IE-8V

Veterinary Portable Monitor

User Manual

Intellectual Property Right

The intellectual property rights of this product and its instruction manual belong to **TOOTOO MEDITECH CO.,LTD.**(hereinafter referred to as the **MEDITECH**), including, but not limited to patent, trademark, copyright etc, MEDITECH reserves final interpretation right of this manual.

MEDITECH has the right to use the instruction as confidential information. Any individual and/or organization shall not disclose the instruction of all or part of the information by any means without MEDITECH 's written permission.Nor shall any other person or organization be allowed to obtain all or part of the information of this instruction manual by any means.

No individual and/or organization shall publish, modify, reproduce, issue, rental, adapted, and translated into other languages without MEDITECH 's written permission.

Statement

MEDITECH reserves the right to modify the content of this manual without prior notice.

MEDITECH reserves the right to change the technology without prior notice.

MEDITECH reserves the right to modify the product specifications without prior notice.

MEDITECH does not guarantee the information in any forms,including (but not limited to) the responsibility of proposing the implied merchantability and suitability for a specific purpose.

MEDITECH in only the following conditions is considered to be responsible for the safety, reliability and performance of the instruments, i.e. Assembly operation, expansion, adjustment,improvements and repairs carried out by **MEDITECH** authorized personnel.

Relevant electrical equipment in line with national standards. The instrument is operated according to the instruction manual.

MEDITECH is not responsible for the products' safety, reliability or operation status in the following conditions:

Components are disassembled, stretched or debugged

Non-authorized personnel by **MEDITECH** repairs or alters to the products without following the manual.

Patient in this manual means patient animals. IE-8V only use for veterinary.

CONTENT

Chapter 1 Introduction

- For an overall introduction to the monitor, please refer to **General Information**.
- For various messages displayed on the screen, please refer to **Screen Display**.
- For basic operating instructions, please refer to **Button Function.**
- For allocation of interface sockets, please refer to **Interfaces**.
- For important facts to be noted during the battery recharging procedure, please refer to **Built-in Battery**.

⚠ **Warning**
IE-8V is intended for clinical monitoring application with operation only granted to trained medical staff.

⚠ **Warning**
There could be hazard of electrical shock by opening the monitor casing. All servicing and future upgrading to this equipment must be carried out by personnel trained and authorized by .

⚠ **Warning**
Possible explosion hazard if used in the presence of flammable anesthetics.

⚠ **Warning**
The user must check that equipment and accessories function safely and see that it is in proper working condition before being used.

⚠ **Warning**
Alarm must be set up according to different situation of individual patient. Make sure that audio sounds can be activated when alarm occurs.

⚠ **Warning**
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.

⚠ **Warning**
Do not touch the patient, table nearby, or the equipment during defibrillation.

⚠ **Warning**
The equipment and devices connected to it should form an equipotential body to ensure effective grounding.

⚠ **Warning**
When the monitor is used with Electrosurgery equipment, the operator must give top priority to the animals' safety.

1.1 General Information

Environment:

Temperature

Working 0 ~ 40 (°C) Transport and Storage -20 ~ 60 (°C)

Humidity

Working <= 85 % Transport and Storage <= 93 %

Altitude

Working -500 to 4,600m(-1,600 to 15,000ft)

Transport and Storage -500 to 13,100m(-1,600 to 43,000ft)

Power Supply

100~250 (V)AC, 50/60 (Hz) Pmax=40VA DC :18V 2A FUSE T 1.6A

General Instruction:

IE-8V is specific for big，middle and small animals. It can monitor vital signals as ECG, Respiratory Rate, SpO2, NIBP, TEMP and IBP. It integrates parameter measuring modules, display and recorder in one device, featuring in compactness, lightweight and portability. Replaceable built-in battery facilitates transportation of patient. Large high-resolution display provides clear view of 5 waveforms and full monitoring parameters.

The POWER switch is on the right quarter of the front panel. The POWER indicator and the BATT indicator lights when the device is powered on. The ALARM indicator flashes or lights when alarm occurs.The sockets of the sensors are at the left side.

1.1.1 Abbreviations and Definitions

Name	Definition	Name	Definition
ECG	Electrocardiogram	ASY	Asystole
RESP	Respiratory	VF/VTA	Ventricular fibrillation/ventricular Tachycardia
TEMP	Body temperature	RonT	RonT type ventricular premature beat
NIBP	Non-invasive blood pressure	RUN	Three or four consecutive ventricular premature
SPO2	Oxygen saturation	CPT	Bigeminy
IBP	Invasive blood pressure	VPB	ventricular premature beats
HR	Heart Beat rate	BGM	Bigeminy
RR	Respiratory Beat rate	TGM	Trigeminy
PR	Pulse Beat rate	TAC	supraventricular tachycardia
MIS	Missed beat	BRD	Bradycardia
LRN	Learning	PNC	Pacemaker not captured
NML	Normal heart beats	PNP	Pacemaker not pacing
NOS	Noise	CVA	Respiratory and cardiac interference

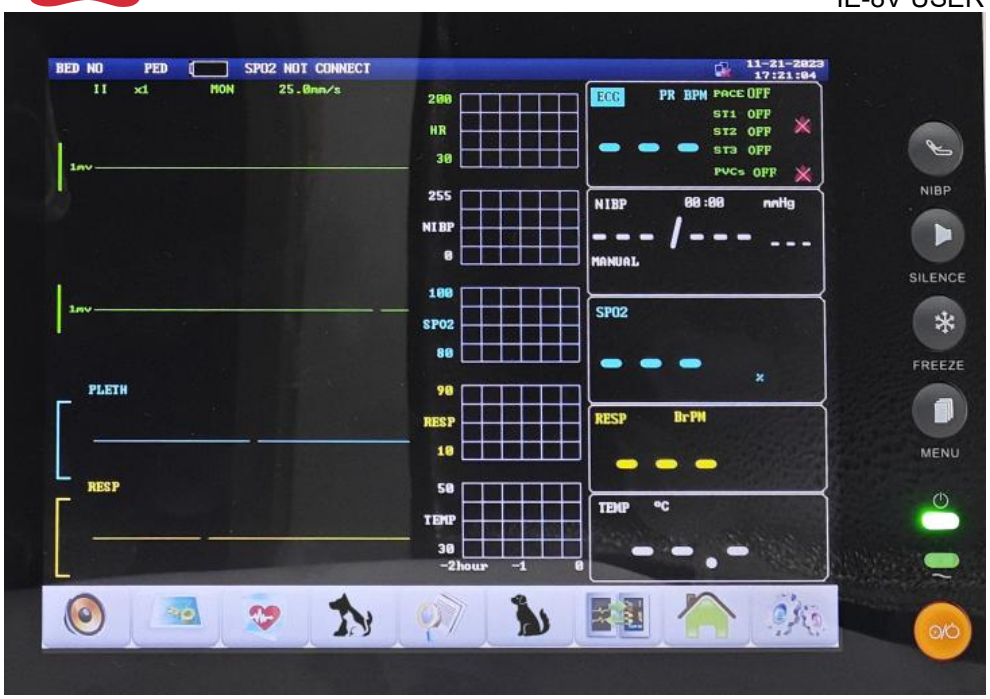


Figure 1-1 Portable Monitor Interface

1.2 Screen Display

The display may be color or monochrome liquid crystal display. The parameters, waveforms, alarm messages, bed number, date, system status and error messages can be reflected on the screen.

1.2.1 Message Area

The Message Area is at top of the screen displaying operating state of the monitor and status of the animal.

The messages and their meanings are:

1. BED NO Bed or Cage number of the monitored animal
2. BIG Type of animal
3. 2023-11-21 Current date
4. 17:21:04 Current time

The above messages appear on the screen throughout the monitoring process.

Other information of the Message Area comes up only with respective monitoring status.

- Signs indicating the operating status of the monitor and the sensors are displayed at the right side of time numeric. When appears, this message will cover the sex and name information of the patient.
-  Indicates that all sounds are disabled manually. It appears after SILENCE button is pressed for more than 1 seconds.
-  Press “SILENCE” button once (more than 1 second) to manually mute the alarm sound and this mark appears at the same time. The SILENCE status terminates when you discharge the status or new alarm occurs.
-  Indicates that the alarm volume is closed. When select the “OFF” item in the ALARM SETUP menu, this mark appears indicating that the operator has permanently closed the audio alarm function. This audio alarm function can resume only after the operator discharges the closing alarm volume setup.

NOTE

When  mark appears, the system can not give the audio alarm prompt. Therefore, the operator should be considerate in using this function. One method of discharging this status is in the ALARM SETUP menu, select the item that the alarm volume is in Non-close. Another method is to press the SILENCE button so as to make the mark change into a  . Then press SILENCE button again, the system will immediately restores the normal alarm status.

- Alarm message is displayed at the right most area.
- "FREEZE" appears when the waveforms are frozen.

1.2.2 Waveform/Menu Area

1. Five waveforms can be displayed at the same time. The waveforms from top to bottom are: ECG I, ECG II, SpO2 Plethysmogram, RESP (possibly coming from ECG module). Waveforms to be displayed are user-selectable. Refer to **Tracing Waveforms Selection** for details.
2. The names of the waveforms are to their left. Gain and filter of this ECG channel are displayed as well. A 1mv scale is marked on the left of ECG waveform. The same menu always appears at a fixed area on the screen. When the menu is displayed, some waveforms become invisible. The size of the menu is also fixed, covering the lowest 2, 3 or 4 waveforms.
3. The waveforms are refreshed in a user-set rate. Refer to the related chapters for details of sweep speed.

1.2.3 Parameter Area

Parameters are displayed at a fixed position.

1. ECG: Heart Rate (Unit: bpm) ST-segment analysis of Channel 1 & 2 (Unit: mv)
2. NIBP (From left to right) Systolic, Mean, Diastolic (Unit: mmHg or kPa)
3. SpO2: SpO2 (Unit: %)
4. RESP: Respiration Rate (Unit: breath/min)
5. TEMP: Temperature (Unit:℃ or ℉)
6. The above monitoring results are displayed in the Parameter Area.

The parameters refresh every second, except that NIBP values refresh each time the measurement is over.

User can select the monitor parameters, and the screen display will change accordingly.

1.2.4 Alarm Indicator:

In normal mode, no indicator lights.

In alarm mode, the alarm indicator lights or flashes.

1.3 Button Function

All the operations to the monitor are through the buttons and a knob at the bottom of the screen. The names of the buttons are above them. They are (from left to right, Figure 1-3):

Change the alarm volume

- POWER(Figure 1-3)

POWER ON/OFF switch

- FREEZE(Figure 1-3)

Press this button and the system will access the FREEZE status. In this status the user may review the waveform of 40 seconds. Also, the frozen waveform can be printed out. In the FREEZE status, press this button again to discharge the FREEZE status. For detailed information, refer to related chapter: Freeze.

- SILENCE(ALARM)(Figure 1-3)

symbol appears in the Message Area. Push this button for more than 1 second to mute all kinds of sounds (including alarm sound, heart beat, pulse tone, key sound). At the same time, a "  "symbol appears in the Message Area. Push this button again to restore all kinds of sounds and the "  "symbol appears from the screen.

NOTE
If new alarm occurs in Alarm Pause/Silence status, the system will discharge Pause/Silence status automatically. For specific rules, see Chapter Alarm.

NOTE
The system will begin to give alarm information again once there exist alarm-triggering event. Nevertheless, remember pushing SILENCE button can permanently shut off audible alarm sound of ECG LEAD OFF and SPO2 SENSOR OFF alarms.

- START(Figure 1-3)

Press to inflate the cuff to start a blood pressure measurement. When measuring, press to cancel the measurement and deflate the cuff.

- MENU(Figure 1-3)

Press this button to call up the SYSTEM MENU, in which the user may set up system information and perform review operation. For detailed information, refer to related chapter: System Menu and related chapter: Trend and Event.

- Rotary knob(Figure 1-3)

The user may use the rotary knob to select the menu item and modify the setup. It can be rotated clockwise or counter-clockwise and pressed like other buttons. The user may use the knob to realize the operations on the screen and in the system menu and parameter menu.

Method of the knob operation on screen:
The rectangular mark on the screen that moves with the rotation of the knob is called “cursor”. Operation can be performed at any position at which the cursor can stay.
When the cursor is in the waveform area, the user may immediately modify the current setup. When the cursor is in the parameter area, the user may open the setup menu of the corresponding parameter module so as to set up the menu items of the module.

Operating method:

- Move the cursor to the item where the operation is wanted
- Press the knob
- One of the following four situations may appear:
  1. The cursor with background color may become into the frame without background color, which implies that the content in the frame can change with the rotation of the knob.
  2. Menu or measuring window may appear on the screen, or the original menu is replaced by the new menu.
  3. A check mark “√” appears at the position, indicating that the item is confirmed.
  4. The system immediately executes a certain function.

1.4 Rotary Knob
1. Square frame that moves with the knob turning is referred to as "cursor".
2. The cursor is placed at any of the first six items, the user can change the current settings.
3. When at any of the last six items, related parameter menu can be called up for setting changes.

Operation steps as follows:
When you move the cursor to a certain item, and press the knob, then:
1. A menu pops up, or the current menu is replaced by a new one
2. The cursor frame turns to dotted line, indicating contents in the frame can be changed by turning the knob
3. A “√” mark appears indicating "selected"
4. A certain function executes.

1.5 Interfaces
For the convenience of operation, different kinds of interfaces place in different parts of the monitor. Different ports for each parameters on the left side which connect animal and sensors.

Figure 1-2 left Side

Figure 1-3 Right Side

This symbol means “BE CAREFUL".

Indicates that the instrument is IEC-60601-1 Type CF equipment. The unit displaying this symbol contains an F-Type isolated (floating) patient applied part providing a high degree of protection against shock, and is suitable for use during defibrillation.

Other symbols in the monitor are explained in **Chapter 4 Patient Animal Safety**.

Power Supply: 100~250 (VAC), 50/60 (Hz) **DC18V 2A**

Warning

Only Clinical Information Center can be connected in Network interface.

Warning

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

1.6 Built-in Battery

IE-8V is equipped with a rechargeable battery. The battery in the Monitor can automatically recharge when connected to AC INPUT until it is full. A symbol “▬” is displayed on the bottom of the screen to indicate the status of recharging, in which the yellow part represents the relative electric energy of the battery.

Warning

Don’t take off battery when the monitor is working.

When operating on battery, the monitor will prompt alarm and shut off automatically when the energy is low. When the electric energy is going out, the monitor will sound continuous level 1 alarm beeping and display “BATTERY TOO LOW” in the Message Area. Connect the monitor to AC power at this moment can recharge the battery while operating. If keep operating on the battery, the monitor will shut off automatically (about 5 minutes since alarming) upon exhaustion of the battery.

Chapter 2 Installation Instruction

- Open the package and check
- Connect the power cables
- Power on the monitor
- Connect patient sensors
- Check the recorder

NOTE
To ensure that the monitor works properly, please read Chapter Patient Safety, and follow the steps before using the monitor.

2.1 Open the Package and Check

Open the package and take out the monitor and accessories carefully. Keep the package for possible future transportation or storage. Check the components according to the packing list.

- Check for any mechanical damage.
- Check all the cables, modules and accessories.

If there is any problem, contact the distributor immediately.

2.2 Connect the Power Cables

Connection procedure of the AC power line:

- **Make sure the AC power supply complies with following specification: 100~250 VAC, 50/60 Hz.**
- **Apply the power line provided with the monitor. Plug the power line to INPUT interface of the monitor. Connect the other end of the power line to a grounded 3-phase power output.**

NOTE
Connect the power line to the jack special for hospital usage.

- Connect to the ground line if necessary. Refer to Chapter **Patient Safety** for details.

