISA Sidestream Gas Analyzer Safety Warning Information

⚠️ Warning

- The ISA sidestream gas analyzer is designed to be used by authorized or trained medical personnel.
- Only Nomoline sampling tubes produced by PHASEIN can be used.
- The ISA sidestream gas analyzer shall not be used in an inflammable anesthetic gas.
- You should earnestly neaten the sampling tube in order to reduce the risk of it wrapping or reining the sick animal.
- Do not repeatedly use a disposable sampling tube.
- Do not lift the ISA/host equipment by grasping the sampling tube; otherwise it may break away from the ISA/host equipment, which may result in that the ISA/host equipment falls onto the sick animal.
- Used disposable sampling tubes should be disposed according to local medical waste stipulations.
- Do not use the ISA sidestream gas analyzer together with a quantitative spraying agent or spray; otherwise it may result in the clogging of the germ filter.
- Check if the flowing speed of the gas sample is too high for the given sick animal type.
- Since successful zeroing requires that the gas analyzer exists in the ambient air (21% oxygen and 0% CO₂), you should make sure that the ISA is placed at a well ventilated position. Before and after executing the zeroing procedure, avoid breathing in the vicinity of the ISA sidestream gas analyzer.
- The Nomoline sampling tube and its interface are not germ free devices. In order to prevent the sampling tube from causing damages, please never carry out high pressure sterilization on any part of the sampling tube.
- Never disinfect the ISA sidestream gas analyzer or soak it into a liquid.
- Mobile and radio frequency communication equipment will affect measurement. Make sure that the ISA gas analyzer is used in the electromagnetic environment designated in this operating instruction manual.
- The ISA gas analyzer can only be used as a piece of auxiliary equipment for patent
evaluation. It must be used together with other vital sign and symptom evaluation equipment.

- If the input interface of the sampling tube starts showing red blinking, or a Nomoline clogging message is displayed on the host, the sampling tube should be replaced.
- It is not allowed to alter this equipment without the manufacturer’s authorization. If this equipment is altered, appropriate checking and testing must be conducted in order to make sure that it can be safely operated over a long period of time.
- The ISA gas analyzer is not designed for being used in a MRI environment.
- During MRI scanning, the host equipment must be placed outside the MRI room.
- Using high frequency electrosurgical equipment in the vicinity of the ISA/host equipment may produce interference, which will result into incorrect measurements.
- Do not use the external natural heat dissipation function of the ISA equipment.
- Do not apply a negative pressure (such as using a syringe) onto the Nomoline to remove condensed water.
- If the positive or negative pressure in the sick animal circuit is too high, it may affect the sample's flowing speed.
- If the discharging or sucking pressure is too high, it may affect the sample's flowing speed.
- The discharged gas should be discharged into the sick animal circuit, or into a discharging system.
- If the collected gas sample needs to supply air for respiration, a germ filter should be used at the discharging side all the time.
- When placing the ISA gas analyzer, try not to place it at a position where the analyzer might fall onto the sick animal's body.

### 15.10.1.2 IRMA Mainstream Gas Analyzer Safety Warning Information

⚠️ **Warning**

- If the airway adapter has water drops/condensation, it should be replaced.
- Use an IRMA airway adapter made by PHASEIN.
- When an energized part is contacted, sufficient protection should be provided to the host equipment.
- Only an adapter cable approved by PHASEIN AB can be used.
- A warning must be implemented in the host equipment, displayed during demonstrative data displaying.
• The host equipment should be equipped with an appropriate alarm system to remind the user of circumstances which may cause death or serious damages to the sick animal’s health.
• Every corresponding alarm message in IRMA state abstract fields must be implemented in the host equipment.
• The IRMA probe is not designed to be contactable to the sick animal.
• Incorrect probe zeroing will result in false gas readings.
• The IRMA probe is designed for being used by authorized or trained medical personnel.
• The IRMA probe is not designed shall not be used in an inflammable anesthetic gas.
• A disposable IRMA airway adapter shall not be used repeatedly. Repeatedly using a disposable adapter will cause cross infection.
• Used disposable airway adapters should be disposed according to local medical waste stipulations.
• Only oxygen sensors made by PHASEIN can be used. Oxygen exhausted oxygen sensors should be disposed according to local battery disposal stipulations.
• Never try to open the oxygen sensor device. The oxygen sensor in the IRMA probe is a disposable product, containing corrosive electrolytes and lead.
• The IRMA probe is designed only as an auxiliary means for sick animal evaluation. It must be used together with other vital sign and symptom evaluation equipment.
• Never place the IRMA airway adapter somewhere between the trachea catheter and the elbow; otherwise it may result in the adapter window being clogged by the sick animal’s secretions and operating errors.
• In order to prevent secretions and moisture from aggregating at the window and the oxygen sensor port, always place the IRMA probe at a vertical position and let the LED face upwards.
• Never use the IRMA airway adapter together with a quantitative spraying agent or spray; otherwise it may affect the light traveling of the airway adapter window.
• If an IRMA OR (without the automatic anesthetic gas identification function) user select a wrong anesthetic gas, it will result in false anesthetic gas readings.
• If the IRMA OR (without the automatic anesthetic gas identification function) is applied to a mixed gas containing several anesthetic gases, it will result in false anesthetic gas readings.
• Mobile and radio frequency communication equipment will affect measurement. You should make sure that the IRMA probe is used in the electromagnetic environment designated in this operating instruction manual.
● Never disinfect the IRMA probe or soak it into a liquid.
● The IRMA oxygen cell and the IRMA airway adapter are not germ free devices. Never carry out high pressure sterilization on the equipment; otherwise it will result in equipment damage.
● Even if an IRMA probe has not been used, do not install an oxygen exhausted oxygen cell on the probe.
● Do not stretch the sensor cable.
● Do not run this equipment beyond the temperature environment designated by this operating instruction manual.
● (USA): According to the federal law, this product can only be sold by doctors or based on prescriptions.

15.10.2 Zeroing
An infrared gas analyzer needs to determine the zero reference level for CO₂ measurement. This zeroing standard is called as “zeroing” here.

Automatic Zeroing
（1）The ISA sidestream gas analyzer execute zeroing automatically by switching the gas sample from the respiration circuit to the ambient air. To execute automatic zeroing once every 24 hours, the ISA sidestream gas analyzer takes less than 3 seconds. If the ISA sidestream gas analyzer is equipped with an oxygen sensor, automatic zeroing also includes the indoor air calibration of the oxygen sensor.

