AccuWAVE Plus Veterinary Monitor
User's Manual

Patterson Veterinary Supply, INC.

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Preface

Thank you for using AccuWAVE Plus veterinary monitor.

In order to enable you to skillfully operate Monitor as soon as possible, we provide this user's manual with delivery. When you install and use this instrument for the first time, it is imperative that you read carefully all the information that accompanies this instrument.

Based on the need to improve the performance and reliability of the parts and the whole instrument, we sometimes will make some amendments to the instrument (including the hardware and software). As a result, there might be cases of discrepancies between the manual and the actual situation of products. When such discrepancies occur, we will try our best to amend or add materials. Your comments and suggestions are welcome.

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Statement

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The contents and version contained in this manual are subject to amendments without notification.

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Manufacturer’s Responsibility

Only under the following circumstances will manufacturer be responsible for the safety, reliability and performance of the instrument.

- All the installation, expansion, readjustment, renovation or repairs are conducted by the personnel certified by manufacturer.
- The electrical safety status at the installation site of the instrument conforms to the national standards.
- The instrument is used in accordance with the operation procedures.

Contents

Chapter 1 General Introduction

1.1 Intended Use

The veterinary monitor is intended to be used in special procedure labs and other areas of a veterinary hospital or clinic where veterinary monitoring systems are needed. The monitoring parameters include ECG、RESP、SpO2、NIBP、TEMP and CO2 continuously of animals. It can also display, review, save and print its monitoring information, and has built-in rechargeable battery, ensuring continuous monitoring of animals in the course of operation. The monitor is suitable for monitoring of vital signs of big animals like horses, mid animals like dogs and small animals like cats.

It is not intended to be used in outdoor transport applications.

1.2 About this Manual

This manual contains the instructions necessary to operate the product safety and in accordance with its function and intended use. Observance of this manual is a prerequisite for proper product performance and correct operation and ensures animals and operator safety.

This manual is based on the maximum configuration and therefore some contents may not apply to your product. If you have any question, please contact us.

This manual is an integral part of the product. It should always be kept close to the equipment so that it can be obtained conveniently when needed.

The manual is geared for clinical professionals who are expected to have a working knowledge of medical procedures, practiced and terminology as required for monitoring animals.

All illustrations in this manual serve as examples only. They may not necessarily reflect the setup or data displayed on your product.

Signs in this manual:

Warning: Means it must be strictly followed so as to prevent the operator or the animal from being harmed.

Caution: Means it must be followed so as not to damage the instrument.

Note: Important information or indications regarding the operation or use.

Warning:

- **Before putting the system into operation, verify that the equipment, connecting cables and accessories are in correct working order and operating condition.**
- **To avoid explosion hazard, do not use the equipment in the presence of flammable anesthetics, vapors or liquids.**
- **Do not open the equipment housings; electric shock hazard may exist. All servicing and future upgrades must be carried out by the personnel trained and authorized by manufacturer only.**
- **When using the equipment with electrosurgical units (ESU), make sure the animal is safe.**
- **Do not come into contact with the animal during defibrillation. Otherwise serious injury or death could result.**
- **Do not rely exclusively on the audible alarm system for animal monitoring. Adjustment of alarm volume to a low level or off may result in a hazard to the animal. Remember that alarm settings should be customized according to different animal situations and always keeping the animal under close surveillance is the most reliable way for safe animal monitoring.**
- **The physiological data and alarm messages displayed on the equipment are for reference only and cannot be directly used for diagnostic interpretation.**
- **To avoid inadvertent disconnection, route all cables in a way to prevent a stumbling hazard. Wrap and secure excess cabling to avoid risk of entanglement or strangulation by animal.**

Caution:

- **To ensure animal safety, use only parts and accessories specified in this manual.**
- **At the end of its service life, the equipment, as well as its accessories, must be disposed of in compliance with the guidelines regulating the disposal of such products. If you have any questions concerning disposal of the equipment, please contact us.**
- **Magnetic and electrical fields are capable of interfering with the proper performance of the equipment. For this reason make sure that all external devices operated in the vicinity of the equipment comply with the relevant EMC requirements. Mobile phone, X-ray equipment or MRI devices are a possible source of interference as they may emit higher levels of electromagnetic radiation.**
- **Before connecting the equipment to the power line, check that the voltage and frequency ratings of the power line are the same as those indicated on the**

equipment's label or in this manual.

- **Always install or carry the equipment properly to avoid damage caused by drop, impact, strong vibration or other mechanical force.**

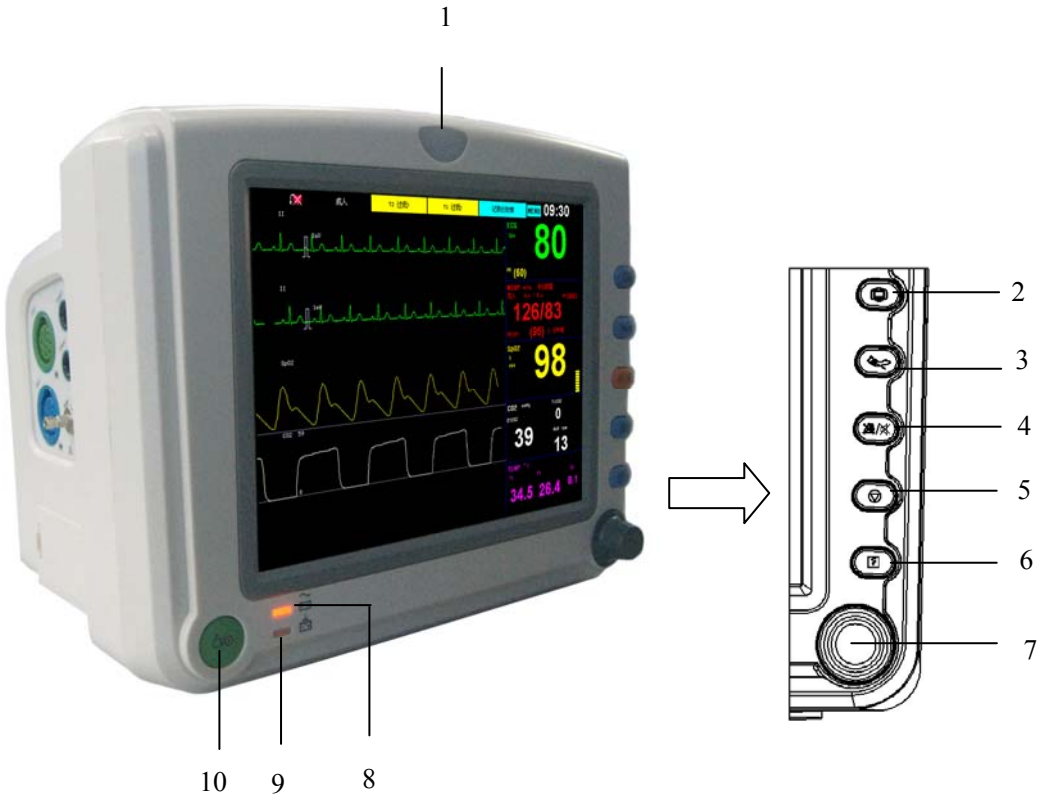
1.3 Brief Introduction to the Monitor

The monitor has features as follows:

- Multiple measuring functions include 3-lead, 7-lead ECG/HR, RESP, dual TEMP, SpO_2/Pulse, NIBP and CO_2 are optional.
- Complete built-in module design ensures stable and reliable performance
- 7-lead ECG display can facilitate the diagnosis and analysis of cardiac disease.
- Function of reviewing 10-30 minutes one important lead's EGC waveform.
- Can store the trend data for 72 hours and has the function of displaying trend data and trend graphs
- Function of alarm event reviewing, can store 1000 pieces of alarm events
- Function of NIBP measurement reviewing, can store 750 pieces of NIBP measurement data
- Built-in recorder is optional and it supports real-time recording, trigger printout by alarm
- Parameter display with big character
- Optional function of Calculator of drug concentration
- Optional function of Display of oxyCRG
- Function of Display of short trend
- 8″ authentic color high brightness TFT LCD monitor
- Portable design, stylish and convenient
- Rechargeable maintenance-free battery, can continue working when AC power is off
- Nurse call function guarantee animal alarm draws enough attention
- Support connecting to VGA display for video output.
- Can be connected with the central unit to realize centralized monitoring
- Is resistant to high-frequency electrotome and is protected against defibrillation effects

1.4 Appearance and Structure of the Monitor

1.4.1 Front View



1. Alarm indicating lamp
2. Press this button to exit the present menu and return to main screen.
3. Press this button to start or stop the NIBP measurement.
4. / Press this button in 2 seconds to make the monitor alarm paused or cancel the pause. Press and hold this button for 2 seconds can silence the monitor's audio system or cancel the silence. When the nurse call function is enabled, pressing this button can cancel the current nurse call alarm.
5. Press this button to freeze or defreeze the waveform.
6. Press this button to start or stop the real-time recording.
7. Trim Knob

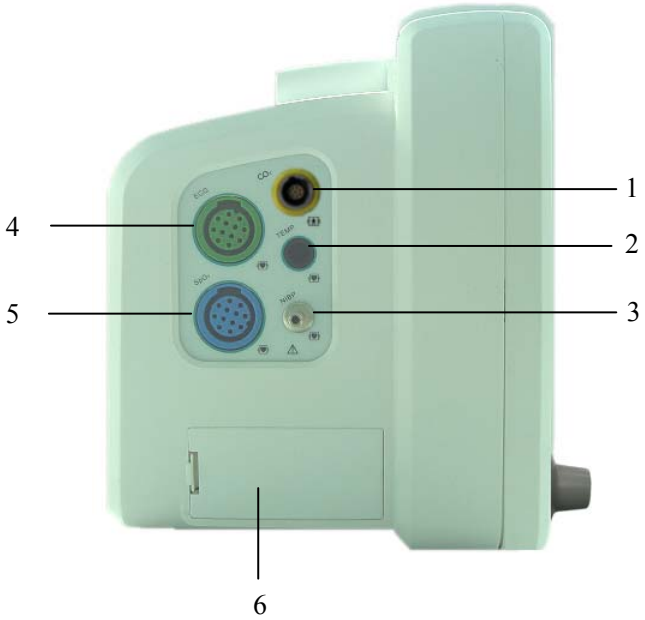
   The Trim Knob is used for:

   ◆ Turn left or turn right to move the cursor.

   ◆ Press down to perform an operation, such as open the menu dialog or select one option.

8. Power indicating lamp
   - ◆ It is illumined green when the AC power is connected.
   - ◆ It is illumined orange when the AC power is not connected and monitor is powered by battery.
   - ◆ It is turned out when the AC power is not connected.
9. Battery charging indicating lamp
   - ◆ It is illumined when the battery is being charged.
   - ◆ It is go out when the battery is fully charged or no battery in monitor
10. ⏻ Power button

1.4.2 Left View



1. CO_2 socket
2. TEMP socket
3. NIBP cuff connector
4. ECG socket
5. SpO_2 socket
6. Battery compartment

Warning: The sensor cable sockets on Monitor can only be connected with the sensor cables supplied with this instrument and no other cables shall be used.

1.4.3 Right View

1. Recorder

1.4.4 Rear View

1. AC input socket

2. Slip board of AC/DC input socket

- ◆ Slip the board to the bottom place if you want to use the AC power;
- ◆ Slip the board to the top place if you want to use the DC power.

3. 12V DC input socket

4. Network connector

Standard RJ45 socket. It is used for connection with the central monitoring system provided by manufacturer.

5. RS 232 socket / VGA display connector

◆ When this socket is RS 232 socket, it is only used for maintenance and upgrading of the monitor by the technical personnel authorized by manufacturer.

◆ When this socket is VGA display connector, it is connected to standard VGA display for secondary displaying.

6. Nurse call connector

When this socket is nurse call connector, it can be connected to nurse call system in hospital. When an alarm occurs, outputting the nurse call signal to remind nurse.

7. Potential equalization conductor terminal

Base on the requirements of safety and anti-interference, the monitor must be connected with potential equalization system individual. Connect the Potential equalization conductor terminal to the potential equalization system with the green and yellow potential equalization cable. If the protection earth system is damaged, the potential equalization system can take on the safety function of protection earth conductor.

8. Hidden handle

Caution: The AC input socket at the back panel of the monitor can be connected with 100-240V AC power by electrical wires supplied with this instrument.

1.4.5 Notes on the signs on the monitor

Signs	Notes on the signs
	Type CF applied part, defibrillation protected The unit displaying this symbol contains an F-Type isolated (floating) applied part providing a high degree of protection against shock, and is defibrillator-proof.
	Type BF applied part, defibrillation protected The unit displaying this symbol contains an F-Type isolated (floating) applied part providing a high degree of protection against shock, and is defibrillator-proof.
	Attention: Consult accompanying documents (this manual).
	Non-ionizing radiation
	Dangerous voltage
	Equipotentiality
	Alternating current (AC)
	Network connector
	Nurse call connector
	VGA display connector
	CE mark
	Symbol for the marking of electrical and electronics devices according to Directive 2002/96/EC. The device, accessories and the packaging have to be disposed of waste correctly at the end of the usage. Please follow local ordinances or regulations for disposal.

	Warning: The protection against the effects of the discharge of a cardiac defibrillator is dependent upon the appropriated cable
	Refer to this user's manual.
ECG	Short for "Electrocardiogram"
RESP	Short for "Respiration"
SpO_2	Short for "Pulse Oxygen Saturation"
TEMP	Short for "Temperature"
NIBP	Short for "Non-invasive Blood Pressure"
CO2	Short for "Carbon dioxide"

Chapter 2 Important Safety Notes

Warning: For pacemaker animals, Rate meters may continue to count the pacemaker rate during occurrences of cardiac arrest or some arrhythmias. Do not rely entirely upon rate meter alarms. Keep pacemaker animals under close surveillance. See this manual for disclosure of the pacemaker pulse rejection capability of this instrument.

Warning: Only trained doctors and nurses can use the device.

Warning: The monitor is neither a therapeutic instrument nor a device that can be used at home.

2.1 General Safety

1. Safety precautions for safe installation

- The input socket of monitor can be connected to the electrical wires and common electrical wire can be used.
- Only the power supply type of AC 100-240V 50/60Hz specified by monitor can be used.
- Connect the electrical wire to a properly grounded socket. Avoid putting the socket used for it in the same loop of such devices as the air conditioners, which regularly switch between ON and OFF.
- Avoid putting the monitor in the locations where it easily shakes or wobbles.
- Enough space shall be left around the monitor so as to guarantee normal ventilation.
- Make sure the ambient temperature and humidity are stable and avoid the occurrence of condensation in the work process of the monitor.

Warning: Never install the monitor in an environment where flammable anesthetic gas is present.

2. Monitor conforms to the safety requirements of IEC 60601-1. This monitor is protected against defibrillation effects.

3. Notes on signs related to safety

Type CF applied part, defibrillation protected

The unit displaying this symbol contains an F-Type isolated (floating) applied part providing a high degree of protection against shock, and is defibrillator-proof.

The type CF applied parts provide a higher degree of protection against electric shock than that provided by type BF applied parts.

Type BF applied part, defibrillation protected

The unit displaying this symbol contains an F-Type isolated (floating) applied part providing a high degree of protection against shock, and is defibrillator-proof.

Attention! Please refer to the documents accompanying this monitor (this manual)!

4. When a defibrillator is applied on an animal, the monitor may have transient disorders in the display of waveforms. If the electrodes are used and placed properly, the display of the monitor will be restored within 10 seconds. During defibrillation, please note to remove the electrode of chest lead and move the electrode of limb lead to the side of the limb. The electrode of the defibrillator should not come into direct contact with the monitoring electrodes. Please ensure the monitor is reliably grounded and the electrodes used repeatedly should be kept clean.

Warning: When conducting defibrillation, do not come into contact with the animal, the bed and the monitor. Otherwise serious injury or death could be resulted in.

5. To guarantee the safe operation of the monitor, Monitor is provided with various replaceable parts, accessories and consuming materials (such as sensors and their cables, electrode pads). Please use the products provided or designated by the manufacturer.

6. Monitor only guarantees its safety and accuracy under the condition that it is connected to the devices provided or designated by manufacturer. If the monitor is connected to other undesignated electrical equipment or devices, safety hazards may occur for causes such as the cumulating of the leakage current.

7. To guarantee the normal and safe operation of the monitor, a preventive check and maintenance should be conducted for the monitor and its parts every 6-12 months (including performance check and safety check) to verify the instrument can work in a safe and proper condition and it is safe to the medical personnel and the animal and has met the accuracy required by clinical use.

Caution: The monitor does not contain any parts for self-repair by users. The repair of the instrument must be conducted by the technical personnel been authorized by manufacturer.

2.2 Some Important Notes for Safety

ANIMAL NUMBER

The monitor can only be applied to an animal at one time.

INTERFERENCE

Do not use cellular phone in the vicinity of this equipment. High level of electromagnetic radiation emitted from such devices may result in strong interference with the monitor performance.

ACCIDENTAL SPILLS

To avoid electric shock or device malfunction, liquids must not be allowed to enter the device. If liquids have entered the device, take it out of service and have it checked by a service technician before it is used again.

ACCURACY

If the accuracy of any value displayed on the monitor or printed on a printout paper is questionable, determine the animal's vital signs by alternative means. Verify that all equipment is working correctly.

ALARMS

Do not rely exclusively on the audible alarm system for animal monitoring. Adjustment of alarm volume to a low level or off during animal monitoring may result in a hazard to the animal. Remember that the most reliable method of animal monitoring combines close personal surveillance and correct operation of monitoring equipment.

The functions of the alarm system for monitoring the animal must be verified at regular intervals.

BEFORE USE

Before putting the system into operation, please visually inspect all connecting cables for signs of damage. Damaged cables and connectors must be replaced immediately.

Before using the system, the operator must verify that it is in correct working order and operating condition.

Periodically, and whenever the integrity of the product is in doubt, test all functions.

CABLES

Route all cables away from animal's throat to avoid possible strangulation.

TO CLEAR ANIMAL DATA

When monitoring a new animal, you must clear all previous animal data from the system. To accomplish this, shut down the device, and then turn on it. Selecting 〈New animal〉 in〈main setup〉 menu can also clear the previous animal data.

DISPOSAL OF PACKAGE

Dispose of the packaging material, please observe the applicable waste control regulations and keeping it out of children's reach.

EXPLOSION HAZARD

Do not use this equipment in the presence of flammable anesthetics, vapors or liquids.

LEAKAGE CURRENT TEST

When interfacing with other equipment, a test for leakage current must be performed by qualified biomedical engineering personnel before using with animals.

BATTERY POWER

The device is equipped with a battery pack. The battery discharges even when the device is not in use. Store the device with a fully charged battery and take out the battery, so that the service life of the battery will not be shortened.

DISPOSAL OF ACCESSORIES AND DEVICE

Disposable devices are intended for single use only. They should not be reused as performance could degrade or contamination could occur.

The service life of this monitor is five years. At the end of its service life, the product described in this manual, as well as its accessories, must be disposed of in compliance with the guidelines regulating the disposal of such products. If you have questions concerning disposal of products, please contact manufacturer or its representatives.

EMC

Magnetic and electrical fields are capable of interfering with the proper performance of the device. For this reason, make sure that all external devices operated in the vicinity of the monitor comply with the relevant EMC requirements. X-ray equipment or MRI devices are a possible source of interference as they may emit higher levels of electromagnetic radiation. Also, keep cellular phones or other telecommunication equipment away from the monitor.

INSTRUCTION FOR USE

For continuous safe use of this equipment, it is necessary that listed instructions were followed. However, instructions listed in this manual in no way can supersede established medical practices concerning animal care.

LOSS OF DATA

Should the monitor at any time temporarily lose animal data, close animal observation or alternative monitoring devices should be used until monitor function is restored.

If the monitor does not automatically resume operation within 60 seconds, restart the monitor using the power on/off switch. Once monitoring is restored, you should verify correct monitoring state and alarm function.

2.3 Classifications

The Monitor is classified, according to IEC 60601-1 as:

Type of protection against electric shock:	I
Degree of protection against electric shock:	BF: CO_2 CF: ECG, RESP, TEMP, NIBP, SpO_2
Degree of protection against harmful ingress of water:	Ordinary Equipment (enclosed equipment without protection against ingress of water)
Degree of safety of application in the presence of a flammable anesthetic-mixture with air or with oxygen or nitrous oxide:	Not suitable
Mode of operation:	Continuous operation

I: Class I equipment

BF: Type BF applied part

CF: Type CF applied part

Not suitable: Equipment is not suitable for use in the presence of flammable anesthetic mixture with air or with oxygen or nitrous oxide.

2.4 Safe Operating and Handling Conditions

Method(s) of sterilization or disinfection recommended by the manufacturer:	Sterilization: not applicable Disinfection: See "Maintenance and Cleaning"
Electromagnetic interference	No cellular telephone nearby
Electro surgical interference damage	No damage
Diathermy instruments influence	Displayed values and prints may be disturbed or erroneous during diathermy
Defibrillation shocks	The monitor specifications fulfill the requirements of IEC 60601-1, IEC 60601-2-27, IEC 60601-2-49
Auxiliary outputs	The system must fulfill the requirements of standard IEC 60601-1

Warning: Please ensure the monitor is working under specified conditions; otherwise, the technical specifications mentioned in this manual will not be met, thus possibly leading to damage of equipment and other unexpected results.

Chapter 3 Preparations before the Use of the Monitor

3.1 Unpacking and Checking

▭ Unpack the package

Open the package, accessories include: electrical wire, various animal sensors and user's manual (this manual), warranty card, certificate and particular paper and the lower foam case contains the monitor.

▭ Remove the monitor and accessories

Caution: Please place the monitor on level and stable supporting plane, not on the places that can easily shock or wake. Enough room should be left around the monitor so as to guarantee normal ventilation.

▭ Keep all the packaging materials for future use in transportation or storage.

▭ Check the monitor and accessories

Check the monitor and its accessories one by one in accordance with the particular paper. Check to see if the parts have any mechanical damages. In case of problems, please contact us or our agent.

3.2 Connecting to Power

3.2.1 AC Power

▭ Confirm the rated AC current is: AC 100-240V 50/60Hz

▭ Use the electrical wires provided along with the instrument, put its output end plug (round headed) into the AC current socket on the back of the monitor, and the plug of input end into a grounded socket of the mains (It must be a special socket of the hospital), connect the monitor through the earth one of electrical wires.

▭ When the indicating light above the power switch on the panel of the monitor is green, it means the AC power is on. And when the monitor is not connected to AC power and the DC battery is used as the power source, the indicating light is orange.

Warning: The monitor must be connected to a properly installed power outlet with protective earth contacts only. If the installation does not provide for a protective earth conductor, disconnect the monitor from the power line and operate it on battery power.

Note: The equipment has no mains switch. The equipment is switched completely only by disconnecting the power supply from the wall socket. The wall socket has to be easily accessible.

Note: For measurements in or near the heart we recommend connecting the monitor to the potential equalization system. Use the green/yellow potential equalization cable and connect it to the pin labeled with the ⏚ symbol.

3.2.2 Battery Power

The monitor has a battery pack to provide power to the monitor whenever AC power is interrupted. The battery is generally referred to as the "battery".

You must charge the battery before using it. There is no external charger. The battery is charged when the monitor is connected to AC power. To assure a fully charged battery that is ready for use, we recommend that the monitor be plugged into AC power whenever it is not in use.

Run time of the batteries is according to the usage and configuration of monitor. NIBP and SpO_2 monitoring and the usage of the recorder will drain battery power faster than other parameters.

Note: When the monitor is connected to AC power, the battery is in a state of being recharged. When it is unable to be connected to the AC power, the battery can be used to supply power, and at this time it is unnecessary to use the electrical wires, and the instrument can be switched on directly.

Note: A "Battery Low" message displaying at the technical alarm information area of screen and an audible system alarm indicate approximate 5 minutes of battery life remaining. You should connect the monitor to an AC power source when the message is displayed.

Note: This monitor contains a rechargeable battery. The average life span of this type of battery is approximately three years. When replacement becomes necessary, contact a qualified service representative to perform the replacement.

Disposal Note: Should this product become damaged beyond repair, or for some reason its service life is considered to be at an end, please observe all local, state, and federal regulations that relate to the disposal of products that contain lead, batteries, plastics, etc.