NOTE
Make sure that the POWER lamp now lights. If it does not light, check your local power supply. If the problem still exists, contact the local Customer Service Center.

NOTE
The battery need to be charged after transportation or storage. If the power supply is not properly connected before turning on the monitor, it may not work properly because of insufficient power. Connect the power supply to charge the battery.

2.3 Power on the Monitor

Press POWER to power on the monitor. Then a beep will be heard and at the same time the indicator will flash twice in yellow and red. After 10 seconds or so, the system will enter monitoring screen after self-test, and you can perform normal monitoring now.
During self-test, the software version will display.

NOTE
1. If the monitor finds any fatal error during self-test, it will alarm.
2. Check all the functions that may be used to monitor and make sure that the monitor is in good status.
3. The battery must be recharged to the full electricity after each use to ensure adequate electricity reserve.
4. The interval between twice press of POWER should be more than 1 minute.

⚠ **Warning**

If any sign of damage is detected, or the monitor displays some error messages, do not use it on any patient animal. Contact MEDITECH engineer or Customer Service Center immediately.

2.4 Connect Animal Sensors

Connect all the necessary animal sensors between the monitor and the patient animal.

2.5 Check the Recorder

If your monitor is equipped with a recorder, open the recorder door to check if paper is properly installed in the output slot. If no paper present, refer to **Chapter Recording** for details.

Chapter 3 System Menu Settings

- New patient register
- Recording
- Trend and Alarm Review
- MONITOR SETUP
- Drug Calculation
- Maintenance

IE-8V has flexible configurations. Users can configure various aspects of the monitor, including the parameters to be monitored, sweeping speed of the waveforms, audio signal volume, and printout text.

Press the “MENU” hot key on the lower right part of the screen to call up “SYSTEM MENU”. The configuration is realized through operations on the SYSTEM MENU, as shown below.

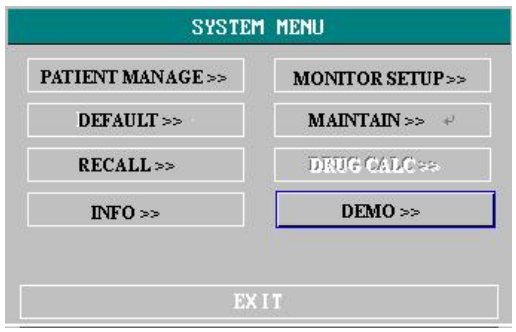


Figure 3- 1 SYSTEM MENU

Figure 3- 2 PATIENT SETUP

3.1 Patient Information Setup

NOTE
To erase present patient data, refer to the section of New Patient Register for details.

Pick "PATIENT MANAGE" in SYSTEM MENU to call up the following menu.
You can setup the following patient record:

Figure 3- 3 PATIENT SETUP

DEPARTMENT	Department in which the patient receives treatment.
BED NO	Patient bed number (Range: 1-200)
PACE	Pace ON or OFF
SEX	A gender (Available options: "F" for Female, "M" for Male)
PAT TYPE	Patient type (Available options: BIG, MIDDLE, and SMALL)
NEW PATIENT	Add new animal

Also in this menu, the user may select “NEW PATIENT” item to access “CONFIRM TO UPDATE PATIENT” dialog box as shown below, in which the user decide whether to monitor a new patient.

Figure 3-4 NEW PATIENT Menu

Pick YES to erase stored record of the previous patient and exit the menu.
Pick NO to refuse the new patient and keep the previous information and exit the menu.

NOTE
Selecting “YES” will delete all information about the currently monitored patient.

3.2 Default Setup

NOTE
Select any item in this sub-menu to cancel the current setup and use the selected default setup.

In this sub-menu, the user can select both the factory default and the user-defined default. Also in this sub-menu, the user can save the current system configuration as a user-defined default configuration. But at this time, the old user-defined configuration will be replaced by the current one. To restore all settings of parameter menu and the ECG lead, gain, and filter to default settings, select the desired default, and pick EXIT to call up the following menu:

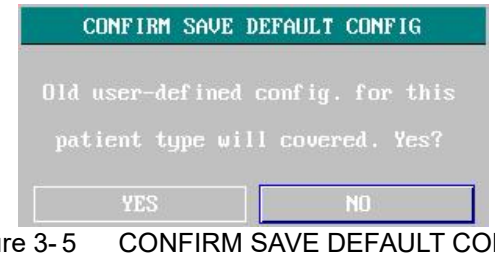


Figure 3-5 CONFIRM SAVE DEFAULT CONFIG

Pick YES to erase stored record of the previous patient and exit the menu.
Pick NO to refuse the new patient and keep the previous information and exit the menu.

NOTE
After selecting “EXIT” item, the “CONFIRM SAVE DEFAULT CONFIG” dialog box will pop up, in which the user may choose YES to confirm the selection or NO to give up the selection.

3.3 Trend Function

Pick RECALL in the SYSTEM MENU, as shown in the figure below.

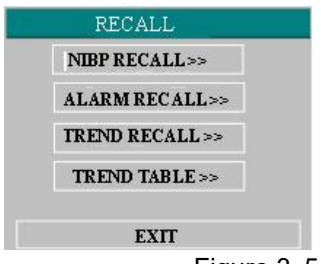


Figure 3-5 RECALL

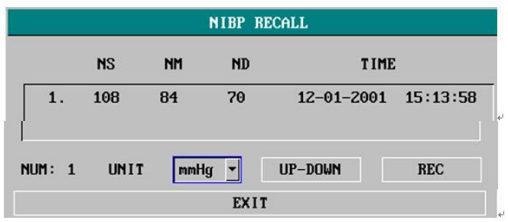


Figure 3-6 NIBP RECALL

NIBP Recall
The monitor can review the latest 400 NIBP measurement data.
Pick NIBP RECALL in the SYSTEM MENU to invoke the result and time of the latest 10 measurements, as shown in the figure below. Figure 3-6 NIBP RECALL

Data is listed chronologically from the latest to the earliest. 10 measurements can be displayed in one screen. Pick UP-DOWN to view other trend curve up to 400 results. Pick REC to print out all measurement data of NIBP RECALL.

3.4 Monitor Information

Select the [VERSION] item in the “SYSTEM MENU” to know the software version of the monitor.

Figure 3-7 Version

Figure 3-8 Monitor Info

Select the [DEVICE CONFIG LIST] to know the configuration of the monitor. Figure 3-8 Monitor Info

3.5 Monitor Setting

Select the [MONITOR SETUP] item in the “SYSTEM MENU” to know Below

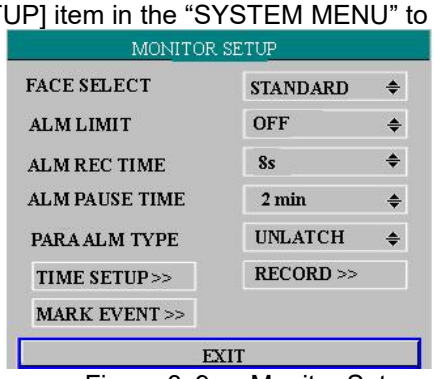


Figure 3-9 Monitor Setup

3.5.1 Alarm Limit

The system can display the alarm limit. The method is:
Select “SELECTION” item in “SYSTEM MENU” to access “SELECTION” sub-menu, in which the user may set up the alarm limit. Set “ALM LIMIT” to ON to display the alarm limits of the parameters displayed on the screen or OFF to hide the alarm limits.

3.5.2 Length of Alarm Records

The system may record the information prior to and after the occurring of alarm if physiological alarm occurs. Three recording time is provided: 8s, 16s and 32s, which are the total length of the time prior to and after the alarm. For example, 8s contains the respective information of 4s before and after the alarm. 16s contains the respective information of 8s before and after the alarm, etc.
The user may select different recording time based on clinical requirement. The method is listed below;
Select “ALARM SETUP” in “MONITOR SETUP” to access the sub-menu of “ALARM SETUP”.

In the “ALARM REC TIME” item, the user may choose the length of alarm record. There are three options for user to select: 8s, 16s or 32s.

3.5.3 Time Setup

Select “TIME SETUP” item in “MONITOR SETUP” menu to access the sub-menu of “TIME SETUP” as shown below. System time is in format of year, month, day, hour, minute and second. Pick the item you wish to modify and turn the knob, the figure will increase or decrease by 1 at each switch.

Then select “EXIT” item to return to the previous menu.

Figure 3-10 TIME SETUP

Figure 3-11 MARK EVENT Menu

3.5.4 Mark Event

There are four types of events that you can define.
Select “MARK EVENT” item in “MONITOR SETUP” to call up the following menu: Figure 3-11 MARK EVENT Menu
To mark the event: Use the rotary knob to select one from event A, B, C and D. There is a “@” signal for the one selected. To cancel your selection, repress the knob at selected item. Press EXIT to return to the previous menu.
You can use event function:
To differentiate the patient events that have impact on parameter monitoring, such as dose taking, injection, therapy status, etc.

3.6 Maintenance

Select “MAINTAIN” item in “SYSTEM MENU” access “ENTER MAINTAIN PASSWORD” dialog box as shown below, in which the user may enter password and set up the user-defined maintenance settings. The user may not execute the factory maintenance function, which is only available for appointed personnel of the Company. The user may select “STATUS” to access “STATUS” sub-menu, in which the user may view the information of the monitor start up and errors detected.

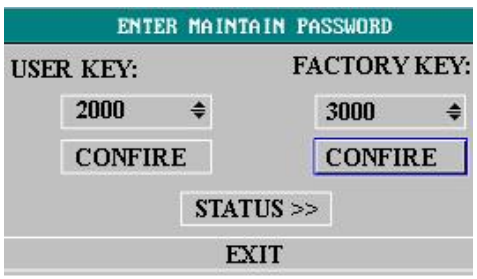


Figure 3-12 ENTER MAINTAIN PASSWORD

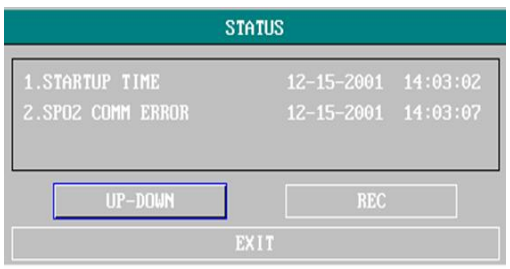


Figure 3-13 STATUS

In “STATUS” sub-menu, the user may use rotary knob to select “UP-DOWN” item and then turn the knob clockwise or counter-clockwise to view the monitor information such as start up time, alarm and the like. The user may select the “REC” item by using knob to print out the currently displayed information via the recorder. Figure 3-6 STATUS

For user default, enter the user key and press the “CONFIRM” key to access “USER MAINTAIN” menu. Following is the detailed description on the settings able to be realized in this menu.

Figure 3-14 USER MAINTAIN

Figure 3-15 COLOR SELF-DEFINE

- LANUGAGE: two selections are available:CHINESE and ENGLISH.
- LEAD: refers to the net No.
- COLOR SELF-DEFINE: is used by the user to define the color of the waveform displayed on the screen. Five colors can be chosen from green, cyan, red, yellow and white. Figure 3-7 COLOR SELF-DEFINE

3.7 DEMO Function

Select the DEMO item in the “SYSTEM MENU” to call up the “ENTER DEMO PASSWORD”. After entering the password, the system enters DEMO status.

The purpose of waveform demonstration is only to demonstrate the machine performance, and for training purpose. In clinical application, this function is not forbidden because the DEMO will mislead the MEDICAL INSTRUMENT staff to treat the DEMO waveform and parameter as the actual data of the patient, which may result in the delay of treatment or mistreatment. Therefore before entering this menu, you shall enter password.

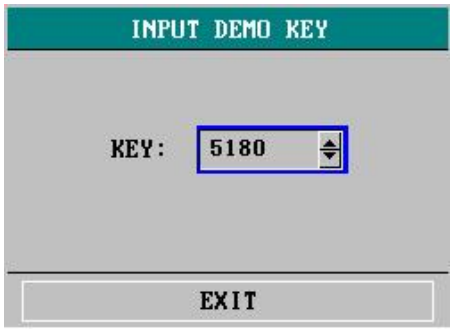


Figure 3-16 Input Demo Key

Chapter 4 Patient Animal Safety

IE-8V is designed to comply with the International National Safety requirements for MEDICAL INSTRUMENT electrical equipment. This device has floating inputs and is protected against the effects of defibrillation and electrosurgery. If the correct electrodes are used and applied in accordance with the manufacturer instructions, the screen display will recover within 10 seconds after defibrillation.


This symbol indicates that the instrument is IEC60601-1 Type CF equipment. The unit displaying this symbol contains an F-Type isolated (floating) patient applied part providing a high degree of protection against shock, and is suitable for use during defibrillation.

⚠ Warning
Do not touch the patient animal, bed or instrument during defibrillation.

Environment
Follow the instructions below to ensure a completely safe electrical installation. The environment where IE-8V will be used should be reasonably free from vibration, dust, corrosive or explosive gases, extremes of temperature, humidity, and so on. For a cabinet mounted installation, allow sufficient room at the front for operation and sufficient room at the rear for servicing with the cabinet access door open.

IE-8V operates within specifications at ambient temperatures between 0℃ and 40℃. Ambient temperatures that exceed these limits could affect the accuracy of the instrument and cause damage to the modules and circuits. Allow at least 2 inches (5cm) clearance around the instrument for proper air circulation.

Grounding
To protect the patient and hospital personnel, the cabinet of IE-8V must be grounded. Accordingly, IE-8V is equipped with a detachable 3-wire cable which grounds the instrument to the power line ground (protective earth) when plugged into an appropriate 3-wire receptacle. If a 3-wire receptacle is not available, consult the hospital electrician. If completeness of the protective grounding wire is in doubt, the equipment must be operated with internal power supply.

⚠ Warning
Do not use a 3-wire to 2-wire adapter with this instrument.
Connect the grounding wire to the equipotential grounding terminal on the main system. If it is not evident from the instrument specifications whether a particular instrument combination is hazardous or not, for example due to summation of leakage currents, the user should consult the manufacturers concerned or else an expert in the field, to ensure that the necessary safety of all instruments concerned will not be impaired by the proposed combination.

Equipotential Grounding
Protection class 1 instruments are already included in the protective grounding (protective earth) system of the room by way of grounding contacts in the power plug. For internal examinations on the heart or the brain, IE-8V must have a separate connection to the equipotential grounding system. One end of the equipotential grounding cable (potential equalization conductor) is connected to the equipotential grounding terminal on the instrument rear panel and the other end to one point of the equipotential grounding system. The equipotential grounding system assumes the safety function of the protective grounding conductor if ever there is a break in the protective grounding system. Examinations in or on the heart (or brain) should only be carried out in MEDICAL INSTRUMENTly used rooms incorporating an equipotential grounding system. Check each time before use that the instrument is in perfect working order. The cable connecting the patient to the instrument must be free of electrolyte.

Warning

If the protective grounding (protective earth) system is doubtful, the monitor must be supplied by inner power only.

Condensation

Make sure that during operation, the instrument is free of condensation. Condensation can form when equipment is moved from one building to another, thus being exposed to moisture and differences in temperature.

Warning

Possible explosion hazard if used in the presence of flammable anesthetics.

Explanation of Symbols in the Monitor


1. Symbol means 'BE CAREFUL '. Refer to the manual.


2. Symbol indicates that the instrument is IEC60601-1 Type CF equipment. The unit displaying this symbol contains an F-Type isolated (floating) patient applied part providing a high degree of protection against shock, and is suitable for use during defibrillation.
This symbol indicates that the instrument is IEC60601-1 Type CF equipment. The unit displaying this symbol contains an F-Type isolated (floating) patient applied part providing a high degree of protection against shock, and is suitable for use during defibrillation.