（2）IRMA CO₂ probes:
Zeroing needs to be performed ONLY when an offset in gas values is observed, or when an unspecified accuracy message is displayed.

Allow 10 seconds for warm up of the IRMA CO₂ probe after power on and after changing the IRMA airway adapter before proceeding with the Zeroing Procedure. The green LED on the probe will be blinking for approximately 5 seconds while zeroing is in progress.

Manual Zeroing
Select [CO₂] in the parameter area, in the [CO₂ Setup] menu popping up, select [Zeroing] to zero the CO₂ module. During zeroing, make sure that the sick animal circuit is exposed to the ambient air (21% oxygen and 0% CO₂) for approximately 30 seconds; when this menu is in a non default (settable) condition, zeroing can be executed.
Warning

- Since successful zeroing requires that the gas analyzer exists in the ambient air (21% oxygen and 0% CO₂), you should make sure that the ISA/IRMA is placed at a well ventilated position. Before and after executing the zeroing procedure, avoid breathing in the vicinity of the ISA/IRMA gas analyzer.

15.10.3 Fault handling

When the sampling system of CO₂ module is abnormal, first check if the tube is knotted. If the input interface of sampling tube flashes red or Nomoline jam message shown on the screen, then replace the sampling tube.

When the anesthetic gas airway is obstructed, on the screen there will be such a prompt message as “The anesthetic gas airway is obstructed”; under such a circumstance, replace the Nomoline sampling tube.

Warning

- Do not use the ISA gas analyzer together with a quantitative spraying agent or pulverization treatment; otherwise it may result in the clogging of the germ filter.

15.10.4 Calibration

Sidestream CO₂ module does not Gases analyzer together with a quantitative spraying agent or pulverization treatment; otherwise

When nitrous oxide and/or an anesthetic gas is used, you should prevent these gases from polluting the operating room. Usually the gas discharging outlet should be connected to (via the gas discharging pipe connected to the sample gas outlet of the host equipment):

A discharging system (used for discharging collected gases) or the sick animal circuit (used for the back flowing of collected gases).

Warning

- Anesthetics: When an anesthetic which is being used or a sick animal who recently used an anesthetic is measured, the gas discharging hole on the module must be connected to a waste gas processing system or the sick animal circuit (on the anesthesia machine or the respirator), so as to prevent medical personnel from inhaling the anesthetic.

15.10.5 Safety Symbol Information

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<thead>
<tr>
<th>Reminding Symbol</th>
<th>Symbol Text, Color Code and Description Text Format</th>
<th>Description</th>
</tr>
</thead>
</table>

15-17
<table>
<thead>
<tr>
<th>![i]</th>
<th>ISA operating instructions</th>
<th>Please refer to ISA operating instructions</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Catalog number</td>
<td></td>
</tr>
<tr>
<td>![SN]</td>
<td>Serial number</td>
<td></td>
</tr>
<tr>
<td>![LOT]</td>
<td>Lot No.:</td>
<td></td>
</tr>
<tr>
<td>![alarm]</td>
<td>Effective period: [YYYY-MM-DD]</td>
<td>The equipment can no longer be run after the date nearby the symbol.</td>
</tr>
<tr>
<td>![no repeat]</td>
<td>No repeated usage</td>
<td></td>
</tr>
<tr>
<td>![waste]</td>
<td>Waste electronic and electrical equipment (WEEE) directives</td>
<td>Electrical and electrical equipment which should be reclaimed in accordance with 2002/96/EC directives</td>
</tr>
<tr>
<td>![CE]</td>
<td>European Union</td>
<td>In conformity with 93/42/EEC medical equipment directives when connected to medical equipment approved by PHASEIN AB</td>
</tr>
<tr>
<td>0413</td>
<td>Carbon dioxide</td>
<td>ISA equipment measures CO₂ only</td>
</tr>
<tr>
<td>![CO2]</td>
<td>Gas inlet</td>
<td></td>
</tr>
<tr>
<td>![gas]</td>
<td>Gas outlet (discharge)</td>
<td></td>
</tr>
<tr>
<td>![sick]</td>
<td>Sick animal circuit connection</td>
<td>Illustration of the connection of Nomoline to the sick animal circuit</td>
</tr>
<tr>
<td>![connected]</td>
<td>Connected to ISA</td>
<td>Illustration of the connection of Nomoline to ISA</td>
</tr>
<tr>
<td>![latex]</td>
<td>Non germ free, no containing latex</td>
<td>This product is not a germ free device, does not contain latex.</td>
</tr>
</tbody>
</table>

**15.10.6 Cleaning the Analyzer**

The “Plug in and measure” ISA & IRMA gas analyzer should be cleaned regularly. Use ethanol or isopropyl alcohol with a maximum concentration of 70% and a wet rag to clean the analyzer.

In order to prevent the cleaning liquid and dust from entering into the ISA gas analyzer from the LEGI interface, the Nomoline sampling tube should be connected all the time during analyzer cleaning.
15.10.7 Patents and Trademarks

(1) Patent Statement
PHASEIN AB owns the following patents for relevant products described in this operating instruction manual: SE519766; SE519779; SE523461; SE524086. Other patents are being applied.

(2) Trademark
PHASEIN IRMA™, PHASEIN ISA™, PHASEIN XTP™, Sigma Multigas Technology™, LEGI™, Nomoline™, IRMA EZ Integrator™, PHASEIN GasMaster™ and ISA MaintenanceMaster™ are trademarks of PHASEIN AB.

Tygothane® is a registered trademark of Saint-Gobain Performance Plastics Corporation.