■ **Install Battery**

The battery compartment is located at the left side of the monitor, following the steps to install a battery.

1. Open the battery gate according to the direction marked on the monitor.
2. Turn the baffle up clockwise.
3. Push the battery into the gate with the electrode point to the bottom of the monitor.
4. After pushing the battery inside the compartment withdraw, the baffle turn back to the middle position.
5. Close the battery gate.

■ **Uninstall battery**

1. Open the battery gate according to the direction marked on the monitor.
2. Turn the baffle up clockwise.
3. Take out the battery. Then close the battery gate.

3.3 Connecting to the Central Monitor System

Warning: Accessory equipment connected to the analog and digital interface must be certified according to the respective IEC standards (e.g. IEC 60950 for data processing equipment and IEC 60601-1 for medical equipment). Furthermore all configurations shall comply with the valid version of the system standard IEC 60601-1. Everybody who connects additional equipment to the signal input part or signal output part configures a medical system, and is therefore responsible that the system complies with the requirements of the valid version of the system standard IEC 60601-1. If in doubt, consult the technical service department or your local representative.

If the user intends to connect the monitor to the central monitoring system, plug its connecting electrical cable into the Network Connector at the back of the monitor.

Note: This monitor can only be connected to the central monitoring system provided by manufacturer, do not attempt to connect this monitor to other central monitoring system.

3.4 Starting the Monitor

- Press the power button. The alarm indicating lamps flash, and then go out. The system gives a beep and displays the startup screen.
- The startup screen disappears and the monitor enters the main screen.

Warning: In case the monitor is found to be working abnormally or indication of errors appears, please do not use this monitor for monitoring and should contact the after-sale service center as soon as possible.

3.5 Connecting to Various Kinds of Sensors

Connect sensor cables to the relevant sockets on the monitor and put sensors on the monitored locations on the body of the animal. Refer to the relevant content of **Chapter 5** for details.

Warning: For safety reasons, all connectors for animal cables and sensor leads (with the exception of temperature) are designed to prevent inadvertent disconnection, should someone pull on the leads. Do not route cables in a way that they may present a stumbling hazard. Do not install the monitor in a location where it may drop to the animal. All consoles and brackets used must have a raised edge at the front.

3.6 Preparation of Recorder

If the monitor you use has been provided with a recorder, before starting of monitoring please check if the recorder has had recording thermal paper installed. The thermal side (that is the smoother side) should face upwards and a small section should be pulled out onto the outlet of the paper (on the right panel of the monitor).

If record paper has been used up, following the steps to install recording paper.

1. Push down the switch to open recorder.
2. Install the paper with the thermal side upwards.
3. Close the recorder with a section of paper outside of the storage.

For detailed operation information, refer to Fig. 3-6-1

Fig. 3-6-1 Install Recording Paper

3.7 Shutting off the Monitor

Please follow these steps to shut off the monitor:

- Confirm that the animal monitoring is finished.
- Disconnect the cables and sensors form animal.
- Confirm that the monitoring data is stored or cleared.
- Press the power switch, then a dialog will pop up to ask you make sure the shut-off operation. Select "OK" to shut off the monitor. If the monitor can't be switched off normally, forced close the monitor by pressing and holding the power switch more than 5s. This may cause some damages to the device.

Chapter 4 Operation Instructions for the Monitor

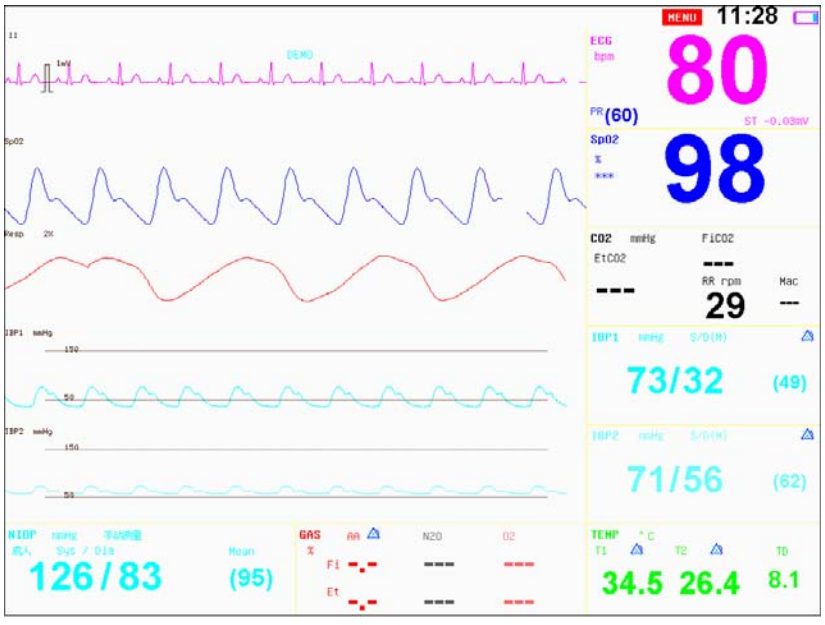
Note: In each menu, press〈Previous〉to return to the previous menu and press the〈Main〉button to return to main screen. In all the dialogue windows, there is help info to indicate the current operation.

Note: The monitor configuration is consist of standard and non-standard parameter configuration, and their operation methods are basically the same, the standard configuration includes ECG, RESP, SpO_2, Single TEMP and NIBP modules, and the non-standard parameter configuration includes Dual TEMP, CO_2.

4.1 Screen Mode

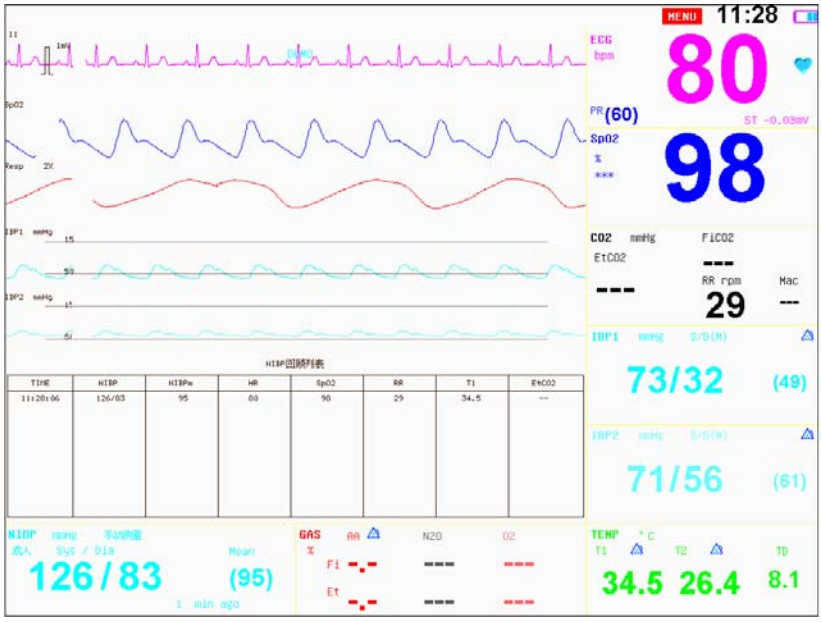
In the <**Select Screen**> of the <**Main Setup**>menu, seven kinds of different screen display modes can be selected, namely: Standard, NIBP Review, Big Numerics, Short Trend, 7 leads and oxyCRG. They are respectively showed as follow:

1） Standard



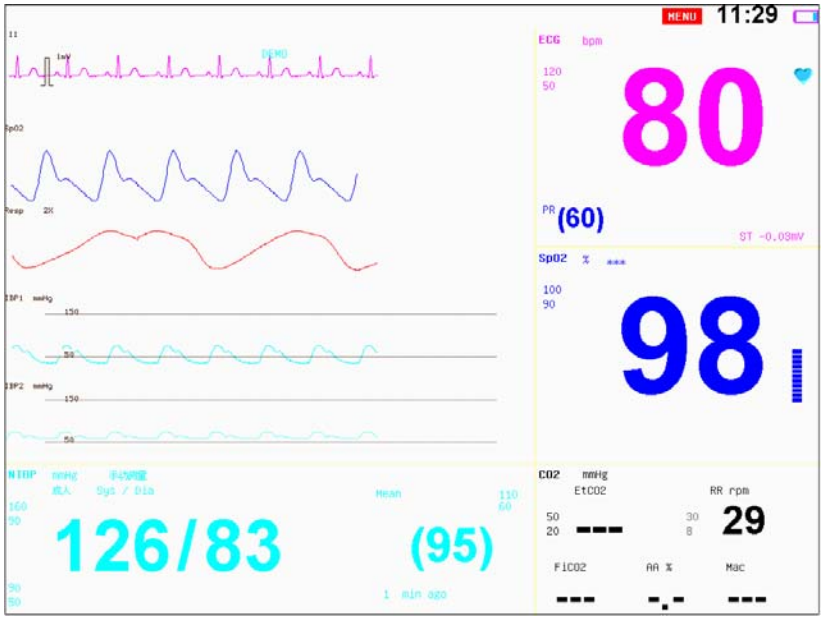
The ECG waveform of one lead is displayed on the uppermost region above the waveforms (this lead is called key monitoring lead and is set by the <**ECG1**> option in <**ECG**>), and the waveforms below are displayed differently according to different configurations.

2） NIBP Review



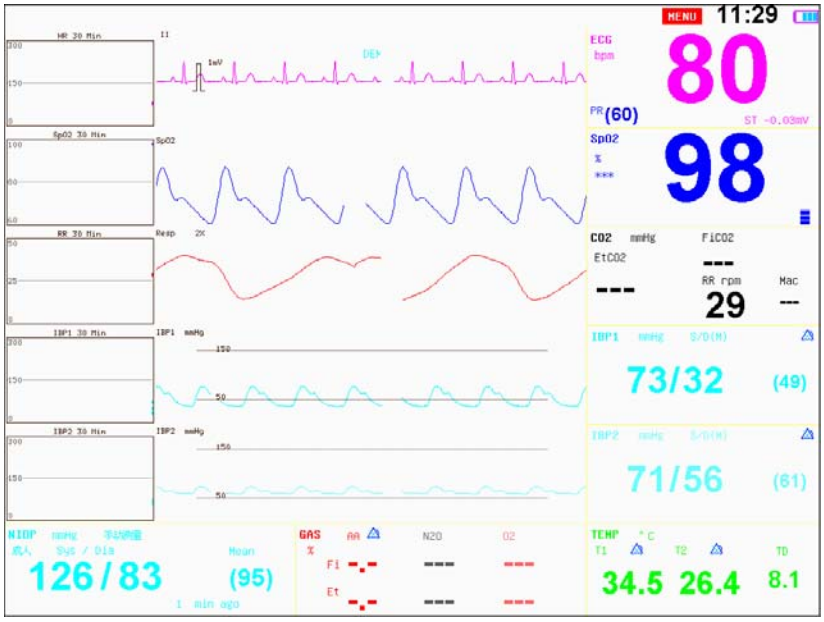
The recent groups of NIBP measurement results are displayed below the waveforms and the measurement records can be browsed by turning the trim knob.

3） Big Numerics



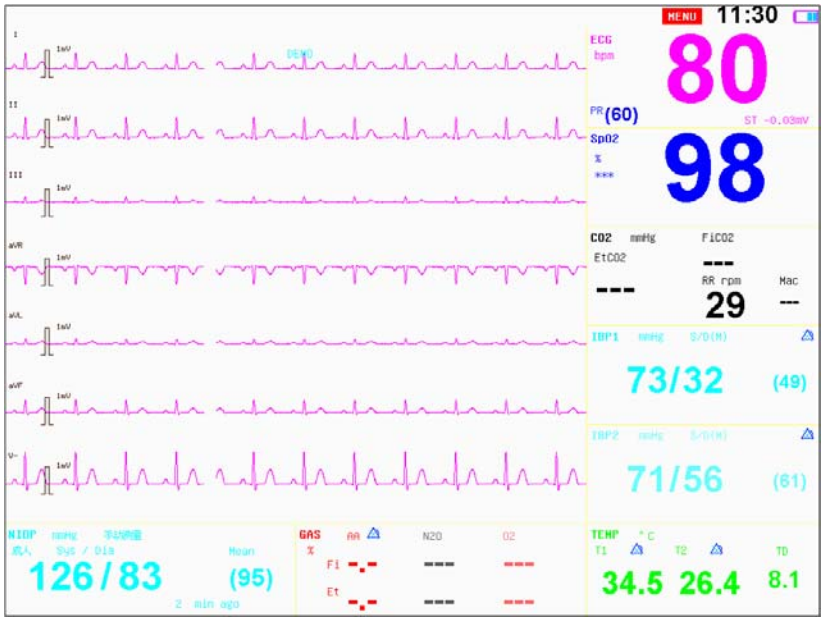
The main parameters are displayed in big font, e.g. HR, SpO_2, NIBP, RESP and CO_2.

4） Short Trend



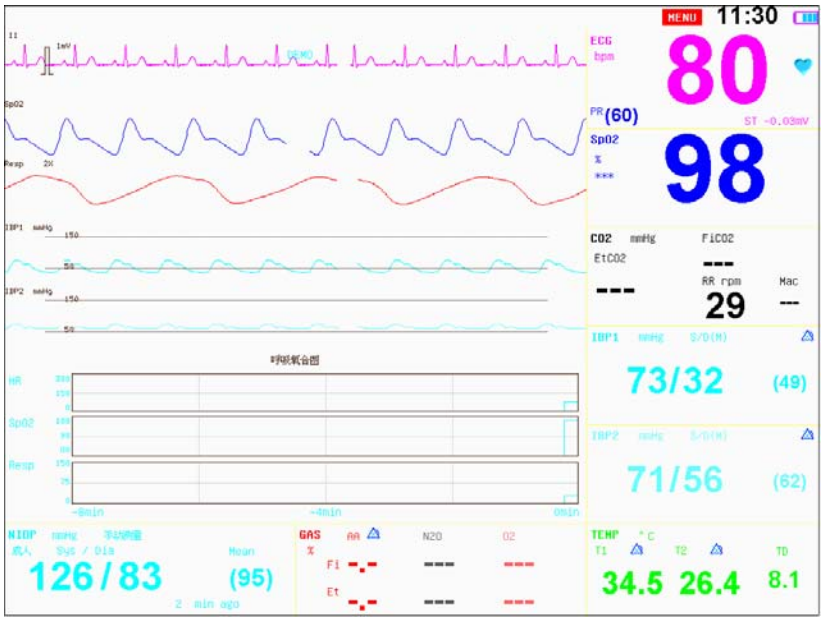
The short trend diagram relevant to the parameters is displayed on the upper-left corner of the waveform.

5） 7-Leads



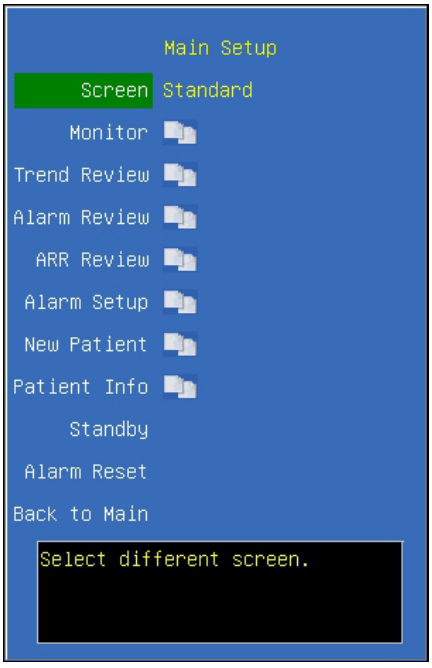
The ECG waveforms of 7-lead are displayed in the waveform display zone, they are I, II, III, aVR, aVL, aVF, and V- respectively.

6） OxyCRG



The trend diagrams of HR, SpO_2 and RESP within 16 minutes are displayed under the waveforms.

4.2 Main Menu



Screen Such seven display modes as **Standard, NIBP Review, Big Numerics, Short Trend, 7 leads and oxyCRG** can be selected. And the display mode varies according to different manufacturer configurations.

Monitor Click and open the dialog of monitor configuration. Conduct some configurations of the monitor.

Trend Review Click and open the dialog of trend browse. Browse trend tables or trend diagrams.

Alarm Review Click and open the dialog of alarm event review. Browse alarm events.

Alarm Setup Click and open the dialog of alarm configuration. Conduct configuration of alarm parameters.

New Patient Terminate the monitoring of the current animal and initiate the monitoring of a new animal. Pressing the option will delete the monitoring data of the current animal and animal Info and initiate the monitoring of a new animal.

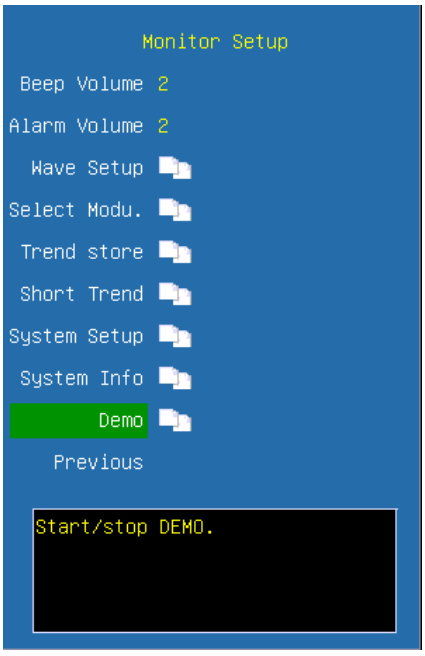
Patient info Click and open the dialog of animal info. It provides the input and browse of animal info.

Calculator Click and open the dialog of calculator.

Standby Click and enter the standby state.

Caution: After initiating the monitoring of a new animal, the data of historical animals will be completely eliminated.

4.2.1 Monitor Setup



Beep Volume Set the volume of BEEP and options are **Off, 1, 2, 3**. After one selection is made, a testing beep will be produced.

Alarm Volume Set the alarm volume and options are **Off, 1, 2, 3**. After one selection is made, a testing beep will be produced.

Wave Setup Click and open the dialog of waveform configuration. Conduct the customization of screen waveforms and relevant waveform displays can be selected

according to needs.

Select Modu. Click and open the dialog of module configuration. Some of the modules not in current use can be switched off, and after switching-off, the relevant parameters and waveforms will not be displayed and no alarm will be made.

Trend Store Click and open the dialog of configuration of trend storage. It provides the configuration function on the mode of trend storage and several modes of trend storage can be defined.

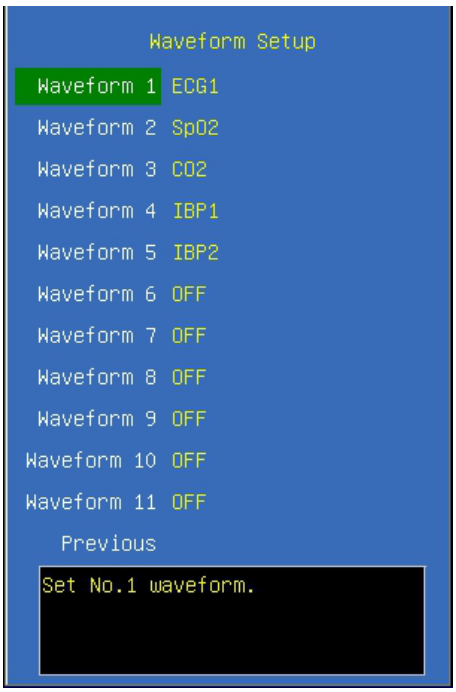
Short Trend Click and open the dialog of short trend diagram. Some scales and time of short trend diagram can be defined.

System Setup Click and open the dialog of system configuration. Conduct the configuration and maintenance of systems.

System Info Click and open the dialog of system info. Some info of the system will be displayed, such as version info.

Demo Switch on or switch off demonstration function.

■ **Waveform Setup**



Waveform 1 Select the waveform displayed in the first line, and according to the lead types, different ECG waveforms can be selected (**Note**: **The lead must be the ECG waveform, and cannot be switched off**). At 3-Leads mode, it is the key monitoring lead and it is defaulted as Lead II.

Waveform 2 Select the waveform displayed in the second line, and options are **Off, Cascade** and **random waveform**. When selecting <**Cascade**>, waveform 2 is the cascade

of waveform 1.

Waveform 3 Select the waveform displayed in the third line. Select **Off** close the wave display or select certain waveform to display.

Waveform 4 Select the waveform displayed in the fourth line. Select **Off** close the wave display or select certain waveform to display.

Waveform 5 Select the waveform displayed in the fifth line. Select **Off** close the wave display or select certain waveform to display.

Waveform 6 Select the waveform displayed in the sixth line. Select **Off** close the wave display or select certain waveform to display.

Waveform 7 Select the waveform displayed in the seventh line. Select **Off** close the wave display or select certain waveform to display.

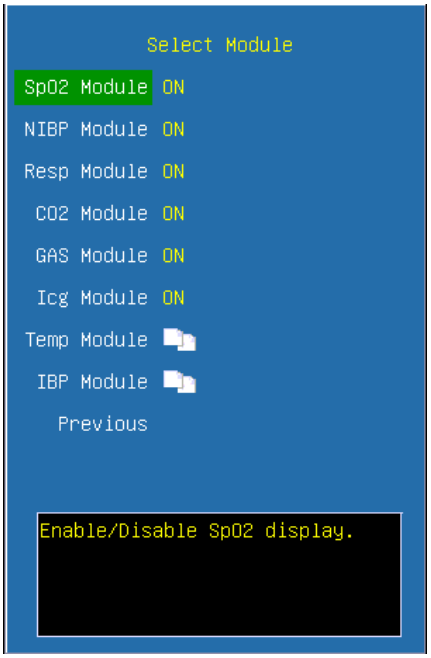
Waveform 8 Select the waveform displayed in the seventh line. Select **Off** close the wave display or select certain waveform to display.

Waveform 9 Select the waveform displayed in the seventh line. Select **Off** close the wave display or select certain waveform to display.

Waveform 10 Select the waveform displayed in the seventh line. Select **Off** close the wave display or select certain waveform to display.

Waveform 11 Select the waveform displayed in the seventh line. Select **Off** close the wave display or select certain waveform to display.

■ **Select Module**



SpO_2 Module Enable/Disable the display of SpO_2 module. After switching-off, the SpO_2 parameters and relevant alarm will not be displayed and the current SpO_2 waveform will

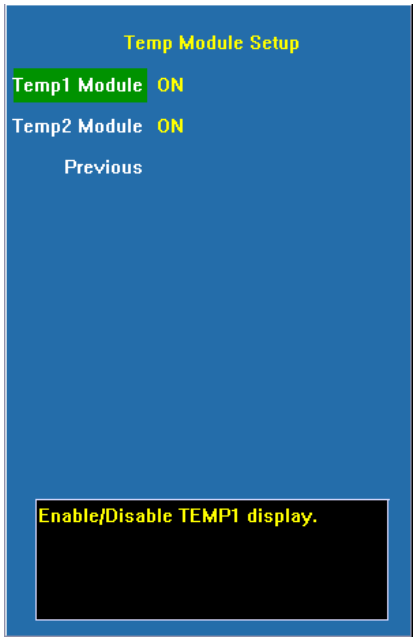
be automatically switched off. After it is open, the SpO_2 waveform will also be opened.

NIBP Module Please refer to **SpO_2 module** instruction

Resp Module Enable/Disable the display of Resp module. After switching-off, the Resp parameters and relevant alarm will no be displayed and the current Resp waveform will be automatically switched off. After it is open, if there is no CO_2 module, the Resp waveform will be opened automatically.

CO_2 Module Enable/Disable the display of CO_2 module. After switching-off, the CO_2 parameters and relevant alarm will no be displayed and the current CO_2 waveform will be automatically switched off. After it is open, the CO_2 waveform will be automatically open, if there is an RESP waveforms, the RESP waveform will be switched off.