3. Equipotential grounding system


5. Protective earth ground


5. Partial On/Off

Chapter 5 Maintenance and Cleaning

5.1 System Check

Before using the monitor, do the following:

- check if there is any mechanical damage;
- check all the outer cables, inserted modules and accessories;
- check all the functions of the monitor to make sure that the monitor is in good condition.

If you find any damage on the monitor, stop using the monitor on patient, and contact the MEDITECH engineer of the hospital or our Customer Service immediately.
The overall check of the monitor, including the safety check, should be performed only by qualified personnel once every 6 to 12 month, and each time after fix up.
You should check the synchronism of the defibrillator in the frequency described in the hospital regulations. At least every 3 months, it should be checked by a qualified customer service technician.

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

The circuits 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, it is recommended that, at least once a month, the monitor be run on battery until it turns itself off and then recharged.

⚠ Warning
Refer the battery replacement only to our service technician.

5.2 General Cleaning

⚠ Warning
Before cleaning the monitor or the sensor, 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.

NOTE
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.
6. If there is any sign that the ECG cable may be damaged or deteriorated, replace it with a new one.

Reusable TEMP Probes

1 The TEMP probe should not be heated above 100℃ (212℉). It should only be subjected briefly to temperatures between 80℃ (176℉) and 100℃ (212℉).
2 Only detergents containing no alcohol can be used for disaffection.
3 The rectal probes should be used, if possible, in conjunction with a protective rubber cover.
4 To clean the probe, hold the tip with one hand and with the other hand rubbing the probe down in the direction of the connector using a moist lint-free cloth.

NOTE
Disposable TEMP probe must not be re-sterilized or reused.

设置格式[User]: 制表位: 40.29 字符, 左对齐 + 44.57 字符, 左对齐, 不对齐到网格

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

5.3 Cleaning Disinfectants

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

- Diluted Ammonia Water
- Diluted Sodium Hyoichlo (Bleaching agent)

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

- Diluted Formaldehyde 35% -- 37%
- Hydrogen Peroxide 3%
- Alcohol
- Isopropanol

NOTE
the monitor and sensor surface can be cleaned with hospital-grade ethanol and dried in air or with crisp and clean cloth.

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

5.4 Sterilization

To avoid extended damage to the equipment, sterilization is only recommended when stipulated as necessary in the Hospital Maintenance Schedule. Sterilization facilities should be cleaned first.
Recommended sterilization material: Ethylate, and Acetaldehyde.
Appropriate sterilization materials for ECG lead, blood pressure cuff are introduced in **Chapters ECG/RESP Monitoring**, **Chapter NIBP Monitoring** respectively.

Warning

- Follow the manufacturer’s instruction to dilute the solution, or adopt the lowest possible density.
- Do not let liquid enter the monitor.
- No part of this monitor can be subjected to immersion in liquid.
- Do not pour liquid onto the monitor during sterilization.
- Use a moistened cloth to wipe up any disinfectants remained on the monitor.

5.5 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.

⚠ Warning

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

Chapter 6 Alarm Settings

- This chapter gives general information about the alarm and corresponding remedies.
- Alarm setup and prompt messages are provided in respective parameter setup sections.

6.1 Alarm Modes

6.1.1 Alarm Level

Each alarm, either technical or physiological, has its own level. For alarm of higher level, when it occurs, the system will give prompt in a more alert way. Some alarm's level can be set by the user via software. Others can not by changed once defined by the system. Alarms are divided into three levels, high, medium and low.

High-level alarm indicates the patient's life is in danger or the monitor under using has serious problem in technical respect. It is the most serious alarm.
Medium-level alarm means serious warning.
Low-level alarm is a general warning.

Alarms are classified into three categories, which are physiological alarm, technical alarm and general alarm. Physiological alarm refer to those alarms triggered by patient's physiological situation which could be considered dangerous to his or her life, such as heart rate (HR) exceeding alarm limit (parameter alarms). Technical alarm refer to system failure which can make certain monitoring process technically impossible or make monitoring result unbelievable. Technical alarm is also called System Error Message. General alarm belongs to those situations that can not be categorized into these two cases but still need to pay some attention.

Alarm level of the System Error Message (technical alarm) is pre-set in the system.
All technical alarm level and general alarm level, some of the physiological alarm level are pre-set in the system and can not be changed by user.

6.2 Alarm Modes

When alarm occurs, may raise the user's attention in at least three ways, which are audio prompt, visual prompt and description. Audio and visual prompt is given by TFT display device, the speaker on the display device and the alarm indicator. Description is displayed on the screen. Physiological alarm is displayed in the Physiological Alarm area. Most of technical alarms are displayed in the Technical Alarm area. Technical alarms related to NIBP measurement are displayed in the NIBP Technical Alarm area at the bottom of NIBP parameter area.

Animal or Machine Condition	Alarm Category
The measured HR of animal is 114bpm which is beyond the alarm range setting by the user	Physiological alarm
Animals ventricular fibrillation to be found	Physiological alarm
The ECG module detects that the ECG lead is detached	Technical alarm
SpO2 measurement module malfunction	Technical alarm

NOTE

1. The Physiological Alarm area is on the upper right part of the screen. The Technical Alarm area is to the left side of the Physiological Alarm area.
2. If is connected to the external alarm prompt system (e.g. the alarm speaker and indicator connected onto the rear panel of), when alarm occurs, the external alarm prompt system responds in the same way as the .
3. The concrete presentation of each alarm prompt is related to the alarm level.

Alarm prompt of the parameter exceeding the alarm limit.
When physiological alarm of the monitored parameter exceeds the alarm limit, besides using the above-mentioned three ways to give the alarm prompt, the monitor also gives alarm by making the monitored parameter flash in the frequency of 1Hz. If at this time the upper and lower limits of the parameter are displayed, they will flash in the same frequency (1Hz).

Screen Display

When an alarm occurs, the parameter triggering the alarm flashes. “*” signal appears on the screen indicating the occurrence of alarm. Red “***” indicates high-level alarm, yellow “**” indicates medium-level alarm, and yellow “*” indicates low-level alarm. Technical alarm will not prompts “*” signal.

Alarm Indicator

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

Alarm level	Visual prompt
High	Alarm indicator flashes in red with high frequency.
Medium	Alarm indicator flashes in yellow with low frequency.
Low	Alarm indicator lights on in yellow.

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 8 seconds.
Medium	Mode is “DO-DO-DO”, which is triggered once every 24 seconds.
Low	Mode is “DO-”, which is triggered once every 24 seconds.

NOTE

When alarms of different levels occur at the same time, the monitor prompts the one of the highest level.

6.2.1 Alarm Setup

The setup of the alarms can be realized in the alarm menu.
Press the “ALARM SETUP” button on the MONITOR SETUP menu to call up “ALARM SETUP” menu (default menu) as shown below. In the “ALM SEL” item, the user may set up the information about common alarm setup (represented by “COMMON ALM SETUP”) and the alarm setup of each parameter.

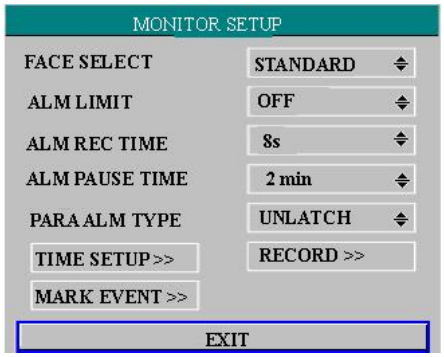


Figure 6- 1 ALARM SETUP

■ **COMMON ALARM SETUP**

Select “COMMON ALM SETUP” selection in “ALM SEL” item. This operation may call up the dialog box as the default one.

- ALARM VOL: which has three selections: OFF, LOW, MED and HIGH.
- ALM REC TIME: which has three selections: 8S, 16S, 32S.
- ALM PAUSE TIME: refers to the alarm suspension time span, which has three selections: 1MIN, 2MIN, 3MIN.
- PARA ALM TYPE: which has two selections: LATCH, UNLATCH. LATCH refers to the situation once alarm occurs, the system will alarm always until the intervention of the operator (press PAUSE or SILENCE on the panel). UNLATCH refers to the situation that once the alarm condition is discharged, the alarm will disappear automatically.

■ **Alarm Setup of Each Parameter**

In “ALARM SETUP” menu select “ALM SEL” item to set up the alarm information of following parameters. They are HR, ST, PVC, SPO2, NIBP, IBP, RESP, TEMP. For example:

- Method to set up alarm information of HR:

Step 1: Select “HR ALM SETUP” in “ALM SEL” item to call up the dialog box “ALARM SETUP” for HR only.

Step 2: Five items are available for the user to set up, which are HR ALM (on/off of the alarm switch), ALM LEV(alarm level), ALM REC(alarm recording switch), ALM HI (higher limit of HR alarm), ALM LO (lower limit of HR alarm). When use the knob to select each item and press the knob, a pull-down list appears for the user to choose his desired selection.

The method for setting the alarm information of other parameters is the same as HR.

6.3 Alarm Cause

Alarm occurs when:

1. Physiological alarm is evoked
2. Alarm for error of the system (technical alarm) is evoked
3. General alert occurs

A. Conditions that activate the parameter alarms:

When the measurement value exceeds the alarm limit and the alarm is set “ON”. Alarm will not activate if the alarm is set “OFF”.

B. Conditions that activate the system alarms (technical alarm):

Upon the system error, the monitor prompts alarm immediately and proceeds corresponding remedy, stops all monitoring and eliminates the final results in order to avoid faulted treatment. If more than one error occur, they will be displayed by turns.

C. General alert

In some circumstances, alerts will behave as physiological alarm but in normal sense, we don’t regard them as real patient health related items.

6.4 SILENCE and PAUSE

■ SILENCE

Press the SILENCE button on the panel for more than 1 seconds can shut off all sounds until the SILENCE button is pressed again. When the system is in SILENCE status, any newly generated alarm will discharge the SILENCE status and make the system give normal status giving audio and visual alarm.

■ PAUSE

Press the SILENCE button on the panel once to 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 user may set up the time for Alarm Pause in the ALARM SETUP menu. Three selections are available: 1min, 2min and 3min.

When in the PAUSE status, press the SILENCE button to restore the normal alarm status. Besides, during PAUSE status, newly occurring technical alarm will discharge the PAUSE status and the system will access 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 SILENCE button can permanently shut off audio sound of Lead Off/Sensor Off alarms.

6.5 Parameter Alarm

The setup for parameter alarms 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 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. Alarm lamp flashes;
4. Store all parameter values during the alarm and 4,8 or 16 second waveform prior to and after alarm.
5. If alarm recording is on, the recorder starts alarm recording. For further information on alarm recording, please refer to Chapter Recording.

6.6 When an Alarm Occurs

NOTE
When an alarm occurs, you should always check the patient's condition first.

The alarm message appears at the top of the screen on the right side. It is needed to identify the alarm and act appropriately, according to the cause of the alarm.

1. Check the patient's condition.
2. Identify the cause of the alarm.
3. Silence the alarm, if necessary.
4. When cause of alarm has been over, check that the alarm is working properly.

You will find the alarm messages for the individual parameter in their appropriate parameter chapters of this manual.

2. ST Segment Alarm

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

3. Arrhythmia Alarm

The monitor records 2-channel ECG waveforms 4 seconds prior to and after the alarm (totally 8 seconds). All measurement results during the alarm will also be recorded.

Chapter 7 ECG/RESP Monitoring

7.1 What Is ECG Monitoring

Monitoring the ECG produces a continuous waveform of the patient's cardiac electric activity to enable an accurate assessment of his current physiological state. Only proper connection of the ECG cables can ensure satisfactory measurement. On the Normal Display, provides display of 2-channel ECG waveforms.

- The patient cable consists of 2 parts(See Chapter **Accessories and Ordering Information** for detail information of the ECG accessories);
  The cable that connects to the monitor;
  The lead set that connects to the patient.
- Using a 5-lead set, the ECG can derive up to two waveforms from two different leads. For requested lead, you may choose from the left side of ECG waveform.
- The monitor displays the Heart Rate (HR), ST segment and Arrhythmia analysis.
- All of the parameters above can be set as alarm parameters.

NOTE
In the default settings of , the ECG waveforms are the first two waveforms from top in the Waveform Area.

7.2 Precautions during ECG Monitoring

Warning

1. **Do not touch the patient, table nearby, or the equipment during defibrillation.**
2. **Use only the original ECG cable for monitoring.**
3. **When connecting the cables and electrodes, make sure no conductive part is in contact with the ground. Verify that all ECG electrodes, including neutral electrodes, are securely attached to the patient.**

NOTE
Interference from a non-grounded instrument near the patient and ESU interference can cause inaccuracy of the waveform.

7.3 Monitoring Procedure

7.3.1 Preparation

1. Prepare the patient's skin prior to placing the electrodes.
   - The skin is a poor conductor of electricity, therefore preparation of the patient's skin is important to facilitate good electrode contact to skin.
   - Shave hair from sites, if necessary.
   - Wash sites thoroughly with soap and water. (Never use ether or pure alcohol, because this increases skin impedance).
   - Rub the skin briskly to increase capillary blood flow in the tissues and remove skin scurf and grease.
2. Attach clip or snap to electrodes prior to placement.
3. Put the electrodes on the patient. Before attaching, apply some conductive jelly on the electrodes if the electrodes are not electrolyte self-supplied.
4. Connect the electrode lead to the patient's cable.
5. Make sure the monitor is ready with power supply.

Warning

1. **Check everyday whether there is skin irritation resulted from the ECG electrodes. If so, replace electrodes every 24 hours or change their sites.**
2. **Verify lead fault detection prior to the start of monitoring phase. Unplug the ECG cable from the socket, the screen will display the error message “ECG LEAD OFF” and the audible alarm is activated.**

NOTE
For protecting environment, the electrodes must be recycled or disposed of properly.

7.3.2 Installing ECG lead

Placing the Electrodes for ECG Monitoring
Electrode placement for 5-lead set (Figure 7- 1 Electrode placement for 5-lead se)

- Red (R) electrode - Be placed near the right shoulder, directly below the clavicle.
- Yellow (L) electrode - Be placed near the left shoulder, directly below the clavicle.
- Black (N) electrode - Be placed on the right hypogastrium.
- Green (F) electrode - Be placed on the left hypogastrium.
- White (C) electrode - Be placed on the chest as illustrated in the F Figure 7- 1)

Note: the following table gives the corresponding lead names used in Europe and America respectively. (Lead names are represented by R, L, N, F and C respectively in Europe, whose corresponding lead names in America are RA, LA, RL, LL and V.)

America		Euro	
Lead names	Color	Lead names	color
RA	White	R	Red
LA	Black	L	Yellow
LL	Red	F	Green
RL	Green	N	Black
V	Brown	C	White

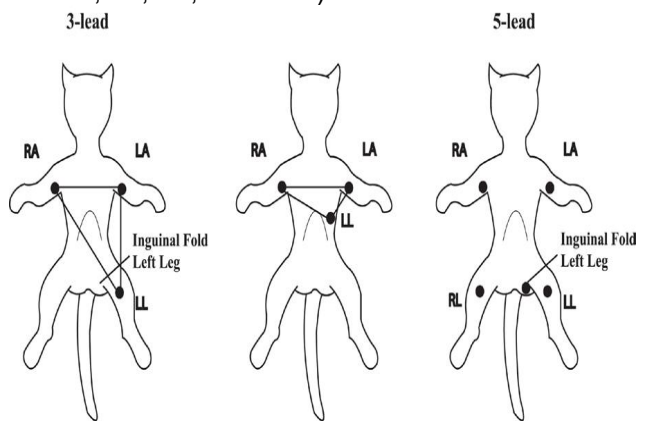


Figure 7-1 Electrode placement for 5-lead set

NOTE
To ensure patient safety, all leads must be attached to the patient.
For 5-lead set, attach the C-electrode to one of the indicated positions as below

⚠ **Warning**
1. When using Electrosurgery equipment, leads should be placed in a position in equal distance from Electrosurgery electrotome and the grounding plate to avoid cautery. Electrosurgery equipment wire and ECG cable must not be tangled up.