15.10.8 CO₂ Module Lighting Information

Overview of States Indicated by LEGI:

<table>
<thead>
<tr>
<th>Indicating Signal</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not blinking green light</td>
<td>The system is normal</td>
</tr>
<tr>
<td>Blinking green light</td>
<td>Zeroing</td>
</tr>
<tr>
<td>Not blinking red light</td>
<td>Sensor Error</td>
</tr>
<tr>
<td>Blinking red light</td>
<td>Checking the sampling tube/airway adapter</td>
</tr>
</tbody>
</table>

15.10.9 Adverse Effects on Performance

(1) The following circumstances can cause known adverse effects on indicated performance:

- Quantitative effects of humidity or condensation.
- Quantitative effects of atmospheric pressure.
- Disturbing gases or water vapor.
CO₂ Monitoring

(2) Gas measurement unit

Volume percentage is used as the unit of concentration of a reported gas. Concentration is defined below:

\[
\%\text{gas} = \frac{\text{Partial pressure of gas component}}{\text{Total pressure of gas mixture}} \times 100
\]

The total pressure of a mixed gas is measured by the cup pressure sensor in the ISA gas analyzer. If you want to convert it into another unit, you can use the actual atmospheric pressure sent by the ISA sidestream analyzer; for example:

\[
\text{CO}_2 \text{ (mmHg)} = (\text{CO}_2) \times (\text{atmospheric pressure (kPa)} \text{ from the ISA}) \times \left(\frac{750}{100}\right).
\]

For example: 5.0 vol% CO₂ @ 101.3 kPa  \[0.05 \times 101.3 \times 750 / 100 = 38 \text{ mmHg}\]

(3) Effects of Moisture

The partial pressure and volume percentage of CO₂, N₂O, oxygen or an anesthetic gas depend on the content of water vapor in the measured gas. Oxygen measurement will be calibrated; at the actual ambient temperature and humidity level, 20.8 vol%, instead of the actual partial pressure, will be displayed. 20.8 vol% of oxygen corresponds to the actual oxygen concentration of indoor air (the water concentration is 0.7 vol%) (for example: at 1013 hPa, corresponding to 25°C and 23% RH). The actual partial pressure at the current humidity level will be displayed all the time when CO₂, N₂O, oxygen and anesthetic gases (all the gases measured the infrared cell) are measured.

In the pulmonary alveoli of a sick animal, the water vapor in breathing gases become saturated at the body temperature. After breathing gases is collected and sent into the sampling tube, their temperature gets near to the ambient temperature before they enter into the ISA sidestream gas analyzer. After Nomoline has removed all the condensed water, water molecules will not enter into the ISA sidestream gas analyzer. The relative humidity of all the gases collected is approximately 95%.

If you need the CO₂ value under BTPS, you can use the following equation:

\[
\text{EtCO}_2(BTPS) = \text{EtCO}_2 \times \left(1 - \left(\frac{3.8}{\text{Pamb}}\right)\right)
\]

Where:

- \(\text{Et CO}_2\) = Et CO₂ value [vol %] sent by the ISA
- \(\text{Pamb}\) = Atmospheric pressure [kPa] sent by the ISA
- 3.8 = Typical partial pressure [kPa] of water vapor condensed between the sick animal’s circuit and the ISA
CO₂ Monitoring

Et CO₂ (BTPS) = Et CO₂ gas concentration [vol%] under BTPS

It is assumed that standard oxygen of indoor air has been used at a humidity level of 0.7 vol% H₂O

15.10.10 Consumables

The Nomoline sampling tube cannot be used repeatedly.
Replace the Nomoline sampling tube every two weeks or when “The sampling tube is clogged” is displayed (based on whichever comes first).

15.10.11 Maintenance

The user should verify gas readings regularly; If finding any problem, please contact an engineer of the manufacturer for maintenance.
Appendix I Appendix

The following accessories are recommended when you use the monitor.

⚠️ **Warning**

Please select the accessory types specified by the manufacturer. Or, the monitor might be damaged.

**Standard accessories:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Material No.</th>
<th>Material name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>040-000148-00</td>
<td>Earth code (type B)</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>040-000343-00</td>
<td>Veterinary blood pressure cuff</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>040-000344-00</td>
<td>Veterinary blood pressure cuff</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>040-000345-00</td>
<td>Veterinary blood pressure cuff</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>040-000346-00</td>
<td>Veterinary blood pressure cuff</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>040-000347-00</td>
<td>Veterinary blood pressure cuff</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>040-000072-00</td>
<td>Neonatal blood pressure conduct</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>040-000385-00</td>
<td>general cavity with 10k temperature probe</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>040-000639-00</td>
<td>NELLCOR patch cord</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>040-000382-00</td>
<td>5 clip-on guide American Standard one-line beast intentions conductance</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>040-000248-00</td>
<td>Power adapter</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>040-000253-00</td>
<td>The power cord gb plum blossom end</td>
<td>1</td>
</tr>
</tbody>
</table>
## Appendix

<table>
<thead>
<tr>
<th>No.</th>
<th>Material No.</th>
<th>Material name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>040-000649-00</td>
<td>Veterinary blood oxygen probe</td>
<td>1</td>
</tr>
</tbody>
</table>

### Optional accessories:

<table>
<thead>
<tr>
<th>No.</th>
<th>Material No.</th>
<th>Material name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>040-000639-00</td>
<td>NELLCOR patch cord</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>040-000649-00</td>
<td>Veterinary oxygen probe</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>040-000312-00</td>
<td>Analog oxygen probe / adult / finger clip</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>040-000023-00</td>
<td>Fixed cable slot</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>040-000381-00</td>
<td>3 lip-on guide American Standard one-line beast intentions conductance</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>040-000382-00</td>
<td>5 lip-on guide American Standard one-line beast intentions conductance</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>040-000383-00</td>
<td>3 European standard guide carefully integrated clip-beast-line conductance</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>040-000384-00</td>
<td>5 European standard guide carefully integrated clip-beast-line conductance</td>
<td>1</td>
</tr>
</tbody>
</table>
Appendix II  Product Specification

1  Monitor type

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>classified by electric shock</td>
<td>belongs to Class I, Type CF application part, Type BF application part</td>
</tr>
<tr>
<td>protection</td>
<td>anti-defibrillator devices with internal power supply Among which</td>
</tr>
<tr>
<td></td>
<td>except for the cardiac electrophysiologic detecting part, which</td>
</tr>
<tr>
<td></td>
<td>belongs to Type CF application part, other detecting part belong to</td>
</tr>
<tr>
<td></td>
<td>Type BF application part</td>
</tr>
<tr>
<td>anti-leakage extent</td>
<td>Common seal apparatus, without anti-leakage character</td>
</tr>
<tr>
<td>Disinfection / sterilization</td>
<td>Refer to Chapter 8 -15 for details</td>
</tr>
<tr>
<td>methods</td>
<td>work mode</td>
</tr>
</tbody>
</table>

2  Monitor Specifications

(1) Size and weight

<table>
<thead>
<tr>
<th>Name</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size and weight</td>
<td>Size: 190mm× 82mm×105mm</td>
</tr>
<tr>
<td></td>
<td>Weight: 1.5kg</td>
</tr>
</tbody>
</table>

