Multi-parameter Patient Monitor

C50

User Manual

Shenzhen Comen Medical Instruments Co., Ltd.

Copyright

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Assembly operations, extensions, re-adjustments, modifications or repairs are carried out by personnel authorized by our company, and the electrical installation of the relevant room complies with safety standards, and the instrument is used in accordance with the instructions for use.

⚠**Note**: This device is not intended for home use.

⚠**WARNING**⚠: This device is not intended for treatment.

⚠**WARNING**⚠

A WARNING label advises against certain actions or situations that could result in personal injury or death.

⚠**Note**

A NOTE label provides useful information about a function or procedure.

Contents

Chapter 1 General Information

For information about the monitor, please read the General Information on the Monitor chapter.

For introduction on various information displayed on screen, please read the Screen Display chapter.

For operational methods, please read the Button Functions and Basic Operations chapter.

For locations of various interfaces, please read the External Interfaces chapter.

For notices of using the monitor with power supply from a battery, please read the Built-in Chargeable Battery chapter.

Warning

This monitor is to monitor clinical patients, only for doctors and nurses' use.

Warning

Don't open cover of the equipment to avoid possible risks in electric shock. Any maintenance or upgrading on the monitor must be conducted by service personnel trained and authorized by COMEN Company.

Warning

Don't use this monitor where there are flammables such as anesthetic agent, so as to prevent from explosion.

Warning

Users before starting use should check whether the equipment and its accessories can work properly and safety.

Warning

Please make sufficient alarming setting for each patient in order to prevent from delayed therapy and make sure there is voice effect during alarming.

Warning

Don't use mobile phones around the monitor. Mobile phones will generate strong emission fields and disturb the monitor.

Warning

During defibrillation don't touch patients, tables and the machine.

Warning

Equipments inter-connected with the monitor should form an equal-potential body (as

protective effective earthing).

Warning

Users (doctors or nurses) should ensure safety of patients under monitoring, when the monitor is used together with electrosurgical equipments.

1.1 General Information

Transport and Storage:

Temperature: -20℃～+40℃

Humidity: ≤80%

Atmospheric Pressure: 50kPa～106kPa

Working:

Temperature: 5℃～+40℃

Humidity: ≤80%

Atmospheric Pressure: 86kPa～106kPa

Voltage:

a.c.100V~250V 50Hz/60Hz

FUSE T 1.6A

The portable multi-parameter monitor is of rich functions, applicable for bedside monitoring on adults, infants and newborns.

This monitor can monitor main parameters including ECG, RESP, SpO_2, NIBP and TEMP. It integrates parameter measurement modules, display and record output to build such a solid and light monitor. Its replaceable built-in battery makes convenience for patient movement and it will clearly display 7 waveforms and all the monitoring parameter information on the high-resolution interface.

'

Attention

IBP and CO_2 are optional.

From left to right they are in turn:

(1) ALARM INDICATOR; (2) Charging INDICATOR; (3) Working INDICATOR; (4) ON/OFF button; (5) SILENCE button; (6) FREEZE button; (7) PRINT button; (8) START button (for blood pressure); (9) MAIN button (for key frame return); (10)Knob; (11) MENU; (12) Parameter area; (13) Waveform area; (14) Information area. The Knob has three working methods as turning left, turning right and pressing to confirm parameters are mainly applied to the operation of menu.

The outlet of the recorder is located on the left side of monitor and AC power line sockets are on the rear panel of the monitor.

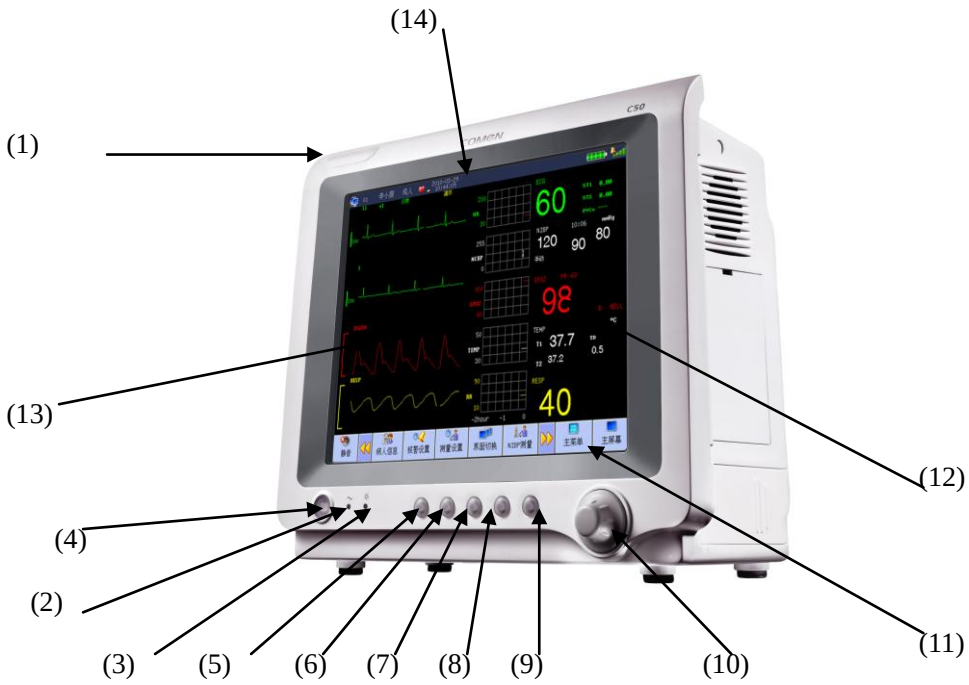


Figure 1-1 Multi-parameter Monitor

This monitor has rich functions, able to provide various functions such as visual/audio alarming, TREND storage & output, NIBP measurement save and review, medicine calculation, ST analysis, pulse analysis, heart rate turbulence analysis, etc.

This monitor has a friendly operation interface, able to provide all functions with the keys and buttons on the front panel, refer to Function Keys part for details.

1.2 Button Functions and Basic Operations

The monitor can be operated through use of the buttons and knobs. Here are the functions of the buttons as follows:

	(SILENCE button): Press this button and the alarm will be silence for 3 minutes (this item can be set in the "Alarm Setting" menu). Press this button over 1 second and the alarm sound can be shielded. In the information area appears  sign. Repress this button again to pause alarm, resume heart beat sound and cancel some technical alarm (ECG off, SPO_2 off), and the  sign disappears.
	(FREEZE button): Press this button and all waveforms on the screen can be frozen in the normal mode. Press this button once again and the frozen waveforms can be freed.
	(PRINT button): Press this button to start a real-time recording. The recording length is determined according to the "real-time recording time" in the "Recorder" submenu of "Setting" menu. Press this button once again in the recording process and the recording will stop at once. Each interval of pressing this button should be greater than 2 seconds and the frequency should not be

	excessively high.
	（To start/stop NIBP measurement）, press to inflate the cuff to start a blood pressure measurement. When measuring, press to stop the measurement and deflate the cuff.
	(MENU button): Press this button to have the main menu pop up when the interface is in the state of non-window setting.
	(ON/OFF button): Press this button to control the startup and shutdown of the monitor.
	a.c. INDICATOR
	Work INDICATOR
JOG-DIAL	JOG-DIAL to select and change the settings. Operation can be performed by turning it clockwise, counterclockwise or pressing it down. JOG-DIAL is mainly used in menu and window operation

1.3 Screen display

This monitor has a color LED screen, able to concurrently display collected patient parameters, waveforms, and alarming information provided by the monitor, bed marks, clocks, monitor status and other reminder information.

The main screen is divided into 4 sub-areas, i.e., Information Area ①, Waveform Area ②, Parameter Area ③and Menu Area④(As shown in Figure 0-2)

Information Area

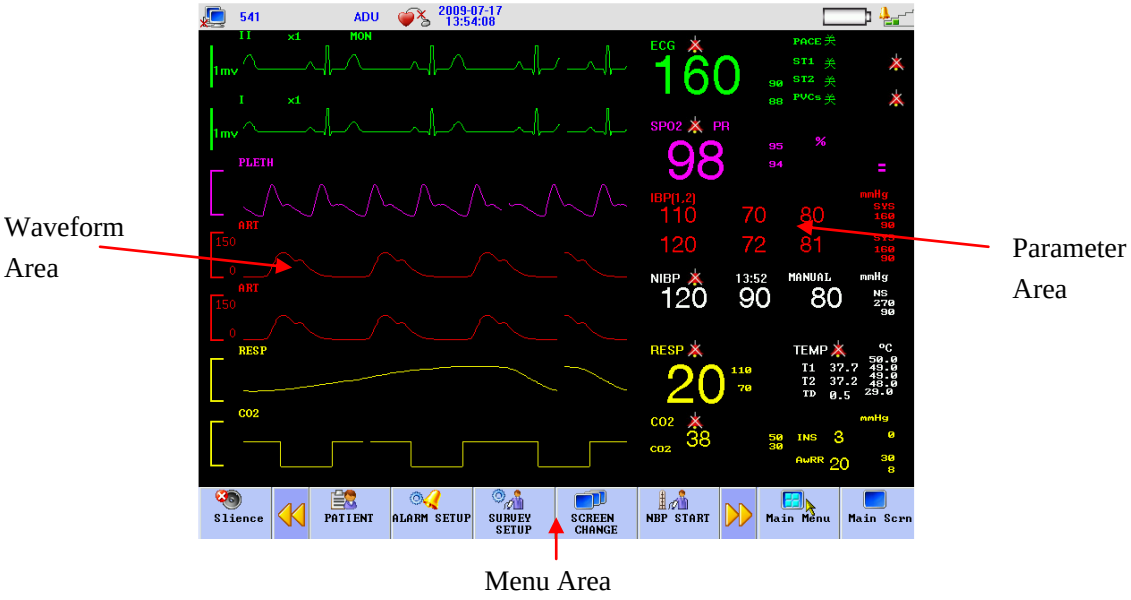


Figure 1-2 Main screen display

Information Area (①):

Prompt message in the information area appears and disappears together with the reported state. In accordance with the content, it is divided into:

1. Network setup: Cursor stops in sign, press to enter system setup.
   - ■ Network Bed No.: refer to IP address for monitor, The IP is 200.200.200.X,（X is Network Bed No.:, from 1 to 100）

' attention '

Connection state of CMS (central monitoring system) : when displaying , no connection; when displaying , connection.

Network Bed No. should not conflict with other monitors, or there will be unnecessary problems for the monitor.

If any problem happens because of confliction, unplug network wire, restart the monitor, reset the Network Bed No. and connect the network wire again.