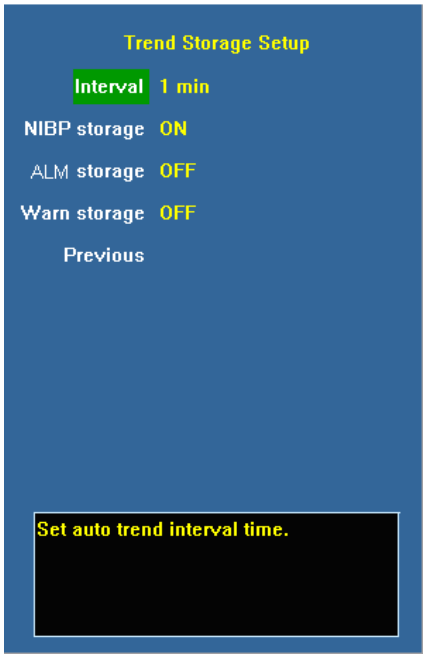
Temp Module Click and open the dialog of Temp module setup**.**



Temp 1 Module Enable/Disable the display of Temp 1 module

Temp 2 Module Enable/Disable the display of Temp 2 module

■ Trend Storage Setup



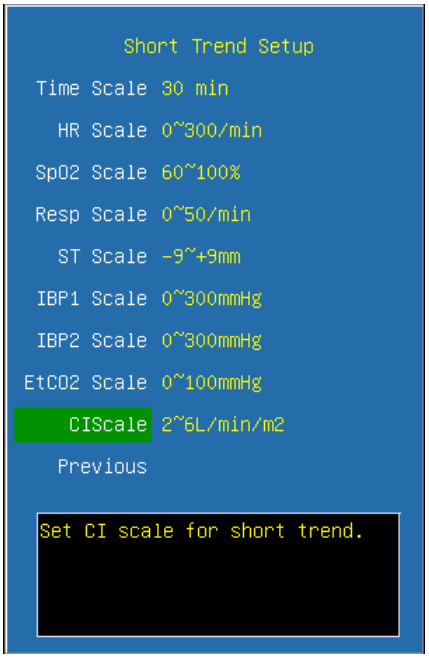
Interval Select the cycle intervals of trend storage and options are **Off, 1min, 2min, 3min, 4min, 5min, 10min, 15min, 20min, 25min** and **30min.**

NIBP storage Enable/Disable the switch of NIBP storage. When it is enabled, it indicates after NIBP measurement completed, a record will be stored.

ALM storage Enable/Disable the switch of alarm storage. When it is enabled, it indicates if there is a high alarm of physiological parameters a record will be stored.

Warn storage Enable/Disable the switch of warning storage. When it is enabled, it indicates if there is a medium alarm of physiological parameters a record will be stored.

■ Short trend Setup



Time Scale Select the time interval of short trend diagram. Options are **5min, 10min, 15min, 20min, 30min, 1h** and **2h**.

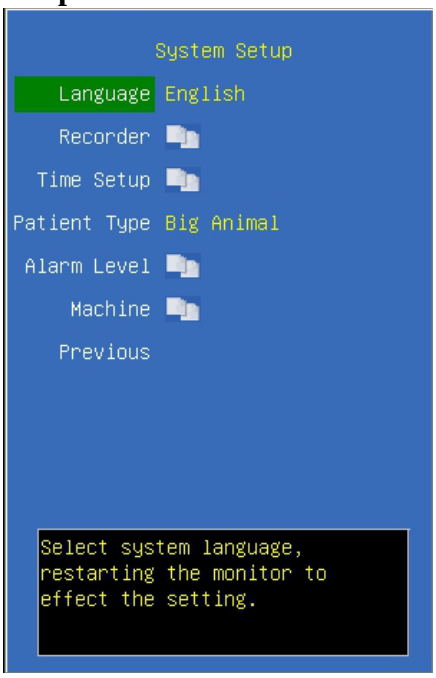
HR Scale Select the scale of heart rate for short trend diagram. Options are **0~160/min** and **0~300/min**.

SpO_2 Scale Select the scale of SpO_2 for short trend diagram. Options are **40~100%, 60~100%** and **80~100%**.

Resp Scale Select the scale of respiration rate for short trend diagram. Options are **0~8/min, 0~24/min, 0~50/min** and **0~100/min**.

$EtCO_2$ Scale Select the scale of $EtCO_2$ for short trend diagram. Options are **0~30mmHg, 0~60mmHg** and **0~100mmHg**.

■ **System Setup**



Language The categories of languages can be selected. To change the language, it is necessary to restart the monitor.

Recorder Click and open the dialog of recorder configuration.

Time Setup Click and open the dialog of time configuration. After the time of the system has been configured, please restart the monitor.

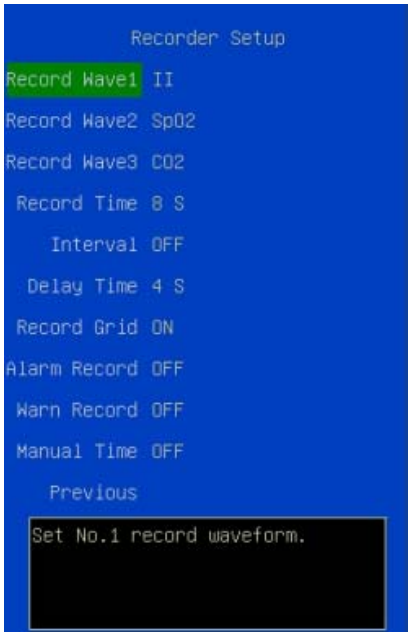
Patient Type Click and choose the patient type you need.

Alarm Level Click and open the dialog of alarm level configuration.

Machine Click and open the dialog of machine maintenance. Enter the interface of machine maintenance and it is necessary to enter the password (The password is **125689**)

Nurse call Click and open the dialog of nurse call setting. Please refer to ***chapter 8.1*** for details.

■ Recorder Setup



Record Wave1 Select the waveform recording in the first line. Select certain waveform to record. **It cannot be switched off.**

Record Wave2 Select the waveform recording in the second line. Select **Off** close the wave display or select certain waveform to record.

Record Wave3 Select the waveform recording in the third line. Select **Off** close the wave display or select certain waveform to display.

Record Time Select the time duration of the waveform for each recording. Options are **8s, 12s** and **16s**.

Interval Select the time interval for cycle recording. Options are **Off, 1min, 2min, 3min, 4min, 5min, 10min, 15min, 20min, 25min** and **30min**.

Delay Time Delayed recordings start documenting on the recorder strip from a preset time before the recording is started. This interval is called the "Delay Time" and can be set to **Real time**, **4s** or **8s**.

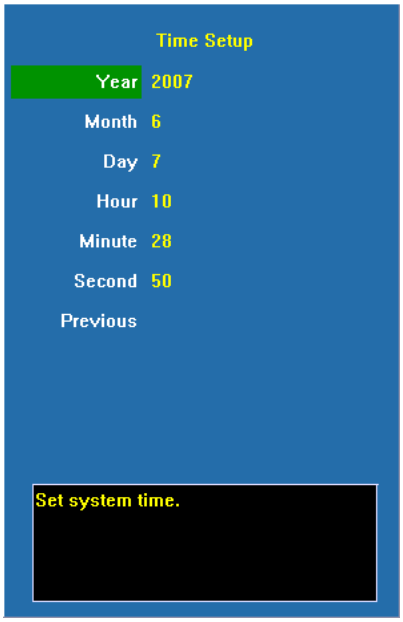
Record Grid Enable/Disable recording of the grids when the recorder is producing waveforms.

Alarm Record Enable/Disable the alarm recording at the high level of physiological alarm.

Warn Record Enable/Disable the warn recording at the medium level of physiological alarm.

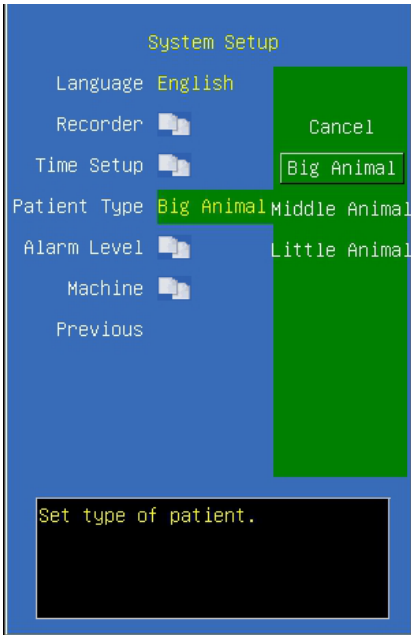
Manual Time Set the manual recording time. Options are **off, 10s, 20s** and **30s.**

■ Time Setup



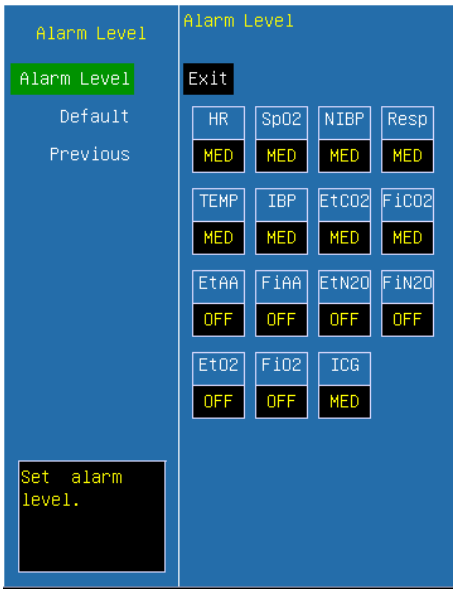
The user can configure system time. The user is advised to set system time before implementing monitoring. If the configuration is to be conducted during the process of monitoring, the user is advised to switch off the monitor after exiting the current window and then restart it. The time for the revision takes effect after the current window is exited.

■ Patient Type



The user can choose patient type like **Big Animal, Middle Animal** and **Little Animal.** When monitoring a cat or small animal, set the object to **Small Animal**, when monitoring dogs or medium-size animals, set to **Middle Animal**, when monitoring horses or large animals, set to **Big Animal**.

■ Alarm level Setup



Alarm levels of all the parameters can be configured. Press <**Set Alarm level** > option, the cursor will move to the region of configuring alarm levels. If the alarm level of a certain parameter is to be configured, first move the cursor to the alarm level of that parameter, press the option and then select the alarm level, Options are **low, med** and **high**.

■ Machine Setup

Maintenance Click and open the dialog of system maintenance.

Factory Manufacturer maintenance is not an operation option for users and it must be operated by the technical and maintenance personnel authorized by manufacturer.

Upgrade Click and open the dialog of upgrade setting.

Nurse call Click and open the dialog of nurse call setting. Please refer to ***chapter 8.1*** for details.

CO2 Function Click and open the dialog of function selection. Options are **CO2 Cal Mode, CO2 Gain Cal, CO2 Flow.**

Fun. Select Click and open the dialog of function selection. Options are **Alarm Limit**, **ShortCut Key**, **ECG BaseLine**, **ECG Auto** and **AlarmSound**.

Alarm Setup Click and open the dialog of alarm setup. You can check or set the alarm limit and alarm state.

Min volume Set minimum alarm volue.

HUM Select the frequency of the AC power supply and options are **50Hz** and **60Hz**. It is mainly configured according to the frequency of local power supply.

- **System Maintenance**

Trend Setup Click and open the dialog of trend display configuration. Conduct configurations of trend diagrams and trend tables.

Color Click and open the dialog of color configuration and configure colors of parameters and waveforms.

Network Click and open the dialog of network configuration. Conduct network configurations.

OverPress Initiate NIBP over-pressure test

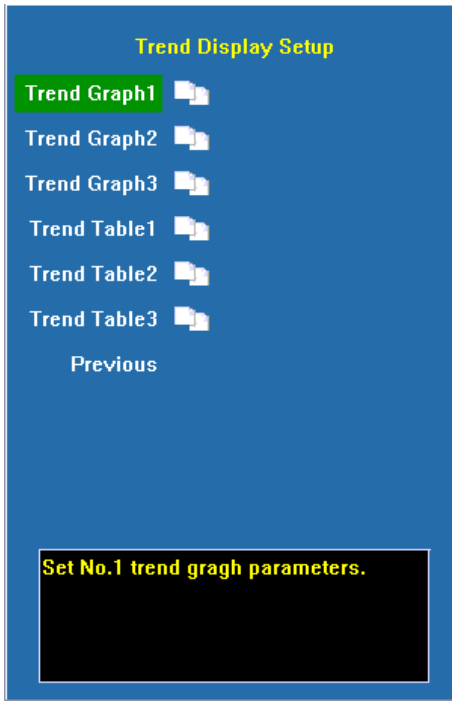
Manometer Initiate NIBP manometer test.

NIBP reset Reset NIBP module.

Recor. Cali. Conduct speed calibration of the recorder. This operation must be conducted when the recorder is changed.

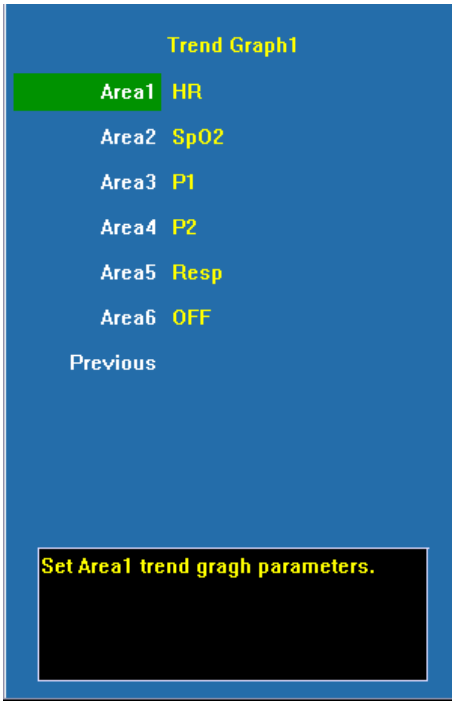
■ Trend Setup

The user can define various trend display info according to needs or use the display configuration for default trend.



Trend Graph1 Configuration of trend diagram.

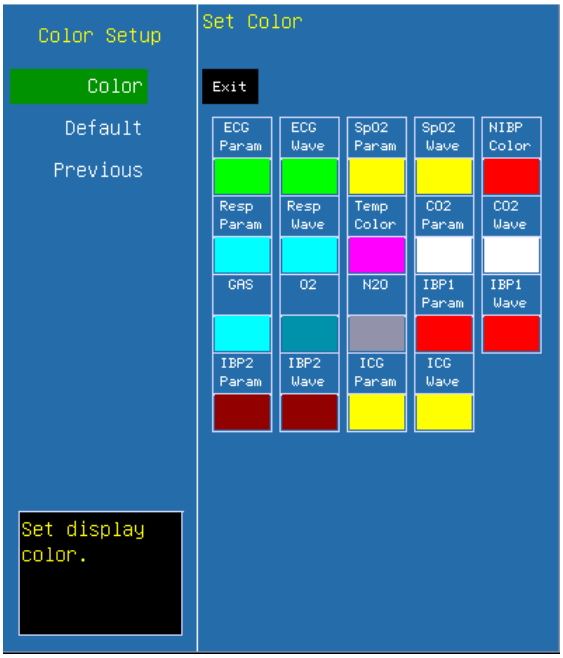
There are a total of three pages of trend diagrams and on each page trend diagram can be configured for six regions, and options are **Off, HR, SpO_2, NIBP, PR, Resp, CO_2, T1, T2, AA, N_2O, O_2, ST, HR+SpO_2, SpO_2+PR, Resp+CO_2, PR+CO_2, T1+T2, AA+CO_2 ,N_2O+O_2.** It is possible to have self-configurations on the contents of the trend diagrams and at least one page of trend diagrams shall be configured.



Trend Table Configuration of trend tables

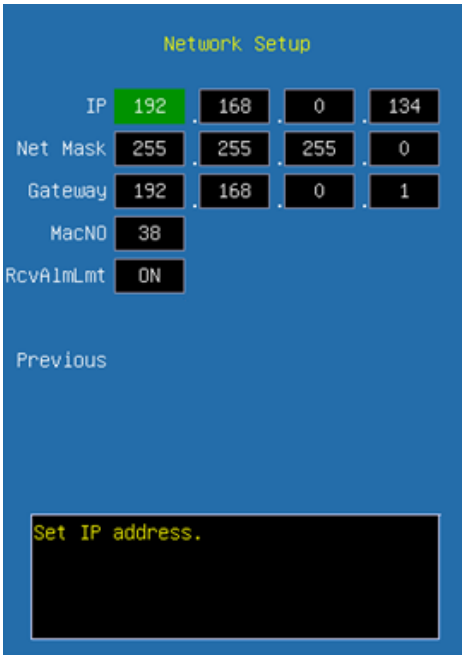
There are a total of three pages of trend tables and on each page trend table can be configured for six regions, and options are **HR, SpO_2, NIBP (S/D), NIBP (M), Resp, PR, T1, T2, CO_2, AA, N_2O, O_2 ,ST.** It is possible to have self-configurations on the contents of the trend tables and at least one page of trend tables shall be configured.

■ Color Setup



Enter the interface of color configuration, the colors of various parameters and waveforms can be configured.

■ Network Setup



In the interface of network configuration, such items as **IP address, Net mask, Gateway, Machine number** can be configured. The configuration is mainly necessary when the monitor connecting to the Central Unit.

Rcv Alm Lmt Select if allow bedside unit receiving alarm limit from the central unit. It can be set to ON or OFF.

■ **System Info**

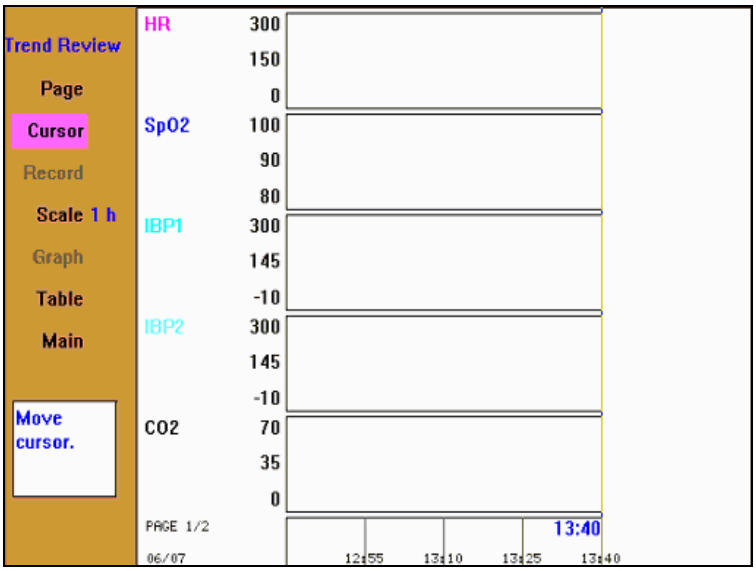
Version It displays the version number of software.

Module SN It displays the product serial number of module.

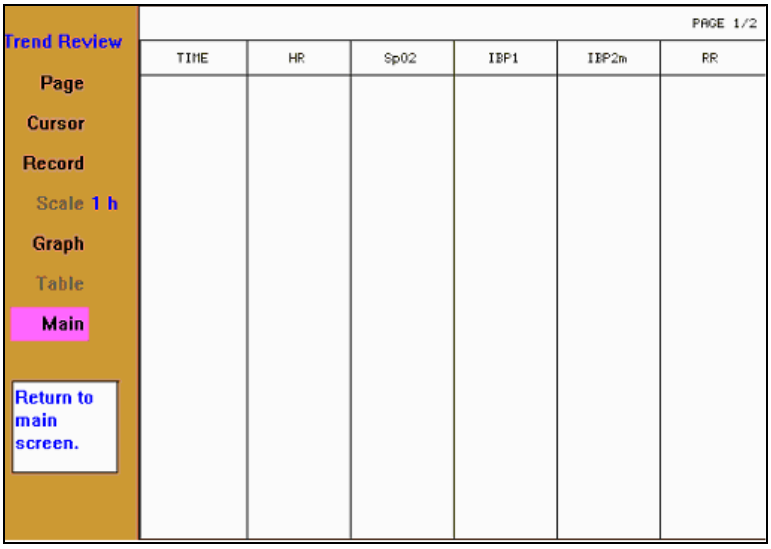
Serial Number It displays the serial number of the machine.

4.2.2 Trend Review

Trend Graph



Trend Table



Page Press this option and turn the trim knob to conduct the paging operation. Press it again to restore the initial status. If more than one page of trend diagrams or trend tables are configured, then the paging is switched between the trend diagrams or trend tables between different pages.

Cursor Press this option, turn the trim knob and move the cursor in the trend diagrams or trend tables. Press it again to restore the initial status. It is possible to move the cursor in the trend diagrams and trend tables. In the trend tables, it is possible to browse the trend records by moving the cursor, and if it moves to the left side or the right side of trend diagram , continue moving can roll the trend diagram by 1/4 screen to the left or right.

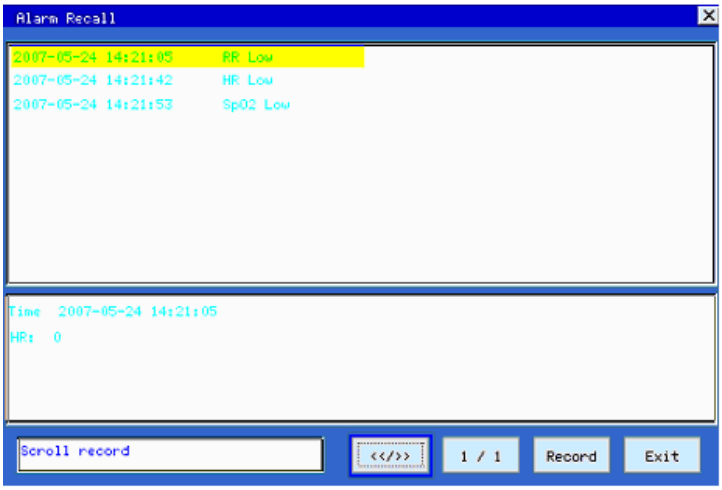
Record Press this option to record the trend tables of the current page, but the trend diagram does not support recording.

Scale Press this option and the time intervals for one page of trend diagrams can be selected. Options are **1h, 2h, 4h, 6h, 8h, 10h, 12h, 24h, 48h ,72h, 168h, 480h and 504h**.

Graph Press this option to switch to the display of trend diagram.

Table Press this option to switch to the display of trend tables.

4.2.3 Alarm Review



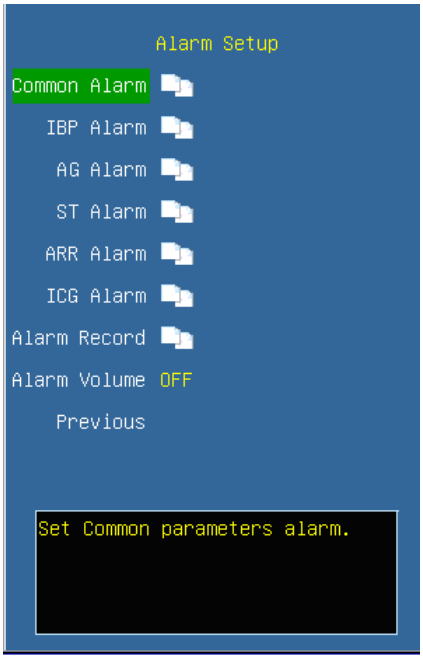
<</>> Select this button, turn the trim knob to roll the records back and forth.

1/1 Select this button, turn the trim knob to turn the pages back and forth.

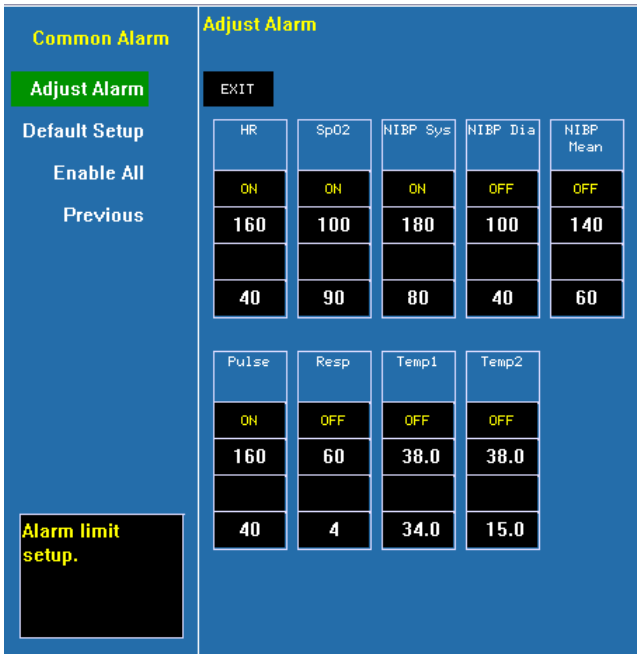
Record Print the currently selected alarm events through the recorder; and if no recorder is configured, this option is invalid.