2. The placing of the ECG leads will depend on the type of surgery that is being performed. For example, with open chest surgery the electrodes may be placed laterally on the chest or on the back. In the operating room, artifacts can sometimes affect the ECG waveform due to the use of ES (Electrosurgery) equipment. To help reduce this you can place the electrodes on the right and left shoulders, the right and left sides near the stomach, and the chest lead on the left side at mid-chest. Avoid placing the electrodes on the upper arms, otherwise the ECG waveform will be too small.

⚠ **Warning**
When using Electrosurgery equipment, never place an electrode near the grounding plate of the Electrosurgery device, otherwise there will be a great deal of interference with the ECG signal.

- Using 5-lead ECG set
  The default setting is ECG CH1 corresponding to Channel II, and ECG CH2 to Channel I, you can modify the setting to meet your needs. You can set them to correspond to any two from I, II, III, AVR, AVL, AVF and V. If you set both to the same value, one of them will be adjusted to another option automatically. (Figure 7- 2)

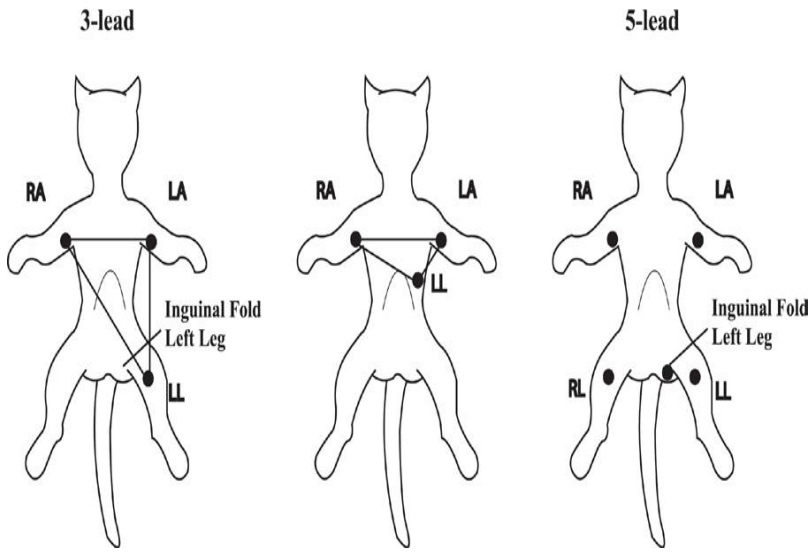


Figure 7- 2 ECG lead

NOTE
If a ECG waveform is not accurate, while the electrodes are tightly attached, try to change the lead.

NOTE
Interference from a non-grounded instrument near the patient and ESU interference can cause inaccuracy of the waveform.
Normal QRS complex should be:

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

For getting 1mv calibrated ECG wave, pick the ECG CAL button in the ECG SETUP menu. A message "when CAL, can't monitor! " prompts on the screen.

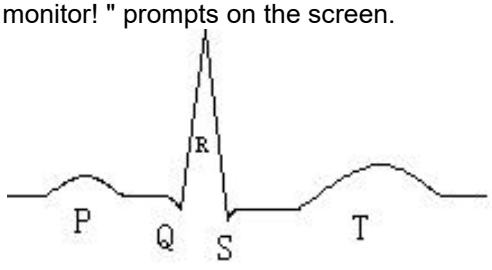


Figure 7-3 Standard ECG Waveform

⚠ **Warning**
Do not touch the patient, table nearby, or the equipment during defibrillation.

7.4 ECG Menu

ECG SETUP Menu
Pick the ECG hot key on the screen, and the following menu will popup.

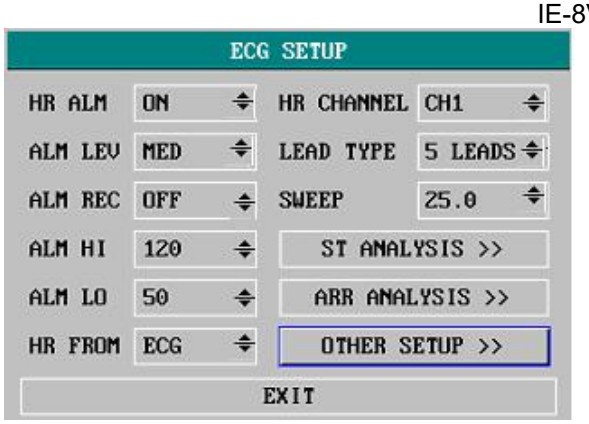


Figure7-4 ECG SETUP Menu

ECG Alarm Setting

- HR ALM: pick "ON" to enable prompt message and data record during the ECG alarm; pick "OFF" to disable the alarm function, and there will be a  beside “ECG”.

- ALM LEV: selectable from HIGH, MED, LOW level. HIGH represents the most serious case.
- ALM REC: pick "ON" to enable report printing upon ECG alarm.
- ALM HI: used to set up the upper limit of ECG alarm.
- ALM LO: used to set up the lower limit of ECG alarm.

ECG alarm is activated when the heart beat exceeds set ALM HI value or falls below ALM LO value.

ECG Alarm Limits:

	Max. ALM HI	Min. ALM LO	Step
HR BIG	300	15	1
HR MIDDLE	350	15	1
HR SMALL	350	15	1

NOTE
Please set the alarm limits according to clinical condition of individual patient. The upper limit shall not exceed 20 beat/min higher than the patient's heart rate.

- HR FROM
  ECG, SpO2, AUTO and BOTH may detect heart rate. AUTO distinguishes heart rate source according to the quality of signal. By picking ECG, the monitor prompts HR and activates HR beep. By picking SpO2, the monitor prompts PULSE and activates pulse beep. BOTH mode displays HR and PR simultaneously, when this item is picked, PR parameter is displayed to the right side of SpO2. As for the sound of HR or PR in BOTH mode, HR is given the priority, i.e., if HR is available, whose sound will be sent out, but if HR is not available, then the sound will be for PR.
- HR CHANNEL
  "CH1" to count the heart rate by CH 1 waveform
  "CH2" to count the heart rate by CH 2 waveform
  "AUTO" the monitor selects a channel automatically
- LEAD TYPE
  Used to select either 5 LEADS or 3 LEADS.
- SWEEP
  Available options for SWEEP are 12.5, 25.0, and 50.0 mm/s.
- ST ANALYSIS
  Pick this item to access ST ANALYSIS menu, the detailed information about the menu is to be discussed in the following section.
- ARR ANALYSIS
  Pick this item to access ARR ANALYSIS menu, the detailed information about the menu is to be discussed in the following section.

■ OTHER SETUP

Pick this item to access ECG SETUP menu as shown below:

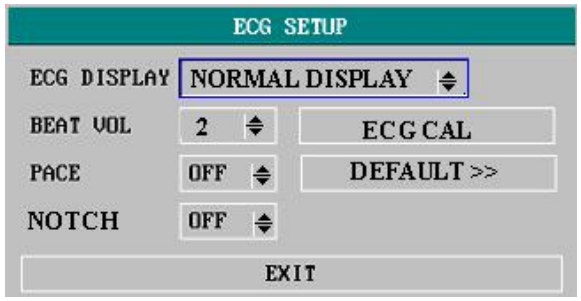


Figure 7-5 ECG SETUP menu

In the sub-menu, following functions are available:

- ECG DISPLAY

  Select NORMAL DISPLAY to display 2 ECG waveforms for 5-lead (for 3-lead, only 1 ECG waveform is displayed.). Select MULTI-LEADS DISPLAY, the waveform area on the screen displays 7 ECG waveforms, and is occupied 7 waveforms position. Select HALF-SCAN MUTTI-LEADS, there are 7 ECG waveforms are displayed on the screen， they occupy 4 waveforms position.

  Note: If 3 LEADS is selected in the ECG SETUP menu, only NORMAL DISPLAY can be selected for ECG DISPLAY item in the sub-menu.
- BEAT VOL

  Four selections are available: OFF, LOW, MED, HIGH. HIGH indicates maximum volume. OFF indicates no sound.
- PACE

  "ON" detected signal will be marked by a " ' " above the ECG waveform.

  "OFF" for non-pacemaking patient

NOTE

If monitoring a patient with the pacemaker, set “PACE” to ON. If monitoring a patient without pacemaker, set “PACE” to OFF.

If “PACE” is on, the system will not perform some types of ARR analysis. For detailed information, please refer to the section: ARR ALARM. In the table, the ARR type marked by All types applies to the analysis in all situations, marked by Non-paced applies only to the analysis in the situation when the patient does not use pacemaker.

- ECG CAL

  Pick this item to start calibrating ECG. The method to end CAL: re-select the ECG CAL key in the menu or re-select the lead name on the screen.
- DEFAULT

  Pick this item to access the ECG DEFAULT CONFIG dialog box, in which the user may select whether the FACTORY DEFAULT CONFIG or the USER DEFAULT CONFIG is to be used. After selecting any of the items and exiting the dialog box, the system will pop up the dialog box asking for the user’s confirmation.

⚠ **Warning**

For pacemaker patient, the pacing impulse analysis function must be switched on, otherwise, the pacing impulse may be counted as normal QRS complex, which results in failure of “ECG LOST” error detection.

NOTE: For monitor with ST segment & Arrhythmia analysis software, refer to **ST Segment Monitoring** and **Arrhythmia Analysis** for details.

NOTE

When Pacer Switch is On, the Arrhythmia events related to PVCs will not be monitored. At the same time, the ST analysis will not be performed either.

7.5 ECG Alarm Information and Prompt

Alarm Message

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

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

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

Physiological alarms:

Message	Cause	Alarm level
ECG LOST	No ECG signal of the patient is detected.	HIGH
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 alarms:

Message	Cause	Alarm level	Remedy
ECG LEAD OFF	ECG electrodes fall off the skin or ECG cables fall off the monitor.	LOW	Make sure that all electrodes, leads and patient cables are properly connected.
ECG V LEAD OFF or ECG C LEAD OFF			
ECG LL LEAD OFF or ECG F LEAD OFF			
ECG LA LEAD OFF or ECG L LEAD OFF			
ECG RA LEAD OFF or ECG R LEAD OFF			
ECG INIT ERR1--8	ECG module failure	HIGH	Stop using measuring function provided by ECG module, notifies MEDITECH engineer or service staff.
ECG COMM STOP	Occasional communication failure	HIGH	If failure persists, notify MEDITECH engineer or service staff.
ECG COMM ERR	Occasional communication failure	HIGH	If failure persists, notify MEDITECH engineer or service staff.

HR ALM LMT ERR	Functional safety failure	HIGH	Stop using HR alarm function, notify MEDITECH engineer or service staff.
ECG NOISE	ECG measuring signal is greatly interfered.	LOW	Make sure the patient is quiet, the electrodes are properly connected and AC power system is well grounded.

Prompt messages (include general alerts):

Message	Cause	Alarm Level
HR EXCEED	HR measuring value exceeds the measurement range.	HIGH

7.6 ST Segment Monitoring

■ ST segment monitoring function is shutoff by default. You can switch it to ON when necessary.

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

■ It is available to measure the variance of ST segment with ST analysis at the waveform tracks for selected lead. The corresponding ST measurement result displays numerically at ST1 and ST2 in the Parameter Area. The trend can be viewed with table or graphic form.
■ Measurement unit of ST segment: mv.
■ Measurement symbol of ST segment: "+" = elevating, "-" = depressing.
■ Measurement range of ST segment: -2.0 mv, ~ + 2.0 mv.

Pick the ST ANALYSIS item in the ECG SETUP menu to access the ST ANALYSIS sub-menu as shown below.

7.6.1 ST ANALYSIS Menu

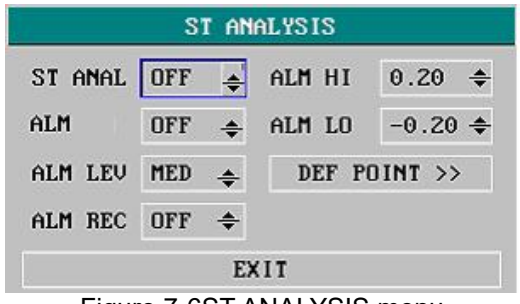


Figure 7-6ST ANALYSIS menu

ST Analysis Alarm Setting

- ST ANAL: the switch for ST analysis. Set it to ON to activate the ST analysis or OFF to disable the ST analysis.
- ST ALM: pick "ON" to enable prompt message and data record during the ST analysis alarm, pick "OFF" to disable the alarm function, and there will be a  beside ST. ST alarm is activated when the result exceeds set ST HI value or falls below ST LO value.
- ALM LEV: used to set up the ST alarm level. There are three selections: HIGH, MED and LOW.
- ALM REC: pick "ON" to enable report printing upon ST analysis alarm.
- ALM HI: used to set up the upper limit of ST alarm. The max. higher limit is 2.0. The minimum higher limit is 0.2 larger than the set lower limit.

- ALM LOW: used to set up the lower limit of ST alarm. The minimum lower limit is –2.0. The max. lower limit is 0.2 lower than the set higher limit.

ST Analysis Alarm Limits

	Max. ST HI	Min. ST LO	Step
ST	2.0 mv	-2.0 mv	0.1

■ DEF POINT pick this item to access the DEF POINT window, in which the position of ISO and ST point can be set up.

□ ISO Base point. Default is 78 ms

□ ST Measurement point

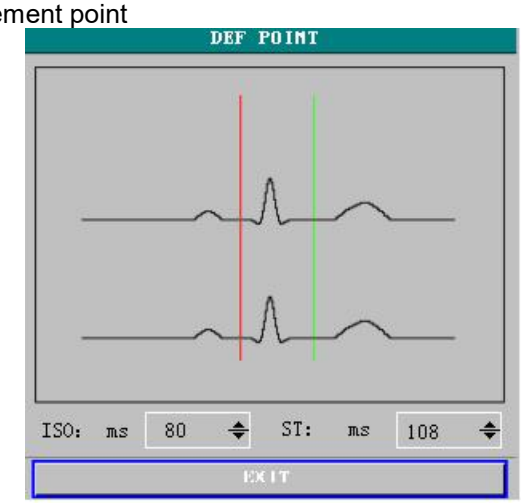


Figure 7-7 DEF POINT window

The operator can adjust the position of both ISO and ST measurement points.
The reference point is the position where the peak of R-wave locates (see Figure 7- 7 DEF POINT).

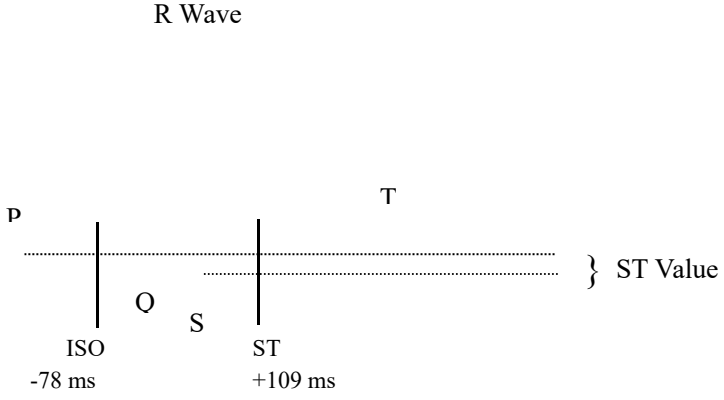


Figure 7-8 DEF Point

The ST measurement for each beat complex is the vertical difference between the two measurement points.