(2) Environment requirement

<table>
<thead>
<tr>
<th>Name</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working</td>
<td>Environment temperature range</td>
</tr>
<tr>
<td>environment</td>
<td>Relative humidity range</td>
</tr>
</tbody>
</table>
### Product Specification

<table>
<thead>
<tr>
<th>Supply voltage requirement</th>
<th>Atmospheric pressure range</th>
<th>70kPa~106kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>Supply voltage</td>
<td>convert a.c.100V~240V alternating current power supply into 15V direct current power supply with a power adapter</td>
</tr>
<tr>
<td>Power frequency</td>
<td>Power frequency</td>
<td>50Hz/60Hz±1Hz</td>
</tr>
<tr>
<td>Input electricity</td>
<td>Input electricity</td>
<td>1A-0.5A</td>
</tr>
<tr>
<td>DC voltage</td>
<td>DC voltage</td>
<td>d.c.12V</td>
</tr>
<tr>
<td>Fuse</td>
<td>Fuse</td>
<td>WH16-200 16V 2A</td>
</tr>
<tr>
<td>Transport:</td>
<td>Must avoid severe shock, vibration, rain and snow during transport</td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>Packed monitors must be stored in well ventilated rooms with -20℃ ~ +55℃ temperature, relative humidity no more than 80%, and without corrosive gases</td>
<td></td>
</tr>
</tbody>
</table>

(3) Displayer specification

<table>
<thead>
<tr>
<th>Name</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>display</td>
<td>4.3 inches 24-bit color LCD displayer</td>
</tr>
<tr>
<td>display information</td>
<td>maximum 2 waveforms display</td>
</tr>
<tr>
<td>Resolution</td>
<td>480×272</td>
</tr>
</tbody>
</table>

(4) Battery

<table>
<thead>
<tr>
<th>Name</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery Specifications</td>
<td>12V Lithium Battery</td>
</tr>
<tr>
<td>Charging time</td>
<td>In normal uses, charging requires at least 6 hours</td>
</tr>
</tbody>
</table>
**Product Specification**

| Working time | In fully-charged normal-using conditions, battery can continuously work for at least 2 hours. After the alarm for low power, there is still power for 5 minutes’ use |
| Emergency transport package (optional) | Adding an emergency transport package can lengthen the battery life by 8 hours |

(5) Data Storage

<table>
<thead>
<tr>
<th>Name</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trend data</td>
<td>Short trend 1h, Resolution 1sec</td>
</tr>
<tr>
<td></td>
<td>Long trend 48h, Resolution 1min</td>
</tr>
<tr>
<td>Parameter alarm event</td>
<td>100 times</td>
</tr>
<tr>
<td>NIBP Measurement data</td>
<td>1000 sets</td>
</tr>
<tr>
<td>Arrhythmia Review</td>
<td>100 times</td>
</tr>
<tr>
<td>Waveform holographic Review</td>
<td>25 min</td>
</tr>
</tbody>
</table>

(6) ECG Specification

<table>
<thead>
<tr>
<th>Name</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range and accuracy of heart rate detection</td>
<td>Big: 15<del>300bpm; Small: 15</del>350bpm ±1% or ±1bpm (both maximum)</td>
</tr>
<tr>
<td>Upper and lower limits and error of alarm</td>
<td>Big: Upper limit of alarm (lower limit +2)bpm<del>300bpm lower limit of alarm 15bpm</del>(upper limit -2) bpm Small: Upper limit of alarm (lower limit +2)bpm~350bpm</td>
</tr>
</tbody>
</table>
Product Specification

<table>
<thead>
<tr>
<th></th>
<th>lower limit of alarm 15 bpm～(upper limit -2) bpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate alarm occurring time</td>
<td>&lt; 12s</td>
</tr>
<tr>
<td>cardiac electrophysiology channel bandwidth</td>
<td>Monitoring mode: 0.5～40 Hz;</td>
</tr>
<tr>
<td></td>
<td>Diagnostic mode: 0.05～130 Hz;</td>
</tr>
<tr>
<td></td>
<td>Surgical mode: 1～20 Hz.</td>
</tr>
<tr>
<td>Lead selection</td>
<td>Standard 3,5</td>
</tr>
<tr>
<td>Lead mode</td>
<td>Five lead ( R, L, F, N, C or RA, LA, LL, RL, V)</td>
</tr>
<tr>
<td>Lead fashion</td>
<td>I, II, III, avR, avL, avF, V</td>
</tr>
<tr>
<td>Waveform display</td>
<td>1 Channel</td>
</tr>
<tr>
<td>Lead mode</td>
<td>3 leads ( R, L, F or RA, LA, LL)</td>
</tr>
<tr>
<td>Lead fashion</td>
<td>I, II, III</td>
</tr>
<tr>
<td>Waveform display</td>
<td>1 channel</td>
</tr>
<tr>
<td>Electrode disconnection</td>
<td>Automatic detection display</td>
</tr>
<tr>
<td>Indication</td>
<td></td>
</tr>
<tr>
<td>Scanning speed</td>
<td>12.5、25、50 mm/s</td>
</tr>
<tr>
<td>Gain selection</td>
<td>×1/4、×1/2、×1、×2、auto</td>
</tr>
<tr>
<td>Cardiac Electrophysiology Noise level</td>
<td>≤25μVP-P.</td>
</tr>
<tr>
<td>Cardiac Electrophysiology Input loop current</td>
<td>≤0.1μA</td>
</tr>
<tr>
<td>Input impedance</td>
<td>≥5MΩ</td>
</tr>
<tr>
<td>Anti-jamming capability</td>
<td>Sick animals who presented on 10 V common-mode signal</td>
</tr>
</tbody>
</table>
suppression, through Calibrator simulation tests, all leads were simulated electrode access - Skin unbalanced impedance (51 kΩ and 0.047 μF capacitor in parallel) case, the output amplitude does not exceed 10 mm.