2. Patient Information: press to enter the Patient Information menu when cursor is in bed No., name or patient group area.
   - ■ "Bed No.": Refer to the bed number of the patient being monitored, this area will be blank if there is no input.
   - ■ Name: Patient name, this area will be blank if there is no input.
   - ■ Sex: Male and Female.
   - ■ Patient Type: neonatal, pediatric, adult
   - ■ Pacer: pacer state, pacer detected displaying , otherwise displaying
   - ■ Height(cm): patient's height
   - ■ Weight(kg): patient's weight
3. Time setup: set up local time
   - ■ time: display system time
4. Technical alarm: display technical alarm, such as ECG lead off.

5. Physical alarm: display physical alarm, such as T2 too low.
6. Battery: display capacity of batter.

 Full capacity

 Not full capacity

 Low capacity

 Very low capacity, need to chatge soon.

7. Volume setup: setup alarm volume, heart beat volume, key volume.
   - Alarm volume: there are five Alarm Vol levels, 1, 2, 3, 4 and OFF, where "OFF" level means the alarm sound is closed.

 Alarm volume on, alarm level 4

 Alarm volume off

' Attention '

Visual alarm and alarm status

Alarm light winks or shines when there is an alarm. The colour of light means the alarm level. Refer to alarm function chapter for details.

Waveform Area (②)

There are four waveforms in the waveform area, which are respectively from up to down: two-channel ECG waveform, SpO2 volume graphic waveform and respiratory waveform (possibly from ECG module).

The name of selected waveform is displayed on the upper left part. For details, please refer to chapter of ECG Monitoring. Each ECG waveform still shows the gain of this channel and the filtering method of ECG waveform. A 1-mv rod is on the left of ECG waveform.

When you choose/touch each waveform, submenu of waveform will be pop up, which always occupies most of space of waveform area, so that some waveforms are invisible. The original image will come back after the menu exit.

Waveforms are refreshed at the set speed. For adjustment on waveform refresh speed, refer to the chapter of each Parameter Setting.

Parameter Area(③):

Parameters can display at the fixed position (as shown in ①~◯,12of the following picture), which are separately:

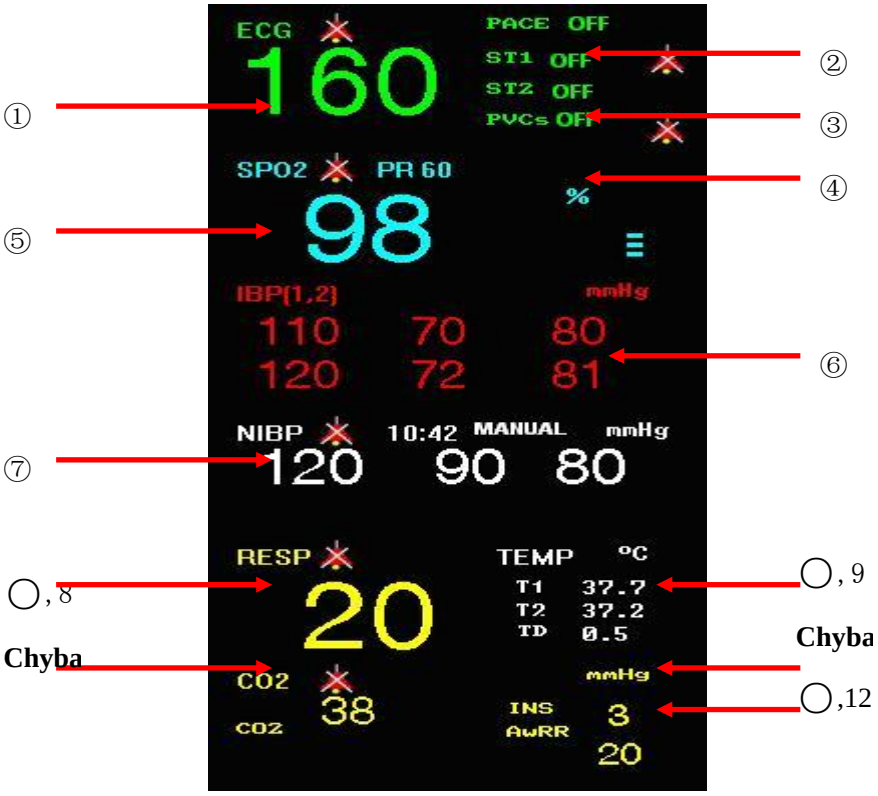


Figure 1-3 Main Screen

ECG

—Heart Rate or Pulse Rate（①,unit：bpm）

—pacer detection (②PACE)

—ST-segment of channel 1 and channel 2 (③, unit: mv)

— PVCs times (④Unit: times/minute)

SpO2

—SpO2（⑤,unit：%）

—Pulse Rate（unit：bpm）

IBP (optional)

— Invisive Blood Pressure

(From left to right) Systolic, Diastolic, Mean (⑥, Unit: mmHg or kPa)

NIBP

— None-Invisive Blood Pressure

(From left to right) Systolic, Diastolic, Mean (⑦, Unit: mmHg or kPa)

RESP

—Respiration Rate（⑧,unit：bpm）

TEMP —TEMP

—Temperature（⑨,unit: ℃or℉）

CO_2 (optional)

—end-tidal CO_2 (⑩, Unit: mmHg or kPa)

—inspiratory CO_2 (○,11, Unit: mmHg or kPa)

—Air Way Respiration Rate (AWRR)（,unit：bpm）

The above monitored results will show in the parameter area.
The parameters are refreshed once per second, but NIBP value, once per measurement.
Users can select the monitoring parameters and the main screen will display the relative content.

Menu Area(○,4)

1. PATIENT: patient information configuration. Refer to chapter of Patient Informatio for details.
2. ALARM SETUP: set up alarm type
   - ALARM RECORD TIME: in case of physiological alarm, the system can record the information before and after the alarm time. The system can give three kinds of time, i.e., 8 seconds, 16 seconds. The seconds in the options are the sum of seconds before and after the alarm time. For example, 8 seconds mean the information within 4 seconds before the alarm time and within 4 seconds after such a time.
   - ALM PAUSE TIME (Alarm pause time)：“1 minute”, “2 minutes” or “3 minutes”
   - PARA ALM TYPE (Parameter alarming method)：“UNLATCH” or “LATCH”, “LATCH” means the system will raise the alarm until someone interferes it in case of alarm; “UNLATCH” means the alarm will automatically disappear with the alarm factor vanishing.
   - ALAM LIMIT (Display alarm limits)：”ON” and”OFF”
3. SURVEY SETUP: ECG, RESP, SpO_2, NIBP and TEMP setup, refer to each chapter for details
4. SCREEN CHANGE: STANDARD, LIST FACE, TREND SCREEN, oxyCRG SCREEN, BIG FONT, AND 7CH MULTI-LEADS DISPLAY. For details,please refer to chapters for each parameter.
5. NIBP STARTt: press this button to start/stop NIBP measurement.
6. FREEZE: the screen freezes when press this button, turn the knob to review all the waveform stored for the last 4 minutes.
7. DEFAULT: Select “Yes”, adopt the neonatal configuration, instead of the previous configuration, Select “NO”, abandon this selecton,and system can continuously keep the original setting. Refer to chapter 3.
8. TREND TABLE (TREND Figure): refer to chapter 3 for details.
9. PRINT: press this button to record waveforms and patient information.

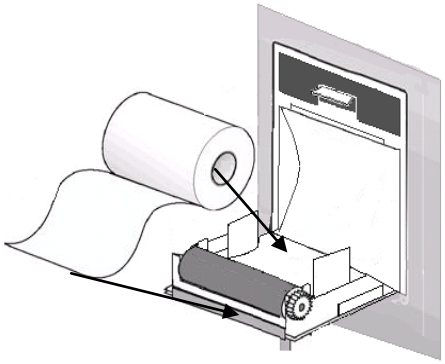
1.4 External Socket

Left Panel

Recorder is optional

1. Open the recorder door.
2. Take away the no-paper rod

3. Fix the new paper correctly, tip of paper out from the head of printer.
4. 3mm paper must out of recorder door, close the door.
5. Press PRINT to check if the paper fixed well or not. If no printing, prease re-fix the paper.



Right Panel

On the right side of the monitor are sockets for each transducer

① TEMP 1

② TEMP2

③ ECG

④ SPO_2

⑤ NIBP

⑥ IBP1（optional）

⑦ IBP2(optional)

⑧ CO2(optional)

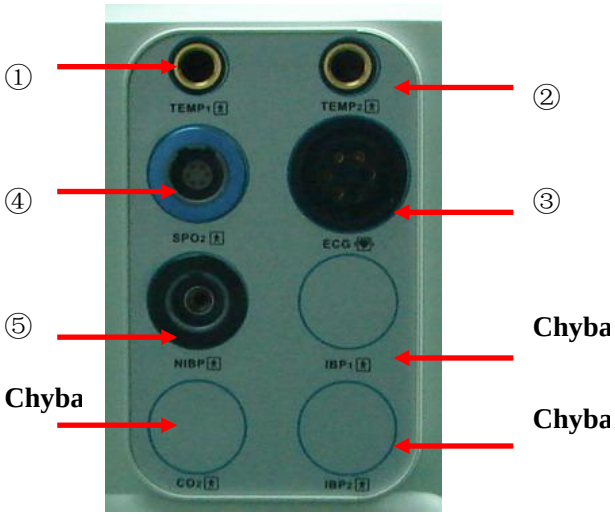


Figure 1-5 Right Side

This symbol means “be careful”; refer to this manual for details.

This symbol means this application part is of CF type, designed with special protection from electric shock (especially provided with F-type floating insulation apparatus for permissible leakage current) and suitable for the defibrillation process.

Other symbols will be introduced in the **Patient Safety** chapter.

this symbol means: BF type

means the equipotential grounding terminal.