Exit Exit the dialog of alarm review

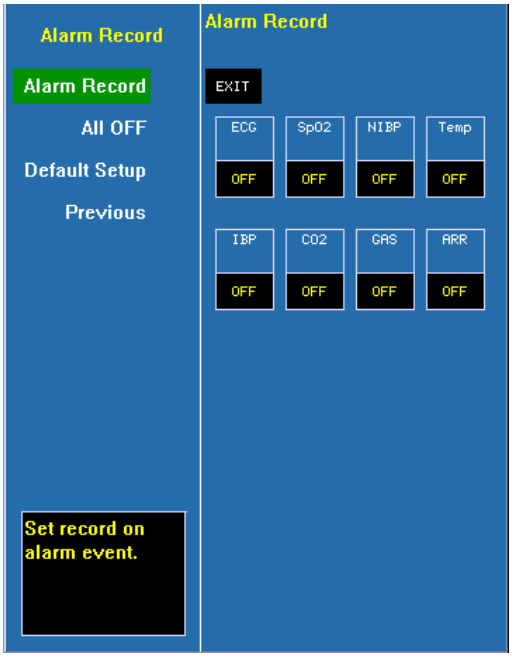
4.2.4 Alarm Setup



Common Alarm Click and open the dialog of common parameters alarm. It can setup the alarm limits of common parameters.



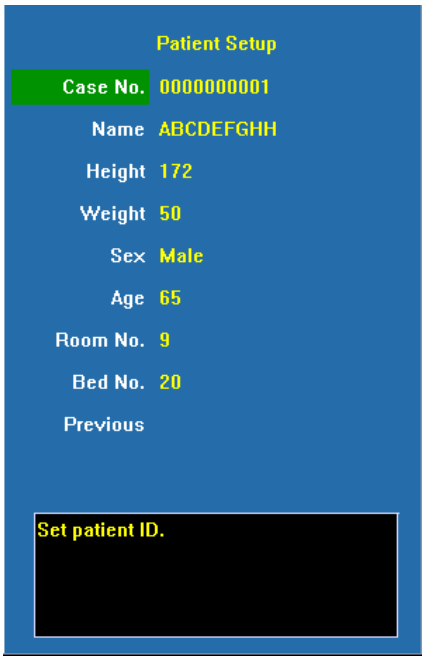
Alarm Record Click and open the dialog of alarm recording. Configure whether the alarm records of various modules are recorded. Only when the switch for alarm recording of the module and the switch for alarm record in the record setup have been switched on, the physiological alarm in the relevant modules will trigger the alarm recording.



Alarm volume Configure the volume of alarm and options are **off, 1, 2**, **3**. Once a level is selected, a testing beep will be produced.

Note: In each dialog of alarm configuration, press the button〈Adjust Alarm〉and the cursor moves to the adjustment region of alarm limits. Press the button〈Enable All〉and all the alarms will be opened. If the user desires to adjust the alarm parameter of a certain parameter, first move the cursor onto the label of that parameter, and then press the trim knob to move the cursor up and down to select the parameter to be adjusted for revision.

4.2.5 Animal Info



Case No. The case number of animals (It can be configured according to the actual status of the hospital and a maximum of 10 letters can be entered), press〈**Del**〉to delete and〈**Clear**〉to clear; enter〈**OK**〉to confirm.

Name Animal name (It can be selected among A-Z and 0-9 and a maximum of 10 letters can be entered) enter〈**OK**〉to confirm.

Height Body height of animal (Turn the trim knob with an increment or decrement of 1 cm)

Weight Body weight of animal (Turn the trim knob with an increment or decrement of 1 kg)

Sex Gender of patient (male or female)

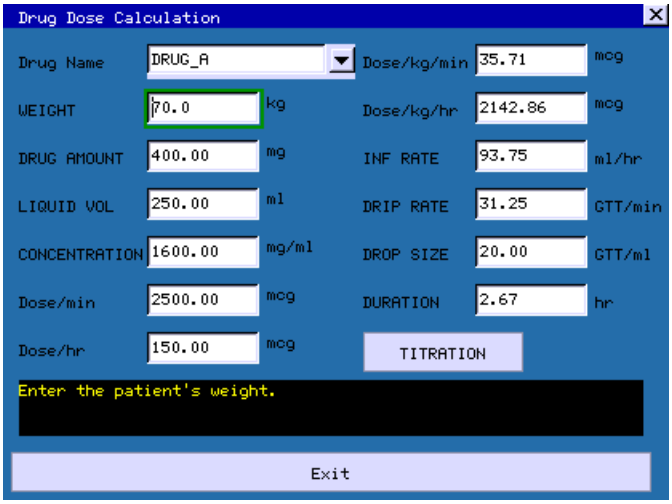
Age Age of patient (Turn the trim knob with an increment or decrement of 1 year)

Room No. Number of patient's room. Patient's room number can be displayed in the central unit.

Bed No. Number of patient's bed. Patient's bed number can be displayed in the central unit.

4.2.6 Drug Dose Calc

Select〈**MENU**〉→〈**Calculator**〉→〈**Drug Calc**〉，enter the Drug dose calculation window. As follows:



This calculation of drug concentration is mainly aimed at facilitating the work of physicians. It conducts concentration calculation on some commonly used drugs. A content of titration table can be output through recorder.

In the system, the following categories of drugs can be calculated:

AMINOPHYLLINE, DOBUTAMINE, DOPAMINE, EPINEPHRINE, HEPARIN, ISUPREL, LIDOCAINE, NIPRIDE, NITROGLYCERIN, and **PITOCIN.** In addition, it provides **DRUG_A, DRUG_B, DRUG_C, DRUG_D** and **DRUG_E** to displace any other drugs flexibly.

The following formulas are used for the calculation of drug dosage:

Drug concentration equal to total amount of drug divided by liquid volume

Liquid velocity equal to drug dosage divided by drug concentration

Duration time equal to total amount of drug divided by drug dosage

Drug dosage equal to velocity of IV drip multiply drug concentration

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

- **Drug name**

Move the cursor to〈**Drug name**〉, press the trim knob, then turn the trim knob to select drug, and only one kind of drug can be selected for calculation at one time.

DRUG_A, DRUG_B, DRUG_C, DRUG_D and DRUG_E are only codes for drugs rather than their real names. The units for these five kinds of drugs are fixed and the operator can select the appropriate units according to the habits of the drugs. The rules of the units are as follow:

DRUG_A, DRUG_B, DRUG_C are fixed at the serial units of **gram (g)**, **milligram**

(mg) and **microgram (mcg)**.

DRUG_D is fixed at the serial units of **unit**, **k unit** and **m unit**.

DRUG_E is fixed at the unit of **mEq**.

- **Weight**

The operator should enter the patient weight first, and as independent info the weight is only used in the function of the calculation of drug concentration.

Turn the trim knob to move the cursor to the positions of the various calculation items in the calculation formula respectively, turn the trim knob, and select calculation value, then press the trim knob and confirm the selected calculation value. When the calculation value is selected, the value of the calculated item will be displayed at relevant locations. There are range limits for the value adoption of each calculation Item, if the calculation results exceed the range, "---"will be displayed.

Regarding this function of drug calculation, the values for other individual items can only be entered after the weight and drug name have been entered. In the system, the values that are given initially are only a group of random initial values and the operator shall not take this value as the calculation standard and a group of values appropriate to the patient must be reentered according to the physicians' comments.

Each kind of drugs has a fixed unit or unit series and the operator must select the appropriate units according to the physicians' comments. In the unit series of the same unit, the addition of the units will be automatically adjusted in accordance with the current entered value. When the expressed range that can be expressed by this unit is exceeded, the system will display "---".

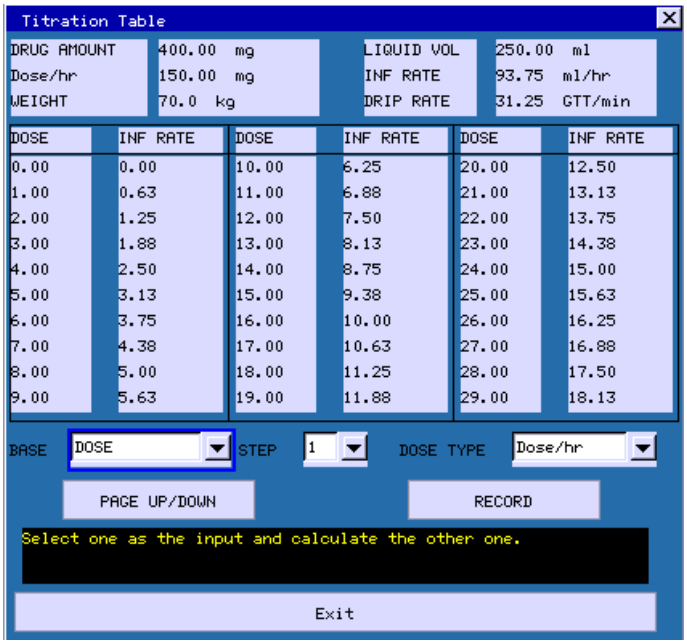
When the operator has entered the value of a certain item, the system will give a prompt in the menu so as to remind the operator to verify the correctness of the entered value. Only by ensuring the correctness of the entered values, the calculated values can be reliable and safe.

In case of neonatal, drip velocity and volume per drip are invalid.

The values in the table may not be related to the patient monitored on this bed. Therefore the weight of this menu and the weight in the patient info are two different values. The values in this menu item are not affected by the values in the patient info.

- **Titration table**

Select〈**Titration**〉in the menu of drug calculation to enter the interface of titration table.



In the titration table, turn the trim knob to〈**Base**〉, then press the trim knob to select the desired item. Options are **Dose, Trans speed** and **Drop speed**. After selecting, press the trim knob to confirm the selection.

Move the cursor to〈**Step**〉and press the trim knob to select the step size; the selectable range is 1-10.

Move the cursor to〈**Dose Type**〉and press the trim knob to select the dosage unit.

Move the cursor to〈**Page Up /Down**〉, press the trim knob, and then turn the trim knob to browse the previous page and next page.

Move the cursor to〈**Record**〉, press the trim knob to give the output of the data of the titration table on the currently displayed interface.

Move the cursor to〈**Exit**〉, press the trim knob to return to the window of drug calculation.

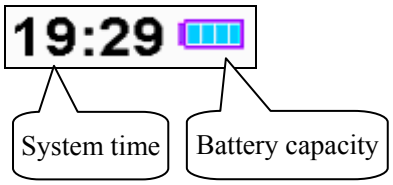
4.3 Screen Display

This Monitor adopts color LCD screen with high brightness, which can display parameters, waveforms, system status and other prompt info. The main screen is mainly divided into three regions, they are respectively:

- Display zone of system info and alarm prompt info (the uppermost part)
- Waveform display zone (left, and It shall vary according to different screen types)
- Parameter display zone (right and lowest part)

4.3.1 System status

The system time and status of battery capacity are displayed on the upper right corner.



Notes on battery capacities:

Battery capacity is full Battery capacity is half-full

Battery capacity is exhausted

Only when the monitor is powered by battery and is recharging the battery, the icon for battery capacity is displayed. If AC power in current use and the battery capacity is full, the icon will not be displayed.

Note: When the battery capacity is exhausted, the system produces an alarm sound, prompting the user to plug in the AC power for recharging; if it is not recharged in time, the monitor will be automatically switched off due to insufficient capacity more than 5 minutes.

Caution: When the energy level of the battery is exhausted, plug in the AC power to recharge, and then the battery indication may quickly return to "Full battery level"; the AC plug should be plugged in so as to ensure the full capacity of the battery.

4.3.2 Info display region

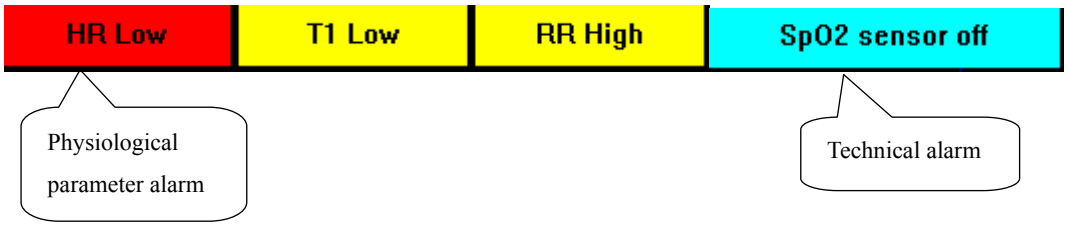
The upper region of the screen is the info display region, which is used to display the status of alarm sound, alarm suspension countdown and alarm info.

Status of alarm sound

The alarm sound is in "Off" status, and if a new alarm is generated, the "Off" status of alarm sound will be automatically cancelled.

Pause the alarm, and if a new alarm is generated, the "Pause" status of alarm sound will be automatically cancelled.

Alarm indicating zone



Alarm levels

Red base color is high alarm

Yellow base color is medium and low alarm

The order displayed by the physiological parameter alarm is displayed from left to right in turn according to the alarm levels.

Parameter alarm

The value of that parameter displayed on the upper part of the screen will flash to indicate the alarm of that parameter.

Chapter 5 Parameters Measurement

5.1 Measurement of ECG/HR

5.1.1 Principles of Measuring

Before the mechanical contraction, the heart will firstly produce electrization and biological current, which will be conducted to body surface through tissue and humors; the current will present difference in potential in different locations of the body, forming potential difference ECG, also known as body surface ECG or regular ECG, is obtained by recording this changing potential difference to form a dynamic curve. Monitor measures the changes in the body surface potentials caused by the heart of the animal, observe the cardioelectric activities, record the cardioelectric waveforms and calculate the HR through the multiple electrodes connected to ECG cable.

5.1.2 Precautions during ECG Monitoring

Warning: Before connecting the ECG cables to the monitor, please check if the lead wires and cables have been worn out or cracked. If so, they should be replaced.

Warning: It is imperative to only use the ECG cables provided with the instrument by manufacturer.

Warning: The equipment is capable of displaying the ECG signal in the presence of pacemaker pulses without rejecting pacemaker pulses.

Warning: To avoid burning, when the electrotome operation is performed, the electrodes should be placed near the middle between ESU grounding pad and electrotome and the electrotome should be applied as far as possible from all other electrodes, a distance of at least 15 cm/6 in is recommended.

Warning: When the electrotome operation is performed, the ECG leadwires should be intertwisted as much as possible. The main unit of the instrument should be placed at a distance from the operation table. Power wires and the ECG lead cables should be partitioned and should not be in parallel.

Warning: The monitor is protected against defibrillation effect. When applying defibrillator to the animal, the monitor will experience transient disorderly waveforms. If the electrodes are used and placed correctly, the display of the monitor will be restored within 5 seconds. During defibrillation, the chest leads such as V_1~V_6 should be removed and such limb electrodes as RA, LA, RL, LL should be moved to the side of the limbs.

Warning: All the electrodes and conducting part shall not be into contact with any other conductors including the ground. For the sake of animal safety, all the leads on the ECG cables must be attached to the animal.

Warning: When conducting defibrillation, it is imperative to only use the electrodes recommended by manufacturer.

Warning: Do not come into contact with the animal, bed and the monitor during defibrillation.

Warning: The monitor cannot be directly applied to heart and electrocardiograph.

Note: When several parts of equipment are interconnected, the total leakage current is limited to the safety range according to standards IEC 60601-2-27.

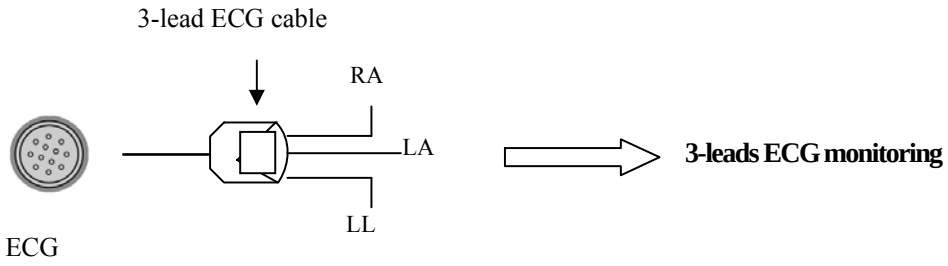
5.1.3 Preparatory Steps before the Measurement of ECG/HR

1) Plug the ECG cable into the ECG socket of the monitor.

2) Place the electrodes onto the body of the animal and connect them to the relevant lead wires of the ECG cables, and at this moment ECG waveforms will appear on the screen.

3) Set the parameters relevant to ECG monitoring.

5.1.4 Connecting the ECG Cables to the Monitor



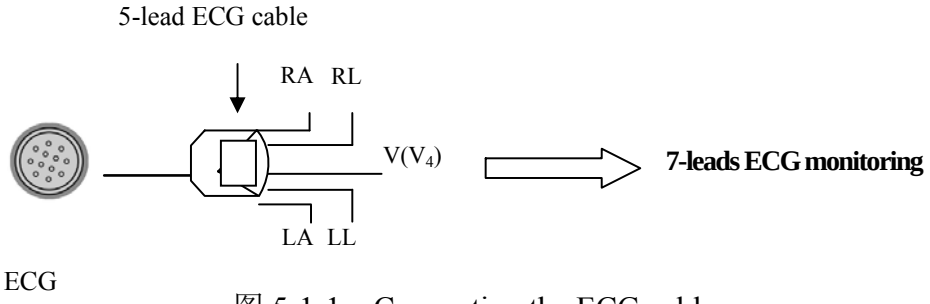


图 5-1-1 Connecting the ECG cable

1) 3-lead ECG cable

- Including three limb leads: RA, LL, and LA.
- Realize 3-lead ECG monitoring.

2) 5-lead ECG cable

- Including four limb leads: RA, RL, LL, LA and one chest-lead V (V_4).
- Realize 7-lead ECG monitoring.

5.1.5 Connecting the ECG Electrodes to the Animals

1) Connection steps

Sites where leads are attached to the body must be properly prepared to optimize contact.

Mid animals and small animals have enough electrolyte material on their skin and hair so that merely moistening lead sites with 70% isopropyl alcohol is appropriate. This will usually be sufficient for ECG monitoring for a short time, 30 to 60 minutes, depending upon the relative humidity.

For monitoring during longer periods, an electrode paste should be used. It is best to first wet the hair at the lead attachment site with alcohol; then place paste on the moistened hair and skin. It is important that the paste be in direct contact with skin. For animals with dense undercoat, rub paste with fingers to assure that it has made contact with skin. Crocodile clips are supplied with this monitor and they must open wide enough to firmly but gently grasp the skin. Finally, Finally, connect the cable leads to the electrodes.

Note: For animals who tremble a lot or animals with especially weak ECG signals, it might be difficult to extract the ECG signals, and it is even more difficult to conduct HR calculation. For severely burnt animals, it may be impossible to stick the electrodes on and it may be necessary to use the special pin-shape electrodes. In case of bad signals, care should be taken to place the electrodes on the soft portions of the muscle.

Note: Check the irritation caused by each electrode to the skin, and in case of any inflammations or allergies, the electrodes should be replaced and the user should relocate the electrodes every 24 hours or at a shorter interval.

Note: When the amplifier is saturated or overloaded, the input signal is medical meaningless, then the equipment gives an indication on the screen.

2) Location for electrode placement

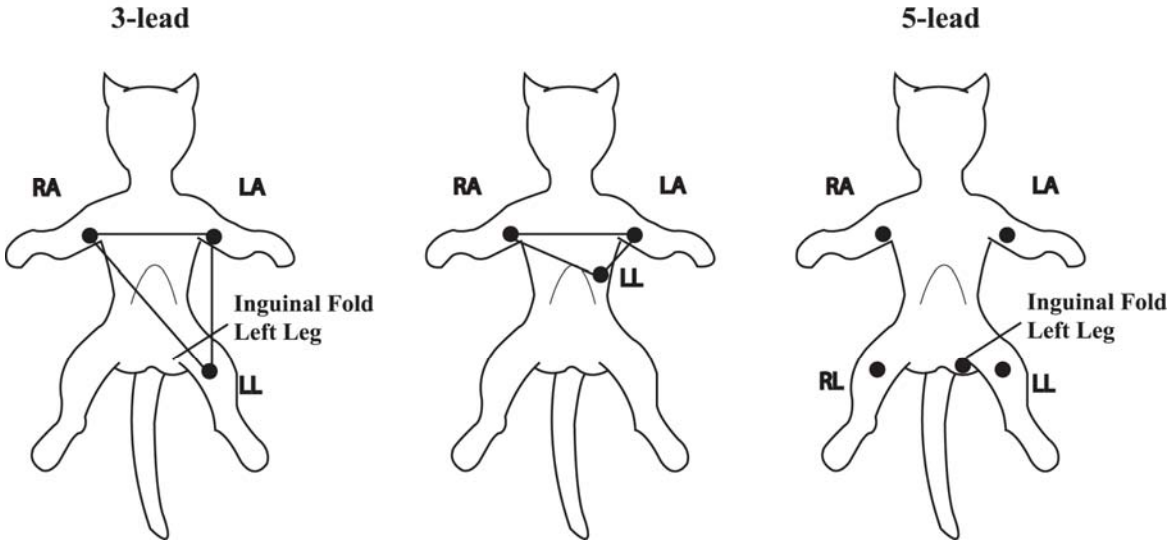


Fig. 5-1-2 Indicative map of the placement of ECG electrodes

The following table shows the lead name to identify each lead wire and its associated color of AHA and IEC standards.

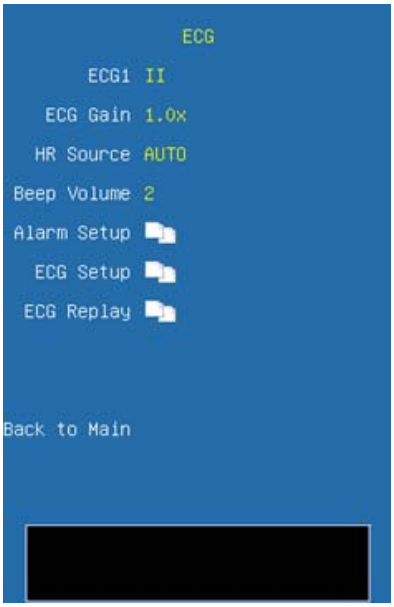
AHA Label	AHA Color	IEC Label	IEC Color	Location
RA	White	R	Red	Right foreleg.
LA	Black	L	Yellow	Left foreleg.
RL	Green	N	Black	Right hind leg.
LL	Red	F	Green	Left hind leg.
V	Brown	C	White	4th intercostal space (left).

When conducting 3-leads ECG monitoring, use 3-lead ECG cable. The three limb-leads of RA, LA and LL as shown in Fig. 5-1-2, will be placed on the relevant locations. This connection can establish the lead of I, II, III.

When conducting 7-leads ECG monitoring, use 5-lead ECG cable. The four limb-leads of RA, LA, RL and LL as shown in Fig. 5-1-2, will be placed on the relevant locations.

This connection can establish the lead of I, II, III, aVR, aVL, aVF; according to actual needs, chest lead V can be placed on any of locations.

5.1.6 Setup of ECG/HR parameters



ECG1 Select the ECG waveform, and this lead is the key monitoring lead.

ECG Gain Select the gain item of ECG waveform,and options are **AUTO, 0.25x, 0.5x, 1.0x, 2.0x** and **4.0x**.

HR Source Select HR source item, and common options are **AUTO, ECG**, **PLETH**.

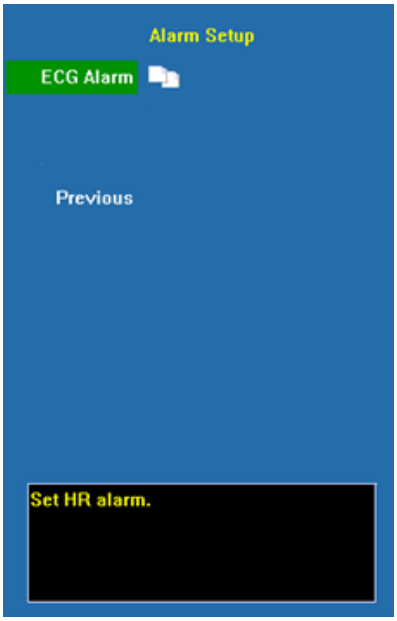
Beep Volume Select the volume of BEEP, and options are **Off, 1, 2, 3**. Once an option is selected, a testing beep will be produced.