<table>
<thead>
<tr>
<th>Time constant</th>
<th>Monitoring mode: ≥0.3s; Diagnosis mode: ≥3.2s.</th>
</tr>
</thead>
<tbody>
<tr>
<td>protection for defibrillator discharge</td>
<td>Recovery time no more than 5s after resetting</td>
</tr>
<tr>
<td>Leakage current</td>
<td>&lt; 10 uA</td>
</tr>
<tr>
<td>ECG Signal detection range</td>
<td>±8 mV</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Heart rate algorithm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tall T wave Inhibition</td>
</tr>
<tr>
<td>Average heart rate</td>
</tr>
<tr>
<td>Heart rate calculation accuracy and response to arrhythmia</td>
</tr>
</tbody>
</table>
(7) Respiration specification

<table>
<thead>
<tr>
<th>Name</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Way</td>
<td>Thoracic impedance method</td>
</tr>
<tr>
<td>Respiration rate detection and accuracy</td>
<td>Measuring range</td>
</tr>
<tr>
<td></td>
<td>Big 6bpm-120bpm</td>
</tr>
<tr>
<td></td>
<td>Small 6bpm-150bpm</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±1bpm</td>
</tr>
<tr>
<td>Accuracy and error of preset alarm of</td>
<td></td>
</tr>
<tr>
<td>respiration rate</td>
<td>Big</td>
</tr>
<tr>
<td></td>
<td>Upper limit not narrower than (lower limit +2)bpm-120bpm</td>
</tr>
<tr>
<td></td>
<td>Lower limit not narrower than 6bpm-(upper limit -2)bpm</td>
</tr>
<tr>
<td></td>
<td>Small</td>
</tr>
<tr>
<td></td>
<td>Upper limit not narrower than (lower limit +2)bpm-150bpm</td>
</tr>
</tbody>
</table>
## Product Specification

<table>
<thead>
<tr>
<th></th>
<th>Lower limit not narrower than 6bpm-(upper limit -2) bpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error</td>
<td>±1bpm</td>
</tr>
</tbody>
</table>

| Range and error of suffocation alarm | Scope: | 10s ~ 40s | Error | ±5s. |

### (8) NIBP specification

<table>
<thead>
<tr>
<th>Name</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring mode</td>
<td>Automatic oscillation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement range and accuracy</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range for big</td>
<td>Systolic blood pressure 5.3-36kPa (40-270mmHg)</td>
</tr>
<tr>
<td></td>
<td>Diastolic blood pressure 1.3-28.7kPa (10-215mmHg)</td>
</tr>
<tr>
<td></td>
<td>Mean blood pressure 2.7-31.3kPa (20-235mmHg)</td>
</tr>
<tr>
<td>Measurement range for small</td>
<td>Systolic blood pressure 5.3-26.7kPa (40-200mmHg)</td>
</tr>
<tr>
<td></td>
<td>diastolic pressure 1.3-20kPa (10-150mmHg)</td>
</tr>
<tr>
<td></td>
<td>Mean blood pressure 2.7-22kPa (20-165mmHg)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±5mmHg, when non-invasive BP exceeds the above range, the monitor can still display normally, but without accuracy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range and accuracy of static pressure</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope:</td>
<td>should be 0mmHg ~ 300mmHg (0~40.0kPa)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>should be ±3mmHg (0.4kPa)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range and tolerance of</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>big mode</td>
<td>300mmHg (39.9kPa)</td>
</tr>
<tr>
<td>small mode</td>
<td>240mmHg (31.9kPa)</td>
</tr>
<tr>
<td>overvoltage protection</td>
<td>tolerance</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>big</td>
<td>Systolic blood pressure</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diastolic pressure</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>small</td>
<td>Mean blood pressure</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Systolic blood pressure</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diastolic pressure</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Product Specification

<table>
<thead>
<tr>
<th>Blood pressure measurement mode</th>
<th>Mean blood pressure</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual, automatic (periodic), continuous</td>
<td>Upper limit: 2.9kPa ~ 22kPa (22-165mmHg)</td>
<td>±0.1kPa or±1mmHg (Both maximum)</td>
</tr>
<tr>
<td></td>
<td>Lower limit: 2.6kPa ~ 21.7kPa (20-163mmHg)</td>
<td></td>
</tr>
</tbody>
</table>

**Test interval of automatic mode**
- 1、2、3、4、5、10、15、30、60、90、120、180、240、480min
- Continuous: 5min

### (9) SpO₂ specification

<table>
<thead>
<tr>
<th>Name</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display range</td>
<td>1%~100%</td>
</tr>
<tr>
<td>Display Resolution</td>
<td>1%</td>
</tr>
</tbody>
</table>
| Detection accuracy       | a) Digital SPO₂: Within range of 0%~100%; In the range of 70%~100%, measurement accuracy of ±2% (non-motion);  
                          | b) Nellcor SPO₂: Within range of 0%~100%; In the range of 70%~100%, measurement accuracy of ±2% (non-motion);  
                          | In other areas, not the definition of the measurement accuracy.                 |
| Upper and lower limit of alarm preset and accuracy | Upper and lower limit of alarm: (lower limit +1)%~100%  
 |                                                        | Lower limit of alarm: 0%~(upper limit -1)%  
 |                                                        | ±1%                                                                            |
### (10) Pulse rate specification

<table>
<thead>
<tr>
<th>Name</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detection range and accuracy</td>
<td><strong>a) Digital SPO2</strong>&lt;br&gt;Within range of 25bpm ~ 250bpm; Resolution: 1bpm, Measurement error ±1bpm.</td>
</tr>
<tr>
<td></td>
<td><strong>b) Nellcor SPO2</strong>&lt;br&gt;Within range of 20bpm ~ 300bpm; Resolution: 1bpm, Measurement error in the 20bpm ~ 250bpm range should be ±3bpm; not defined in 251bpm ~ 300bpm inside.</td>
</tr>
<tr>
<td>Alarm setting and accuracy</td>
<td><strong>Upper limit of alarm:</strong> lower limit +1bpm ~ 300bpm, Lower limit of alarm: 0bpm ~ upper -1bpm; Accuracy: ±1bpm</td>
</tr>
</tbody>
</table>

### (11) TEMP specification

<table>
<thead>
<tr>
<th>Name</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range and accuracy</td>
<td><strong>Detection range</strong>: 0°C ~ 50°C</td>
</tr>
<tr>
<td></td>
<td><strong>Measurement error</strong>: ±0.1°C</td>
</tr>
<tr>
<td>Alarm setting and accuracy</td>
<td><strong>Alarm setting range</strong>: Upper limit of alarm should be (lower limit +0.1)°C ~ 50.0°C&lt;br&gt;Lower limit of alarm should be 0°C ~ 49.9°C</td>
</tr>
<tr>
<td></td>
<td><strong>Alarm error</strong>: ±0.1°C</td>
</tr>
<tr>
<td>Display resolution</td>
<td><strong>0.1°C</strong></td>
</tr>
<tr>
<td>Number of channels</td>
<td><strong>Dual-channel</strong></td>
</tr>
</tbody>
</table>
## (12) CO₂ specification