A.C. indicator

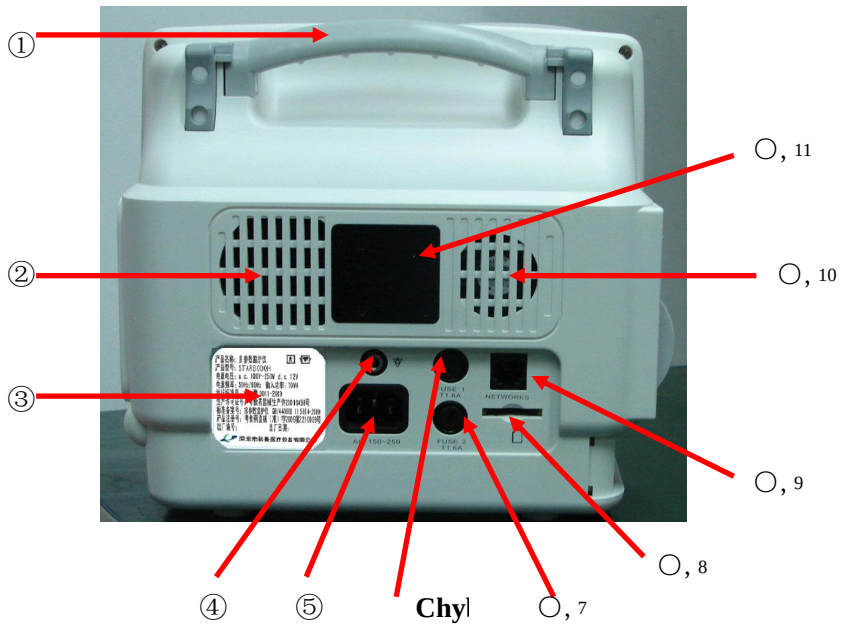
work indicator

Power-up

Shutdown

Rear Panel

There are the following soclets in the rear panel:



1. Handle 2. Speaker 3.Label 4.Earth line socket 5. AC power socket 6. Fuse holder 1

7. Fuse holder 2 8.SD card socket 9. Network socket 10.Fan 11.Place for clamp or hook

Warning

This network port can only be connected with CARL NOVEL's central monitoring system.

Warning

All the simulated or digital equipments connected with this monitor must be certified under the designated IEC standards (such as IEC 60950 Date Processing Equipment Standard and IEC 60601-1 Medical Equipment Standard). And all configurations must comply with effective versions of IEC 60601-1-1 system standards. Persons in charge of connecting additional equipments with the input/ output signal terminals should configure the medical system and be responsible for compliance of the system to IEC 60601-1-1 standard. For any enquiries, please contact the supplier.

Attention

Patient cable interface, network interface and other interfaces connected to different equipments, the leakage current should not exceed the limit.

1.5 Built-in charge battery

The multi-parameter monitor has a built-in charge battery. When connected with AC power, the

battery will charge automatically until it is full. On the right side of the screen, there is a "  ", it means charging state. Its yellow part means the quantity of the battery. If this monitor has no built-in battery, the battery state will display "  ", it means no battery or defective battery.

Chapter 2 Monitor Assembly

′

′**Attention**′

For normal work of the monitor, before use please read this chapter and the Patient Safety chapter and assemble in accordance with the requirements.

2.1 Open Package and Check

Carefully pick up the monitor and accessories from the package box, and properly keep the package materials for future transport or storage. Please check the accessories with the package checklist.

- Check whether there is any mechanical damage;
- Check all the exposed cables and plug in some accessories for test.

Any problems should be immediately raised to the Sales Department of our Company or our agents.

2.2 Connect with AC Cable

Procedures to connect with AC power cables:

Make sure the AC supply complies with the following specification: 100-250VAC，50/60Hz
Use the power cables provided with the monitor together. Plug in the power cable into power supply interface of the monitor, while insert the other end of this cable to a 3-phase earthing power socket.

′**Attention**′

Connect the power cable with the sockets special for hospital use.

If deemed necessary, connect with an equal-potential earthing cable. Refer to the equal-potential earthing part in the Patient Safety chapter.

′**Attention**′

In case configured with a battery, the equipment after transport or storage must have the battery taken for charging. Thus in case of direct booting without connection with AC power supply, the equipment may not work properly due to insufficient power. With AC power supply connected, the battery will be charged no matter the monitor is booted or not.

2.3 Power on

The logo displays when the power is on, and appears the processing screen. After the 3~5 seconds

checking process, the system enters the monitoring main screen and the users can start operations.

′Attention′

In case of any fatal errors found during the self-detection process, the system will alarm.

′Attention′

Check all the available monitoring functions and make sure they work properly.

′Attention′

If a battery is configured, users must charge the battery after each time of use so as to ensure sufficient power storage.

′Attention′

If any monitoring functions are found with damage or there are any error reminders, don’t use this monitor to monitor patients and quickly contact with the biomedical engineers of your hospital or maintenance engineers of our Company

′Attention′

Reboot the equipment at least 1 minute after shut down.

2.4 Connect with Sensor

Connect the required sensor between the monitor and the monitoring position of a patient.

′Attention′

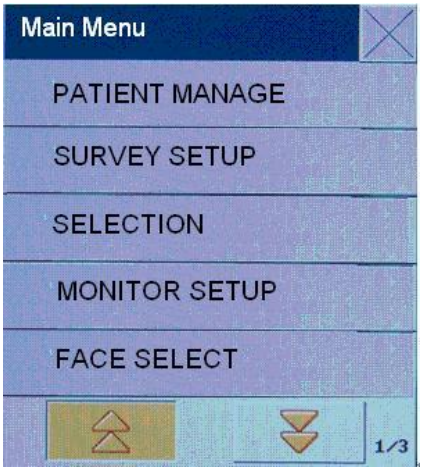
For correct connection methods and relevant requirements of various sensors, please refer to Chapters 10-15.

2.5 Check Recorder

If there is recorder in monitor, check the paper. If there is no paper, see reference related in chapter 1.

Chapter 3 Syetem Menu

The monitor system setting is more flexible. Monitoring, waveform speed, volume and output, all can be setup by user. Press the "↵" button or use turn-knob to choose main menu, popping up MAIN MENU.



MAIN MENU including: PATIENT MANAGE, SURVEY SETUP, SELECTION, MONITOR SETUP, FACE SELECT, TREND GRAPH, TREND TABLE, NIBP RECALL, INFO, DRUG CALC, MAINTAIN, DEMO, DEFAULT

3.1 PATIENT MANAGE

Attention′

For deleting the patient's current data, please refer to the "NEW PATIENT" in this chapter.

Select the "PATIENT MANAGE" item under the system menu, and then pop up the following menu:

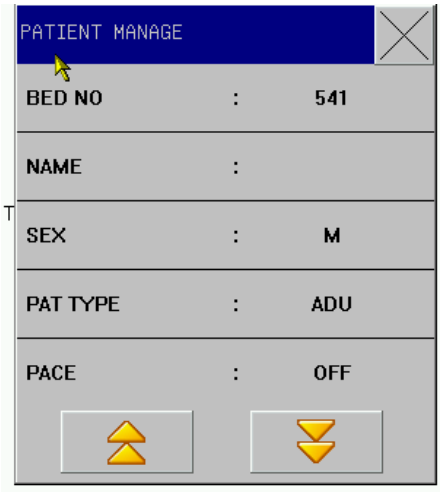


Figure 3-1 Patient Manage

Users can set the following content:

1. Bed NO. 0-999 for option, for example, 666
2. Name input patient name to the popping up menu

Lock	Shift	Del	Clr	Enter
Caps Lock（permanent）	Caps shift（one-off）	delete	clear	enter

3. SEX Patient gender(female, male)
4. PAT TYPE PATIENT TYPE (Neonate, Pediatric)
5. PACE Packmaker ON/OFF
6. Height(cm) 0~300, for example, 180
7. Weight(kg) 0~200, for example, 100

Attention′

PACE: The default setting is OFF after you restart the monitor.

In this menu, user can select the “NEW PATIENT” and select “CONFIRM TO UPDATE PATIENT” to update patient information.

⚠Warning⚠

Patient type changed, the alarm parameters such as heart beat and NBP may vary, usually make sure the limits are suitable for the patient.

Pacer detection must be on for pacing patients. If falsely setting OFF, the monitor would miktake pacing pulse as QRS, and not alarm for heatbeat stop

3.2 DEFAULT (Default Setting)

′ Attention′

After any item is selected in the submenu, the selected one will take the place of the current system configuration and become the default setting of the system.

After any item is selected in the “Default Setting” menu, the dialog box “Confirm Default Setting” will pop up. Select “Yes” and you can save all configuration of the current patient type as the user’s default setting. Select “No” and you can abandon the current operation so that the system can continuously keep unchanged the original setting.

3.3 WORK INTERFACE SELECTION

In the System Menu, select the “FACE SELECT” to enter the dialog box in the following Figure. Here there are such six options as “STANDARD”, “LIST FACE” “TREND SCREEN”, “oxyCRG SCREEN” , “BIG FONT” , “7CH MULTI-LEADS DISPLAY”

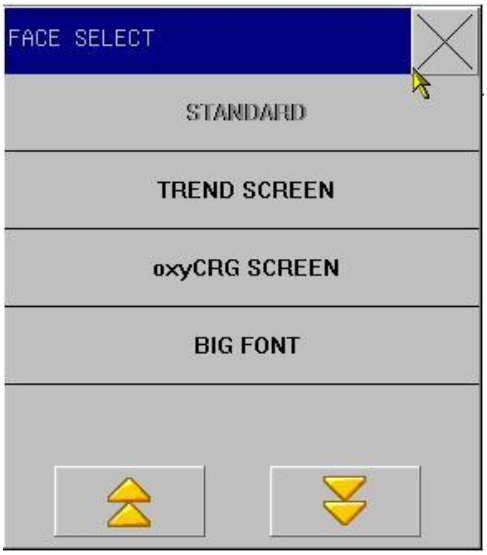


Figure3-2 Work Interface

3.4 TREND SCREEN

Trend gragh for the previous 1 hour can be diplayed in the resolution of one data per one second or one data per five seconds.

Trend gragh for the previous 96 hour can be diplayed in the resolution of one data per minute, per five minutes or per ten minutes.

Users can select the TREND Diagram Review item under the System menu so as to pop up the following window:

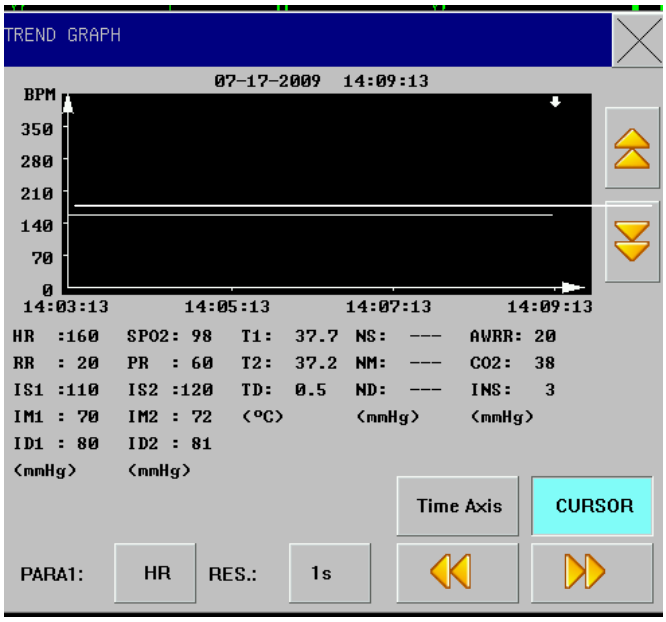


Figure 3-3 Trend Graph

Parameter selection: HR、RR、SPO_2、PR、TEMP、NIBP、IBP1、IBP2、CO_2、INS、AwRR.Y-axis means measurement value, X-axis means measurement time. "↓" is cursor for trend graph, The measurement values it points to display at the bottome of the graph, corresponding time at the upper end of the graph: 2009-06-22　09：50：35。

Vertical axis is for measured values and horizontal axis for measurement time. The "↓" symbol is the cursor for TREND diagrams, and the measured value at the position it arrows is displayed below the TREND diagram while its corresponding time is displayed above the TREND diagram.