Alarm Setup Click and open the dialog of alarm setup.

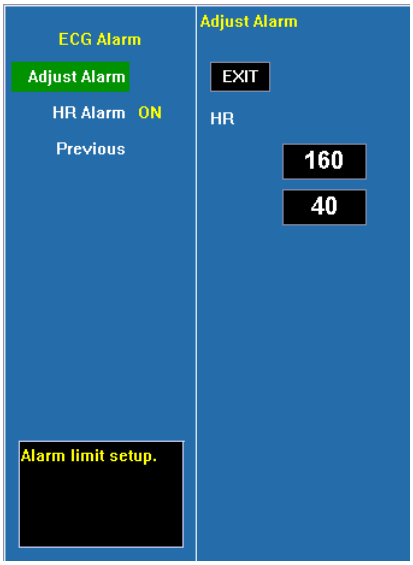
ECG Setup Click and open the dialog of ECG setup.

ECG Replay Click and open the dialog of ECG replay.

- **Alarm Setup**



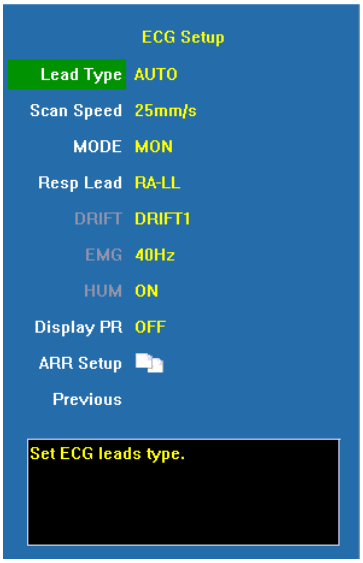
ECG alarm Click and open the dialog of HR alarm



Adjust alarm Select this option to enter the configuration of alarm limits and configure the limits by turning the trim knob to select the high limits and low limits, and exit by selecting〈**EXIT**〉. The upper part is the high limit and the lower part is the low limit.

HR alarm Select <**ON**> to enable HR over limit alarm; select <**OFF**> to disable HR over limit alarm.

- **ECG Setup**



Lead Type Select the lead type of ECG input, and options are **5 leads, 3 leads**.

Scan speed Select the scanning speed of ECG waveforms and options are **6.25mm/s, 12.5mm/s, 25mm/s** and **50mm/s**. The output speed of the recorder remains the same as the scanning speed of the ECG lead.

MODE Select monitoring mode, and options are **USER, DIAG, MON** and **OPS**.

Resp Lead Select the calculation methods of RESP lead, and options are **RA-LL, RA-LA, RL-LA** and **RL-LL**.

DRIFT Select the modes of drift filtrations, and options are **Off, Drift 1** and **Drift 2**.

EMG Select myoelectric filtration, and options are **Off, 25Hz** and **40Hz**.

HUM Select hum frequency filtration, and options are **Off** and **on**. Specific frequencies (50Hz, 60Hz) are configured in〈**Machine**〉and they must be configured according to the frequency of local power supply.

Display PR Select to simultaneity display pulse rate. If simultaneity display of PR is selected, PR will be simultaneity displayed at the lower left corner of the ECG parameter display region.

Hr Average Select HR average, and options are 8bpm, 12bpm, 14bpm and 16bpm.

The states of the filter under various modes of ECG

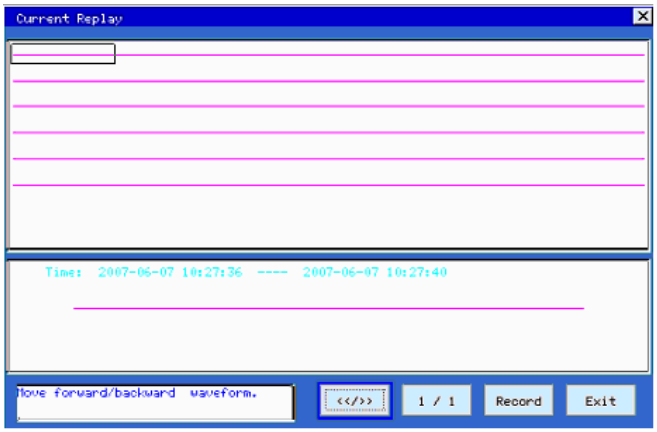
Filter / ECG mode	Drift filter	HUM filter	EMG filter
DIAG	OFF	OFF	OFF
OPS	Drift 2	50Hz/60Hz	25Hz
MON	Drift 1	50Hz/60Hz	40Hz
USER	Optional	Optional	Optional

Note: Under the mode of DIAG, OPS and MON, the state of the filter cannot be regulated. Only under the state of USER can the state be regulated.

Caution: When "3 Lead" is selected as <Lead Type>, ECG is in 3-lead input mode, and only Lead I, II or III can be measured.

Caution: When "5 Lead" is selected as <Lead Type>, ECG is in 5-lead input mode, and Lead I, II, III, aVR, aVL and aVF and one chest lead can be measured at the same time; if chest lead ECG cable is connected, V1~V6 can be measured at the same time.

- **ECG replay**



<</>> Select this button and it is possible to roll the waveform block by turning the trim knob back and forth, with 5 seconds each block.

1/1 Select this button, and it is possible to turn the pages back and forth, and the number before "/" shows the current page and the number following "/" shows total page numbers.

Record Print the enlarged waveform in current selection through the recorder**.**

Exit Exit the dialog of ECG replay.

5.1.7 Maintenance and Cleaning

If there is any sign that the ECG cable may be damaged or deteriorated, replace it with a new one instead of continuing its application on the animal.

To avoid extended damage to the equipment, disinfection is only recommended when stipulated as necessary in the hospital maintenance schedule, disinfection facilities should be cleaned first.

■ **Cleaning**:

Use a piece of clean cloth moistened in water or mild soap solution to clean the ECG cable.

■ **Disinfection**:

Use a piece of clean cloth to wipe the surface of the cable with a 10% bleach solution or 2% Cidex®, clean with clear water and wipe it dry.

5.2 Measurement of RESP

5.2.1 Principles of Measuring

Monitor measures RESP with the method of impedance. When an animal exhales and inhales, changes will take place in the size and shape of the thoracic cavity, causing consequent changes in the impedance between the two electrodes installed at the animal's chest. Based on the cycle of impedance changes, the respiration rate can be calculated.

5.2.2 Preparatory Steps of the Measurement of RESP

1) Plug the 5-lead ECG cable into the ECG socket of the monitor.

2) Place the various pads of the electrodes onto the body of animal and connect them to the relevant lead cables. At this moment, the screen will show RESP waves and the RESP rate will be calculated.

3) Set the parameters relevant to RESP monitoring.

5.2.3 Connect the ECG Cable with Animal and the Monitor

To measure RESP parameters, it is unnecessary to use other cables and it is only necessary to use the two RA and LL leads in the 5-lead ECG cable. So please plug the 5-lead ECG cable into the ECG socket and refer to Fig. 5-1-2 to place the RA and LL leads onto the body of animal.

Warning: For the sake of safety, all the leads on the 5-lead ECG cable must be connected to the body of animal.

Caution: In order to get the best RESP waveforms, when selecting lead Ⅱ for measuring RESP, it is advised to place RA and LL electrodes cornerways.

Caution: For reducing the influence of rhythmic blood flow on Resp electrode pickup impedance changes, avoid the liver area and ventricles of heart in the line between RA and LL electrodes. This is particularly important for cats.

Caution: The measurement of RESP is not applicable for animal with excessive motion, otherwise it may cause the mistake of RESP alarm.

5.2.4 Setup of RESP parameters

Scan Speed Select the scanning speed of RESP waveform, and options are **6.25mm/s, 12.5mm/s** and **25mm/s**.

Resp Gain Select the waveform gain, and options are **0.25x, 1x, 2x** and **4x**.

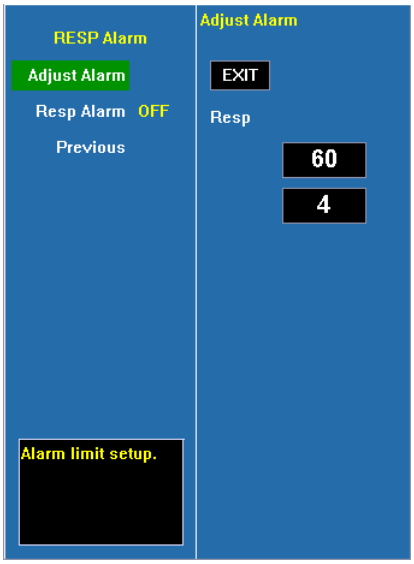
Resp Source When the system is configured with CO_2 module, RESP source can be selected as **AUTO and ECG**. Only when the monitor that user has bought has CO_2 module, **$EtCO_2$** of RESP source is valid, otherwise the RESP source is defaulted as **ECG**.

Apnea Alarm Suffocation alarm occurs when the time of zero RESP rate has reached this time scale, the alarm will be set off.

Resp Alarm Click and open the dialog of RESP alarm configuration.

Resp Lead Select the calculation methods of RESP lead, and options are **RA-LL, RA-LA, RL-LA** and **RL-LL**.

- **Resp Alarm**



Adjust alarm Select this option to enter the configuration of alarm limits; conduct the configurations by turning the trim knob to select high or low limits and exit by selecting 〈**EXIT**〉.The upper part is the high limit and the lower one is the low limit.

RESP alarm Select <**ON**> to enable RESP over limit alarm; select <**OFF**> to disable RESP over limit alarm.

5.2.5 Maintenance and Cleaning

No special operation demanded. Please refer to **chapter 5.1.7**.

5.3 Measurement of SpO_2/Pulse

5.3.1 Principles of Measuring

The measurement of degree of blood oxygen saturation (also known as pulse oxygen saturation, usually shortened as SpO_2) adopts the principles of light spectra and volume tracing. The LED emits lights with two specific bandwidths, which are selectively absorbed by hemoferrum and desoxyhemoglobin. The optical receptor measures the changes in the light intensity after the light passes the capillary network and estimates the ratio of hemoferrum and the total hemoglobin.

$$\text{Degree of pulse oxygen saturation \%} = \frac{\text{hemoferrum}}{\text{hemoferrum} + \text{desoxyhemoglobin}} \times 100\%$$

The sensor measurement wavelengths are nominally 660nm for the Red LED and 940nm for infrared LED.

Abnormal hemoglobin, carboxyhemoglobin, oxidative hemoglobin are not directly measured, for they are not the affecting factors in the measurement of SpO_2

Monitor adopts FFT filter and signal correlation techniques to deal with SpO_2 module's pulse waveform signals. Before the measurement of SpO_2, the noise produced in the false trace is smoothed so as to the eliminate disturbance in the measurement of saturation. In case of weak blood pulse, the noise produced by some confinements of electrical properties is greatly reduced.

The monitor is designed for measurement and recording of functional saturation.

5.3.2 Monitoring Procedure

1. Selecting SpO2 Sensor

Depending on the animal category, weight and application site, you can select the SpO2 sensor as required.

2. Connecting SpO2 Sensor

Plug the SpO2 sensor cable into the SpO2 connector on the measurement module.

3. Applying SpO2 Sensor

Place the sensor on the animal's tongue or ear. For dogs, cats and equines, place the sensor on their tongue. When placing the sensor, place the optical part of the sensor in the center of the tongue. You can also place the sensor on the animal's lips, toes, ears, prepuce and vulva.

Caution: In case it is necessary to add a clip to fix the fingertip sensor, the cable instead of the sensor itself should be clipped. Please note that the cable of sensor should not be pulled with force.

Note: Frequent movements of the sensor may result in errors in the readings of the monitor.

Warning: In case NIBP and SpO_2 are measured at the same time, please do not place the SpO_2 sensor and the NIBP cuff on the same end of the limb, for the measurement of NIBP will block blood flow, affecting the measurement of SpO_2.

Note: When using SpO_2 sensor, care should be taken to shield external light sources, such as light of thermo therapy or ultraviolet heating light, otherwise the measurements may be disturbed. Under such conditions as shock, hypothermia, anemia or the use of blood vessel-activating drugs, and with the existence of such substances as carboxyhemoglobin, methemoglobin, methylene blue the result of the SpO_2 measurement will be possibly not accurate.

Note:

- **Make sure the nail faces to the light window.**
- **The wire should be on the backside of the hand.**
- **SpO_2 waveform is not proportional to the pulse volume.**

Warning: Do not use the sterile supplied SpO_2 sensors if the packing or the sensor is damaged and return them to the vendor.

Warning: Prolonged use or the animal's condition may require changing the sensor site periodically. Change the sensor site and check skin integrity, circulatory status, and correct alignment at least every 4 hours.

5.3.4 Setup of SpO2/Pulse parameters

Beep Volume Select the BEEP volume and options are **Off, 1, 2**, **3**. Once an option is selected, a testing beep will be produced.

HR Source Select the option of HR source, and options are **AUTO, ECG** and **PLETH**. When selecting **AUTO**, the HR source is ECG with the priority; and if there is no current ECG, the system automatically derives HR from SpO_2.

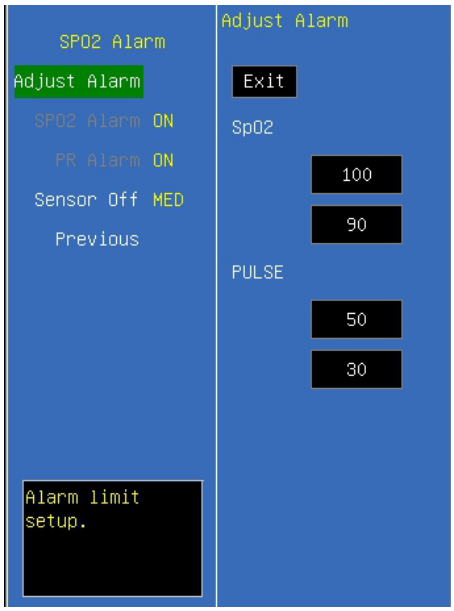
Scan Speed Select the scanning speed of the SpO_2 waveform, and options are **6.25mm/s, 12.5mm/s, 25mm/s** and **50mm/s**.

Alarm Setup Click and open the dialog of SpO_2 alarm configuration.

Average Time Select the average time for SpO_2. The shorter the averaging time is, the

quicker the monitor responds to the change in the animal's oxygen saturation level.（It is invalid while use Nellcor SpO_2 module）.

■ **Alarm Setup**



Adjust alarm Select this option to enter the configuration of alarm limits; conduct the configurations by turning the trim knob to select high and low limits and exit by selecting 〈**EXIT**〉**.** The upper part is the high limit and the lower one is the low limit.

SpO_2 alarm Select <**ON**> to enable SpO_2 over limit alarm; select <**OFF**> to disable SpO_2 over limit alarm.

PR alarm Select <**ON**> to enable PR over limit alarm; select <**OFF**> to disable PR over limit alarm.

Sensor off Set SpO2 sensor off alarm level.

5.3.5 Signal strength prompt

The signal strength prompt is used to indicate if the SpO_2 signal strength measured is adequacy.

Prompt	Description
Weak Signal	The invalidation weak signal
*	The low intensity signal
**	The medium intensity signal
***	The high intensity signal

5.3.6 Measurement Limitation

If you doubt the SpO_2 measurements, check the animal's vital signs first, then check the monitor and SpO_2 sensor. The following factors may influence the accuracy of measurements:

——Incorrect sensor application or use;

——Significant levels of dysfunctional hemoglobins. (such as carboxyhemoglobin or methemoglobin);

——Intravascular dys such as indocyanine green or methylene blue;

——Exposure to excessive illumination, such as surgical lamps (especially ones with a xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps, or direct sunlight (exposure to excessive illumination can be corrected by covering the sensor with a dark or opaque material)

——Excessive animal movement;

——Venous pulsations;

——Placement of a sensor on an extremity with a blood pressure cuff, arterial catheter, or intravascular line.

——Low perfusion;

——Electromagnetic interference, such as MRI device;

——Electrosurgical units.

Loss of pulse signal can occur in any of the following situation:

——The sensor is too tight;

——There is excessive illumination from light sources such as a surgical lamp, a brilirubin lamp, or sunlight;

——A blood pressure cuff is inflated on the same extremity as the one with a SpO2 sensor attached;

——The animal has hypotension, severe vasoconstriction, severe anemia, or hypothermia;

——There is arterial occlusion proximal to the sensor.

——The animal is in cardiac arrest or is in shock.

5.3.7 Maintenance and Cleaning

Warning:

- **Do not sterilize by irradiation, steam, or ethylene oxide.**
- **Do not subject the sensor to autoclaving.**
- **Do not immerse the sensor into any liquid.**
- **Do not use any sensor or cable that may be damaged or deteriorated.**

Note: When disposing the disposable SpO_2 probe or useless SpO_2 probe, please observe all local, state, and federal regulations that relate to the disposal of this products or similar products.

For reusable SpO_2 sensor

Please unplug the sensor from the monitor before cleaning or disinfection.

Clean or disinfect the sensor before attaching to a new animal.

■ **Cleaning**:

Use a piece of clean cloth moistened in water or mild soap solution to clean the sensor and animal contact surfaces.

■ **Disinfection:**

Use a piece of clean cloth to wipe the sensor and animal contact surfaces with a 10% bleach solution or 70% isopropyl alcohol, clean with clear water and wipe it dry.

5.4 Measurement of TEMP

5.4.1 Brief Introduction to Measurement of TEMP

Monitor measures TEMP with TEMP sensors. The TEMP module of Monitor uses TEMP cable compatible with YSI-400. The minimum time to get accurate temperature measuring value is 3 minutes.

5.4.2 Preparatory Steps of the Measurement of TEMP

1) Plug the TEMP cables into the TEMP sockets of the monitor.

2) Place the TEMP sensors on body of animal and the screen will show the value of TEMP measurement.

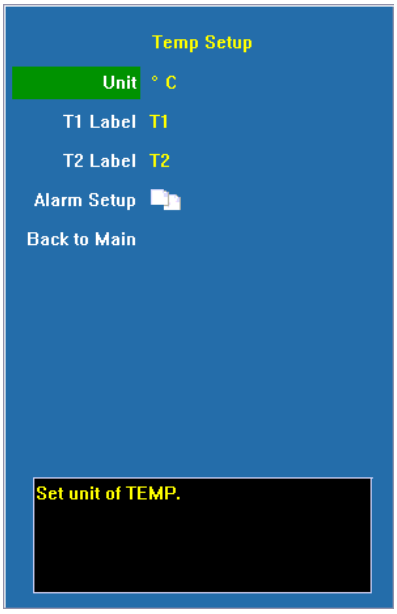
3) Set the parameters relevant to TEMP.

5.4.3 Connecting Animal and Monitor

Plug the TEMP cable into the sockets marked with TEMP (either of TEMP1 and TEMP2), and then stick the TEMP sensor securely onto the body of animal.

Caution: The TEMP sensor and cables should be handled with care. When not in use, the sensor and the cable should be rounded into loose ring shape.

5.4.4 Setup of TEMP Parameters



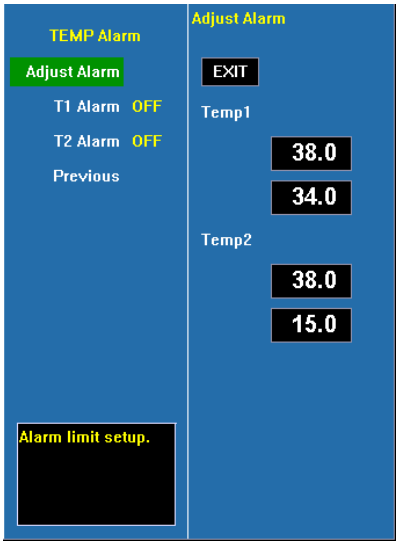
Unit Select the unit of TEMP, and options are ℃ and ℉.

T1 Label Select the labeling name for TEMP 1, and options are **T1, Eso, Naso, Tymp, Rect, Blad** and **Skin**.

T2 Label Select the labeling name for TEMP 2,and options are **T2, Eso, Naso, Tymp, Rect, Blad** and **Skin**.

Label	Meanings	Label	Meanings
Eso	Esophageal temperature	Rect	Rectal temperature
Naso	Nasopharyngeal temperature	Blad	Bladder temperature
Tymp	Tympanic temperature	Skin	Skin temperature

Alarm Setup Click and open the dialog of configuration for TEMP alarm.



Adjust alarm Select this option to enter the configuration of alarm limits; conduct the configurations by turning the trim knob to select high or low limits and exit by selecting 〈**EXIT**〉. The upper part is the high limit and the lower one is the low limit.

T1 alarm Select <**ON**> to enable T1 over limit alarm; select <**OFF**> to disable T1 over limit alarm.

T2 alarm Select <**ON**> to enable T2 over limit alarm; select <**OFF**> to disable T2 over limit alarm.

5.4.5 Maintenance and Cleaning

Reusable temp probes

1. The temp probe should not be heated above 100℃. It should only be subjected briefly to temperatures between 80℃ and 100℃.
2. Only detergents containing no alcohol can be used for disinfection.
3. The rectal probes should be used, if possible, in conjunction with a protective rubber cover.

■ **Cleaning**:

Use a piece of clean cloth moistened in water or mild soap solution to clean the probe.

■ **Disinfection**:

Use a piece of clean cloth to wipe the surface of the cable with 70% isopropyl alcohol, a 10% bleach solution or 2% Cidex®, clean with clear water and wipe it dry.

Warning: Disposable TEMP probes must not be re-sterilized or reused.

Note: For protecting environment, the disposable TEMP probe must be recycled or disposed of properly.

Disposal Note: Should the TEMP probe become damaged beyond repair, or for some reason its useful life is considered to be at an end, please observe all local, state, and federal regulations that relate to the disposal of this products or similar products.

Warning: The calibration of temperature measurement is necessary for every two years (or as frequently as dictated by your Hospital Procedures Policy). When you need calibrate the temperature, contact the manufacture please.

Note: The self-test of the temperature measurement is performed automatically once every 10 minutes during the monitoring. The test procedure lasts about one second and does not affect the normal measurement of the temperature monitoring.

Note: If Temperature to be measured beyond probe's measuring range, over measuring range alarm will display on the screen. Check out if probe is on the corresponding animal body site, or change it to other site on the animal.

Note: If "TEMP self-check error" display on the screen, it is possibly that something is wrong with the temperature capture circuit, the operator should stop using the monitor and contact with the company.

5.5 Measurement of NIBP

5.5.1 Brief Introduction to Measurement of NIBP

Monitor automatically conducts measurement of NIBP with the method of shockwave. The method of shockwave indirectly estimates the systolic and diastolic pressures within the blood vessels by measuring the change of the pressure within blood pressure cuff along with the volume of the arteries and calculates the average pressure.

The measurement time of BP on a calm animal is less than 40s, and when each measurement ends, the cuff automatically deflates to zero.

The monitor applies to large animals, medium-size animals and small animals.

The monitor measures the blood pressure during the time of deflation. Monitor automatically conducts the second and third inflation measurements in case during the first inflation it is unable to measure the value of BP, and gives out the information for measurement failures.

The longest cuff pressure maintaining duration is 120s, and when the time is exceeded, the air will be deflated automatically. The monitor has been designed with hardware protection circuit regarding overpressure, errors of microprocessors, and the occurrence of power failure.

5.5.2 Preparatory Steps of Measurement of NIBP

1) Plug the air hose of cuff into the NIBP socket of the monitor and tighten it clockwise to ensure secure contact of the plug and the socket (Please note that the plug should be

loosened by turning counterclockwise first before unplugging).

2) Place the cuff on the veterinary animal.

Place the animal on a padded surface or chair to provide comfort. Shivering will inhibit the monitor from making a determination.

■ Cuff placement for a cat

A cat may be left in its owner's lap to keep it calm. Measurements are best done in an area of the hospital away from noise and bright lights. The animal may be held so that the front limbs are free for cuff placement. In conscious animals, the tail may be the most appropriate location for placement of the cuff. Cats may be most comfortable in sternal recumbency making the tail a more preferable site.