<table>
<thead>
<tr>
<th>Name</th>
<th>Specifications</th>
</tr>
</thead>
</table>
| CO₂ measuring range           | 0mmHg~150mmHg, 0%~19.7%, 0kPa~20kPa (at 760mmHg).  
Atmospheric pressure is provided by the main engine |
| CO₂ Resolution                | 1mmHg or 0.1kPa or 0.1%                                                     |
| CO₂ Accuracy                  | 0mmHg~40mmHg should be ±2mmHg;                                              |
|                               | 41mmHg~70mmHg should be ±5%;                                               |
|                               | 71mmHg~100mmHg should be ±8%;                                              |
|                               | 101mmHg~150mmHg should be ±10%.                                             |
| Setting range and error of alarm | **Scope:** 0 mmHg~150mmHg or 0 kPa~20kPa (at 760mmHg)                      |
|                               | **Error** ±0.1kPa or ±1mmHg                                                 |
Appendix III  System Alarm Information

Some of the most important physiological and technical alarm information is listed in this section, however, some might not be included.

XX represents the mode name or physiological parameter of some module in systems such as HR, ST1, ST2, PVCs, RR, TEMP (including TEMP 1, TEMP 2 and TD), SpO₂, PR, CO₂ (including AwRR and INS), NIBP (NS, NM and ND), and so on.

A corresponding remedy is offered following each warning. If the problem still exists after the remedy, please contact the maintenance crew.

1) Physiological alarm

<table>
<thead>
<tr>
<th>Origin</th>
<th>alarm</th>
<th>alarm levels</th>
<th>Causes:</th>
<th>Remedies:</th>
</tr>
</thead>
<tbody>
<tr>
<td>XX</td>
<td>Too high XX</td>
<td>An user’s option</td>
<td>XX is beyond the upper value of the alarm limit.</td>
<td>Check the alarm limiting values, or the sick animal’s current condition.</td>
</tr>
<tr>
<td></td>
<td>Too low XX</td>
<td>An user’s option</td>
<td>XX is below the lower value of the alarm limit.</td>
<td></td>
</tr>
<tr>
<td>ECG</td>
<td>Too weak ECG signals</td>
<td>High</td>
<td>The sick animal’s ECG signals are too weak for ECG analysis by the system.</td>
<td>Check the connections of the electrodes and the lead cords, and the sick animal’s current condition.</td>
</tr>
<tr>
<td></td>
<td>ASYSTOLE (cardiac arrest)</td>
<td>High</td>
<td>Asystole arrhythmias occurs in the sick animal.</td>
<td>Check the sick animal’s current condition and the connections of the electrodes and the lead cords.</td>
</tr>
<tr>
<td>Origin</td>
<td>alarm</td>
<td>alarm levels</td>
<td>Causes:</td>
<td>Remedies:</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------------------</td>
<td>--------------</td>
<td>-------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>VFIB/VTAC</td>
<td>(ventricular fibrillation/tachycardia)</td>
<td>High</td>
<td>Ventricular fibrillation or tachycardia occurs in the sick animal.</td>
<td>Check the sick animal’s current condition and the connections of the electrodes and the lead cords.</td>
</tr>
<tr>
<td>COUPLET</td>
<td>(couplet premature ventricular contractions)</td>
<td>Average</td>
<td>Couple premature ventricular contractions occur in the sick animal.</td>
<td>Check the sick animal’s current condition and the connections of the electrodes and the lead cords.</td>
</tr>
<tr>
<td>BIGEMINY</td>
<td>(bigeminy coupled rhythm)</td>
<td>Average</td>
<td>Premature ventricular contractions in a bigeminy coupled rhythm occur in the sick animal.</td>
<td>Check the sick animal’s current condition and the connections of the electrodes and the lead cords.</td>
</tr>
<tr>
<td>TRIGEMINY</td>
<td>(trigeminy rhythm)</td>
<td>Average</td>
<td>Premature ventricular contractions in a trigeminy rhythm occur in the sick animal.</td>
<td>Check the sick animal’s current condition and the connections of the electrodes and the lead cords.</td>
</tr>
<tr>
<td>R ON T</td>
<td></td>
<td>Average</td>
<td>R ON T arrhythmia occurs in the sick animal.</td>
<td>Check the sick animal’s current condition and the connections of the electrodes and the lead cords.</td>
</tr>
</tbody>
</table>
## Product Specification

<table>
<thead>
<tr>
<th>Origin</th>
<th>alarm</th>
<th>alarm levels</th>
<th>Causes:</th>
<th>Remedies:</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC (premature ventricular contractions)</td>
<td>Average</td>
<td>Premature ventricular contractions occur in the sick animal.</td>
<td>Check the sick animal’s current condition and the connections of the electrodes and the lead cords.</td>
<td></td>
</tr>
<tr>
<td>TACHY (tachycardia)</td>
<td>Average</td>
<td>Tachycardia occurs in the sick animal.</td>
<td>Check the sick animal’s current condition and the connections of the electrodes and the lead cords.</td>
<td></td>
</tr>
<tr>
<td>BRADY (bradycardia)</td>
<td>Average</td>
<td>Bradycardia occurs in the sick animal.</td>
<td>Check the sick animal’s current condition and the connections of the electrodes and the lead cords.</td>
<td></td>
</tr>
<tr>
<td>VT &gt; 2 (multiple premature ventricular contractions)</td>
<td>Average</td>
<td>Multiple premature ventricular contractions occur in the sick animal.</td>
<td>Check the sick animal’s current condition and the connections of the electrodes and the lead cords.</td>
<td></td>
</tr>
<tr>
<td>MISSED BEATS (missed beats)</td>
<td>Average</td>
<td>Missed beats occur in the sick animal.</td>
<td>Check the sick animal’s current condition and the connections of the lead cords.</td>
<td></td>
</tr>
</tbody>
</table>
## Product Specification