3.5 TREND TABLE (TREND Figure)

TREND Figure data over the previous 96 hours can be displayed in the following resolutions: 1 minute, 5 minutes, 10 minutes, 30 minutes and 60 minutes.

Select "TREND Figure review" under the system menu to pop up the following TREND Figure:

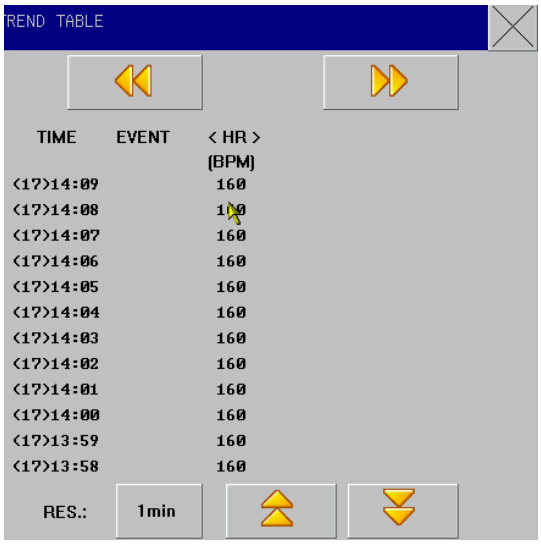


Figure 3-4 Trend Table

Time corresponding to various groups of TREND data is displayed at the left column, with dates braced. What are listed is the cases that have once been marked, which corresponds to the time of the marked cases. Parameters in the TREND Figures can be categorized into the following 9 groups:

HR,

ST1, ST2

RR,

T1，T2，TD

SPO_2, PR

NIBP （S/M/D）DATE

IBP1（S/M/D）

IBP2（S/M/D）

CO_2 INS AwRR

NIBP TREND data has its own characteristics; besides of measured values, below each “measurement point” there is time for this NIBP measurement.

3.6 NIBP RECALL

The monitor can display the latest 400 NIBP measurement data in the NIBP review function. After users select the NIBP Data Review item under the System menu, the windows will display the latest 10 NIBP measurement results and measurement time, as shown in the following:

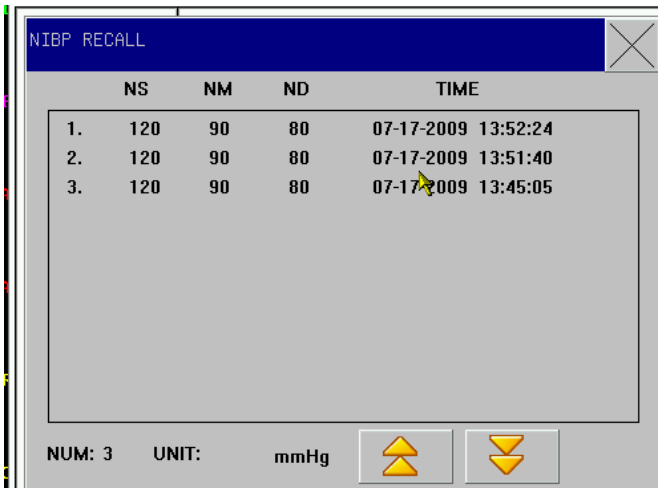


Figure3-5 NIBP Recall

Data is sorted in time sequence, from early to late, and each screen can display 10 times of measurement data, while users can select “Page up/ down” to view later or earlier data. Maximally 400 measurement results can be displayed, and when the measure times are over 400, only the latest 400 will be displayed.

3.7 MONITOR SETUP (Monitor Setting)

Select MONITOR SETUP in MAIN MENU, sub-menu following with figure below, including

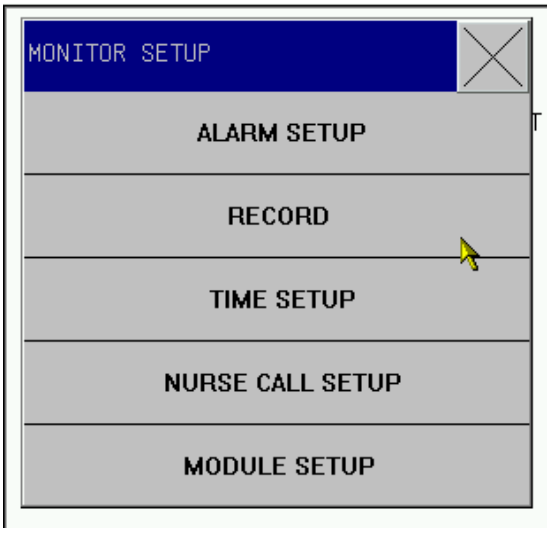


Figure3-7 Monitor Setup

3.7.1 ALARM SETUP (Alarm Setting)

Alarm Setup has the following options:

ALM REC TIME (Alarm Record Time):

In case of physiological alarm, the system can record the information before and after the alarm time. The system can give three kinds of time, i.e., 4 seconds, 8 seconds, 16 seconds. The seconds in the options are the sum of seconds before and after the alarm time. For example, 8 seconds mean the information within 4 seconds before the alarm time and within 4 seconds after such a time.

ALM PAUSE TIME (Alarm pause time)：“1 minute”, “2 minutes” or “3 minutes”

PARA ALM TYPE (Parameter alarming method)：“UNLOCK” or “LOCK”, “LOCK” means the system will raise the alarm until someone interferes it in case of alarm; “LOCK” means the alarm will automatically disappear with the alarm factor vanishing.

ALM LIMIT (Display alarm limits)：”ON” and”OFF”

3.7.2 RECORD (Record output setting)

Options for record output:

REC WAVE1/ REC WAVE2: can not change

REC RATE: 25.0/50.0 mm/s, record speed

REC GRID: ON/OFF

RT REC TIME: 3S/5S/8S/CONTINUAL (real-time record time)

CONTINUAL means after pressing PRINT BUTTON  , monitor will keep printing parameters and waveform, until press  to stop

′ ′Attention′
The recorder is a component for option.
′Attention′
Where two similar waveforms are selected, the system will automatically adjust the other one into a different one.

3.7.3 TIME SETUP (System Time Setting)

"TIME SETUP" with options below:
Setup year, month, day, hours, minutes and seconds.
Pitch on the content required for correction.

3.7.4 NURSE CALL SETUP

Options in nurse call setting:
Signal Duration: continuous/pulse
Signal type: Normal Open/Normal closed
Alarm level: high, middle, low, low+middle, middle+high, low+middle+high
Alarm type: technical, physical, technical+physical

3.7.5 MODULE SETUP.

Options in module setup:
ECG and SpO_2 are not optional.
TEMP: ON/OFF. When it is ON, machine can monitor TEMP, when it is OFF, machine can not monitor TEMP, and no parameter area of TEMP in main interface.
RESP: ON/OFF. When it is ON, machine can monitor RESP, when it is OFF, machine can not monitor REST, and no parameter area of RESP in main interface.
NIBP: ON/OFF. When it is ON, machine can monitor NIBP, when it is OFF, machine can not monitor NIBP, and no parameter area of NIBP in main interface.

3.8 SELECTION

Select the “SELECTION SETUP” in the “MENU MENU” and sub-menu following with Figure below, including

Figure3-7 Selection Setup

3.8.1 ALARM Volume

In the system there are five levels of Alarm Vol: OFF, 1~4.

"OFF" level means the alarm sound is closed.

⚠WARINING⚠

Where the alarm volume of the system is set at OFF, the monitor will not give alarm sound in case of alarm, so you should use this function carefully.

3.8.2 HEART BEAT VOLUME

In the “SYSTEM MENU” select the “SELECTION”. Pitch on the “BEAT VOL ” with the cursor and turn the knob to select the volume from such five options as “OFF”, “1”,“2”、“3” and “4”.

3.8.3 KEY VOL (Keyboard Vol)

Pitch on the “KEY VOL ” with the cursor and select the volume from such five options as “OFF”, “1”,“2”、“3” and “4”.

3.8.4 LCD Brightness (LCD LIGHT)

In the system there are five Brightness level, i.e. “1~5”, where “5” means the maximum brightness.

3.9 INFO (Monitoring Information)

In the “MAIN MENU” select the “INFO” to look through the version information of the software and hardware.

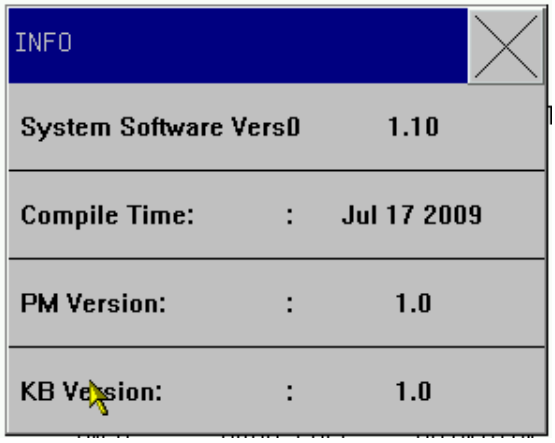


Figure3-8 Monitoring Information

3.10 DRUG CALCULATION & TITRATION LIST

The portable-type multi-parameter monitor can provide the computation for 15 kinds of medicines as well as the Titration List Display Function, and output the content of Titration list on the recorder.

3.11 Maintenance

In the “MAIN MENU” select the “MAINTENANCE”, submenu pop out:
Password: 5188

1. Wave type: SpO2 waveform and RESP waveform has two type to select: LINE and FILL
2. Wave Mode: Color or not
3. Secreen Adjust: switch on touch screen as monitor indicated

Password: 2016

1. Language Selection
2. Filter Hz: OFF/ON

3.11 DEMO (Password: 5188)

In the “System Menu” select the “Demo” to have the “Input Demo Password” dialog box pop up. Input the correct password and the system will enter the waveform demonstration state.
Demo Waveform means the simulated one set by the manufacturer for showing the monitor performance and helping users with training.
In the practical clinical l use it is prohibited to use such a function because it will make the medical personnel misthink they are the monitored patient’s waveforms and parameters so as to affect patient monitoring and delay treatment. So this menu is set with the password.