For the median artery on the foreleg, place the cuff around the forelimb, between the elbow and carpus. It is not necessary to center the cuff over the artery which is on the medial side of the leg because of the fully encircling bladder design. Hair need not be clipped except when heavily matted. In cats less than five pounds when measurements are difficult to obtain, place the cuff around the leg above the elbow to obtain measurements from the brachial artery. Measurements from the coccygeal artery may be used by placing the cuff around the base of the tail but not in anesthetized animals. As shown in Fig.5-5-1.

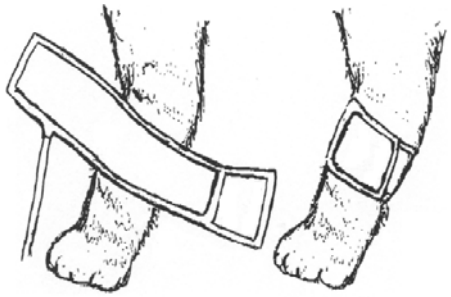


Fig.5-5-1 Cat cuff placement

■ Cuff placement for a dog

For measurements in dogs, it is preferable to use the right lateral, sternal or dorsal recumbent positions. That is not a problem in anesthetized animals, but it may be difficult to get large dogs to cooperate for proper positioning. If the dog is in a sitting position, place the front paw on the operator's knee and take measurements from the metacarpus.

Sites for cuff placement are the metacarpus, metatarsus and anterior tibial. In anesthetized animals, most surgeries are done on the posterior part of the body so the metacarpal area of the forelimb is most convenient. In situations where this is not possible, the cuff should be wrapped around the metatarsus just proximal to the tarsal pad or around the hind leg just distal to the hock. The tail site should not be used for cuff placement during anesthesia.

It is not necessary to center the cuff over the artery because of the fully encircling bladder design. If the hair over the artery site is too thick or matted for good contact, it should be clipped. As shown in Fig.5-5-2.

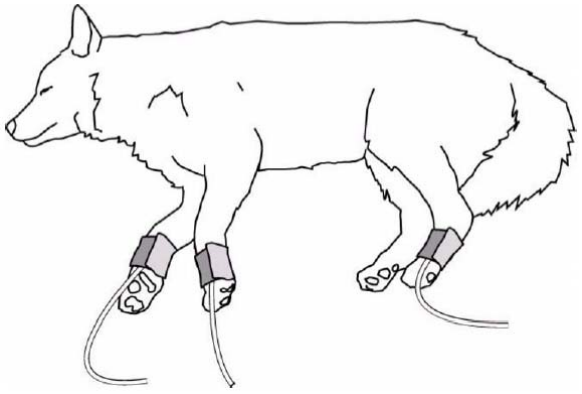


Fig.5-5-2 Dog cuff placement

■ Large animals

A large animal such as a horse should be in a stock, standing still, or lying down.

For horses and cows, the cuff can be wrapped around the base of the tail using the coccygeal artery on the ventral surface.

3) Set the parameters and modes relevant to NIBP.

Note: Make sure that the air conduit connecting the blood pressure cuff and the monitor is neither blocked nor tangled, and avoid compression or restriction of air conduit.

5.5.3 Connecting to Animal and the Monitor

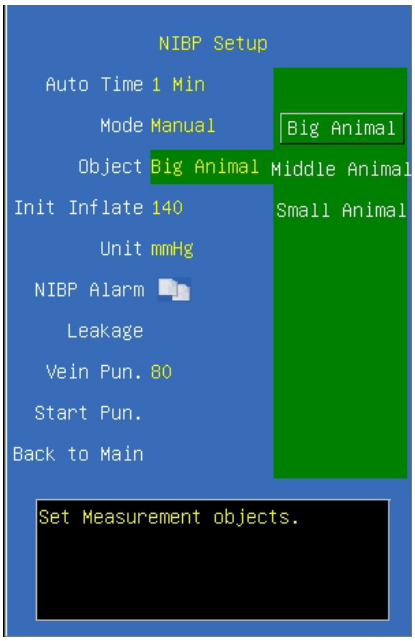
Plug the connector of air hose on cuff into the socket marked with NIBP and wrap the cuff onto the arm of animal. Make sure the mark of Φ on the cuff is placed on the femoral artery of the arm and the air hose should be below the cuff so as to ensure the air hose is not snarled after coming out of the cuff. The white line on the cuff should be within the range of " ⟺ ", otherwise it will be necessary to replace it with a more suitable cuff (smaller or bigger one). The cuff should be placed on the same plane with the heart so as to prevent the errors in readings caused by the effects of hydrostatics of the blood column between the heart and the cuff. If the position of the cuff is higher than the plane of heart, the measured BP readings tend to be smaller; in case the position of the cuff is lower than the plane of the heart, the measured BP readings tend to be higher.

Note: The accuracy of measurement of BP depends on the suitability of the cuff. Select the size of the cuff according to the size of the arm of animal. The width of the cuff should be 40% of the circumference of the upper arm or 2/3 of the length of the upper arm.

Warning:

- **You must not perform NIBP measurements on animals with sickle-cell disease or under any condition that the skin is damaged or expecting to be damaged.**
- **For a thrombasthemia animal, it is important to determine whether measurement of the blood pressure shall be done automatically. The determination should be based on the clinical evaluation.**
- **Prolonged non-invasive blood pressure measurements in Auto mode are associated with purport, ischemia and neuropathy in the limb wearing the cuff. When monitoring an animal, examine the extremities of the limb frequently for normal color, warmth and sensitivity. If any abnormality is observed, stop the blood pressure measurements.**

5.5.4 Setup of NIBP Parameters



Auto Time Configure the cycle intervals of BP measurement and options are **1min, 2min, 3min, 4min, 5min, 10min, 15min, 30min, 60min, 90min, 2Hour, 4Hour** and **8Hour**. During measurements, it cannot be altered.

Mode Configure the measurement mode of NIBP and options are **Manual, Auto** and **STAT**.

If STAT mode is configured, after measurement, the system will be automatically configured as the previous measurement mode. There is no STAT mode for neonatal. If STAT is selected, the rapid measurement will be initiated once it is confirmed.

Object Objects of measurements shall be configured, and options are **Big Animal, Middle Animal** and **Small Animal**. The selection of objects of measurements during the measuring process will terminate the ongoing measurement.

Init_Inflate Select an appropriate initial cuff inflation pressure according to animal category and requirement.

Unit Select the unit for the NIBP measurement, and options are **kPa** and **mmHg**.

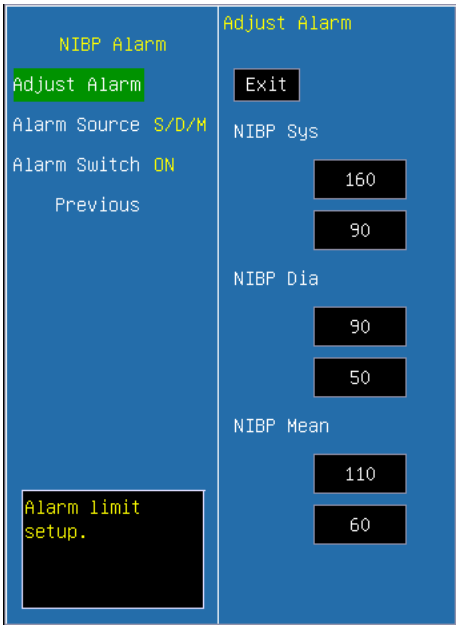
NIBP Alarm Click and open the dialog of alarm configuration of NIBP.

Leakage Click it and start air leakage test.

Vein Pun. You can use the NIBP cuff to cause sub-diastolic pressure, and block the venous blood vessel to assist venous puncture. Select〈**Vein Pun**.〉, and set to a proper value.

Start Pun. After you set a proper value for 〈**Vein Pun**.〉, and select〈**Start Pun.**〉to start it.

- **NIBP Alarm**



Adjust alarm Select this option to enter the configuration of alarm limits; conduct the configurations by turning the trim knob to select high or low limits and exit by selecting 〈**EXIT**〉. The upper part is the high limit and the lower one is the low limit.

Alarm Source Select the alarm source for NIBP parameters. When the selected parameter or one of the parameter exceed alarm limit, the monitor will give out alarm signal. The options are as follow:

〈**S**〉: Only Systolic pressure exceeds the alarm limit will trigger the alarm system.

〈**D**〉: Only Diastolic pressure exceeds the alarm limit will trigger the alarm system.

〈**M**〉: Only Mean pressure exceeds the alarm limit will trigger the alarm system.

〈**S/M**〉：Systolic pressure or mean pressure exceeds the alarm limit will trigger the alarm system.

〈**D/M**〉：Mean pressure or diastolic pressure exceeds the alarm limit will trigger the alarm system.

〈**S/D**〉：Systolic pressure or diastolic pressure exceeds the alarm limit will trigger the alarm system.

〈**S/D/M**〉：Mean pressure, systolic pressure or diastolic pressure exceeds the alarm limit will trigger the alarm system.

Alarm Switch Select <**ON**> to enable parameter over limit alarm; select <**OFF**> to disable parameter over limit alarm.

5.5.5 Precautions during Measurement

When using the STAT measurement or AUTO measurement, if the time duration is relatively long, care must be taken to check such abnormalities as purple spots, coldness and numbness at the limb end. If there are such phenomena, the cuff should be relocated or the measurement of NIBP should be halted.

The presence of factors that change the properties of the cardiovascular dynamics of animal will adversely affect the measurement value of the monitor, and shock and hypothermia will also affect the accuracy of the measurement.

When the built-in main artery balloon pump is applied on the animal, the measurement value of NIBP will be affected.

For the limb that is on an intravenous drip or in a catheter insertion, or if the animal is connected to the heart-lung machine, or the animal is experiencing shiver or convulsions, the measurement of NIBP cannot be conducted.

When errors occur in the measurement of NIBP, the error codes will appear in the parameter display zone of the NIBP, and for the cause of the errors, please refer to **chapter 6.8.5**.

5.5.6 Blood pressure reference values

The blood pressure values for cats are not breed-specific. However, the most sensitive way to detect changes in feline blood pressure is also by comparing individual blood pressure readings taken over time.

Normal feline blood pressure: 124/84.

The normal values for dogs are breed-specific. Those for Golden Retrievers, Labradors and giant breeds tend to be lower than the overall average, and those for greyhounds and in general racing hounds tend to be higher. The table that follows lists the normal values for common dog breeds using oscillometric blood pressure monitors.

Average canine blood pressure: 133/75.

Breed	Systolic(mmHg)	Diastolic(mmHg)	Pulse Rate(bpm)
Labrador Retriever	118 ± 17	66 ± 13	99 ± 19
Golden Retriever	122 ± 14	70 ± 11	95 ± 15
Great Pyrenees	120 ± 16	66 ± 6	95 ± 15
Yorkshire Terrier	121 ± 12	69 ± 13	120 ± 14
West Highland	126 ± 6	83 ± 7	112 ± 13
Border Collie	131 ± 14	75 ± 12	101 ± 21
King Charles Spaniel	131 ± 16	72 ± 14	124 ± 24
German Shepherd	132 ± 13	75 ± 10	108 ± 23
Terrier	136 ± 16	76 ± 12	104 ± 16
Bullterrier	134 ± 12	77 ± 17	122 ± 6
Chihuahua	134 ± 9	84 ± 12	109 ± 12
Miniature Breeds	136 ± 13	74 ± 17	117 ± 13
Pomeranian	136 ± 12	76 ± 13	131 ± 14
Beagle	140 ± 15	79 ± 13	104 ± 16
Dachshound	142 ± 10	85 ± 15	98 ± 17
Saluki	143 ± 16	88 ± 10	98 ± 22
Greyhound	149 ± 20	87 ± 16	114 ± 28
Pointer	145 ± 17	83 ± 15	102 ± 14

5.5.7 Periodic Check

Calibration

Warning: The calibration of the NIBP measurement is necessary for every two years (of as frequently as dictated by your Hospital Procedures Policy). The performance should be checked according to the following details.

Procedure of the Pressure Transducer Calibration:

1) Replace the cuff of the device with a rigid metal vessel with a capacity of 500 ml ±5%.
2) Connect a calibrated reference manometer with an error less than 0.8 mmHg and a ball pump by means of a T-piece connector and hoses to the pneumatic system.
3) Access the NIBP menu.
4) Turn the trim knob to the〈**Manometer**〉option and press. Then the NIBP module has started performing calibration.
5) Inflate the pneumatic system to 0mmHg, 50mmHg and 200mmHg by ball pump separately. The difference between the indicated pressure of the reference manometer and the indicated pressure of the monitor will not exceed 3 mmHg. Otherwise, please contact our customer service.

6) Press the button on front panel can stop the calibration.

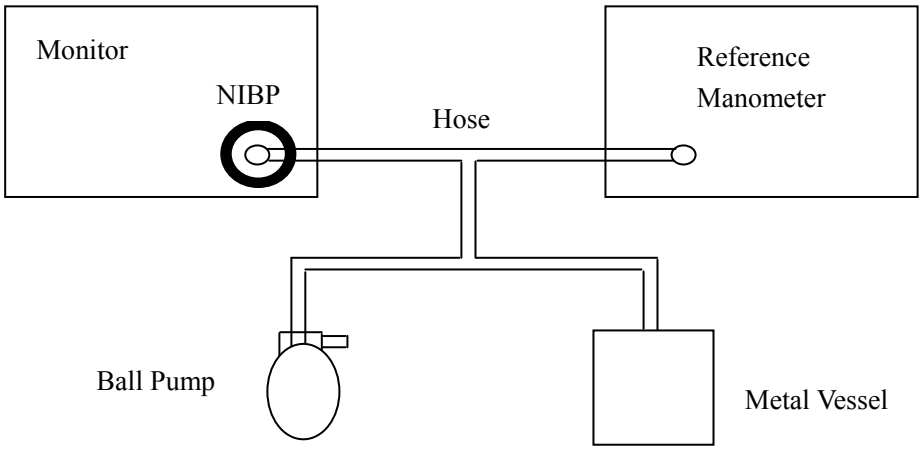


Fig. 5-5-6 Diagram of NIBP calibration

Air Leakage check

Procedure of the air leakage test:

1) Connect the cuff securely with the socket for NIBP air hole.
2) Wrap the cuff around the cylinder of an appropriate size.
3) Access the NIBP setup window.
4) Select the〈**Leakage**〉option and press. Then the prompt "Air Leakage test" will appear on the NIBP parameter area indicating that the system has started performing Air Leakage test.
5) The system will automatically inflate the pneumatic system to about 180mmHg.
6) After 20 seconds or so, the system will automatically open the deflating valve, which marks the completion of an air leakage test.
7) If no error information displays on NIBP parameter area, it indicates that the airway is in good situation and no air leaks exist. However if the prompt "AIR SYSTEM LEAK" appears in the place, it indicates that the airway may have air leaks. In this case, the user should check for loose connection. After confirming secure connections, the user should re-perform the air leakage test. If the failure prompt still appears, please contact the manufacturer for repair.

8） Press the button on front panel can also stop the test.

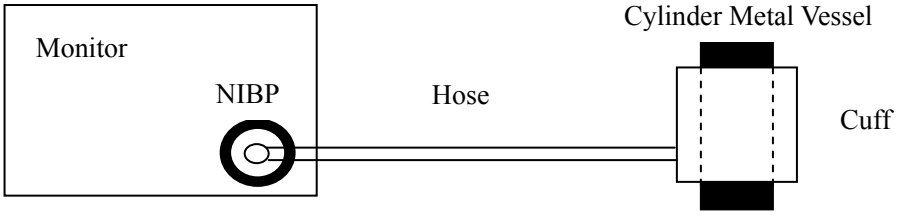


Fig. 5-5-7 Diagram of air leakage check

5.5.7 Maintenance and Cleaning

Warning: Do not squeeze the rubber hose on the cuff. Do not allow liquid to enter the connector socked at the front of the monitor. Do not wipe the inner part of the connector socked when cleaning the monitor.

Warning: If liquid is inadvertently splashed on the equipment or its accessories, or may enter the conduit or inside the monitor, contact local customer service center.

Warning: Disposable blood pressure cuff must not be re-sterilized or reused.

Disposal Note: Should the blood pressure cuff become damaged beyond repair, or for some reason its useful life is considered to be at an end, please observe all local, state, and federal regulations that relate to the disposal of this products or similar products.

For Reusable Blood Pressure Cuff:

■ **Cleaning**:

1. Please clean the cuff termly.
2. Take down the cuff from the connector, take out the bladder from the cover of the cuff.
3. Use a piece of clean cloth moistened in water or mild soap solution to clean the bladder and the tube.
4. Clean the cover of the cuff with the mild soap solution.
5. Dry the cover and the bladder, then take the bladder into the cover to use again.

Warning:

- **Clean the bladder frequently, will cause the bladder scathed, except the necessary, do not clean the bladder.**
- **Do not dry the bladder and cover with high temperature.**
- **If need the high level disinfecting, please selecting the disposable cuff.**

5.6 Measurement of CO2 (Microflow, LoFlo)

Use the CO_2 measurement to monitor the animal's respiratory status and to control animal ventilation.

5.6.1 Preparing to Measure CO2

1. Attaching the LoFlo Module Cable

To attach the LoFlo module cable, plug the cable into the CO_2 socket on the left panel of monitor by matching the key on the cable to the key on the connector.

Caution: To remove the module cable from the monitor, grasp the collar surrounding the cable and pull up.

2. Attaching the Sample Cell

Follow these steps:

1) Insert the LoFlo sample cell into the LoFlo sample cell receptacle .A "click" will be heard when the sample cell is properly inserted. (Fig.5-6-1, Fig.5-6-2)

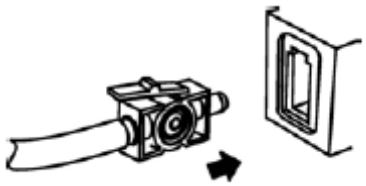


Fig.5-6-1

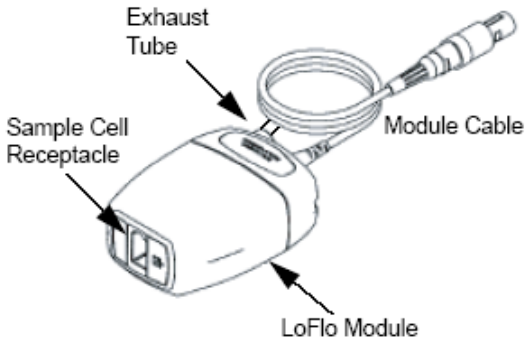


Fig.5-6-2

Note:

- **Inserting the sample cell into the receptacle automatically starts the sampling pump. Removal of the sample cell turns the sample pump off.**
- **To remove the sample cell from the sample cell receptacle, press down on the locking tab and pull the sample cell from the sample cell receptacle.**

2) If the sampling pump fails to turn on, or runs intermittently, perform a "Zero" procedure. (Refer to the ***chapter 5.6.3***)

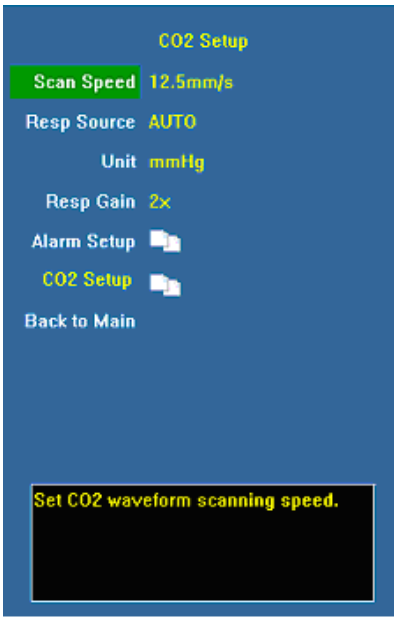
3) Ensure that the LoFlo module exhaust tube vents gases away from the module environment.

4) Wait for the CO2 module to warm up.

The monitor will display the **Sensor Warm Up** message for approximately one minute while the module warms up to operating temperature. The message disappears when the module is ready for use.

Note: Warm up time varies with ambient temperature of the module.

5.6.2 Setup of CO2 parameters



Scan speed Select the scanning speed of RESP waveforms, and options are **6.25mm/s, 12.5mm/s** and **25mm/s**.

RESP source Select RESP source. And options are **AUTO, ECG** and **EtCO$_2$**.

Unit Select the unit for CO_2, and options are **mmHg, %** and **kPa**.

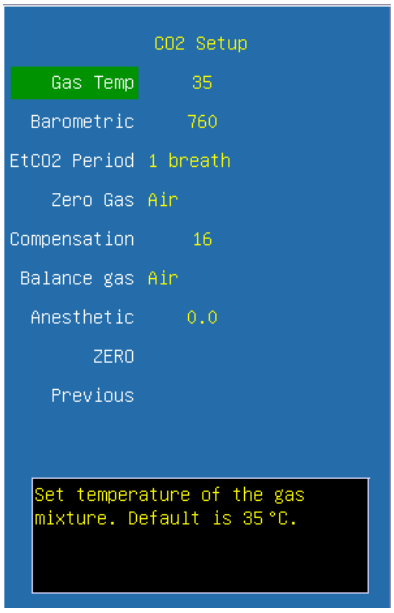
Resp Gain Select the gain of RESP waveform from ECG, and options are **1x, 2x** and **4x**.

Alarm setup Click and open the dialog of CO_2 alarm.

CO_2 setup Click and open the dialog of CO_2 setup.

Wave Type Select display type of CO_2 waveform. The options are **Draw** and **Fill**.

Back to Main Return to main screen.



Gas Temp Select the temperature of gas. (Turn the trim knob with an increment or decrement of 1℃)

Barometric Select the Atmospheric pressure. (Turn the trim knob with an increment or decrement of 1mmHg)

$EtCO_2$ Period Select the response time of $EtCO_2$, the options are **1 breath, 10s** and **20s**.

Zero Gas Select the gas type of zeroing, the options are **Air** and **N_2**.

Compensation Select the concentration of oxygen. (Turn the trim knob with an increment or decrement of 1%)

Balance gas Select the balance gas type, the options are **Air, N_20** and **Helium**.

Anesthetic Select the concentration of balance gas. (Turn the trim knob with an increment or decrement of 0.1%)

Zero Press the button to start zeroing. It is only valid when the system detects that the module can be zeroed.

5.6.3 Zero

Zeroing allows the LoFlo module or CAPNOSTAT 5 sensor to adjust to the optical characteristics, in order to obtain accurate readings. While zeroing is recommended the first time a LoFlo module or CAPNOSTAT 5 sensor is connected to the unit, it is only absolutely necessary when the message **Zero Required** is displayed.

Warning:

- **Always ensure that the sample cell is properly connected to the LoFlo module before zeroing.**
- **Always ensure that the CAPNOSTAT5 sensor is properly connected to the airway adapter before zeroing.**

Follow these steps:

1) Ensure that the nasal cannula or airway adapter is not connected to the animal or close to any source of CO2 (including the animal's, your own, exhaled breath and ventilator exhaust valves).

1) Press the〈**Zero**〉option in〈**CO_2 Setup**〉menu. The unit zeroes the module and displays the **Zero In Progress** message for approximately 15-20 seconds. The message disappears upon completion of the zeroing.

Note:

- **Do not attempt zeroing for 20 seconds after removing the adapter or cannula from the animal's airway. This time allows any CO2 remaining in the adapter or cannula to dissipate before zeroing.**
- **Do not attempt to zero the module while the adapter or cannula is in the animal's airway.**
- **Do not attempt zeroing if the temperature is not stable.**
- **Zeroing with CO2 in the adapter or cannula can lead to inaccurate measurements or other error conditions. If you attempt zeroing while CO2 remains in the adapter or cannula, the time required to zero the module may be increased.**

5.6.4 Applying LoFlo airway adapter or cannula

For intubated animals requiring an airway adapter: Install the airway adapter at the proximal end of the circuit between the elbow and the ventilator Y section. (Fig.5-6-3)

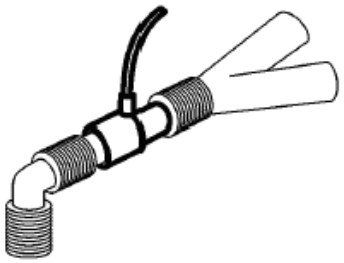


Fig.5-6-3

For intubated animals with an integrated airway adapter in the breathing circuit: Connect the male connector on the straight sample line to the female port on the airway adapter. (Fig.5-6-4)

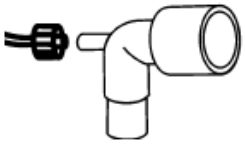


Fig.5-6-4

For non-intubated animals: Place the nasal cannula onto the animal. (Fig.5-6-5)

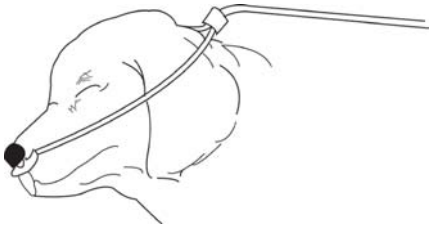


Fig.5-6-5

For nasal or oral-nasal cannulas with oxygen delivery, place the cannula on the animal as shown then attach the oxygen supply tubing to the oxygen delivery system and set the prescribed oxygen flow.