<table>
<thead>
<tr>
<th>Origin</th>
<th>alarm</th>
<th>alarm levels</th>
<th>Causes:</th>
<th>Remedies:</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNP</td>
<td>(Pacemaker non-pacing)</td>
<td>Average</td>
<td>The pacemaker does not pace.</td>
<td>Check the connections of the pacemaker, the electrodes and the lead cords as well as the sick animal’s current condition.</td>
</tr>
<tr>
<td>PNC</td>
<td>(Pacemaker non-capturing)</td>
<td>Average</td>
<td>The pacemaker signals are not captured.</td>
<td>Check the connections of the electrodes and the lead cords, and the sick animal’s current condition.</td>
</tr>
<tr>
<td>SpO₂</td>
<td>Pulse missing</td>
<td>High</td>
<td>The sick animal’s pulse signals are too weak for pulse analysis by the system.</td>
<td>Check the connection of the sensor and the sick animal’s current condition.</td>
</tr>
<tr>
<td>RESP</td>
<td>RESP asphyxia</td>
<td>High</td>
<td>The sick animal’s respiration signals are too weak for RESP signal analysis by the system.</td>
<td>Check the connections of the lead cords and the sick animal’s current condition.</td>
</tr>
<tr>
<td>CO₂</td>
<td>RESP asphyxia</td>
<td>High</td>
<td>The sick animal’s respiration signals are too weak for RESP signal analysis by the system.</td>
<td>Check the connections of the lead cords and the sick animal’s current condition.</td>
</tr>
</tbody>
</table>
### Product Specification

<table>
<thead>
<tr>
<th>Origin</th>
<th>alarm</th>
<th>alarm levels</th>
<th>Causes:</th>
<th>Remedies:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Others:</td>
<td>Alarm pause</td>
<td>None</td>
<td>Alarming is artificially suspended.</td>
<td>Press the Silence/Reset button again to restore the normal alarming function.</td>
</tr>
</tbody>
</table>

### (2) Technical alarm information:

<table>
<thead>
<tr>
<th>Origin</th>
<th>Alarm</th>
<th>Alarm levels</th>
<th>Causes:</th>
<th>Remedies:</th>
</tr>
</thead>
<tbody>
<tr>
<td>XX</td>
<td>Initialization errors of the XX module</td>
<td>High</td>
<td>An initialization error of the XX module occurs.</td>
<td>Restart the machine for another try. If the same problem still exists, please contact the manufacturer.</td>
</tr>
<tr>
<td>XX</td>
<td>XX module communication failure</td>
<td>High</td>
<td>The XX module cannot communicate with the main system.</td>
<td></td>
</tr>
<tr>
<td>XX</td>
<td>XX communication errors</td>
<td>High</td>
<td>The XX module cannot communicate normally with the main system.</td>
<td></td>
</tr>
<tr>
<td>XX</td>
<td>XX alarm limit errors</td>
<td>High</td>
<td>The parameters of the XX alarm limits are altered accidentally.</td>
<td>Please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td>XX</td>
<td>XX out-of-range measurement</td>
<td>High</td>
<td>The XX parameter goes beyond the measurement range of the system.</td>
<td>Please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td>ECG</td>
<td>ECG lead shedding</td>
<td>Low</td>
<td>The ECG lead cords do not have a good</td>
<td>Check the connections of the ECG lead cords.</td>
</tr>
<tr>
<td>Origin</td>
<td>Alarm</td>
<td>Alarm levels</td>
<td>Causes:</td>
<td>Remedies:</td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>--------------</td>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td></td>
<td>ECG YY lead shedding</td>
<td>Low</td>
<td>The ECG YY lead cords do not have a good connection.</td>
<td>Check the connections of the YY lead cords.</td>
</tr>
<tr>
<td></td>
<td>Too strong interference in ECG</td>
<td>High</td>
<td>Strong interference appears in the ECG signals.</td>
<td>Check the connections of the ECG lead cords and the sick animal’s current condition to make sure whether the interference is caused by movement.</td>
</tr>
<tr>
<td></td>
<td>ARR on-going learning</td>
<td>None</td>
<td>The formation of the ORS wave template is in process.</td>
<td>The status will terminates after the ARR learning finishes.</td>
</tr>
<tr>
<td></td>
<td>ECG lead shedding</td>
<td>Low</td>
<td>The ECG lead cords do not have a good connection.</td>
<td>Check the connections of the ECG lead cords.</td>
</tr>
<tr>
<td>SpO2</td>
<td>SpO2 shedding off the finger</td>
<td>Low</td>
<td>The SpO2 sensor has fallen off the finger.</td>
<td>Check the connection of the SpO2 sensor.</td>
</tr>
<tr>
<td></td>
<td>No probe connected to</td>
<td>Low</td>
<td>The SpO2 sensor does not have a good connection.</td>
<td>Check the connection of the SpO2 sensor.</td>
</tr>
</tbody>
</table>
## Product Specification