Chapter4 System Work Interface

4.1 Work Interface Selection

In the Main Menu, select the “FACE SELECT” to enter the dialog box in the following Figure. Here there are such six interfaces to choose:
STANDARD, LIST FACE, TREND SCREEN, oxyCRG SCREEN, BIG FONT, and 7CH MULTI-LEADS DISPLAY.

4.1.1 STANDARD

In the “FACE SELECT” menu, select the “STANDARD” to enter the standard work interface. The Standard interface provides us the parameter waveforms under monitoring and displays the parameters in the parameter area, as shown in the following picture:

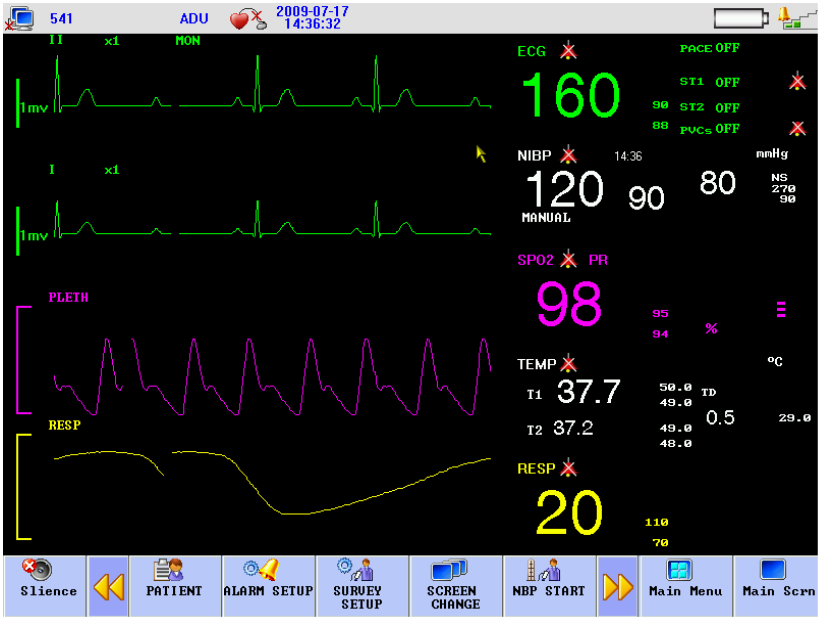


Figure 4-1 Standard Interface

4.1.2 LIST FACE

In the “FACE SELECT” menu, select the “LIST FACE” to enter the LIST FACE work interface.

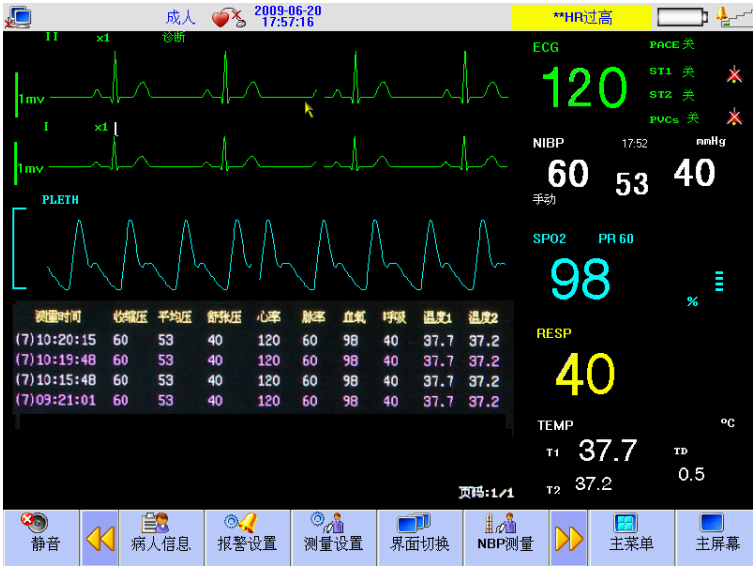


Figure 4-1 List interface

4.1.3 TREND SCREEN

Enter the “FACE SELECT” and select the “TREND SCREEN” in the Work Interface Selection menu to enter such an interface.

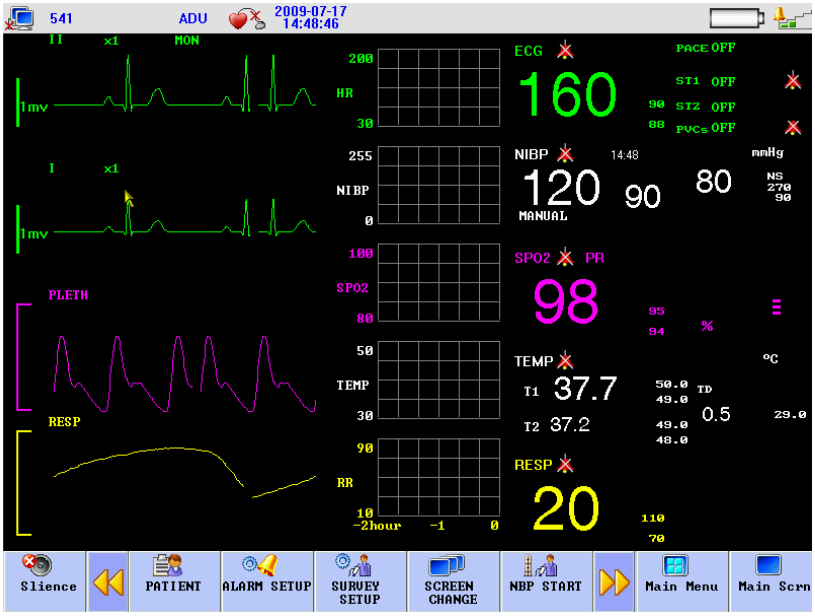


Figure 4-2 Trend Sreen Interface

■ Location of trend diagrams

TREND diagrams is located at right side of waveforms, with the same colors to the corresponding

parameters.

- TREND length

Dynamic trend length is 2 hours; in a trend diagram, the right side of the horizontal axis is 0 hour, and the left side is 2 hours.

- End of trend concurrence interface

Out of the “Interface Selection” options, select any other work interface to end the trend concurrence interface.

4.1.4 OxyCRG SCREEN

In the Work Interface Selection menu, select the “oxyCRG Screen” to enter the oxyCRG work interface.

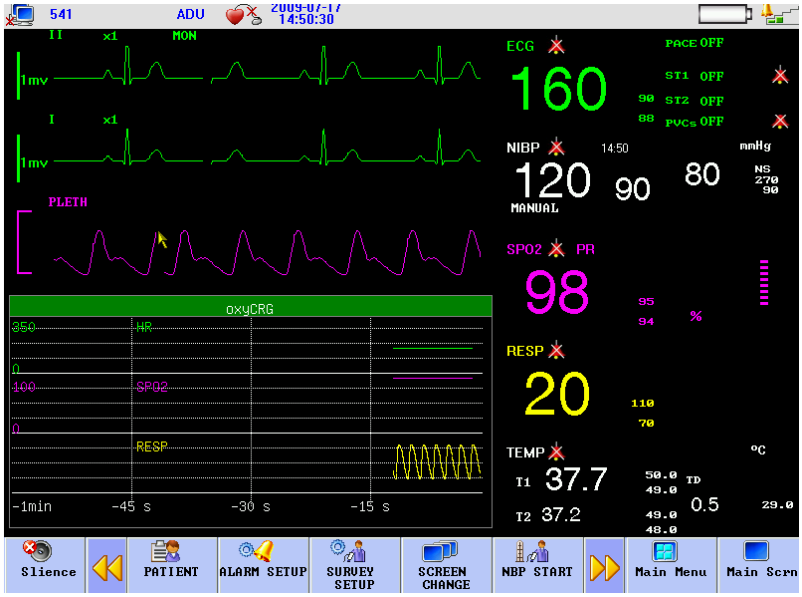


Figure 4-3 OxyCRG Screen

- TREND Diagram in oxyCRG Interface

  OxyCRG Dynamic Interface is consist of compressed respiratory wave and RR.

- OxyCRG Trend Length Selection

  Two hot key at the below part of dynamic interface: TIME and TYPE

  TREND Diagram for “1 minute” and “2 minute” can be selected through the trend time buttons.

- Compressed Respiratory Wave and RR

  “The function of “Respiratory Rate/Compressed Respiratory Wave” means the operator can select the “PR Trend” or “Compressed Respiratory Wave” as needed, under which the displayed content occupies the same position. Select the “PR Trend” and this position will show the TREND Diagram of the respiratory rate; select the “Compressed Respiratory Wave” and this position will show the respiratory wave after compression.

In the Work Interface Selection menu, select other work interface to end the OxyCRG work interface.

4.1.5 BIG FONT INTERFACE

In the Work Interface Selection menu, select the “BIG FONT” to enter the big font interface.