NOTE
The ST measurement point should be adjusted if the patient's HR or ECG morphology changes significantly.

Adjusting ISO, ST

These two points can be adjusted turning the knob.
When adjusting ST measurement point, the system will show the ST Measurement Point Window. The QRS complex template displays in the window (If the template is not established, a horizontal line will display. If the channel is not at ON position, a horizontal line will also display). It is

adjustable of the highlight bar in the window. You may select ISO or ST, then switch the knob left or right to move the cursor line. When the cursor is at the required position, you may select the base point or the measurement point.

NOTE
Abnormal QRS complex is not considered in ST segment analysis.

7.6.1.1 ST Alarm Message

NOTE: The alarm limits for two ST measurements are identical. No setting of alarm limits can be made only for one channel.

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

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

Physiological alarms:

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

Technical alarms:

Message	Cause	Alarm Level	Remedy
ST ALM LMT ERR	Functional safety failure	HIGH	Stop using ST alarming function, notify MEDITECH engineer or service staff.

Prompt messages (include general alerts):

Message	Cause	Alarm Level
ST1 EXCEED	ST measuring value of channel 1 exceeds the measurement range	HIGH
ST2 EXCEED	ST measuring value of channel 2 exceeds the measurement range	HIGH

7.7 Arr. Monitoring

Arrhythmia Analysis
The arrhythmia algorithm is used to monitor ECG of small and Big patient in clinical, detect the changing of heart rate and ventricular rhythm, and also save arrhythmia events and generate alarming information. Arrhythmia algorithm can monitor paced and non-paced patients. Qualified personnel can use arrhythmia analysis to evaluate patient's condition (such as heart rate, PVCs frequency, rhythm and ectopic beat) and decide the treatment. Besides detecting changing of ECG, arrhythmia algorithm can also monitor patients and give proper alarm for arrhythmia.

- The arrhythmia monitoring is shutoff by default. You can enable it when necessary.

- This function can call up the doctor's attention to the patient's heart rate by measuring and classifying the arrhythmia and abnormal heart beat and triggering the alarm.
- The monitor can conduct up to 13 different arrhythmia analyses.
- The monitor can store the latest 60 alarm events when taking arrhythmia analysis to a peculiar buffer. The operator can edit these arrhythmia events through the menu below.

Pick the item ARR ANALYSIS in ECG SETUP menu to access the ARR ANALYSIS sub-menu.

7.7.1 ARR ANALYSIS Menu

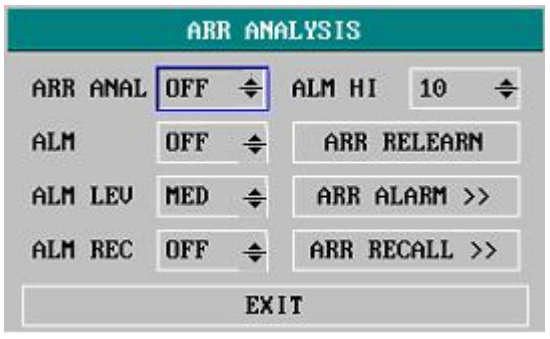


Figure 7-9 ARR ANALYSIS Menu

- ARR ANAL: Pick "ON" during monitoring. Default set is "OFF".
- ALM: Pick "ON" to enable prompt message and data record when alarm occurs; pick "OFF" to disable the alarm function, and there will be a  beside "PVCs".
- ALM LEV: selectable from HIGH, MED, LOW. Level HIGH represents the most serious case.
- ALM REC: pick "ON" to enable report printing upon PVCs alarm.
- ALM HI: PVCs alarm is activated when the PVCs exceeds set PVCs ALM HI value.
  PVCs alarm upper limits:

	Max	Min	Step
PVCs	10	1	1

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

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

Physiological alarms:

Message	Cause	Alarm Level
PVCs TOO HIGH	PVCs measuring value is above upper alarm limit.	User-selectable

Technical alarms:

Message	Cause	Alarm Level	Remedy
PVCs ALM LMT ERR	Functional safety failure	HIGH	Stop using PVCs alarming function, notify MEDITECH engineer or service staff.

- ARR RELEARN Pick this item to start a learning procedure.

- ARR ALARM Pick this item to access the ARR ALARM dialog box to set arrhythmia alarm parameters.
  Set ALM to ON/OFF to enable/disable the alarm function; Set REC to ON/OFF to enable/disable alarm record function, turn the knob under LEV column to set alarm level to HIGH, MED or LOW.

Figure7-10 ARR ALARM Menu

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

■ ARR RECALL Pick this item to review and edit the ARR analysis result.
The latest arrhythmia events (up to 60) are displayed.

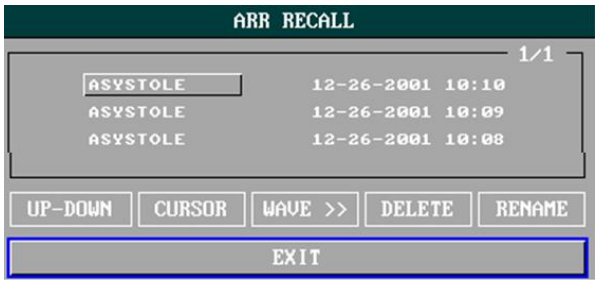


Figure 7-11 ARR RECALL Menu

- UP-DOWN Observe other event lists of other page.
- CURSOR Select the Arr. event, whose name is displayed in a protruding frame.
- DELETE Delete the selected Arr. event.
- RENAME Rename the selected Arr. event, whose name is displayed in a sunken frame. Switch the knob until the name you want appears.
- WAVE To display the Arrhythmia waveform, time and parameter value.
  1. UP-DOWN To observe waveforms of other Arrhythmia events.
  2. L-RIGHT To observe 8-second waveform of Arrhythmia events.
  3. REC To print out displayed Arrhythmia event.
  4. EXIT To return to ARR RECALL menu of Arrhythmia event

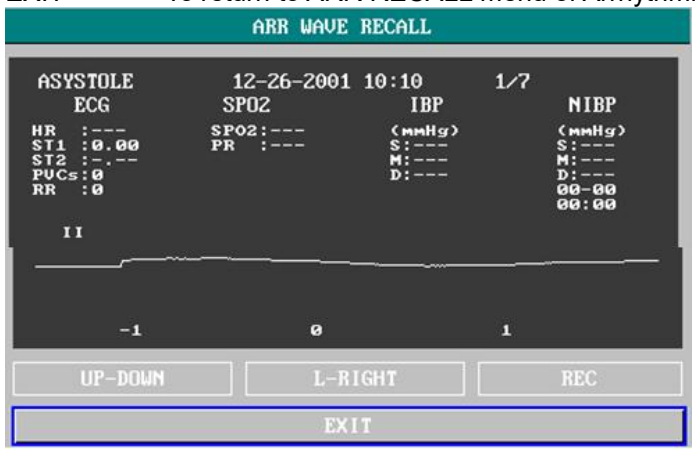


Figure 7-12 ARR WAVE RECALL Menu

NOTE
If there are more than 60 Arrhythmia events, the latest will be retained.

7.7.2 ARR ALARM

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

Physiological alarms:

Arr. Type	Applicable Patient Type	Occurring Condition	Prompt	Alarm Level
ASYSTOLE	All patients	No QRS is detected for 4 consecutive seconds	ASYSTOLE	selectable

VFIB /VTAC	Without pacemaker	Fibrillatory wave for consecutive 4 seconds; or The number of continuous Vent beats is larger than the upper limit of cluster Vent beats (≥5). The RR interval is less than 600ms.	VFIB/VTAC	selectable
VT>2	Without pacemaker	3 ≤ the number of cluster PVCs < 5	VT>2	selectable
COUPLET	Without pacemaker	2 consecutive PVCs	COUPLET	selectable
BIGEMINY	Without pacemaker	Vent Bigeminy	BRGEMINY	selectable
TRIGEMINY	Without pacemaker	Vent Trigeminy	TRIGEMINY	selectable
R ON T	Without pacemaker	A type of single PVC under the condition that HR<100， R-R interval is less than 1/3 the average interval, followed by a compensating pause of 1.25X the average R-R interval(the next R wave advances onto the previous T wave).	R ON T	selectable
PVC	Without pacemaker	Single PVCs not belonging to the type of above mentioned PVCs.	PVC	selectable
TACHY	All patients	5 consecutive QRS complex , RR interval is less than 500ms.	TACHY	selectable
BRADY	All patients	5 consecutive QRS complex, RR interval is longer than 1.5s.	BRADY	selectable
BEAT MISS	Without pacemaker	When HR is less than 100 beats/min., no heart beat is tested during the period 1.75 times of the average RR interval; or When HR is larger than 100 beats/min., no beat is tested with 1 second.	BEAT MISS	selectable
PNP	With pacemaker	No QRS complex and pacing pulse are availabe during the period 1.75 times of the average R-R interval (only considering patients with pacemaker.)	PNP	selectable
PNC	With pacemaker	When pacing pulse is available, no QRS exists during the period 1.75 times of the average RR interval (only considering patients with pacemaker.)	PNC	selectable

Prompt message:

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

NOTE
Arrhythmia name displays in the Alarm Message Area.

7.8 Measuring RESP

7.8.1 How to Measure RESP?

The monitor measures respiration from the amount of thoracic impedance between two ECG electrodes. The change of impedance between the two electrodes, (due to the thoracic movement), produces a respiratory waveform on the screen.

7.8.2 Setting Up RESP Measurement

1. For RESP monitoring, it is not necessary for additional electrodes, however, the placing of electrodes is important.

2. Some patients, due to their clinical condition, expand their chest laterally, causing a negative intrathoracic pressure. In these cases it is better to place the two RESP electrodes laterally in the right axillary and left lateral chest areas at the maximum point of breathing movement to optimize the respiratory waveform.

NOTE
It is not recommended using the RESP monitoring on patients who are very active, as this can cause false alarms.

Checklist for RESP Monitoring

1. Prepare the patient's skin prior to placing the electrodes.
2. Attach snap or clip to the electrodes and attach the electrodes to the patient as described below.
3. Switch on the monitor.

7.8.3 Installing electrode for RESP Measurement

Placing the Electrodes for Respiratory Monitoring

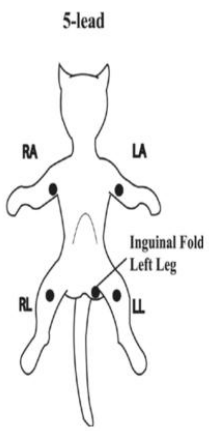


Figure 7-13 Electrodes placement (5-lead)

NOTE
Place the red and green electrodes diagonally to optimize the respiration waveform. Avoid the liver area and the ventricles of the heart in the line between the RESP electrodes so as to avoid cardiac overlay or artifacts from pulsating blood flow. This is particularly important for small animals.

7.8.4 RESP Menu

RESP SETUP Menu
Pick RESP hot key on the screen to call up the following menu:

Figure 7-14 RESP SETUP Menu

RESP Alarm Setting

- ALM: pick "ON" to enable prompt message and data record during the RESP alarm; pick "OFF" to disable the alarm function, and there will be a  beside “RESP”.
- ALM REC: pick "ON" to enable report printing upon RESP alarm.
- ALM LEV: selectable from HIGH, MED and LOW. Level HIGH represents the most serious case.
- ALM HI: used to set up the upper alarm limit.
- ALM LO: used to set up the lower alarm limit.
  RESP alarm is activated when the respiration rate exceeds set ALM HI value or falls below ALM LO value.

RESP Alarm Limits:

	Max. RR HI	Min. RR LO	Step
RESP BIG	120	0	1
RESP SMALL/MIDDLE	150	0	1

- APNEA ALM: to set the standard of judging an apnea case. It ranges from 10 to 40 seconds, increases / decreases by 5.
- SWEEP: Available options are 6.25, 12.5 and 25.0 mm/s.
- WAVE AMP: The user may set up the displaying amplitude of the RESP waveform. The selections are 0.25, 0.5, 1, 2, 3, 4, 5.
- HOLD TYPE: AUTO/MANUAL adjustable. When it is AUTO mode, HOLD HI and HOLD LO menus cannot be used and the monitor automatically calculates the RESP RATE.
- HOLD HI and HOLD LO: When the HOLD TYPE is MANUAL, the user can use the knob to pick either HOLD HI or HOLD LO and turn the knob to adjust the two dashed lines in the RESP WAVEFORM area respectively. The positions of the dashed lines will be used to calculate the upper and lower limits of RESP RATE by the monitor.
- DEFAULT: pick this item to access the RESP DEFAULT CONFIG dialog box, in which the user may select whether the FACTORY DEFAULT CONFIG or the USER DEFAULT CONFIG is to be used. After selecting any of the items and exiting the dialog box, the system will pop up the dialog box asking for the user’s confirmation

RESP Alarm Message

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

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

Physiological alarms:

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

Technical alarms:

Message	Cause	Alarm Level	Remedy
RESP ALM LMT ERR	Functional safety failure	HIGH	Stop using RESP alarming function, notify MEDITECH engineer or service staff.

Prompt message (general alerts):

Message	Cause	Alarm Level
RR EXCEED	RR measuring value exceeds the measure range.	HIGH

Chapter 8 SpO2 Monitoring

8.1 What is SpO_2 Monitoring

SpO2 Plethysmogram measurement is employed to determine the oxygen saturation of hemoglobin in the arterial blood. If, for example, 97% hemoglobin molecules in the red blood cells of the arterial blood combine with oxygen, then the blood has a SpO2 oxygen saturation of 97%. The SpO2 numeric on the monitor will read 97% .The SpO2 numeric shows the percentage of hemoglobin molecules which have combined with oxygen molecules to form oxyhemoglobin. The SpO2/PLETH parameter can also provide a pulse rate signal and a plethysmogram wave.

8.1.1 How the SpO_2 / PLETH Parameter Works

- Arterial oxygen saturation is measured by a method called pulse oximetry. It is a continuous, non-invasive method based on the different absorption spectra of reduced hemoglobin and oxyhemoglobin. It measures how much light, sent from light sources on one side of the sensor, is transmitted through patient tissue (such as a finger or an ear), to a receiver on the other side. The sensor measurement wavelengths are nominally 660nm for the Red LED and 940nm for Infrared LED. Maximum optical power output for LED is 4 mW.
- The amount of light transmitted depends on many factors, most of which are constant. However, one of these factors, the blood flow in the arteries, varies with time, because it is pulsating. By measuring the light absorption during a pulsation, it is possible to derive the oxygen saturation of the arterial blood. Detecting the pulsation gives a PLETH waveform and pulse rate signal.
- The SpO_2 value and the PLETH waveform can be displayed on the main screen.

⚠ **Warning**

Pulse oximetry can overestimate the SpO_2 value in the presence of Hb-CO, Met-Hb or dye dilution chemicals.

8.1.2 SpO_2 / Pulse Monitoring

⚠ **Warning**

ES (Electrosurgery) equipment wire and SpO2 cable must not be tangled up.

⚠ **Warning**

Do not put the sensor on extremities with arterial catheter or venous syringe.

NOTE

Do not perform SpO_2 measuring and NIBP measuring in same arm at one time, because obstruction of blood flow during NIBP measuring may adversely affect the reading of SpO_2 value.

8.2 Precautions during SpO2/Pulse Monitoring

NOTE

- **Make sure the nail covers the light window**
- **The wire should be on the backside of the hand**

NOTE

SpO_2 value always displays at the same position. Pulse Rate will display when HR FROM is set at "SPO2", “BOTH” in the ECG SETUP menu.