Warning: Always connect the airway adapter to the sensor before inserting the airway adapter into the breathing circuit. In reverse, always remove the airway adapter from the breathing circuit before removing the sensor.

Caution: Always disconnect the cannula, airway adapter or sample line from the sensor when not in use.

5.6.5 Removing Exhaust Gases from the System

Warning: **When using the microflow CO2 measurement on animals who are receiving or have recently received anesthetics, connect the outlet to a scavenging system, or to the anesthesia machine/ventilator, to avoid exposing medical staff to anesthetics.**

Use an exhaust tube to remove the sample gas to a scavenging system. Attach it to the LoFlo sensor at the outlet connector.

5.6.6 Safety considerations

Warning:

- **Do not use in the presence of flammable anesthetics or other flammable gasses. Use of the LoFlo Module in such environment may present an explosion hazard.**
- **Electrical Shock Hazard: Always disconnect the LoFlo Module before cleaning. Do not use if it appears to have been damaged. Refer servicing to qualified service personnel.**
- **Do not position the sensor cables or tubing in any manner that may cause entanglement or strangulation.**
- **Reuse, disassembly, cleaning, disinfecting or sterilizing the single animal use cannula kits and on-airway adapters may compromise functionality and system performance leading to a user or animal hazard. Performance is not guaranteed if an item labeled as single animal use is reused.**
- **Inspect the LoFlo on- airway adapters, LoFlo sampling kits and CO2 airway adapters for damage prior to use. Do not use the LoFlo on- airway adapters, LoFlo sampling kits and CO2 airway adapters if they appear to be damaged or broken.**
- **Replace the LoFlo on- airway adapters, LoFlo sampling kits and CO2 airway adapters if excessive secretions are observed.**
- **Monitor the CO_2 waveform (Capnogram). If you see changes or abnormal appearance check the airway adapters and the sampling line. Replace it if needed.**
- **Do not operate the LoFlo Module when it is wet or has exterior condensation.**
- **Do not apply excessive tension to any cable.**
- **Do not use device on animals that cannot tolerate the withdrawal of 50 ml/min±10 ml/min from the airway or animals that cannot tolerate the added dead space to the airway.**
- **Do not connect the exhaust tube to the ventilator circuit.**

Caution:

- **Use only accessories provided by manufacturer.**
- **Do not sterilize or immerse the LoFlo Module in liquids.**
- **Do not clean the LoFlo Module and accessories except as directed in this manual.**
- **Remove the LoFlo sampling kit sample cell from the receptacle when not in use.**
- **Do not stick appendage into sample receptacle.**
- **Always insert sample cell before inserting the on-airway adapter into the ventilated circuit**
- **Always remove the on-airway adapter from the ventilated circuit before removing the sample cell.**

Note:

- **This product and its accessories are latex free.**
- **After the life cycle of the LoFlo Module and its accessories have been met, disposal should be accomplished following national and local requirements.**
- **Nitrous oxide, elevated levels of oxygen and helium can influence the CO2 measurement. Please setup gas compensation according to actual state.**
- **Barometric pressure compensation is required to meet the stated accuracy of the LoFlo Module.**

Chapter 6 Alarm

This chapter gives general information about the alarm and corresponding remedies.

Note: The equipment generates all the auditory and visual alarms through speaker, LED and screen.

6.1 Alarm Category and level

There are two kinds of alarms, defined as physiological alarm and technical alarm. Physiological alarms refer to those alarms triggered by animal's physiological situation which could be considered dangerous to his or her life, such as SpO_2 exceeding alarm limit (parameter alarms). Technical alarms refer to system failure, which can make certain monitoring process technically impossible or make monitoring result unbelievable. General alarm belongs to those situations that cannot be categorized into these two cases but still need to pay some attention. Each alarm, either technical or physiological, has its own priority.

Alarms in the monitor are divided into three priorities, that is: high level, medium level and low level.

- High level alarm indicates the animal's life is in danger. It is the most serious alarm.
- Medium level alarm means serious warning.
- Low level alarm is a general warning.

Only alarm level of parameters exceeding limits alarm can be modified by the user, the other alarm level of physiological and technical alarms are preset by the system and they cannot be changed by the user.

6.2 Alarm Modes

When alarm occurs, the monitor may raise the user's attention in two ways, which are auditory prompt, visual prompt and description. Visual prompt is given by alarm indicating lamp and screen of the monitor, auditory prompt is given by speaker in the device. Physiological alarm information is displayed in the Physiological Alarm area. Most of technical alarm information is displayed in the Technical Alarm area. Technical alarms related to NIBP measurement are displayed in the NIBP parameter area.

The Physiological Alarm area is on the upmost right part of the screen. The Technical Alarm area is to the left side of the Physiological Alarm area.

The alarm sound and visual display comply with the standard IEC 80601-1-8.

Note: The concrete presentation of each alarm prompt is related to the alarm priority.

Alarm Sound

The high/medium/low-level alarms are indicated by the system in following different audio ways:

Alarm level	Audio prompt
High	Mode is "DO-DO-DO------DO-DO, DO-DO-DO------DO-DO", which is triggered once every 10 seconds.
Medium	Mode is "DO-DO-DO", which is triggered once every 25 seconds.
Low	Mode is "DO-", which is triggered once every 25 seconds.

Alarm Lamp light

The high/medium/low-level alarms are indicated by the system in following different visual ways:

Alarm level	Visual prompt
High	Alarm indicating lamp flashes in red with 2 Hz.
Medium	Alarm indicating lamp flashes in yellow with 0.5 Hz.
Low	Alarm indicating lamp lights on in yellow.

Screen Display

Physiological alarm: The parameter, which triggers the alarm, splashes in the frequency of 2Hz on the screen. The physiological alarm area on the screen displays alarm message, and red indicates high priority alarm, yellow indicates medium or low priority alarm.

When Technical alarm or General alarm occurs, the Technical alarm area displays alarm message, red indicates high priority alarm, yellow indicates medium or low priority alarm, cyan indicates general message.

Note: When alarms of different priorities occur at the same time, the monitor prompts the one of the highest priority.

6.3 Alarm Setup

Set Alarm volume

Step 1: Select <Alarm Volume> item in Menu: <MENU> → <Alarm Setup> → < Alarm Volume >.

Step 2: Set < Alarm Volume > item to <Off>, <1>, <2>, <3>.

Set alarm limits of physiological parameters

The alarm limit of each physiological parameter can be set in its menu, and they are continuous in alarm range. For example:

ECG alarm setup:

Step 1: Select Menu <ECG>

Step 2: Configure the following parameters related to ECG alarm, <HR LO> and <HR HI>.

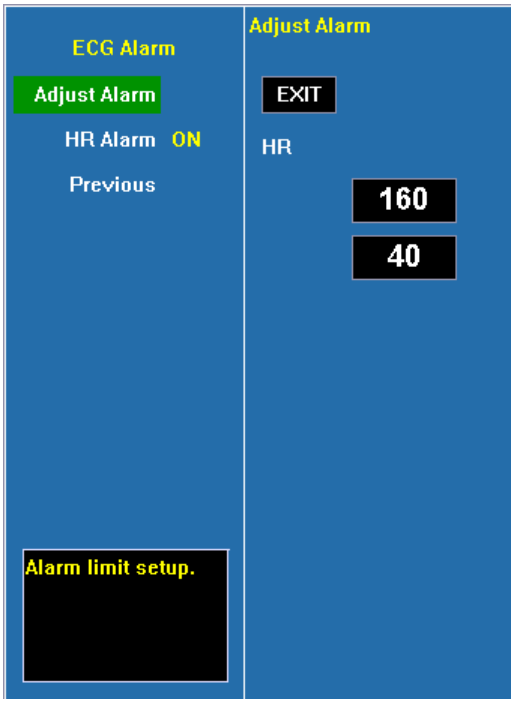
Please refer to above operation for Methods of Alarm setup of the other parameters

It is important to set physiological alarm limits properly. The monitor can't give medicinal alarm prompt in clinical application with improper setting of physiological alarm limit.

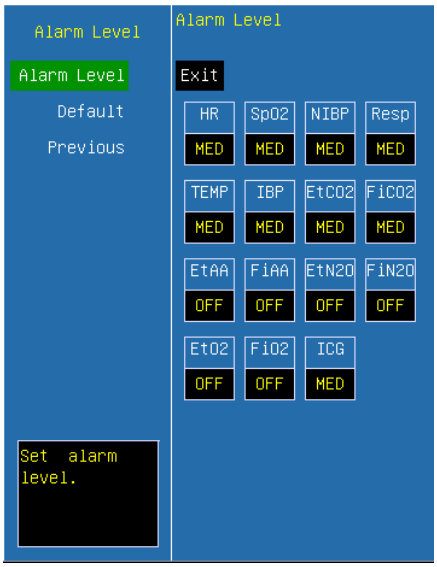
The physiological alarm occurs when the measurement exceeds the set parameter limits.

Please refer to above operation for Methods of alarm setup of the other parameters.

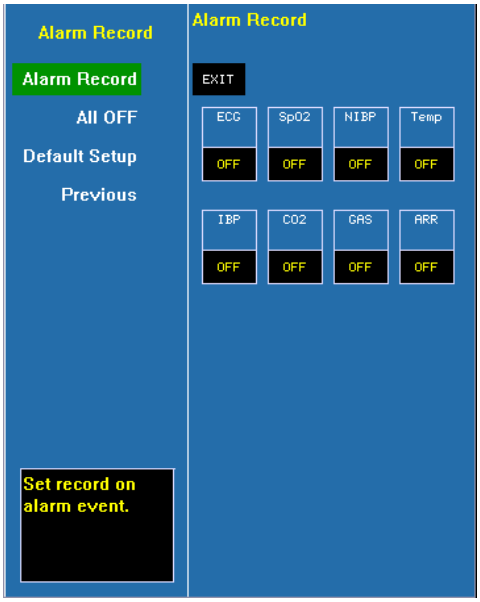
ECG Alarm configuration



Alarm levels configuration



Alarm recording configuration



Alarm indication of physiological parameters

Audio: when alarm occurs, the system generates alarm sound to raise the user's attention (audio alarm can be disabled).

Visual: The parameter flashes on the display area of the screen and alarm LED lights.

Warning: The lower limit and the upper limit of parameter must be set based on clinical practices and general clinical experiences.

Note：When parameter alarm level is off, alarm will be disabled, even if the measurement results exceed the limits. Alarm indicating lamp in the front of the monitor will alarm at the highest level, if different levels alarms coexist.

6.4 Alarm Cause

Alarm of the monitor includes:

1. Physiological Alarm
2. Technical Alarm
3. General Prompt

- Physiological Alarm

  When the measuring value has exceeded the set parameter limit and its <ALM LEV> is not <OFF>, the monitor alarms. The monitor wouldn't alarm with absence of either of the two conditions.

- Technical Alarm

  Once system fault occurs, the monitor will alarm immediately and trigger corresponding operations, such as stop displaying values and waveforms, erase the last screen to avoid misleading. The screen displays more than one fault message by alterative.

- General Prompt

  Sometimes there are alarms similar to Technical Alarms but can be considered as normally. The condition, which triggers this kind of alarm wouldn't bring danger to the animal.

6.5 Silence/Suspension

- **SILENCE**

Press the 🔔/🔕 button and hold for 2 seconds can shut off all sounds until the 🔔/🔕 is pressed again. When the system is in SILENCE status, any newly generated alarm will cancel the SILENCE status and make the system back to normal status.

When in the SILENCE status, the icon 🔕 will be displayed in the left upper of the screen.

- **SUSPENSION**

Press the 🔔/🔕 button once can close all audio and visual prompt and description about all the physiological alarms and to make the system enter ALARM PAUSE status. The rest

seconds for alarm pause is displayed in the Physiological Alarm area. And the symbol  is displayed in the System Prompt area.

The time for Alarm Suspension is 2 minutes.

When in the PAUSE status, press the  button again to restore the normal alarm status. Besides, during PAUSE status, newly occurring technical alarm will cancel the PAUSE status and the system will come back to the normal alarm status. The symbol  disappears, too.

Note: Whether an alarm will be reset depends on the status of the alarm cause. But by pressing  button can permanently shut off audio sound of Lead Off or Sensor Off alarms.

6.6 Parameter Alarm

The setup for parameter alarm is in their menus. In the menu for a specific parameter, you can check and set the alarm limit, alarm status. The setup is isolated from each other.

When a parameter alarm is off, a symbol "  " displays near the parameter. If the alarms are turned off individually, they must be turned on individually.

For the parameters whose alarm switch is set to ON, the alarm will be triggered when at least one of them exceeds alarm limit. The following actions take place:

1. Alarm message displays on the screen as described in alarm mode;
2. The monitor beeps in its corresponding alarm class and volume;
3. If alarm recording is on, the recorder starts alarm recording at set interval.

6.7 When an Alarm Occurs

Note: When an alarm occurs, you should always check the animal's condition first.

Check the alarm message appeared on the screen. It is needed to identify the alarm and act appropriately, according to the cause of the alarm.

1. Check the animal's condition.
2. Identify which parameter is alarming or which kind of alarm it is.
3. Identify the cause of the alarm.
4. Silence the alarm, if necessary.
5. When cause of alarm has been over, check that the alarm is working properly.

6.8 Alarm Description and Prompt

6.8.1 ECG Alarm

Physiological Alarm:

Message	Cause	Alarm Level
HR too high	HR measuring value is above the upper alarm limit	User-selectable
HR too low	HR measuring value is below the lower alarm limit	User-selectable

Technical Alarm：

Message	Cause	Alarm Level
ECG RA LA LL V- LEAD OFF	ECG electrode fall off the skin or ECG cables fall off the monitor	Low
ECG electrode polarized	ECG electrode polarized	Low
ECG communication error	ECG measurement failure or communication failure	Low
HR alarm error	Alarm failure	Low

6.8.2 RESP Alarm

Physiological Alarm：

Message	Cause	Alarm Level
RR too high	RR measuring value is above the upper alarm limit	User-Selectable
RR too low	RR measuring value is below the lower alarm limit	User-Selectable
RESP Apnea	No signal for breath in specific interval	User-Selectable

Technical Alarm：

Message	Cause	Alarm Level
RR alarm error	Alarm failure	Low

6.8.3 SpO2 Alarm

Physiological Alarm：

Message	Cause	Alarm Level
SpO_2 too high	SpO_2 measuring value is above the upper alarm limit	Medium ,High User-Selectable
SpO_2 too low	SpO_2 measuring value is below the lower alarm limit	Medium ,High User-Selectable

PR too high	PR measuring value is above the upper alarm limit	User-Selectable
PR too low	PR measuring value is below the lower alarm limit	User-Selectable

Technical Alarm：

Message	Cause	Alarm Level
SpO_2 sensor off	SpO_2 sensor may be disconnected from the animal or the monitor	Low
SpO_2 communication error	SpO_2 measurement failure or communication error	Low
SpO_2 alarm error	Alarm failure	Low
PR alarm error	Alarm failure	Low
SpO_2 sensor failure	SpO_2 sensor failure	Low
SpO2 pulse timeout	Search pulse too long	High

Prompt:

Message	Cause	Alarm Level
Search pulse	SpO_2 module is searching for pulse	No alarm
Motion interference	Animal movement too much.	No alarm
Disconnected	SpO2 sensor may be disconnected form the monitor.	No alarm

6.8.4 TEMP Alarm

Physiological Alarm:

Message	Cause	Alarm Level
TEMP1 too high	TEMP1 measuring value is above upper alarm limit	User-Selectable
TEMP1 too low	TEMP1 measuring value is below lower alarm limit	User-Selectable
TEMP2 too high	TEMP2 measuring value is above upper alarm limit	User-Selectable
TEMP2 too low	TEMP2 measuring value is below lower alarm limit	User-Selectable

Technical Alarm：

Message	Cause	Alarm Level
TEMP1 sensor off	TEMP1 sensor may be disconnected from user or monitor	Low
TEMP2 sensor off	TEMP2 sensor may be disconnected from user or monitor	Low

TMEP communication error	TEMP measurement error or communication error	Low
TMEP1 alarm error	Alarm failure	Low
TEMP2 alarm error	Alarm failure	Low
T1 over measuring range	TEMP1 over measuring range	Low
T1 below measuring range	TEMP1 below measuring range	Low
T2 over measuring range	TEMP2 over measuring range	Low
T2 below measuring range	TEMP2 below measuring range	Low
TEMP Self checking error	TEMP calibration failure	Low

6.8.5 NIBP Alarm

Physiological Alarm：

Message	Cause	Alarm Level
NIBP SYS too high	NIBP SYS measuring value is above upper alarm limit	User-Selectable
NIBP SYS too low	NIBP SYS measuring value is below lower alarm limit	User-Selectable
NIBP DIA too high	NIBP DIA measuring value is above upper alarm limit	User-Selectable
NIBP DIA too low	NIBP DIA measuring value is below lower alarm limit	User-Selectable
NIBP MAP too high	NIBP MAP measuring value is above upper alarm limit	User-Selectable
NIBP MAP too low	NIBP MAP measuring value is below lower alarm limit	User-Selectable

Technical Alarm 1(display in description area)：

Message	Cause	Alarm Level
NIBP communication error	NIBP measurement failure or communication failure	Low
NIBP SYS alarm error	Alarm failure	Low
NIBP DIA alarm error	Alarm failure	Low
NIBP MAP alarm error	Alarm failure	Low

Technical Alarm 2(display in description area below NIBP mean arterial pressure value):

Message	Cause	Alarm Level
SELF-TEST FAILED	Transducer or other hardware failure.	Low

LOOSE CUFF	a. Cuff is completely unwrapped. b. The cuff is not connected. c. Big animal cuff used in Small animal mode.	Low
AIR LEAK	Air leak in pneumatics, hose, or cuff.	Low
AIR PRESSURE ERROR	Unable to maintain stable cuff pressure, e.g. kinked hose.	Low
WEAK SIGNAL	a. Very weak animal signal due to a loosely wrapped cuff. b. The pulse of animal is too weak.	Low
RANGE EXCEEDED	Measurement range exceeds module specification.	Low
EXCESSIVE MOTION	a. Too many retries due to interference of motion artifact. b. Signal is too noisy during measurement, e.g. animal has severe tremor. c. Irregular pulse rate, e.g. arrhythmia.	Low
OVERPRESSURE SENSED	Cuff pressure exceeds the specified upper safety limit. Could be due to rapid squeezing or bumping of cuff.	Low
SIGNAL SATURATED	Large motion artifact that saturates the BP amplifier's amplitude handing capability.	Low
AIR SYSTEM LEAK	Module reports Air Leakage failure while in the Pneumatic Test mode.	Low
SYSTEM FAILURE	Module occurs abnormal processor event.	Low
TIME OUT	Measurement took more than 120 seconds in big animal mode, 90 seconds in small animal mode.	Low
CUFF TYPE ERR	Small animal cuff used in big animal mode.	Low

Prompt (display in description area below NIBP mean arterial pressure value):

Message	**Cause**	**Alarm Level**
NIBP Resetting	NIBP measurement module is resetting	No alarm
Over Press Testing	NIBP is testing Over-Pressure	
Manometer Testing	NIBP is testing Manometer	
Pneumatic Testing	NIBP is testing Pneumatic	

6.8.6 CO2Alarm

Physiological Alarm:

Message	**Cause**	**Alarm Level**
$EtCO_2$ Hi	$EtCO_2$ measuring value is above upper alarm	User-Selectable
$EtCO_2$ Lo	$EtCO_2$ measuring value is below lower alarm	User-Selectable

$FiCO_2$ Hi	$FiCO_2$ measuring value is above upper alarm	User-Selectable
$FiCO_2$ Lo	$FiCO_2$ measuring value is below lower alarm	User-Selectable
Apnea	No breath detected in the set period	User-Selectable

Technical Alarm:

Message	**Cause**	**Alarm Level**
Sensor Over Temp	Sensor over temperature.	High
Sensor Faulty	Sensor error	High
Check Sampling Line	Sampling line blockage or damage; Sampling line is kinked or pinched; Exhaust tube is blocked.	Low
Zero Required	Negative CO_2 detected; the module needs to be zeroed.	High
CO_2 Out of Range	The calculated CO_2 value is out of range.	Low
Check adapter	The adapter is removed from the module.	Low
Sensor no initialized	Sensor or module is not initialized	Low

Prompt:

Message	**Cause**	**Alarm Level**
Zero in Progress	Zeroing is in progress.	No Alarm
Sensor Warm Up	Module is warming up.	No Alarm

6.8.7 System Alarm and Prompt

Technical Alarm

Message	**Cause**	**Alarm Level**
Battery failure	Battery failure or no battery	Low
Battery low	Voltage of battery is too low	Medium
Key error	Keyboard error	Low
Recorder error	No paper in the recorder when recording or the recorder door is open or recorder is absent	Low

Prompt

Message	**Cause**	**Alarm Level**
Recording. . .	Recorder is in printing operation	No alarm

Chapter 7 Recording

Monitor carries out the recording function by the built-in recorder.

Alarm recording

Monitor provides the function of alarm trigger recording. To make alarm recording available, Please keep <**Alarm Record** >of <**Recorder setup**> of <**System setup**> in **<Monitor setup>** menu is **ON**, and adjust alarm level of alarm parameter to non-close. If any monitoring parameter exceeds the limit and <**Alarm Record>** is **ON**, recorder will print all monitoring parameter values in the alarm time. Moreover, if monitor alarms continuously, recorder will print every two minutes.

Auto recording

Monitor has the function of Auto recording. To make Auto recording available, user can adjust **<Record Interval**> of <**Recorder Setup**> of <**System Setup**> in <**Monitor Setup**> to a necessary interval time. All monitoring parameter values and waveforms will be recorded automatically according to the determined period.

Real-Time recording

Monitor has the function of real time recording. If  button in the front panel has been pressed over 2 seconds, the waveform and data of ECG and SpO_2 can be recorded in real time. If this key pressed again, real time recording will end. The lead ECG waveform (determined by <**Record Wave**> in <**Recorder Setup**>) will be monitoring in emphasis, when ECG waveforms are being recorded.

Note: During real time recording, three waveforms can be recorded at the same time. Users can configure the waveforms according to need. Please refer to chapter 4.2.1. Measurement parameter values of individual module have been recorded on the top of waveforms.

Chapter 8 Other Functions

8.1 Nurse Call

Nurse Call is a function that the monitor will send signal to call nurse when the alarm conditions destined are occurred.

The monitor has a nurse call output socket, connect the socket to the nurse call system of the hospital by the nurse-call cable provided along with the monitor, the nurse call function can be realized.

The nurse call function is valid when the following conditions are concurrent:

- The nurse call function is open.
- An alarm condition destined is occurred.
- The monitor is not in the state of alarm paused or system silence.

To set up nurse call function:

1. Select <MENU>→<Monitor>→<System Setup>→<Nurse Call>, and configuration the following options:

Nurse call Select <**ON**> to enable nurse call function; select <**OFF**> to disable nurse call function.

Phy trigger Select the Physiological alarm level that can trigger the nurse call action. The options are **OFF, Low, MED** and **High**, and select <**OFF**> to disable the trigger action.

Tech trigger Select the Technical alarm level that can trigger the nurse call action. The options are **OFF, Low, MED** and **High**, and select <**OFF**> to disable the trigger action.

2. Select <MENU>→<Monitor>→<System Setup>→<Machine>, enter the password (password is **125689**) .

3. Enter the interface of Nurse call setup and configuration the following options:

Call mode Select the duration of nurse call signal and options are **Pulsing** and **Continuous**.