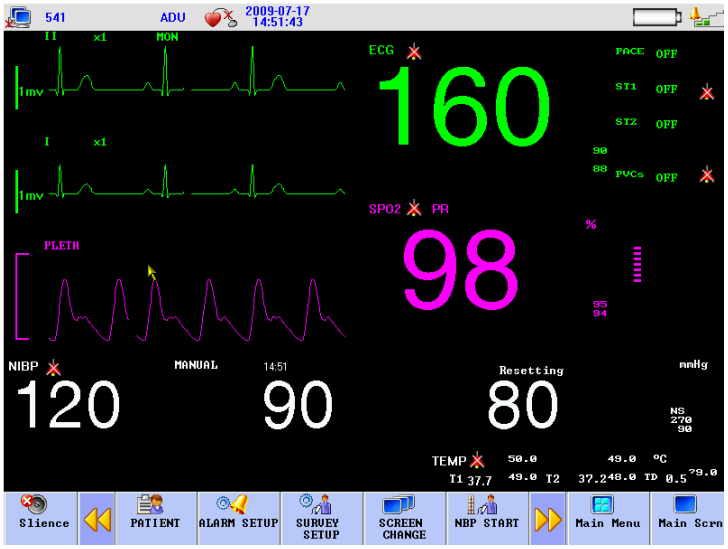


Figure 4-4 Bif Font Interface

4.1.6 7-CH MULTI-LEADS DISPLAY

In the Work Interface Selection menu, select “7-CH MULTI-LEADS SCREEN” to enter the MULTI-LEADS SCREEN interface. Users could observe seven ECG channels in this screen, including II, I, III, AVR, AVL, AVF

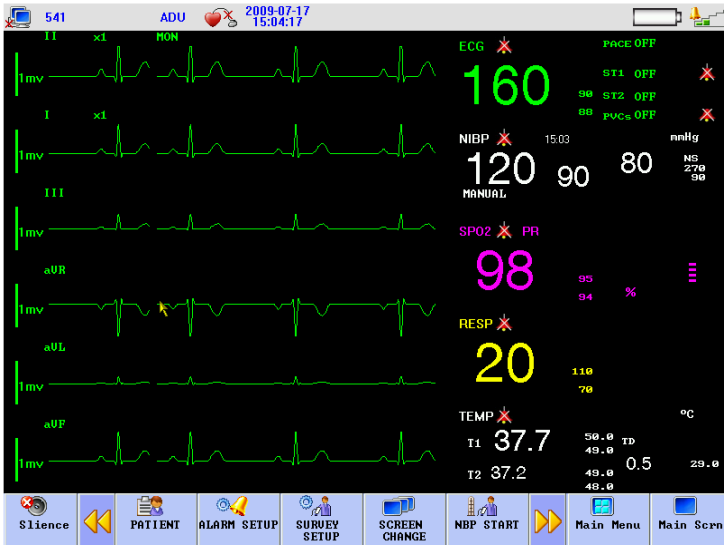


Figure4-6 7CHANNEL ECG DISPLAY

Chapter 5 Recording

In the Main Menu, select the “MONITOR SETUP”, then to RECORD menu

5.1 General Information on the Recorder

The recorder used with this monitor is a heat-sensitive array recorder, with print width of 50mm.

Recorder capability

1. Outputted waveforms run at 25mm /sec. or 50mm / sec
2. Maximally record two waveforms
3. Grid output function is optional
4. English output
5. Real-time record time and waveforms are selected by users through menus
6. Automatic record interval is selected by users through menus, while waveforms are identical to real-time records

5.2 Record Type

This monitor generates slip records of the following types:

Real-time continuous record;
Real-time 3, 5, 8-second record;
Automatic alarm record;
Frozen waveform record;

Start recording waveforms from the moment you press the button.

Real-time continuous record for 8-second defaulted by machine system (normally only for two waveforms) or set by users through menu. Please refer to relevant chapters for details.

″Attention′
During output process, the next parameter alarming output will be outputted after completion of the current output.

Frozen waveform record

In case waveforms are frozen, the system can output the designated waveforms on the screen and in such a way record those unusual waveforms captured by freezing.

Remark record

Real-time record
Alarm parameter, alarming time, and FREEZE time
Bed number

Parameter name and value
Record time

Waveform name
Waveform amplitude (only for ECG waveforms)
ECG lead, ruler, and gain

5.3 Operation and Status Information of Recorder

Requirements on record paper

Only qualified heat-sensitive record paper can be used, otherwise there may be failure or quality reduction in record, or damage to the heat-sensitive head.

Normal service

Do not pull out paper when the recorder is working.

Do not use recorder without record paper.

Insufficient paper

Don’t boot the recorder when there is a reminder of “add paper to the recorder” in the information area. Please load qualified heat-sensitive record paper.

Paper loading procedures

Open the recorder door;
Pull up the slide switch at the left rod of the recorder;
Load new paper exactly following the paper inlet, with the print side toward the heat-sensitive head;
Slightly pull the paper exposed from the other side, and align the paper properly;
Pull back the slide switch at the left rod of the recorder;
Remove the paper from the paper outlet of the recorder;
Close the recorder door.

′Attention′
Paper loading must be done softly so as to avoid heat on the heat sensitive head. Unless during paper loading or trouble shooting, the recorder door must be kept open.

Solution to paper jam

When the running voice of the recorder sounds improper or paper outputs improperly, users should open the recorder door to check whether there is paper jam. Procedures to clear paper jam:

Cut the recorder paper at the paper outlet side;
Pull up the slide switch at the left rod of the recorder;
Pull out the recorder paper from the bottom;
Re-load paper.

Chapter 6 Trend

It can store 96 hours trend data, 400 NIBP and 60 alarm events and support recording. Observation methods are provided in this chapter.

6.1 TREND GRAPH (TREND Diagram)

TREND diagram for the latest 1 hour can be displayed one data per second or one data per five seconds;

TREND diagram for latest 96 hours can be displayed one data per minute, per 5 minutes, or per 10 minutes.

Select “TREND GRAPH” in the “MAIN MENU” to pop up the following TREND figure:

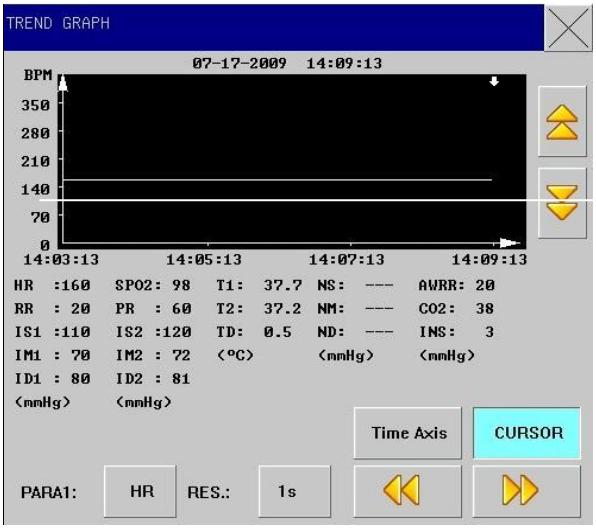


Figure6-1 Trend Graph

Vertical axis is for measured values and horizontal axis for measurement time. The “🡻” symbol is the cursor for TREND diagrams, and the measured value at the position it arrows is displayed below the TREND diagram while its corresponding time is displayed above the TREND diagram.

6.1.1 Select trend diagrams for various parameters to be displayed:

Use the cursor to select the Parameter Selection option and revise the displayed contents. Upon display of the expected parameter, press the knob, then the TREND diagram for this parameter will be displayed in the window.

6.1.2 Select 1-hour or 96-hour TREND diagrams:

Use the cursor to select the Resolution option, then select 1 seconds or 5 seconds if you want to observe 1-hour TREND, or select 1 minute, 5 minutes or 10 minutes if you want to observe 96-hour TREND.

6.1.3 Observe TREND diagrams of later or earlier duration:

Press the "  or  " button or rotate the knob clockwise or anticlockwise so as to observe later or earlier TREND curves.

6.1.4 Change the display zoom

Use the "  or  " button to change displayed size of the vertical axis, while displayed size of the TREND curves will follow to change. Values higher than the biggest axis value will be represented by the biggest axis value.

6.1.5 Obtain the TREND data at certain time in the current TREND diagram

Select "Cursor" and rotate the knob to control movement of the cursor; with the cursor moves, its arrowed time also changes, and the parameter value at such time will be displayed below the horizontal axis. If there is a "➔" indication in the right side of the window, when the cursor moves onto this indication the TREND diagram will automatically page down to display later TREND curves; and if there is a "🡐" indication in the left side of the window, when the cursor moves onto this indication the TREND diagram will automatically page up to display earlier TREND curves.

6.1.6 Operation sample

Observe the NIBP TREND diagram within the latest 1 hour:

Press the TREND button on the control panel to pop up the Main menu;

Select the TREND Diagram Review option in the menu;

1. Select the parameter: rotate the knob in the Parameter Selection item until "NIBP" is shown in the dropdown box;
2. Select 1 or 5 seconds in the Resolution item;
3. Press the "  or  " button or rotate the knob, while observing changes in the TREND diagram time and TREND curves;
4. Stop at the period to be carefully observed; in case the vertical axis is out of proper size, for example, some TREND values exceed the highest value of the current vertical axis, select

"Adjust amplitude" to adjust;

5. If users want to know the measured value at certain time, just select "move cursor" and move the cursor to where they wants, then time will be displayed above the curve and measured values below the curve;
6. If users need output the TREND diagrams to the recorder, just select the "record" button so as to let the recorder output NIBP TREND of the current review window;
7. Press "⊠" to exit observation on TREND diagram.

6.2 TREND TABLE (TREND Figure)

TREND Figure data over the previous 96 hours can be displayed in the following resolutions: 1 minute, 5 minutes, 10 minutes, 30 minutes and 60 minutes.

Select "TREND TABLE" under the "Main Menu" to pop up the following TREND figure:

Figure 6-2 Trend Table

Time corresponding to various groups of TREND data is displayed at the left column, with dates braced. What are listed is the cases that have once been marked, which corresponds to the time of the marked cases. Parameters in the TREND Figures can be categorized into the following 9 groups:

HR,
ST1, ST2
RR,
T1，T2，TD
SPO_2, PR

NIBP （S/M/D）DATE

IBP1（S/M/D）

IBP2（S/M/D）

CO_2, INS, AwRR

NIBP TREND data has its own characteristics; besides of measured values, below each "measurement point" there is time for this NIBP measurement.

6.2.1 Select TREND Figures in various resolutions

Use the cursor to select a resolution and use the knob to change options so as to change the time interval for TREND data.

6.2.2 Observe earlier or later TREND curves

Press "  or  " button or rotate the knob clockwise or anticlockwise so as to observe later or earlier TREND curves.

6.2.3 Observe TREND data of various parameters

Press "  or  " button and select one group of parameters out of 6 available groups.

6.2.4 Operation sample

To observe a NIBP TREND Figure:

Press the TREND button on the control panel to pop up the Main menu;

Select the TREND Figure Review option in the menu;

1. Press "  or  " button or rotate the knob to select the NIBP （S/M/D）DATE;
2. Select the resolution: click the left item and select the expected data interval;
3. Press "  or  " button or rotate the knob, while observing NIBP TREND data over various time;
4. Press "  " to exit observation on TREND table.

6.3 NIBP RECALL

The monitor can record the latest 400 NIBP datas. After select the NIBP RECALL in MAIN MENU,

the window will display 10 groups of NIBP records as follows:

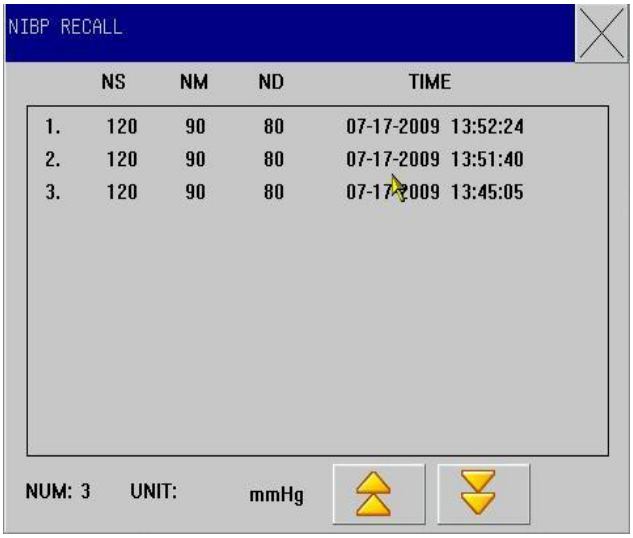


Figure 6-3 NIBP RECALL

Data is sorted in time sequence, from early to late, and each screen can display 10 times of measurement data, while users can Press "⏫ or ⏬" button to view later or earlier data. Maximally 400 measurement results can be displayed, and when the measure times are over 400, only the latest 400 will be displayed.