NOTE

SpO_2 waveform is not proportional to the pulse volume

Warning

1. Verify sensor cable fault detection before beginning of monitoring phase. Unplug the SpO_2 sensor cable from the socket, the screen will display the error message “SPO2 SENSOR OFF” and the audible alarm is activated.
2. Do not use the sterile supplied SpO_2 sensors if the packaging or the sensor is damaged and return them to the vendor.
3. Prolonged and continuous monitoring may increase jeopardy of unexpected change of dermal condition such as abnormal sensitivity, rubescence, vesicle, repressive putrescence, and so on. It is especially important to check the sensor placement of small and patient of poor perfusion or immature dermogram by light collimation and proper attaching strictly according to changes of the skin. Check per 2~3 hours the sensor placement and move it when the skin deteriorates. More frequent examinations may be required for different patients.

8.3 Monitoring Procedure

SpO_2 plethysmogram measurement

1. Switch on the monitor
2. place the sensor clip on a relatively thin tissue, the tongue, lip, deep in the ear, paw, toe etc
3. Plug the connector of the sensor extension cable into the SpO_2 socket

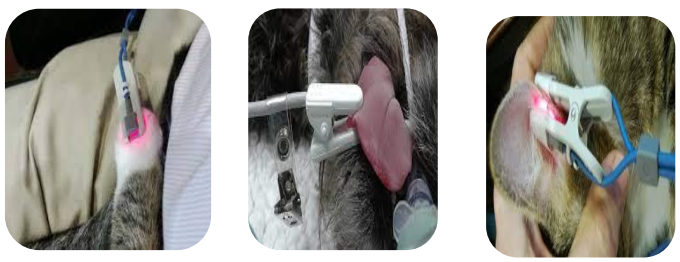


Figure8-1 mounting of the sensor

8.4 Limitations for Measurement

Measurement Limitations

In operation, the accuracy of oximetry readings can be affected by:

- High-frequency electrical noise, including noise created by the host system, or from external sources, such as electrosurgical apparatus, which is admitted by the host system.
- Do not use oximeters and oximetry sensors during magnetic resonance imaging (MRI) scanning. Induced current could potentially cause burns.
- Intravascular dye injections
- Excessive patient movement
- Improper sensor application
- Sensor temperature (maintain between 28°C and 42°C for best operation)
- Placement of the sensor on an extremity that has a blood pressure cuff, arterial catheter, or intravascular line.
- Significant concentrations of dysfunctional hemoglobin, such as carboxyhemoglobin and methemoglobin.
- External illumination more than 5,000 lumens/square meter (typical office lighting)
- Venous pulsations
- It is recommended to use SpO_2 sensors described in chapter Accessories and Ordering Information.

8.5 SpO2 Menu

SPO2 SETUP Menu

Pick the SPO2 hot key on the screen to call up the SPO2 SETUP menu as shown below.

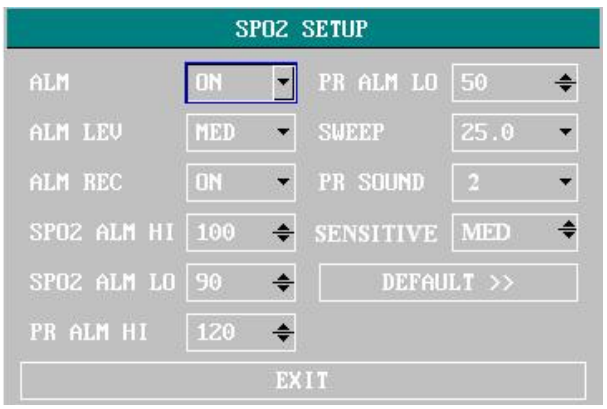


Figure 8-2 SPO2 SETUP menu

⚠ **Warning**

Setting the SpO_2 upper alarm limit to 100% is equivalent to switching off the alarm on upper limit. High oxygen levels may predispose a premature infant to retrolental fibroplasia. Therefore, the upper alarm limit for oxygen saturation must be carefully selected in accordance with commonly accepted clinical practices.

SpO_2 Alarm Setting

- ALM: pick "ON" to enable prompt message and data record during the SpO_2 alarm.
  pick "OFF" to disable the alarm function, and there will be a  beside "SpO_2".
- ALM REC: pick "ON" to enable report printing upon SpO_2 alarm.
- ALM LEV: used to set up alarm level, selectable from HIGH, MED and LOW. HIGH represents the most serious case.
- SPO2 ALM HI and SPO2 ALM LO:SpO2 alarm is activated when the result exceeds set SPO2 ALM HI value or falls below SPO2 ALM LO value. Use the knob to pick the SPO2 ALM HI or SPO2 ALM LO item and turn the knob to select the desired alarm limit.
- PR ALM HI and PR ALM LO: PR alarm is activated when the pulse rate exceeds set PR ALM HI value or falls below PR ALM LO value. Use the knob to pick the PR ALM HI or PR ALM LO item and turn the knob to select the desired alarm limit.

SpO2 and PR Alarm Limits:

	Max. Upper Limit	Min. Lower Limit	Step
SpO2	100	0	1
PR	254	0	1

■ SWEEP
Available options are 12.5, 25.0 mm/s.

■ PR SOUND
Pulse beep volume. Options are OFF, HIGH, MED, LOW.

■ AVG TIME
4S, 8S, 16S represent times that SpO_2 average value is counted.

■ DEFAULT:
Pick this item to access the SPO2 DEFAULT CONFIG dialog box, in which the user may select whether the FACTORY DEFAULT CONFIG or the USER DEFAULT CONFIG is to be used. After selecting any of the items and exiting the dialog box, the system will pop up the dialog box asking for the user's confirmation.

8.6 Alarm Description and Prompt

SpO_2 Alarm Message

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

Tables below describe the possible physiological alarms, technical alarms and prompt messages occurring during SpO2 measurement.

Physiological Alarm:

Message	Cause	Alarm Level
SPO2 TOO HIGH	**SpO2 measuring value is above upper alarm limit**	**selectable**
SpO2 TOO LOW	**SpO2 measuring value is below lower alarm limit**	**selectable**
PR TOO HIGH	**PR measuring value is above upper alarm limit**	**selectable**
PR TOO LOW	**PR measuring value is below lower alarm limit**	**selectable**

Technical alarms:

Message	Cause	Alarm Level	Remedy
SPO2 SENSOR OFF	SpO2 sensor may be disconnected from the patient or the monitor	LOW	Make sure that the monitor and the patient are in correct connection with the cables.
SPO2 INIT ERR	SpO2 module failure	HIGH	Stop using the measuring function of SpO2 module, notify MEDITECH engineer or service staff.
SPO2 COMM STOP	SpO2 module failure or communication error	HIGH	Stop using the measuring function of SpO2 module, notify MEDITECH engineer or service staff.
SPO2 COMM ERR	SpO2 module failure or communication error	HIGH	Stop using the measuring function of SpO2 module, notify MEDITECH engineer or service staff.
SPO2 ALM LMT ERR	Functional safety failure	HIGH	Stop using the measuring function of SpO2 module, notify MEDITECH engineer or service staff.
PR ALM LMT ERR	Functional safety failure	HIGH	Stop using the measuring function of SpO2 module, notify MEDITECH engineer or service staff.

Prompt message (include general alerts):

Message	Cause	Alarm Level
SPO2 EXCEED	SpO2 measuring value exceeds the range	HIGH
PR EXCEED	PR measuring value exceeds the range	HIGH
SEARCH PULSE	SpO2 module is searching for pulse	No alarm
NO PULSE	SpO2 module cannot detect SpO2 signal for a long time	HIGH

8.7 Maintenance and Cleaning

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

⚠ **Warning**
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.

For cleaning:

- Use a cotton ball or a soft mull moistened with hospital-grade ethanol to wipe the surface of the sensor, and then dry it with a cloth. This cleaning method can also be applied to the luminotron and receiving unit.
- The cable can be cleaned with 3% hydrogen dioxide, 7% isopropanol, or other active reagent. However, connector of the sensor shall not be subjected to such solution.

Chapter 9 TEMP Monitoring

9.1 TEMP Monitoring

TEMP monitoring setup

- If you are using disposable TEMP probes you need to plug the TEMP cable into the monitor and then connect the probe to the cable. With a reusable TEMP probe you can plug the probe directly into the monitor
- Apply the TEMP probe(s) securely to the patient.
- Switch on the system.

⚠ Warning

1. Verify probe cables fault detection before beginning of monitoring phase. Unplug the temperature probe cable from the socket, the screen will display the error message "TEMP SENSOR OFF" and the audible alarm is activated.
2. The calibration of the temperature measurement is necessary for every two years (or as frequently as dictated by your Hospital Procedures Policy). When you need calibrate the temperature measurement, contact the manufacture please.
3. The calibration of the temperature measurement is necessary for every two years (or as frequently as dictated by your Hospital Procedures Policy). When you need calibrate the temperature measurement, contact the manufacture please.

NOTE

1. Disposable TEMP probe can only be used once for one patient.
2. The self-test of the temperature measurement is performed automatically once per hour during the monitoring. The test procedure lasts about 2 seconds and does not affect the normal measurement of the temperature monitoring.

9.2 TEMP SETUP Menu

Pick the TEMP hot key on the screen to call up the TEMP SETUP menu shown as below:

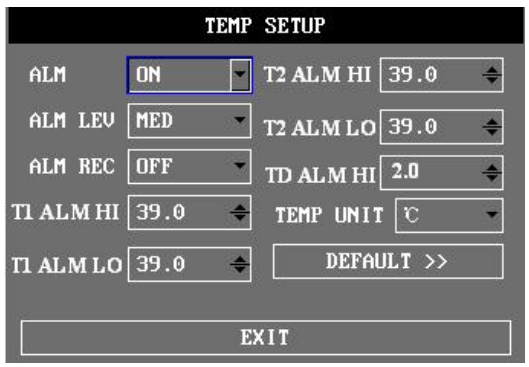


Figure 9-1 TEMP SETUP Menu

- **TEMP Alarm Setting**
  - ALM: pick "ON" to enable prompt message and data record during the TEMP alarm; pick "OFF" to disable the alarm function, and prompt the symbol beside TEMP numeric.
  - ALM LEV: used to set up the alarm level, selectable from HIGH, MED or LOW.
  - ALM REC: used to start/stop recording TEMP alarms. Pick "ON" to enable report printing upon TEMP alarm.

  Alarm for TEMP occurs when the measured temperature exceeds set alarm high limit or falls below alarm low limit.

TEMP Alarm Limits:

	Max. TEMP HI	Min. TEMP LO	Step
TEMP	50	0	0.1

■ **UNIT**

To set temperature unit (ºC or ºF).

■ **DEFAULT**

Pick this item to access the TEMP DEFAULT CONFIG dialog box, in which the user may select whether the FACTORY DEFAULT CONFIG or the USER DEFAULT CONFIG is to be used. After selecting any of the items and exiting the dialog box, the system will pop up the dialog box asking for the user's confirmation.

9.3 TEMP Alarm Message

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

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

Physiological alarms:

Message	Cause	Alarm Level
TEMP TOO HIGH	Measuring value of sensor is above upper alarm limit.	User-selectable
TEMP TOO LOW	Measuring value of sensor is below lower alarm limit.	User-selectable

Technical alarms:

Alarm Message	Cause	Alarm Level	Remedy
TEMP SENSOR OFF	Temperature cable may be disconnected from the monitor.	LOW	Make sure that the cable is properly connected.
TEMP ALM LMT ERR	Functional safety failure	HIGH	Stop using alarming function of TEMP module, notify MEDITECH engineer or service staff.

Prompt message:

Message	Cause	Alarm Level
TEMP EXCEED	Measuring value of sensor is beyond measuring range.	HIGH

Chapter 10 NIBP Monitoring

10.1 Introduction

- Reference to the European standard EN 1060-1: Specification for Non-invasive sphygmomanometers Part 1, General requirements.
- The Non-invasive Blood Pressure (NIBP) module measures the blood pressure using the oscillometric method.
- It is applicable for Big, middle, and small usage.
- There are three modes of measurement available: manual, automatic and continuous. Each mode displays the diastolic, systolic and mean blood pressure.
  - In the MANUAL mode, only one measurement is conducted for each time.
  - In the AUTO mode, the measurement is cycled; you can set the interval time to 1/2/3/4/5/10/15/30/60/90/120/180/240/480 minutes.
  - In the continuous mode, the monitor measures the blood pressure as many times as possible in five minutes.

⚠ Warning

1. **You must not perform NIBP measurements on patients with sickle-cell disease or under any condition which the skin is damaged or expected to be damaged.**
2. **For a thrombasthemia patient, it is important to determine whether measurement of the blood pressure shall be done automatically. The determination should be based on the clinical evaluation.**
3. **Ensure that the correct setting is selected when performing measurements on children. It may be dangerous for the children to use an over pressure level.**

10.2 NIBP Measuring

10.2.1 NIBP Measuring

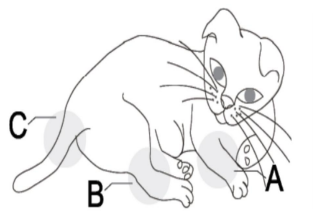
⚠ Warning

- **Before starting a measurement, verify that you have selected a setting appropriate for animal (big, middle or small.)**
- **Do not apply the cuff to a limb that has an intravenous infusion or catheter in place. This could cause tissue damage around the catheter when infusion is slowed or blocked during cuff inflation.**
- **Make sure that the air conduit connecting the blood pressure cuff and the monitor is neither blocked nor tangled.**

1. Plug in the air hose and switch on the system.
2. Apply the blood pressure cuff to the animal's limb or tail following the instructions below (Figure 10- 2 Measure position).
3. Ensure that the cuff is completely deflated(Figure 10- 1 Applying Cuff).

- Apply the appropriate size cuff to the patient, and make sure that the symbol "Φ" is over the appropriate artery. Ensure that the cuff is not wrapped too tightly around the limb. Excessive tightness may cause discoloration and eventual ischemia of the extremities.

Figure 10- 1 Applying Cuff



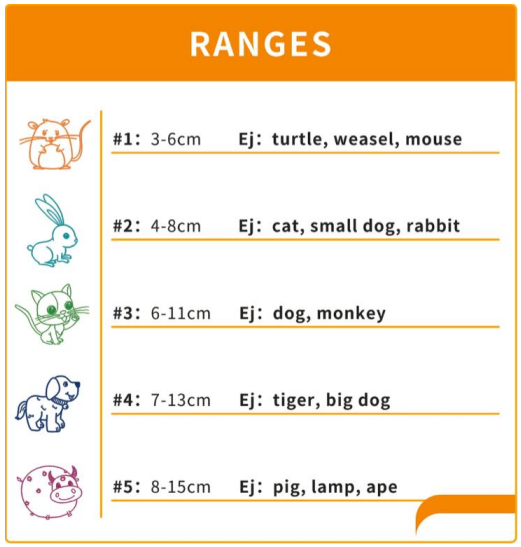
A: forelimb B: hindlimb C: tail
Measure position: A>B>C

Figure 10- 2 Measure position

NOTE
The width of the cuff should be either 40% of the limb circumference (50% for smalls) or 2/3 of the upper arm length. The inflatable part of the cuff should be long enough to encircle 50-80% of the limb. The wrong size of cuff can cause erroneous readings. If the cuff size is in question, then use a larger cuff.

Size of disposable cuff for small/middle/big animals

Size No.	Limb perimeter	Cuff width	Hose
1	3.1 ~ 5.7 cm	2.5 cm	1.5 m or 3 m
2	4.3 ~ 8.0 cm	3.2 cm	
3	5.8 ~ 10.9 cm	4.3 cm	
4	7.1 ~ 13.1 cm	5.1 cm	



- Make sure that the cuff edge falls within the range of mark. If 2 cuffs fit the animal, choose the larger one to gain better BP result.