Call type Select the type of nurse call. Select < **N.C**.> is normal Close, select <**N.O**.> is normal on.

Warning: The nurse call function should not be used as the primary animal alarm inform source. It is necessary for combining the auditory and visual alarm signal and the animal clinical feature and symptom as the primary information to medical and nursing staff about the physiological condition of the animal.

Chapter 9 Maintenance and Cleaning

9.1 System Check

An effective maintenance schedule should be established for your monitoring equipment and reusable supplies. This should include inspection as well as general clearing on a regular basis. The maintenance schedule must comply with the policies of your institution's infection control unit and/or biomedical department.

Check with your biomedical department to be sure preventive maintenance and calibration has been done. The Service manual contains detailed information.

Before using the monitor, check the equipment following these guidelines:

- Check the equipment for obvious mechanical damage.
- Check all the outer cables, inserted modules and accessories for fraying or other damage. Qualified service personnel should repair or replace damaged or deteriorated cables.
- Check all the functions relevant to animal monitoring, make sure that the monitor is in good condition.

If you find any damage on the monitor, stop using the monitor on animal, and contact the biomedical engineer of the hospital or Manufacturer's Customer Service immediately.

Note: Refer to the User Maintenance Instruction for more comprehensive checkout procedures.

The overall check of the monitor, including the safety check, should be performed only by qualified personnel once every 6 to 12 month, and whenever the monitor is fixed up.

- Inspect the safety relevant labels for legibility.
- Verify that the device functions properly as described in the instructions for use.
- Test the protection earth resistance according IEC 60601-1, Limit 0.1ohm.
- Test the earth leakage current according IEC 60601-1, Limit: NC 500uA, SFC 1000uA.
- Test the animal leakage current according IEC 60601-1, Limit: 100uA(BF), 10uA(CF).
- Test the animal leakage current under single fault condition with mains voltage on the applied part according IEC 60601-1, Limit: 5mA(BF), 50uA(CF).

The leakage current should never exceed the limit. The data should be recorded in an equipment log. If the device is not functioning properly or fails any of the above tests, the device has to be repaired.

The synchronism of the defibrillator should be checked by in the frequency described in the hospital regulations. At least every 3 months, it should be checked by the biomedical engineer of the hospital or qualified service technician.

All the checks that need to open the monitor should be performed by qualified service technician. The safety and maintenance check can be conducted by persons from the manufacturer. You can obtain the material about the customer service contract from the local office.

The circuit diagrams, parts lists and calibration instructions of the monitor can be provided by the manufacturer.

Warning: If the hospital or agency that is responding to using the monitor does not follow a satisfactory maintenance schedule, the monitor may become invalid, and the human health may be endangered.

Note: To ensure maximum battery life, please ensure that the battery is fully charged when you are keeping the device in storage for an extended period of time, and then take out the battery.

Warning: Refer the battery replacement only to manufacturer's service technician.

9.2 Battery Maintenance

A rechargeable and maintenance-free battery is designed for Monitor, which enables continuous working when AC power off. Special maintenance is not necessary in the normal situation. Please pay attention to the followings in using for more durable usage and a better capability.

- Operate the monitor in the environment according to the instruction.
- Use AC power for the monitor when available.
- Recharge the battery sooner when it is off. The volume of battery will not be charged to what it should be, when the battery has not been charged for a long time.
- If the monitor is not used for long time, the AC power should be plugged in until the

battery is fully recharged, then take out the battery, so that the service life of the battery will not be shortened.

- Avoid exposed and sun shine.
- Avoid infrared and ultraviolet radiation.
- Avoid moist, dust and erosion from acid gas.

For Lithium ion battery:

A lithium ion battery needs at least two conditioning cycles when it is put into use for the first time. A battery conditioning cycle is one complete, uninterrupted charge of the battery, followed by a complete, uninterrupted discharge of the battery. A lithium ion battery should be conditioned regularly to maintain its useful life. Condition a battery once when it is used or stored for two months, or when its run time becomes noticeably shorter.

To condition a lithium ion battery, follow this procedure:

1. Disconnect the monitor from the animal and stop all monitoring and measuring procedures.
2. Place the lithium ion battery in need of conditioning into battery compartment of the monitor.
3. Connect the monitor to the AC mains. Allow the battery to be charged uninterruptedly for above 6 hours.
4. Remove the AC mains and allow the monitor to run from the battery until it shuts off.
5. Reconnect the monitor to the AC mains. Allow the battery to be charged uninterruptedly for above 6 hours.

Now the battery is conditioned and the monitor can be returned to service.

9.3 General Cleaning

Warning: Before cleaning the monitor or the sensors, make sure that the equipment is switched off and disconnected from the power line.

The Monitor must be kept dust-free.

Regular cleaning of the monitor shell and the screen is strongly recommended. Use only non-caustic detergents such as soap and water to clean the monitor shell.

Please pay special attention to the following items:

1. Avoid using ammonia-based or acetone-based cleaners such as acetone.
2. Most cleaning agents must be diluted before use. Follow the manufacturer's directions carefully to avoid damaging the monitor.

3. Don't use the grinding material, such as steel wool etc.
4. Don't let the cleaning agent enter into the chassis of the system.
5. Don't leave the cleaning agents at any part of the equipment.

9.4 Cleaning Agents

Examples of disinfectants that can be used on the instrument casing are listed below:

- Diluted soap solution
- Diluted Ammonia Water
- Diluted Sodium Hypochlorite (Bleaching agent).

Note: The diluted sodium hypochlorite from 500ppm (1:100 diluted bleaching agent) to 5000ppm (1:10 bleaching agents) is very effective. The concentration of the diluted sodium hypochlorite depends on how many organisms (blood, mucus) on the surface of the chassis to be cleaned.

- Hydrogen Peroxide 3%
- Alcohol 70%
- Isopropyl alcohol 70%

The surface of monitor can be cleaned with hospital-grade ethanol and dried in air or with crisp and clean cloth.

The manufacturer has no responsibility for the effectiveness of controlling infectious disease using these chemical agents. Please contact infectious disease experts in your hospital for details.

9.5 Disinfection

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

Appropriate disinfection materials for ECG cable, SpO_2 sensor, blood pressure cuff, TEMP probe and CO_2 sensor are introduced in the corresponding chapters respectively.

Warning: Do not use EtO gas or formaldehyde to disinfect the monitor.

Chapter 10 Accessories

This chapter lists the recommendation accessories used in this device.

Warning: The accessories listed below are specified to be used in this device. The device will be possibly damaged or lead some harm if any other accessories are used.

1. ECG

Accessory	Description	PN
ECG Electrode	Electrode with snap clips	15-100-0077
ECG CABLE	5-lead ECG cable (12pin, snap, IEC)	15-027-0003
	5-lead ECG cable (12pin, snap, AHA)	15-027-0001

2. SpO2

Accessory	Description	PN
SpO2 probe	Animal rectal analog SpO2 probe(9 PIN)	15-100-0347
	Animal Y type analog SpO2 probe(9 PIN)	15-100-0348
	Tongue clip (small)	15-100-0079
	Tongue clip (large)	15-100-0189

Accessory	Model/PN
12PIN SpO2 probe extension cord	BD1-1-7

Nellcor SpO2 (optional)

Accessory	Description	Model/PN
SpO2 sensor	D-YS Y-type SpO2 probe(9 PIN)	BZ2-2-3
	D-YSE Y-type ear clip (big)	FD3-1-1
	D-YSE Y-type ear clip (small)	FD3-1-1
Extension cord	10PIN	BY2-3

3. Temp

Temp probe

Accessory	Model/PN
Coelom	15-100-0028
Surface	15-100-0027

4. NIBP

Accessory	Limb Girth (cm)	Model/PN
NIBP CUFF (Disposable)	3-6	98-0400-99
	4-8	98-0400-96
	6-11	98-0400-97
	7-13	98-0400-98
	8-15	98-0400-90

5. CO2

Accessory	Model/PN
LoFlo CO2 Nasal Cannula—Big animal	BD1-4-14
Microflow CO2 with luer port and sampling tube of dehumidifying tube	BC2-4-9

Appendix A Product Specifications

A.1 Environmental Specifications

Environment

Ambient Temperature	Operating temperature: 0~+40℃ Transportation and storage temperature: –20~+55℃
Relative humidity	Working ≤85% Transportation and storage ≤93%
Atmospheric pressure	Working 700~1060 hPa Transportation and storage 500~1060 hPa

Power supply

Power Voltage	AC 100-240V 50/60Hz
Power Input	≤70VA
Safety class	Category I

A.2 Hardware Specifications

Size and weight

Size	210mm(H)×258mm(W)×180mm(D)
Weight	＜3.5kg (include recorder and battery)

Display

LCD	
Size	8″
Type	Color TFT-LCD
Resolution	800×600 pixels or higher
Indicators	
Alarm LED	1 (Yellow/Red)
AC Power LED	1 (Green/Orange)
Battery Charge LED	1 (Yellow)

Battery

Type	Rechargeable Lithium ion battery
	11.1V/4.0AH
Charge time	≤6 hours
Operating time under the normal use and full charge	≥5 hours
	New and fully charged battery at 25℃ ambient temperature and NIBP work on AUTO mode for 15 minutes interval.
Operating time after the first alarm if low battery	≥10 minutes

Recorder (Option)

Method	Thermal dot array
Paper width	50 mm
Record width	40 mm
Paper Speed	12.5 mm/s ,25 mm/s ,50 mm/s
Traces	Maximum 3 tracks

Audio indicator

Speaker	QRS Sound with Pitch Tone Alarm Sound, according to the requirement of IEC 60601-1-8

Interface

Power supply	1 AC power socket
Wired network	1 standard RJ45 socket
Nurse call	1 standard BNC socket, nurse call connector
Video output	1 standard VGA display connector
Equipotentiality grounding terminal	1

System output

Nurse Call signal	
Driver mode	Relay
Specs	≤60W, ≤2A, ≤36VDC, ≤25VAC

Isolated voltage	1500VAC
Type	N.C., N.O.

Alarm

Level	Low, medium and high
Indication	Auditory and visual
Setup	Default and custom
Silence	All alarms can be silenced
Volume	45~85 dB measured at 1 meter

A.3 Measurement Specifications

ECG

Lead Mode	1. 5-leads ECG input 2. 3-leads ECG input
Lead selection	1. I, II, III, aVR, aVL, aVF, V- 2. I, II, III
Gain	AUTO, 0.25x, 0.5x, 1.0x, 2.0x, 4.0x
Input impedance	≥5.0 MΩ
CMRR	MON ≥105dB OPS ≥105dB
Frequency response	MON 0.5~40Hz OPS 1~25Hz
Electrode offset potential	±500mV d.c.
Leakage Current	<10 uA
ECG signal range	±6.0 mV
Baseline recovery	<5s after Defibrillation. (MON or OPS mode)
Pacemaker pulses	No rejection of pulses with amplitudes of ±2mV ~ ±700 mV and durations of 0.5 ~ 2.0 ms.
Insulation	Breakdown Voltage 4000VAC 50/60Hz
Indication of electrode separation	Every electrode (exclusive of RL)
Sweep speed	12.5mm/s, 25mm/s, 50mm/s

HR

Measurement range	10~400 bpm
Refreshing time	Per 4 pulses
Resolution	1 bpm
Accuracy	±1% or ±1 bpm, whichever is greater
Sensitivity	≥0.2mVpp
Alarm range	0~400 bpm, continuously adjustable between upper limit and lower limit
Alarm indication	Sound and light alarming
Time to Alarm for Tachycardia	Average 4s
Tall T-Wave Rejection Capability	0-1 mV T-Wave amplitude
Response Time of Heart Rate Meter to Change in Heart Rate	HR change from 80 to 120 bpm: Range: 6 to 10s HR change from 80 to 40 bpm: Range: 6 to 10s

SunTech NIBP

Way of measurement	Automatic oscillometry		
Range of measurement	Big animal	SYS	40~260 mmHg
		DIA	20~200 mmHg
		MEAN	26~220 mmHg
	Mid animal	SYS	40~160 mmHg
		DIA	20~120 mmHg
		MEAN	26~133 mmHg
	Small animal	SYS	40~130 mmHg
		DIA	20~100 mmHg
		MEAN	26~110 mmHg
Resolution	1 mmHg		
Pressure accuracy Static: Clinic:	±3 mmHg Average error: ±5 mmHg, standard deviation: ≤8 mmHg		
Unit	mmHg, kPa		
Inflation time for cuff	<75s		

Intervals for periodic measurement time	5 min~240min, continuously adjustable.	
Overpressure protection	Is beyond the overpressure protection set by software and hardware. Big animal: <300mmHg Mid animal: <300mmHg Small animal: <150mmHg	
Alarm range	SYS	0~300 mmHg, continuously adjustable between upper limit and lower limit
	DIA	0~300 mmHg, continuously adjustable between upper limit and lower limit
	MEAN	0~300 mmHg, continuously adjustable between upper limit and lower limit
Alarm indication	Sound and light alarming	
Measurement Mode	Big animal	Single, Cycle, STAT, Averaging
	Mid animal	Single, Cycle, STAT, Averaging
	Small animal	Single, Cycle
Recovery time after defibrillation	<5s	
Initial inflation pressure	Big animal :100~280mmHg, Default: 140mmHg	
	Mid animal:100~240mmHg, Default: 160mmHg	
	Small animal :50~240mmHg, Default: 160mmHg	
PR		
PR range	30bpm to 220bpm	
Accuracy	2bpm or ±3%, whichever is the greater	

SpO2

PATTERSON-SpO_2	
Measurement Range	0~99%
Resolution	1%
Accuracy	At 70~99%, ±2% At 0~69%, unspecified
Data update Rate	1s
Alarm range	0~99%, continuously adjustable between upper limit and lower limit.
PR	

Measurement Range	18~400bpm
Resolution	1 bpm
Accuracy	±2% or ±2 bpm, whichever is greater
Data update period	1s
Alarm range	0~400 bpm, continuously adjustable between upper limit and lower limit.

Nellcor-SpO_2	
Measurement Range	0~100%
Resolution	1%
Accuracy	At 70~100%, ±2 digits (Big animal) At 70~100%, ±3 digits (Small animal) At 0~69%, unspecified
Perfusion Range	0.03 ~ 20%
Data update period	Average 7s
Alarm range	0~100%, continuously adjustable between upper limit and lower limit.
PR	
Measurement Range	20~250 bpm
Resolution	1 bpm
Accuracy	±3 digits
Data update period	Average 7s
Alarm range	0~300 bpm, continuously adjustable between upper limit and lower limit.

TEMP

Measurement Range	0.0~50.0℃
Accuracy	±0.1℃
Resolution	0.1℃
Unit	Celsius (℃), Fahrenheit (℉)
Refreshing time	1s
Self check	Every 10 minutes
Accuracy	At 45.1~50.0℃, ±0.2℃ (exclusive of probe) At 25.0~45.0℃, ±0.1℃ (exclusive of probe) At 0.0~24.9℃, ±0.2℃ (exclusive of probe)

Connecting cable	Compatible with YSI-400
Alarm range	0.0~50.0℃, continuously adjustable between upper limit and lower limit
Alarm indication	Sound and light alarming

RESP

Method	Impedance variation between RA-LL (R-F)
Measuring impedance range	0.2 ~3 Ω
Excitation frequency	64.8 kHz
Excitation current	≤300 μ A at 64.8 kHz
Base line impedance range	500~4000 Ω (50~120 kHz exciting frequency)
Measurement Range	0~150 rpm
Resolution	1 rpm
Accuracy	±2 rpm
Gain	x1，x2，x4
Sweep speed	6.25mm/s, 12.5mm/s, 25mm/s
Delay of Apnea Alarm	Off, 10s, 20s, 40s, 60s
Alarm range	0～150 rpm, continuously adjustable between upper limit and lower limit.
Alarm indication	Sound and light indication

CO2 (Microflow，LoFlo)

Measure method	Infrared spectrum
Measure mode	Microflow
Warm up time	Capnogram displayed in less than 20 s, At an ambient temperature of 25℃, full specifications within 2 minutes.
CO_2Measurement Range	0 ~ 19.7%(0 ~ 150 mmHg)
CO_2 Resolution	1mmHg
CO_2 Stability	Short-Term Drift: Drift over four hours≤0.8mmHg. Long-Term Drift: Accuracy specification will be maintained over a 120 hours period.
unit	%, mmHg, kPa
CO_2 Accuracy	0 ~ 40 mmHg, ±2 mmHg

(at 760 mmHg, ambient temperature of 25°C)	41 ~ 70 mmHg, ±5% of reading 71 ~100 mmHg, ±8% of reading 101 ~ 150 mmHg, ±10% of reading Above 80 breath per minute ± 12% of reading Gas temperature at 25℃.
CO_2 response time	＜3s (includes transport time and rise time)
Respiration Rate Range	2~150 rpm
Respiration Rate Accuracy	±1 rpm
Sample Flow Rate	50 ml/min ±10 ml/min
Alarm range	0.0~13.1 % (0~99.6mmHg), continuously adjustable between upper limit and lower limit
Alarm indication	Sound and light indication

Appendix B Default System Setup

There are three options of default system setup: BIG ANIMAL, MID ANIMAL and SMALL ANIMAL. The followings are the details:

B.1 System

1. Standard Configuration

1） Trend Graph Configuration

Region	Parameter
Region 1	HR
Region 2	SpO_2
Region 3	PR
Region 4	NIBP
Region 5	Resp
Region 6	T1+T2

2）Trend Table Configuration

Page 1

Region	Parameter
Region 1	HR
Region 2	SpO_2
Region 3	PR
Region 4	NIBP(S/D)
Region 5	NIBP(M)
Region 6	Resp

Page 2

Region	Parameter
Region 1	HR
Region 2	T1
Region 3	T2

2. Standard Configuration + $EtCO_2$

1）Trend Graph Configuration

Page 1

Region	Parameter
Region 1	HR
Region 2	SpO_2
Region 3	PR
Region 4	NIBP
Region 5	RESP
Region 6	T1+T2

Page 2

Region	Parameter
Region 1	CO2

2）Trend Table Configuration

Page 1

Region	Parameter
Region 1	HR
Region 2	SpO_2
Region 3	PR
Region 4	NIBP(S/D)
Region 5	NIBP(M)
Region 6	Resp

Page 2

Region	Parameter
Region 1	T1
Region 2	T2
Region 3	CO_2

B.2 Alarm Limit

1. Setup of parameters alarm limit for BIG ANIMAL

Parameter	Low limit	High limit
HR (bpm)	30	50
SpO_2 (%)	90	100
PR (bpm)	30	50
RR (rpm)	5	35
T1 (℃)	37.5	38.6
T2 (℃)	37.5	38.6
NIBP SYS(mmHg)	80	130
NIBP DIA (mmHg)	20	70
NIBP MEAN (mmHg)	60	90
$EtCO_2$ (mmHg)	20	61
$FiCO_2$ (mmHg)	0	8

2. Setup of parameters alarm limit for MID ANIMAL

Parameter	Low limit	High limit
HR (bpm)	70	160
SpO_2 (%)	90	100
PR (bpm)	70	160

RR (rpm)	8	40
T1 (℃)	38.1	39.2
T2 (℃)	38.1	39.2
NIBP SYS (mmHg)	70	180
NIBP DIA (mmHg)	35	90
NIBP MEAN (mmHg)	60	125
$EtCO_2$ (mmHg)	20	61
$FiCO_2$ (mmHg)	0	8

3. Setup of parameters alarm limit for SMALL ANIMAL

Parameter	Low limit	High limit
HR (bpm)	90	200
SpO_2 (%)	90	100
PR (bpm)	90	200
RR (rpm)	8	40
T1 (℃)	38.1	39.2
T2 (℃)	38.1	39.2
NIBP SYS(mmHg)	90	200
NIBP DIA (mmHg)	40	105
NIBP MEAN (mmHg)	60	110
$EtCO_2$ (mmHg)	20	61
$FiCO_2$ (mmHg)	0	8

Appendix C EMC

Guidance and manufacture's declaration – electromagnetic emissions- for all EQUIPMENT and SYSTEMS

Guidance and manufacture's declaration – electromagnetic emission		
The Monitor is intended for use in the electromagnetic environment specified below. The customer of the user of the Multi-parameter Monitor should assure that it is used in such and environment.		
Emission test	**Compliance**	**Electromagnetic environment – guidance**
RF emissions CISPR 11	Group 1	The Monitor uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emission CISPR 11	Class A	The Monitor is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

Guidance and manufacture's declaration – electromagnetic immunity – for all EQUIPMENT and SYSTEMS

Guidance and manufacture's declaration – electromagnetic immunity			
The Monitor is intended for use in the electromagnetic environment specified below. The customer or the user of Low Frequency Therapeutic Device should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tile. If floor are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 k V for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5% UT (>95% dip in UT) for 0.5 cycle 40% UT (60% dip in UT) for 5 cycles 70% UT (30% dip in UT) for 25 cycles <5% UT (>95% dip in UT) for 5 sec	<5% UT (>95% dip in UT) for 0.5 cycle 40% UT (60% dip in UT) for 5 cycles 70% UT (30% dip in UT) for 25 cycles <5% UT (>95% dip in UT) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment.
Power frequency (50Hz) magnetic field IEC 61000-4-8	3A/m	3A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE UT is the a.c. mains voltage prior to application of the test level.			

Guidance and manufacture's declaration – electromagnetic immunity – for EQUIPMENT and SYSTEMS that are not LIFE-SUPPORTING

<table>
<tr><th colspan="4">Guidance and manufacture's declaration – electromagnetic immunity</th></tr>
<tr><td colspan="4">The Monitor is intended for use in the electromagnetic environment specified below. The customer or the user of Low Frequency Therapeutic Device should assure that it is used in such an environment.</td></tr>
<tr><th>Immunity test</th><th>IEC 60601 test level</th><th>Compliance level</th><th>Electromagnetic environment - guidance</th></tr>
<tr><td>Conducted RF
IEC 61000-4-6</td><td>3 Vrms
150 kHz to 80 MHz</td><td>3 Vrms</td><td rowspan="2">Portable and mobile RF communications equipment should be used no closer to any part of the monitor, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.
Recommended separation distance
$d = \left[\frac{3.5}{V_1}\right]\sqrt{P}$
$d = \left[\frac{3.5}{E_1}\right]\sqrt{P}$ 80 MHz to 800 MHz
$d = \left[\frac{7}{E_1}\right]\sqrt{P}$ 800 MHz to 2.5 GHz
Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m).
Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,a should be less than the compliance level in each frequency range.b
Interference may occur in the vicinity of equipment marked with the following symbol:
  </td></tr>
<tr><td>Radiated RF
IEC 61000-4-3</td><td>3 V/m
80 MHz to 2.5 GHz</td><td>3 V/m</td></tr>
<tr><td colspan="4">NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.</td></tr>
<tr><td colspan="4">a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Low Frequency Therapeutic Device is used exceeds the applicable RF compliance level above, the Low Frequency Therapeutic Device should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the Low Frequency Therapeutic Device.
b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.</td></tr>
</table>

Recommended separation distances between portable and mobile RF communications equipment and the EQUIPMENT or SYSTEM – for EQUIPMENT or SYSTEM that are not LIFE-SUPPORTING

Recommended separation distances between portable and mobile RF communications equipment and the Low Frequency Therapeutic Device			
The Monitor is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the Low Frequency Therapeutic Device can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Low Frequency Therapeutic Device as recommended below, according to the maximum output power of the communications equipment.			
Rated maximum output power of transmitter (W)	**Separation distance according to frequency of transmitter (m)**		
	150 kHz to 80 MHz $d = \left[\frac{3.5}{V_1}\right]\sqrt{P}$	80 MHz to 800 MHz $d = \left[\frac{3.5}{E_1}\right]\sqrt{P}$	800 MHz to 2.5 GHz $d = \left[\frac{7}{E_1}\right]\sqrt{P}$
0.01	0.35	0.12	0.23
0.1	1.1	0.38	0.73
1	3.5	1.2	2.3
10	11	3.8	7.3
100	35	12	23
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in metres (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer. NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies. NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

Product name: Veterinary Monitor

Product type: AccuWAVE Plus

Manufacturer: Guangdong Biolight Meditech Co., Ltd.

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