Chapter7 Drug Calculation & Titration List

The portable-type multi-parameter monitor can provide the computation for 15 kinds of medicines as well as the Titration List Display Function, and output the content of Titration list on the recorder.

7.1 DRUG CALC

Medicines able to be calculated under this system are: aminophylline, dobutamine, dopamine, epinephrine, heparin, isuprel, lidocaine, nipride, nitroglycerin and pitocin. Besides, there are Drag A, Drag B, Drag C, Drag D and Drag E provided to flexibly replace any medicine.
Users can select “Drug Calculation” under the MAIN MENU to pop up the following window:

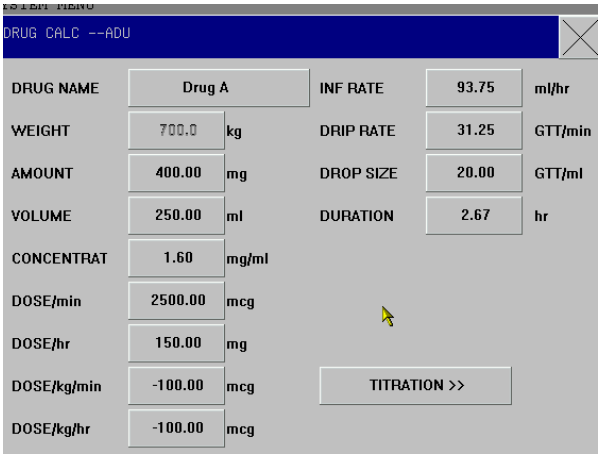


Figure7-1 Drug Calculation

The following formulae are used for medicine dosage calculation:
Medicine contents = Total medicine volume / Liquid volume
Infusion speed = Medicine dosage / Medicine contents
Continued time = Total medicine volume / Medicine dosage
Medicine dosage = Infusion speed × Medicine contents

7.1.1 Operation method:

In the medicine calculation window, operators should firstly select names of the medicines to be calculated, and then confirm patient weight, and input other known values. Subsequently, operators move the cursor to the various calculation items in the calculation formulae, press the knob and rotate it, so as to select the calculation value. After the calculation value is selected, value of the items to be calculated will be displayed at the corresponding position. Values for each calculation item have their limits, if the calculated results exceed such limits, the system will display “---.--”.

′Attention′

Under this medicine calculation function, other menu items are available for input only after operators input patient weight and medicine names. The values firstly given in the system are only a random group of initial values, and operators should not take such values as calculation standard, instead, should re-input a group of values suitable for the current patient, based on the comments by doctors.

′Attention′

Each kind of medicine is subject with fixed units or unit series, and operators must select proper unit based on comments by doctors. Under the same unit series, numbering system of the units will be automatically adjusted with the current input values, and when the input value exceed out of expression of the relevant unit, the system will display "---".

′Attention′

After operators input a certain value, the system will give a clear reminder in the menu, reminding operators to check correctness of the inputted value; only inputted values are guaranteed to be correct, the calculated values will be reliable and safe.

′Attention′

In case of newborns, dropping speed and volume of an infusion drop make no sense.

′Attention′

The system gives a reminder for each inputted value, asking operators to confirm. Operators must be serious with every such reminder, as only valid and correct inputs can get reliable calculation results.

Select medicine type: move the cursor onto "Medicine name", rotate the knob and select one from aminophylline, dobutamine, dopamine, epinephrine, heparin, isuprel, lidocaine, nipride, nitroglycerin, pitocin, Medicine A, Medicine B, Medicine C, Medicine D and Medicine E, altogether 15 types. At one time, only one type of medicine can be selected for calculation.

′Attention′

The above introduced A, B, C, D, and E are not actual medicine names but only codes for medicines. Units for these five types of medicines are fixed, and operators can select proper units based on general practice of medicines. The expression rules of their units are as follows:

Medicines A, B, and C are fixed under the "mg" unit series, including g, mg, and mcg; Medicine D is fixed under the "unit" unit series, including unit, k unit, and m unit; and Medicine E is fixed under the "mEq" unit.

Patient weight: When entering the medicine calculation window, operators should firstly or secondly input patient weight, which will be taken as independent information for calculation of medicine contents.

′Attention′

This function of medicine calculation is only to provide a medicine calculator, while values in the list should not be related with the patient under monitoring. Thus the patient weight under this menu is different from the patient weight in the system; when the system refresh with a new patient, values in this menu will not be affected.

7.2 TITRATION

Enter the Titration list:

In the “Drug Calculation” menu, pitch on the “Titration” to enter the Titration list interface.

The Titration list interface for medicines is shown in the following Figure:

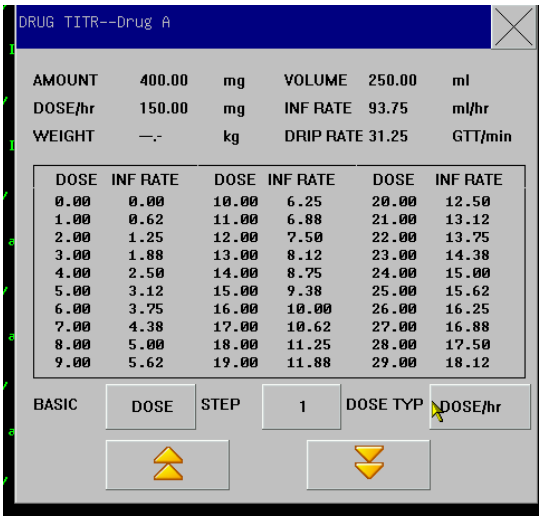


Figure7-2 Titration List

The specific operations are as follows:

In the Titration list, move the cursor to the “Reference Item” with the knob first, and then press the knob to select the required item. “Dosage” and “Injection Speed” are two options.

Move the cursor to the “Step Length” and press the knob to select the step length in the range of 1~10.

Move the cursor to the “Dosage Type” and press the knob to select the dosage unit.

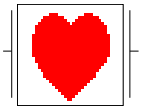
Move the cursor to the “ or ” button and press and turn the knob to check the previous and next pages of the list.

Move the cursor to the”Record” and press the knob to output the Titration list data on the current display interface.

Move the cursor to the” ” and press the knob to return to the “Medicine Calculation” menu.

Chapter 8 Patient Safety

The portable monitor is designed to meet the international safety requirements IEC60601-1, EN60601-2-27 and EN60601-2-30 formulated for medical electric equipments. It's furnished with floating inputted defibrillation resistance and surgery electric knife protection. If correct electrodes (referring to the ECG and RESP chapters) are installed following supervision of the manufacturer, screen display will be recovered within 10 seconds after defibrillation.



This symbol means the application part is of IEC 60601-1 type CF equipment, and designed with special electric shock resistant apparatus (especially with an F-type floating insulation apparatus for permissible leakage current), especially recommended for use during defibrillation period.

Warning

During defibrillation period don't touch the relevant patients, beds or equipments.

Environment

Users should follow the following guides to ensure absolute safety of electricity installation. For an environment where the portable monitor is located, users should reasonably avoid vibration, dusts, corrosive or explosive gases, extreme temperature and moisture. In case installed inside a chamber, the front side must be given sufficient space for convenient operations, and while the chamber door is open, the rear side must be given sufficient space for easy repair. Besides, must make sure of air flow inside the chamber.

The monitor, when working in an ambient temperature between 0℃～40℃, can meet the technical indexes, otherwise may have equipment accuracy affected or parts or circuits damaged. Moreover, there should be at least 2 inch (5 cm) of space reserved surrounding the monitor to ensure air flow.

Power Source

Please refer to the **Product Specification** chapter.

Monitor earthing

To protect patients and medical staffs, the portable monitor must has its cover connected with the earth; for such reason the monitor is equipped with a dismountable 3-line cable, which should be plugged into a matching 3-line socket and further connected with the earth through the ground line of the power supply cable. In case of no 3-line socket, please consult with the electricity staffs of your

hospital.

Don’t connect the 3-line cable of this monitor with a 2-line socket.

Connect the ground line with the equal-potential earthing terminal of the monitor. If unaware whether a certain equipment combination is risky in terms of equipment specification, for example, whether gathered leakage current is dangerous, users should consult with relevant manufacturers or specialists, so as to make sure the necessary safety of the relevant equipment will not be damaged by the proposed combination.

Equal-potential earthing

First level protection on the equipment has been contained in the house protective earthing system through earthing of the power socket. For heart or head internal check, this portable monitor must be individually connected with an equal-potential earthing system. One side of the equal-potential cable (potential balanced cable) should be connected with the equal-potential earthing terminal on the rear panel of the monitor, while the other side connected with one interface of the equal-potential system. In case of any damage to the protective earthing system, the equal-potential earthing system will take the safety function of protecting the earthing cable. Heart or head checks should be conducted within houses for medical use installed with protective earthing systems. Before each time of use, users should check whether the equipment is under good work status and pay attention the cable connecting patients and the equipment must be free from electrolytes pollution.

If the protective earthing system is instable, the monitor should be applied with internal power supply.

Condensation

During work period the equipment must be made sure of no condensation. When the equipment is shifted from one room to another room, condensation may be formed as the equipment is exposed in moistured atmosphere and different temperature.

If the monitor is used where there are flammable anesthetic agents, there may be explosion.

Explanations on Symbols Used in the Monitor

See reference in external interface in chapter 1.

Chapter 9 Maintenance & cleaning

9.1 Maintenance check

Before monitoring patients, you shall:

- Check whether there is any physical damage;
- Check all the disclosed leads, plugs, and accessories;
- Check all the functions to be used to monitor the patients and ensure the equipment works well; if any phenomenon is observed with the possibility of damaged functions, the Monitor shall not be used onto the patients and please contact the biochemical engineers of your hospital or the maintenance engineers of our company.
- Comprehensive checks, including safety checks, must be conducted by qualified personnel once per 6-12 months and after each time of repair.