4. Connect the cuff to the air hose. The limb chosen for taking the measurement should be placed at the same level as the animal's heart. If this is not possible you should apply the following corrections to the measured values:

- If the cuff is placed higher than the heart level, add 0.75 mmHg (0.10 kPa) for each inch of difference.
- If it is placed lower than the heart level, deduct 0.75mmHg (0.10kPa) for each inch of difference.

5. Check whether the patient mode is appropriately selected. Access PATIENT SETUP menu from SYSTEM MENU and pick PAT TYPE item and turn the knob to select the required patient type.
6. Select a measurement mode in the NIBP SETUP menu. Refer to the following paragraphs **Operation Hints** for details
7. Press the NIBP button on the front panel to start a measurement.

Operation Hints

1. To start auto measuring:
   Access NIBP SETUP menu and pick the INTERVAL item, in which the user may choose the selections other than MANUAL to set up the time interval for auto measurement. After that, press NIBP button on the front panel to start the auto measuring according to the selected time interval.

⚠ **Warning**

Prolonged non-invasive blood pressure measurements in Auto mode may be associated with purport, ischemia and neuropathy in the limb wearing the cuff. When monitoring a patient, examine the extremities of the limb frequently for normal color, warmth and sensitivity. If any abnormality is observed, stop the blood pressure measurements.

2. To stop auto measuring:
   During auto measuring press NIBP button on the front panel at any time to stop auto measurement.
3. To start a manual measuring:
   - Access NIBP SETUP menu and pick the INTERVAL item. Select the MANUAL selection. Then press the NIBP button on the front panel to start a manual measurement.
   - During the idle period of auto measuring process, press the NIBP button on the front panel at any time to start a manual measurement. Then press the NIBP button to stop manual measurement and the system continues executes auto-measuring program according to selected time interval.
4. To start a manual measuring during the AUTO mode:
   Press NIBP button on the front panel.
5. To stop a manual measuring
   Repress the NIBP button again.
6. To perform continuous measuring:
   Access NIBP SETUP menu and pick the CONTINUAL item to start the continuous measurement. The monitor will measure as many times of NIBP as possible within 5 minutes.

⚠ **Warning**

Prolonged non-invasive blood pressure measurements in Auto mode may be associated with purport, ischemia and neuropathy in the limb wearing the cuff. When monitoring a patient, examine the extremities of the limb frequently for normal color, warmth and sensitivity. If any abnormality is observed, stop the blood pressure measurements.

7. To stop continuous measuring:
   During continuous measuring press NIBP button on the front panel at any time to stop continuous measurement.

NOTE

If you are in doubt about the accuracy of any reading(s), check the patient's vital signs by an alternative method before checking the functioning of the monitor.

⚠ **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.

Measurement Limitations

To different patient conditions, the oscillometric measurement has certain limitations. The measurement is in search of regular arterial pressure pulse. In those circumstances when the patient's condition makes it difficult to detect, the measurement becomes unreliable and measuring time increases. The user should be aware that the following conditions could interfere with the measurement, making the measurement unreliable or longer to derive. In some cases, the patient's condition will make a measurement impossible.

- **Patient Movement**

Measurements will be unreliable or may not be possible if the patient is moving, shivering or having convulsions. These motions may interfere with the detection of the arterial pressure pulses. In addition, the measurement time will be prolonged.

- **Cardiac Arrhythmia's**

Measurements will be unreliable and may not be possible if the patient's cardiac arrhythmia has caused an irregular heartbeat. The measuring time thus will be prolonged.

- **Heart-lung Machine**

Measurements will not be possible if the patient is connected to a heart-lung machine.

- **Pressure Changes**

Measurements will be unreliable and may not be possible if the patient's blood pressure is changing rapidly over the period of time during which the arterial pressure pulses are being analyzed to obtain the measurement.

- **Severe Shock**

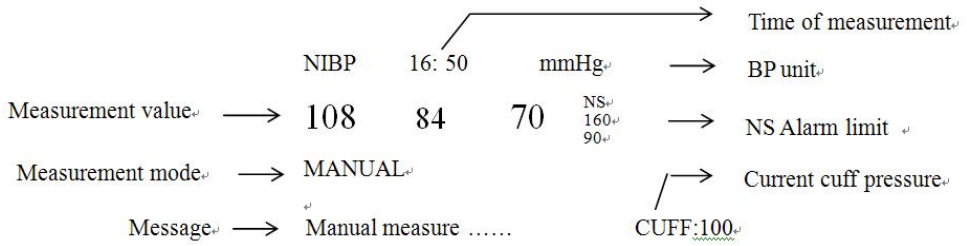
If the patient is in severe shock or hypothermia, measurements will be unreliable since reduced blood flow to the peripheries will cause reduced pulsation of the arteries.

- **Heart Rate Extremes**

Measurements can not be made at a heart rate of less than 40 bpm and greater than 240 bpm.

10.2.2 NIBP Monitoring Screen

NIBP measurement result and corresponding message are displayed as follows:



10.3 NIBP SETUP Menu

Pick the NIBP hot key on the screen to call up the NIBP menu shown as below:

Figure 10-2 NIBP SETUP Menu

NIBP Alarm Setting

- ALM: pick "ON" to enable prompt message and data record during the NIBP alarm; pick "OFF" to disable the alarm function, and there will be a  beside “NIBP”.
- ALM LEV: selectable from HIGH, MED to LOW. HIGH represents the most serious case.
- ALM REC: pick "ON" to enable report printing upon NIBP alarm.
- SYS ALM HI, SYS ALM LO, MEAN ALM HI, MEAN ALM LO, DIA ALM HI, DIA ALM LO are for the user to set up the alarm limit for each type of pressure. NIBP alarm is activated when the pressure exceeds set upper alarm limits or falls below lower alarm limits.

NIBP Alarm Limits:

Big	SYS 40-270 mmHg，DIA 10-215 mmHg	Mean	20-235 mmHg
Middle	SYS 40-200 mmHg，DIA 10-150 mmHg	Mean	20-165 mmHg
Small	SYS 40-135 mmHg，DIA 10-100 mmHg	Mean	20-110 mmHg

■ RESET
Restore measurement status.
Pick this item to restore initial settings of the pressure pump.
When the pressure does not work properly and the system fails to give message for the problem, pick this item to activate self-test procedure, thus restore the system from abnormal performance.

■ CONTINUAL
Start continuous measuring.
When this item is picked, the menu will disappear automatically.

■ INTERVAL
Interval time for automatic measuring. Available selections: 1/2/3/4/5/10/15/30/60/90/120/180/240/480 minutes. Press NIBP button on the front panel to start the first auto measuring.
Pick MANUAL selection in INTERVAL item to set up the measuring mode to MANUAL.

■ UNIT
Pick this item to set measurement unit. (Option: mmHg or kPa)

■ CALIBRATE
Calibrate the cuff pressure reading with a calibrated reference manometer. Pick the CALIBRATE item to start the calibration and the item will change into STOP CAL, which if picked, the system will stop calibration.

■ DEFAULT
Pick this item to access the NIBP DEFAULT CONFIG dialog box, in which the user may select whether the FACTORY DEFAULT CONFIG or the USER DEFAULT CONFIG is to be used.

After selecting any of the items and exiting the dialog box, the system will pop up the dialog box asking for the user's confirmation.

⚠**Warning**
The calibration of the NIBP measurement is necessary for every two years (or 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:
Replace the cuff of the device with a rigid metal vessel with a capacity of 500 ml ± 5%. 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. Set the monitor in **CALIBRATE** mode. Inflate the pneumatic system to 0, 50 and 200 mmHg 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.

■ PNEUMATIC
This item is used for air leakage test. Turn the knob to pick the item to start the air leakage test. Then the item will change into STOP PNEUM, which if picked, the system will stop air leakage test.

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

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 menu.
4) Turn the knob to the PNEUMATIC item and press the knob. Then the prompt "PNEUM testing…" will appear on the bottom of the NIBP parameter area indicating that the system has started performing pneumatic 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 a pneumatic measurement.
7) If no prompt appears on the bottom of the NIBP parameter area, it indicates that the airway is in good situation and no air leaks exist. However if the prompt "PNEUMATIC 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 pneumatic test. If the failure prompt still appears, please contact the manufacturer for repair.

10.4 Maintenance and Cleaning

⚠ **Warning**
- **Do not squeeze the rubber tube on the cuff.**
- **Do not allow liquid to enter the connector socket at the front of the monitor.**
- **Do not wipe the inner part of the connector socket when cleaning the monitor.**
- **When the reusable cuff is not connected with the monitor, or being cleaned, always place the cover on the rubber tube to avoid liquid permeation.**

Reusable Blood Pressure Cuff
The cuff can be sterilized by means of conventional autoclaving, gas, or radiation sterilization in hot air ovens or disinfected by immersion in decontamination solutions, but remember to remove the rubber bag if you use this method. The cuff should not be dry-cleaned.
The cuff can also be machine-washed or hand-washed, the latter method may prolong the service life of the cuff. Before washing, remove the latex rubber bag, and for machine-washing, close the Velcro fastening. Allow the cuff to dry thoroughly after washing, then reinsert the rubber bag.

To replace the rubber bag in the cuff, first place the bag on top of the cuff so that the rubber tubes line up with the large opening on the long side of the cuff. Now roll the bag lengthwise and insert it into the opening on the long side of the cuff. Hold the tubes and the cuff and shake the complete cuff until the bag is in position. Thread the rubber tubes from inside the cuff, and out through the small hole under the internal flap.

Disposable Blood Pressure Cuffs
Disposable cuffs are intended for one-patient use only. Do not use the same cuff on any other patient. Do not sterilize or use autoclave on disposable cuffs. Disposable cuffs can be cleaned using soap solution to prevent infection.

NOTE
For protecting environment, the disposable blood pressure cuffs must be recycled or disposed of properly.

Chapter 11 CO2 Measurement (Optional)

11.1 Side Stream CO2 Monitoring Instructions

This module measures the carbon dioxide pressure of the patient's gas path and can obtain the carbon dioxide content of tidal end ($EtCO_2$), Minimum carbon dioxide inhalation volume (Inspired Minimum CO_2: InsCO2) and airway respiratory rate (Air Way Respiration Rate: AWRR) and showed CO_2 Pressure waveform. The parameter labels displayed on the screen are specified as follows:
CO2: End-tidal carbon dioxide ($EtCO_2$)
INS: inhalation inhalation minimum CO_2
AWRR: Airway respiration rate (number of breaths per minute)

Warning NO collision and vibration to CO2 module

Warning NO use it in environments where flammable anesthetic gases are placed

The monitor is only for professionals trained and familiar with this manual.

CO_2 Measurement Settings:

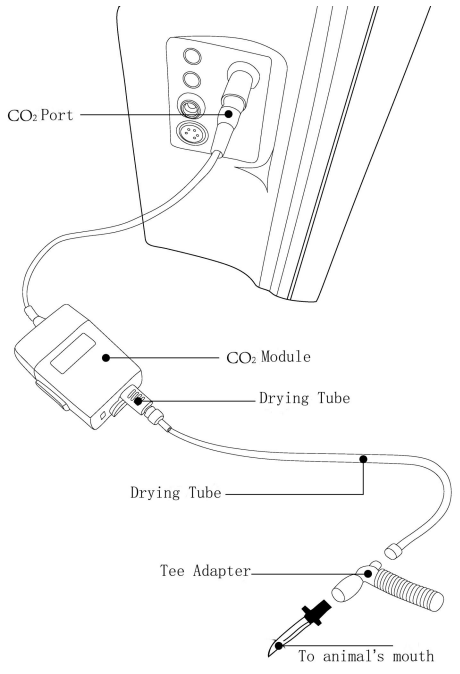


Figure 11-1 Connection Diagram of Side Stream CO2 Module

NOTE

1. **When the screen displays the message " CO_2 Preheating "and" CO_2 sensor heating " indicates that the sensor is preheat and starting. Standard measurements can be performed when this information disappears from the screen.**
2. **Sampling tubes disposable and can not be re-disinfected, it should not be crossed by animals.**

11.2 CO2 Menu

Set and adjust the rotation knob, move the cursor to the CO2 hot key in the parameter area of the screen, and press the knob to enter the "CO2 Setup" menu.

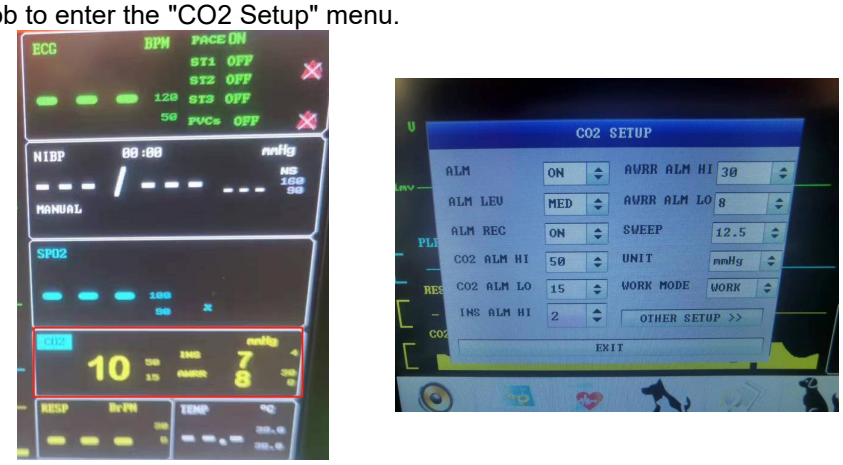


Figure 11-2 CO_2 Setup Interface

Here are the functions of each options in the CO2 Setup menu.