<table>
<thead>
<tr>
<th>Origin</th>
<th>Alarm</th>
<th>Alarm levels</th>
<th>Causes:</th>
<th>Remedies:</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpO₂</td>
<td>Low</td>
<td>The system is reset due to NELLCOR module breakdowns.</td>
<td>If the system cannot be reset or the same problem still exists after system re-start, please contact the manufacturer for maintenance.</td>
<td></td>
</tr>
<tr>
<td>SpO₂ sensor shedding</td>
<td>Low</td>
<td>The SpO₂ sensor does not have a good connection or the sick animal has moved their arm.</td>
<td>Check the connection of the SpO₂ sensor and the sick animal’s current condition.</td>
<td></td>
</tr>
<tr>
<td>Pulse searching</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEM P2</td>
<td>TEMP1 sensor shedding</td>
<td>Low</td>
<td>The TEMP sensor does not have a good connection.</td>
<td>Check the connection of the TEMP sensor.</td>
</tr>
<tr>
<td></td>
<td>TEMP2 sensor shedding</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NIBP</td>
<td>NIBPself-checking</td>
<td>Low</td>
<td>NIBP errors occur during initialization.</td>
<td>Select the Reset function in the NIBP menu. If the same problem still exists after reset, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td></td>
<td>NIBP</td>
<td>Low</td>
<td>NIBP communication</td>
<td>Select the Reset function</td>
</tr>
<tr>
<td>Origin</td>
<td>Alarm</td>
<td>Alarm levels</td>
<td>Causes:</td>
<td>Remedies:</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------------------</td>
<td>--------------</td>
<td>----------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>communication errors</td>
<td></td>
<td>Low</td>
<td>errors occur.</td>
<td>in the NIBP menu. If the same problem still exists after reset, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td>Cuff loosening or connection failure</td>
<td></td>
<td>Low</td>
<td>The NIBP cuff does not have a good connection.</td>
<td>Please reconnect the NIBP cuff.</td>
</tr>
<tr>
<td>Gas leak</td>
<td></td>
<td>Low</td>
<td>The NIBP cuff has a poor connection, or there are gas leaks in the gas path.</td>
<td>Check the connections of different sections, or replace the cuff. If the problem still exists, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td>Air pressure errors</td>
<td></td>
<td>Low</td>
<td>Errors occur during curve measurement, which incapacitates the system in performing measurement analysis calculation.</td>
<td>Check the connections of different sections, or replace the cuff. If the problem still exists, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td>Too weak signals</td>
<td></td>
<td>Low</td>
<td>Errors occur during curve measurement, which incapacitates the system in performing</td>
<td>Check the sick animal type setup, the connections of different sections, or replace the cuff. If the</td>
</tr>
<tr>
<td>Origin</td>
<td>Alarm</td>
<td>Alarm levels</td>
<td>Causes:</td>
<td>Remedies:</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------</td>
<td>--------------</td>
<td>-------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Out-of-range pressure</td>
<td>Low</td>
<td>Low</td>
<td>Errors occur during curve measurement, which incapacitates the system in performing measurement analysis calculation.</td>
<td>Check the connections of different sections, or replace the cuff. If the problem still exists, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td>Arm move</td>
<td>Low</td>
<td>Low</td>
<td>The sick animal has moved their arm.</td>
<td>Check the connections of different sections, or place the cuff. If the problem still exists, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td>Overpressure protection</td>
<td>Low</td>
<td>Low</td>
<td>There may be folding in the gas path.</td>
<td>Check the gas path and the sick animal’s current condition, and then perform measurement again. If the alarm still exists, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td>Signal</td>
<td>Low</td>
<td>Low</td>
<td>Errors occur during measurement analysis calculation.</td>
<td>Check the gas path and the</td>
</tr>
<tr>
<td>Origin</td>
<td>Alarm</td>
<td>Alarm levels</td>
<td>Causes:</td>
<td>Remedies:</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------</td>
<td>--------------</td>
<td>-------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>saturation</td>
<td>curve measurement,</td>
<td>Low</td>
<td>which incapacitates the system in performing measurement analysis</td>
<td>sick animal’s current condition, and then perform measurement again. If the alarm still exists, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td></td>
<td>which incapacitates</td>
<td></td>
<td>calculation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the system in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>performing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>measurement analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>calculation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump gas leak</td>
<td>There is gas leak in</td>
<td>Low</td>
<td></td>
<td>Check the connections of different sections, or replace the cuff. If the problem still exists, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td></td>
<td>the NIBP gas path.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NIBP system failures</td>
<td>Errors occur during</td>
<td>Low</td>
<td></td>
<td>Check the connections of different sections and the sick animal’s current condition, and then perform measurement again. If the problem still exists, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td></td>
<td>curve measurement,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>which incapacitates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>the system in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>performing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>measurement analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>calculation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement timeout</td>
<td>Errors occur during</td>
<td>Low</td>
<td></td>
<td>Check the connections of different sections and the sick animal’s current condition, and then perform measurement again. If the problem still exists, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td></td>
<td>curve measurement,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>which incapacitates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>the system in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>performing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>measurement analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>calculation.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Product Specification

<table>
<thead>
<tr>
<th>Origin</th>
<th>Alarm</th>
<th>Alarm levels</th>
<th>Causes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuff model errors</td>
<td></td>
<td>Low</td>
<td>incapacitates the system in performing measurement analysis calculation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>sick animal’s current condition, and then perform measurement again. If the problem still exists, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td>NIBP measurement failures</td>
<td></td>
<td>Low</td>
<td>Low Errors occur during curve measurement, which incapacitates the system in performing measurement analysis calculation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Check the connections of different sections and the sick animal’s current condition, and then perform measurement again. If the problem still exists, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td>NIBP mistaken</td>
<td>Low</td>
<td></td>
<td>Unlawful reset occurs</td>
</tr>
</tbody>
</table>
|                      |                |              | Check the NIBP gas path
## Product Specification

<table>
<thead>
<tr>
<th>Origin</th>
<th>Alarm</th>
<th>Alarm levels</th>
<th>Causes:</th>
<th>Remedies:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>reset</td>
<td></td>
<td></td>
<td>to make sure whether there in a blockage or not, and then perform measurement again. If the problem still exists, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td></td>
<td>NIBP self-checking</td>
<td>Low</td>
<td>Errors occur when NIBP initializes.</td>
<td>Select the Reset function in the NIBP menu. If the problem still exists, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td>Other alarm info</td>
<td>Button errors</td>
<td>High</td>
<td>A system fault occurs.</td>
<td>Restart the monitor. If the problem still exists, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td>Other alarm info</td>
<td>Too high voltage at 5 v</td>
<td>High</td>
<td></td>
<td>Restart the monitor. If the problem still exists, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td>Other alarm info</td>
<td>Too low voltage at 5 v</td>
<td>High</td>
<td>A power fault occurs in the system.</td>
<td></td>
</tr>
<tr>
<td>Other alarm info</td>
<td>Too high voltage at 12 v</td>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other alarm info</td>
<td>Too low voltage at 12 v</td>
<td>High</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Origin

<table>
<thead>
<tr>
<th>Alarm</th>
<th>Alarm levels</th>
<th>Causes:</th>
<th>Remedies:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too low battery energy</td>
<td>High</td>
<td>The electric energy of the battery is low.</td>
<td>Connect to alternating current and recharge the battery. If the problem still exists after 6-hour recharging, please contact the manufacturer for maintenance.</td>
</tr>
<tr>
<td>20-minute battery-powered endurance</td>
<td>Average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-minute battery-powered endurance</td>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low battery energy</td>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automatic system shutdown: xxxS</td>
<td>High</td>
<td>The electric energy of the battery is so low that the system will shut down.</td>
<td>Connect to alternating current and recharge the battery.</td>
</tr>
</tbody>
</table>

#### (3) System prompt information:

<table>
<thead>
<tr>
<th>Origin</th>
<th>Alarm</th>
<th>alarm levels</th>
<th>Causes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIBP</td>
<td>Manual measurement...</td>
<td>None</td>
<td>System prompt information is only prompted for a certain function or an on-going operational procedure.</td>
</tr>
<tr>
<td></td>
<td>Adjustment...</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gas leak detection...</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manual reset...</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Consecutive measurement...</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Please press the Restart</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>
## Product Specification

<table>
<thead>
<tr>
<th>Origin</th>
<th>Alarm</th>
<th>alarm levels</th>
<th>Causes:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>button</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Error reset</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Modular reset...</td>
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III-14
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