- Alarm switch: "ON" in the CO_2 When the parameter has alarm, conduct alarm prompt and storage, and "close" does not alarm.
- Alarm record: Select "ON" is in CO_2 Recorder output when the parameter has an alarm. The default value is Off .
- Alarm level: There are three options: "High", "Medium" and "Low". "High" indicates the most serious alarm, followed by the severity of "medium" and "low" respectively. The change of "alarm level" affects only the physiological alarm level of the CO2 parameters (including upper EtCO2, lower EtCO2, upper InsCO2, upper AWRR and lower AWRR). The default alarm level is Medium.
- CO2 ALM HI: used to adjust the alarm upper limit of Et CO2. When the measured value is greater than the upper alarm limit of CO2, the message "CO2 is too high" appears on the screen. This information disappears when the measurement returns to normal.
- CO2 ALM LO: used to adjust the lower limit of Et CO2. When the measurement value is less than the lower alarm limit of CO2, the message "CO2 is too low" appears on the screen. This information disappears when the measurement returns to normal.
- INS ALM HI: used to adjust the alarm upper limit of InsCO2. When the measured value is greater than the upper alarm limit of InsCO2, the message "INS is too high" appears on the screen. This information disappears when the measurement returns to normal.
- AWRR ALM HI: used to adjust alarm limit of AWRR. When the measurement value is greater than the alarm limit of AWRR. This information disappears when the measurement returns to normal.
- AWRR ALM LO: used to adjust the alarm lower limit of AWRR. When the measurement value is greater than the alarm limit of the AWRR, the message is too low. This information disappears when the measurement returns to normal.
- UNIT: Pressure Unit Display units used to change the CO2 and InsCO2 parameters. Select "mmHg" or "kPa".
- Apnea Alarm: If a certain time of suffocation alarm time (10 seconds, 15 seconds, 20 seconds, 25 seconds, 30 seconds, 35 seconds and 40 seconds), then the "CO2 suffocation" alarm information will appear on the screen after the corresponding set time of asphyxiation. The alarm level is high.
- SWEEP-Waveform speed: used to adjust the display speed of the CO2 waveform, optional "6.25 mm/s", "12.5 mm/s", and "25.0 mm / s".
- Exit: Close the CO2 Setup menu.
- ⚠ **NOTE**
- **1. Do not close the apnea alarm.**
- **2. When multiple alarms occur at the same time, the screen will display the highest level of alarm information.**

Other Setup: Select this item to enter the CO2 Other Setup menu

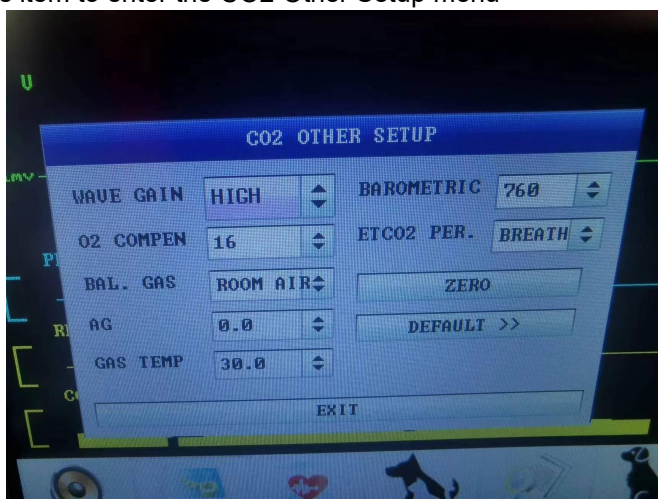


Figure 11-3 CO2 Other Setup Interface

- Here are the functions of the menu in the CO2 Other Setup menu:
- WAVE GAIN: Waveform Gain used to adjust the magnitude of the CO 2 waveform display area, select Low or High. The default value is "low ".
- Pump rate: used to adjust the pump rate of the CO 2 module pump, select "100 ml/min" or "150 ml/min" or "200 ml/min". The default value is "100 ml/min".
-
- ⚠**NOTE**
- Operation mode: used to change the carbon dioxide working mode, can select the "measurement" mode or "standby" mode. The default is the "standby" mode. When CO2 is monitored, Measurement mode is selected. The "on standby" mode will turn off the air pump of the side stream module, the sensor and infrared IR source of the mainstream module, reducing power consumption and extending the IR source and the entire CO2 module life.

- **When the CO2 monitoring function is not used, it is recommended that the user do not connect to the mainstream sensors or side grooves, and choose the measurement mode as "standby" mode.**
- Calculate compensation: conduct different compensation operations according to the compensation gas selected by the user. Option: general / oxygen / N_2O / DES / all. Operating conditions for calculating the compensation are shown in the table below. Operation method: first, according to the contents of the table, choose which gas compensation used (general, oxygen, desflurane or all), and then decide whether to make water vapor compensation (VA) and BTPS compensation.
-

Calculate Compensation	O2 Correction	N2O/Desflurane Correction	Operating Conditions
General	Close	Close	O2≤60%，w/o N2O
O2	Open	Close	O2>50%，w/o N2
Desflurane	Close	Open	O2≤60%，with N2O or Desflurane ≥12%
All	Open	Open	O2>60%,with N2O

- Water gas compensation: this item can set if make water gas compensation.
- Water and gas compensation is based on the CO2 infrared absorption characteristics, and can be used in the main stream and side stream types. In some case, the user can set this feature to invalid. During the normal side stream measurement process, the system will automatically adjust the compensation value through the calculation formula.
- Set this function to the off state when measuring the dry air. The measurement process of dry

air includes the steady state measurement and the calibration process. Steady-state measurements were performed only when measuring the CO2 in the current environment.

- The system default value of the water and gas compensation item is "ON", and the setting can be changed by the system command.
- BTPS: This functions to compensate when calculating the CO2 concentration. The system will automatically make BTPS compensation when elected ON, the system will not make BTPS compensation when choosing Off.
  Setting ON for measuring the CO2 concentration inside lung.

  This is set to Off when measuring CO2 concentration in the environment or fixed container.

  Under the standard ambient pressure, and the gas is dry, the measured value of the sensor will not be distorted, so there is no deviation, so the BTPS function should be turned off.

  The default setting is ON.

NOTE

- If the "calculation compensation" menu item is not set correctly according to the operating conditions, the measurement results will seriously deviate from the actual value and lead to serious misdiagnosis.
- Water vapor compensation opens in default. Close "dry" gas when measurement, such example during regular maintenance or measurement verification with "dry" calibration gas.
- The BTPS opens by default. Turn it on when measuring "wet" gas saturated at body temperature, ambient pressure. Turn it off when measuring the "dry" gas at ambient temperature and pressure.
- Strictly according to the calculation and compensation operation method.
- Default configuration: Select this item to enter the "CO2 Default Configuration" dialog box. Users can select the "Manufacturer Default Configuration" or "User Default Configuration" items. After the selected exit, the system will pop up the dialog box, asking the user to confirm the selection.

EtCO2 alarm upper limit: When the parameter value is above this limit, conduct the super upper limit alarm.default value:
Large animal: 50 mmHg Small animal: 45 mmHg
EtCO2 alarm lower limit: When the parameter value is lower than this limit, exceed the lower limit alarm, default value:
Large animal: 15 mmHg Small animal: 30 mmHg
InsCO2 Upper alarm limit: when the parameter value is higher than this limit, then conduct the super upper limit alarm, default value:
Large animal: 4 mmHg Small animal: 4 mmHg
AwRR alarm upper limit: when the parameter value is higher than this limit, to conduct the super upper limit alarm, default value:
Large animal: 30 rpm Small animal: 100 rpm
AwRR alarm lower limit: when the parameter value is lower than this limit, to conduct the super lower limit alarm.default value:

Large animal: 8 rpm Small animal: 30 rpm
Apnea Time: default: 20S
Operation Mode: Main stream type: standby, measurement
Side Stream type: on standby, measuring
Default mode: standby
Compensation Method: Mainstream type: general / oxygen / N2O / DES / all
Side stream type: general / oxygen / N2O / DES / all
Default mode: general, other compensation mode open (including: water vapor compensation, BTPS compensation)
Pump Tate: 100,200 ml/min, default pump rate: 100 ml / min
Unit: mmHg / kPa Default: mmHg
Waveform Velocity: 25.0/12.5/6.25 (mm/s) Default: 25.0mm /s
Waveform Amplitude: low / high default: low

In addition, the alarm function of the CO2 module is shown in the "Alarm Function" section, and its recording function is shown in the "Record function" section. The alarm event reviews, trend charts and trend tables for CO2 parameters are shown in the "Trends and Events" section.

11.3 CO2 Alarm Information and Prompt Information

When the alarm record switch in the related menu is turned on, those physiological alarms caused by the parameter over-alarm limit will trigger the recorder to automatically output the alarm parameter value and the related measurement waveform.

CO2 The physiological alarm, technical alarm and prompt information that may occur in the module measurement are listed in the following table:

Physiological Alarm:

Prompt Message	Cause	Alarm level
CO2 too high	EtCO2 measured value is higher than the set alarm high limit	Selectable
CO2 too low	EtCO2 measurement value is lower than the set alarm low limit	Selectable
INS too high	The measured value of InsCO2 is higher than the set alarm limit	Selectable
AWRR too high	The AWRR measurement value is higher than the set alarm high limit	Selectable
AWRR too low	The AWRR measurement value is lower than the set alarm low limit	Selectable
CO2 respiratory apnea	Respiratory arrest (no breathing detected within the set delay time)	High

11.4 Main Stream CO2 Monitoring Instructions

Figure 11-4 Mainstream CO2 Sensor

Figure 11-5 Mainstream CO_2 Sensor Connection

NOTE: Connect the CO2 sensor cable according to Figure 11-5.

11.5 Points for Attention:

11.5.1 Zero Operation

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

11.5.2 Check Adaptor

When “check adapter” warning appears

Check to see if the adapter is connected and that the optical analysis window is clean

Clean probe with alcohol or install a new probe if needed

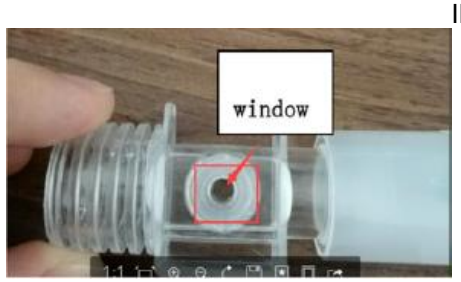


Figure 11-6 Airway Adapter

11.5.3

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

11.5.4

Upon initial power up and after connecting a new probe to the monitor, a solid red light will illuminate on the module itself. This means the module is in a pre-heated state. When the red light goes out, the probe is preheated. When the probe is pre-heated and in a normal measurement state, a green light will illuminate during exhalation and will turn off during inhalation. If the red light is slowly blinking, that indicates a “check adaptor” alarm. A fast blinking red light indicates he adapter needs to return to zero.

NOTE

The adapter needs to be preheated for 2-3 minutes (until the red light extinguishes) to prevent condensation on the optical analysis window from affecting the measurement results.

11.6 Proper Connection

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

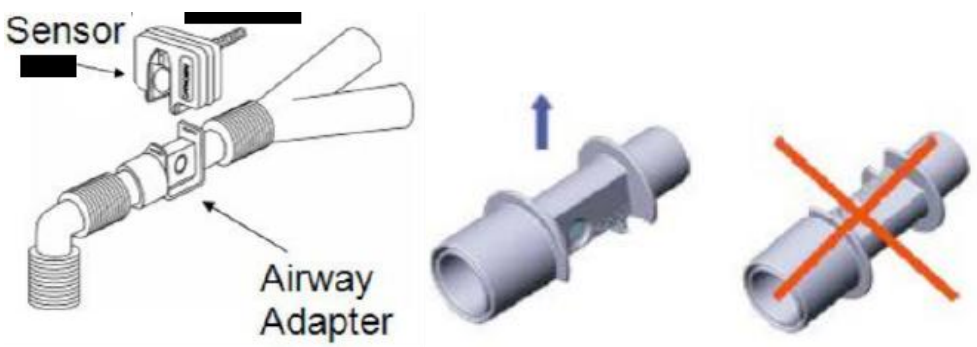


Figure 11-7 Airway Adapter Connection

11.7 Troubleshooting of Mainstream CO2 Module

11.7.1 The mainstream ETCO2 module needs to be pre-heated before use

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

11.7.2 Clean or Replace New Adapter

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

11.8 CO2 Compensations

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

11.9 Apnea Alarm

The “Apnea Time(s)” is the maximum time allowed from the detection of one breath to the next breath. Therefore, if the time between breaths exceeds the time out period, the alarm “Apnea” will be trig-geared.

At start-up, or following a zero operation, three breaths need to be detected before this timer is activated. To clear the “Apnea” alarm, three breaths are required, or a zero operation must be carried out.

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

Chapter 12 Appendix I

Parameters Specification

12.1 ECG

Lead Mode	5 Leads (R, L, F, N, C or RA, LA, LL, RL,V)
Lead selection	I, II, III, avR, avL, avF, V,
Waveform	**3 channel**
Lead mode	3 Leads (R, L, F or RA, LA, LL)
Lead selection	I, II, III,
Waveform	**1 channel**
Gain	×2.5mm/mV, ×5.0mm/mV, ×10mm/mV, ×20mm/mV, auto HR and Alarm
Range： Big	15 ~ 300 bpm SMALL/Middle 15 ~ 350 bpm
Accuracy	± 1% or ± 1bpm,which great
Resolution	1 bpm
Sensitivity	> 200 (uV $_{P-P}$)
Differential Input Impedance	> 5 MΩ
CMRR： Monitor	> 105 dB， Operation > 105 dB， Diagnosis > 85 dB
Electrode offset potential	±300mV
Leakage Current	< 10 uA
Baseline Recovery	< 3 S After Defi.
ECG Signal Range	±8 m V (Vp-p)
Bandwidth： Surgery	1 ~ 15 Hz，Monitor 0.5 ~ 35 Hz，Diagnostic 0.05 ~ 100 Hz
Calibration Signal	1 (mV $_{p-p}$), Accuracy ：±5%
ST Segment Monitoring Range	
Measure and Alarm	-2.0 ~ +2.0 mV
ARR Detecting	
TypeASYSTOLE, VFIB/VTAC, COUPLET, BIGEMINY, TRIGEMINY, R ON T, VT>2, PVC, TACHY, BRADY, MISSED BEATS, PNP, PNC	
Alarm	Available
Review	Available

12.2 RESPARATION

Method	Impedance between R-F(RA-LL)
Differential Input Impedance	>2.5 MΩ
Measuring Impedance Range:	0.3~5.0Ω
Base line Impedance Range:	0 – 2.5 KΩ
Bandwidth	0.3 ~ 2.5 Hz
Resp. Rate	
Measuring and Alarm Range： Big	0 ~ 120 rpm， SMALL/Middle 0 ~ 150 rpm
Resolution	1 rpm
Accuracy	±2 rpm
Apean Alarm	10 ~ 40 S

12.3 NIBP

Method	Oscillometric
Mode	Manual, Auto, STAT
Measuring Interval in AUTO Mode	
1, 2, 3, 4, 5, 10, 15, 30, 60, 90, 120, 180, 240,480 (Min)	
Measuring Period in STAT Mode	5 Min
Pulse Rate Range	40 ~ 240 bpm
Alarm Type	SYS, DIA, MEAN

Measuring and alarm range：
Big Animal：SYS 40 ~ 270 mmHg，DIA 10 ~ 215 mmHg，MEAN 20 ~ 235 mmHg
Middle Animal：SYS 40 ~ 200 mmHg，DIA 10 ~ 150 mmHg，MEAN 20 ~ 165 mmHg
Small Animal：SYS 40 ~ 135 mmHg，DIA 10 ~ 100 mmHg，MEAN 20 ~ 110 mmHg
Resolution： Pressure 1mmHg
Accuracy： Pressure
Maximum Mean error ±5mmHg
Maximum Standard deviation ±8mmHg
Overpressure Protection
Big Animal 297±3 mmHg
Middle Animal 240±3 mmHg
Small Animal 147±3 mmHg

12.4 SpO2

Measuring Range 0 ~ 100 %
Alarm Range 0 ~ 100 %
Resolution 1 %
Accuracy 70% ~ 100% ±2 % ， 0% ~ 69% unspecified
Actualization interval about 1 Sec
Alarm Delay 10 Sec
Pulse Rate
Measuring and Alarm Range 0~254bpm
Resolution 1bpm
Accuracy ±2bpm

12.5 TEMPERATURE

Channel	1
Measuring and Alarm Range	0 ~ 50 °C
Resolution	0.1°C
Accuracy	±0.1°C
Actualization interval	about 1 Sec
Average Time Constant	< 10 Sec

12.6 CO2 （Optional）

Main Stream Module

Measurement Method: Infrared
Measuring Range: 0.0~ 13.1% (0~99.6 mmHg)
Resolution: 0.01mmHg
Measurement Accuracy: ±2mmHg @<5.0% CO2 (at BTPS)
<10%of the reading @>5.0% CO2(at BTPS)
Respiratory Rate Measurement Range: 0~150bpm
Response Time:8ms

Side Stream Module

Measurement Method: Infrared
Measuring Range: 0-20% volume ratio(0-152mmHg@BTPS）
Measurement Accuracy: 0-40mmHg ±2mmHg, 41-70mmHg±5%
71-100mmHg ±8%, 10-152mmHg ±10%
Respiratory Rate Measurement Range: 2~150bpm
Response Time: 28ms（sensor）

Tootoo Meditech Co., Ltd.
Address: 3A, Phase II, Smart Home, Baolong Street,
Longgang District, Shenzhen, Guangdong, China
Tel: +86-755-28306385 Whatsapp:+86 136 3258 4549
Email:info@newtootoo.com
Web: www.newtootoo.com