Warning

if any hospital or agency responsible for using the Monitor fails to implement a set of satisfying maintenance plan, unusual functional failure may be resulted to the Monitor and may threaten the people's health.

9.2 Normal cleaning

The Monitor shall be kept without dust.

It is recommended to clean the outer surface of the cover and the monitor screen. To clean the cover, soft clothes moistened with soap water or diluted non-corrosive cleaning liquid shall be used.

Warning

You, before cleaning the Monitor or the sensor, shall have the Monitor power-off.

Caution

Pay attention not to damage the Monitor:

- No strong solvent such as acetone shall be used;
- Most of cleaning liquids shall be used only after diluted, and you shall dilute them

following the instructions given by manufacturers;

- ♦ No abrasive material (such as fiber wire or silver polisher) shall be used;
- ♦ No liquid shall enter the cover, and you shall not immerse any part of the Monitor into any liquid;
- ♦ No cleaning liquid shall be remained on the surface of the Monitor.

9.3 Sterilization

Except those listed as "For careful use", any other solutions that may be classified into the following types may be used as cleaning liquids for the Monitor:

* Diluted ammonia
* Diluted sodium hypochlorite (bleaching powder)

Attention: sodium hypochlorite of 500ppm (diluted in 1:100) to 5000ppm (diluted in 1:10) is very effective. The specific ppm value is up to how many organics (blood, grume of animals or plants) remained on the surface to be cleaned and sterilized.

* Diluted formaldehyde (35~37%)
* Hydrogen peroxide (3%)
* Alcohol
* Isopropyl alcohol

Caution

The surface of the Monitor and the sensor may be swept with medical alcohol, dried within natural wind, or cleaned with clean and dry clothes.

Caution

Our company is not responsibly for the effectiveness of taking these chemicals or methods as infection control methods. Please consult with the persons in charge of infection control of your hospital or epidemic experts.

9.4 Disinfection

For no long-term damages to the equipment, we recommend you to disinfect the equipment only you're your hospital rules require so. The disinfection product shall firstly be cleaned. Recommended disinfection materials: alcohol and acetaldehyde.

For disinfection materials for ECG leads, blood pressure cuffs, blood oxygen sensor and TEMP probe, please refer to the Maintenance & cleaning part of the applicable chapters or sections.

Caution

Be careful not to damage the Monitor. No EtO or formaldehydeshall be used for disinfection purpose.

* Try to use low-content liquids or dilute liquids following the instructions of manufacturers.

* Don’t let any liquid enter the cover and don’t immerse any part of the equipment into any liquids.

* Don’t remain any cleaning liquid on the equipment surface.

* Don’t pour liquids onto the equipment during the disinfection process.

Chapter 10 ECG Monitoring

10.1 Definition of ECG Monitoring

ECG monitoring describes continuous waveforms of cardiac activities of patients so as to accurately assess the current psychological status of the patients. Thus proper connection of ECG cables must be ensured in order to obtain correct measurement values. This portable monitor concurrently can display 2 waveforms under normal work status.

A patient cable consists of two parts:

Wire connecting the monitor;

Leads connecting patients

With a 3-lead facility for monitoring, ECG can obtain two waveforms from two different leads. Users can use the knob, in the left side of the ECG waveforms on the screen, to directly select the lead to be monitored.

Displayed monitoring parameters include HR, ST segment measurement value and arrhythmia.

All the above parameters can be taken as alarm parameters.

'Attention'

In the ex-factory setting of the monitor the ECG waveform displays at the position of the first two waveforms in the waveform area.

10.2 Attentions during ECG Monitoring

Warning

Don’t touch patients, tables or the equipment during defibrillation.

Warning

The ECG cable used for ECG signal monitoring by this portable monitor must be provided by our Company.

Warning

When connecting electrodes or patient cables, users should ensure there is no connection with other electric conductive parts or the ground, and more importantly, ensure all the ECG electrodes including neutral electrodes are attached with patient bodies instead of touching with electric conductive parts or the ground.

'Attention'

Disturbance from non-earthing equipments around a patient or ESU disturbance may

affect waveforms to function improperly.

Where this monitor is operated according to the conditions specified in the EN60601-1-2 (anti-radiation ability: 3V/M) and the electric-field strength above 1V/M may give rise to the measurement mistakes under various frequencies, it is suggested that the electroradiant equipment should not be used in the place next to the ECG/Respirometer.

10.3 Monitoring Procedures

10.3.1 Preparation

Take patient skin preparation before installation of electrodes:

1. Skin is bad conductor, thus to ensure good touch between electrodes and skin it's very important to well prepare patient skin.
2. When necessary, remove body hair surrounding the electrode positions.
3. Clean thoroughly the skin with soap and water (don't use ethyl ether or pure alcohol, as they will increase skin resistance)
4. Drily sweep the skin so as to increase capillary blood flow as remove skin scraps and oil.
5. Install spring clamp or snap before installation of electrodes
6. Put the electrodes on patient body; in case the electrodes contain no conductive paste, coat the conductive paste before installation.
7. Confirm power supply.

Warning

Daily check whether the ECG electrode plates stimulate skin; in case of any sensitiveness phenomenon, change the electrodes or positions every 24 hours.

′Attention′

To protect the environment, used electrode must be recycled or properly treated.

Warning

Before monitoring check whether the leads work properly. After users plug out the ECG cables, screen will display the error information of "Sensor disconnected" and activate voice alarming.

10.3.2 Install ECG leads

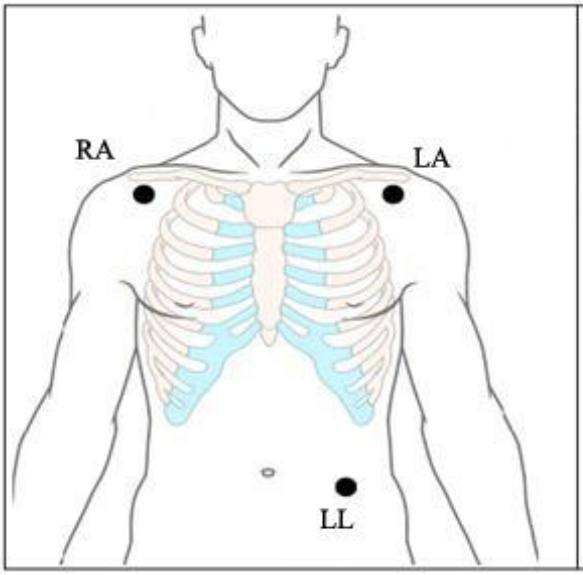
′ ′Attention′

The following table lists the lead names under the European and US standards (leads are

represented in R, L, N, F and C under the European standard and in RA, LA, RL, LL, and V under the US standard)

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

Three-lead ECG electrodes position (Figure 9-1):

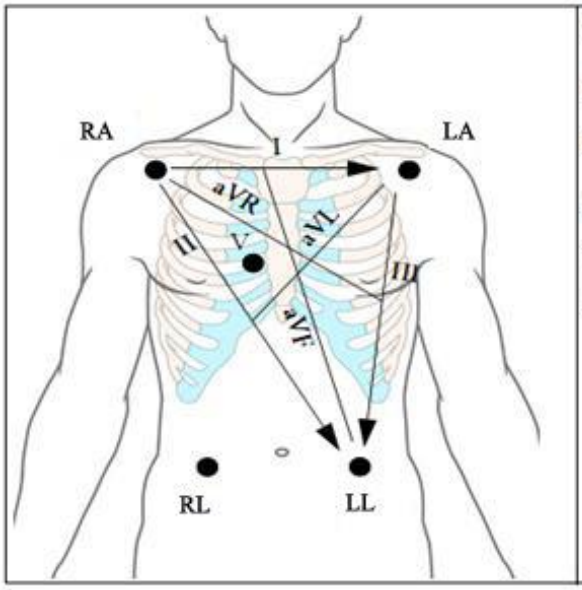


RA: Under the clavicle , near the R-shoulder

LA: Under the clavicle , near the L-shoulder

LL: On the L-lower quadrant

Five-lead ECG electrodes position (Figure 9-2):



RA :under the clavicle ,near by R-shoulder

LA :under the clavicle , near by L-shoulder

RL:on the R-lower quadrant

LL : on the L-lower quadrant

V: on the chest , the electrodes must be put at optional of the position

Speical 3-leads ECG for neonate monitoring

′ Attention′

For patient safety, all the leads must be connected with patient body.

For 5-lead device, put the breast (V) electrode at one of the following positions:

V1, around the 4th frame at right side to the breast bone

V2, around the 4th frame at left side to the breast bone

V3, between V2 and V4

V4, around the 5th frame along middle line of the left clavicle

V5, at front line of the left axilla, at the same horizontal position of V4

V6, at middle line of the left axilla, at the same horizontal position of V4

V3R-V7R, at right side of the breast, identical to those positions at left side

VE, at apophysis of the xiphoid process; in case V leads are put on the back, the electrodes must be put at one of the following position:

V7, around the 5th frame at back line of the left axilla on the back

V7R, around the 5th frame at back line of the right axilla on the back

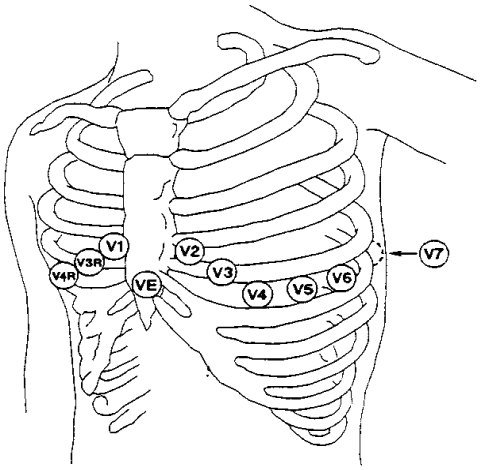


Figure 10-3 5-lead Chest Electrode Position

10.3.3 ECG lead connection recommended for surgery patients

Warning

When using ES equipments, users should put ECG electrodes at middle of the ES earthing plate and ES knives to prevent from burns. Cables of ES equipments can not be wrapped with ECG cables together.

Positioning of ECG leads is up to operation types, for example, for chest operation, electrodes can be put on breast sides or back. Inside operation rooms using surgery electric knives, sometimes artificial discrepancy may affect ECG waveforms; to reduce such artificial discrepancy, users may put the electrodes at the left and right shoulders, near left and right abdomen, with breast lead at left to the middle breast. No electrodes should be put on left arm; otherwise the ECG waveforms will be very small.

Warning

During use of ES equipments, don't put electrodes near the earthing plate of such equipments, otherwise ECG signals will be much disturbed.

10.4 ECG Hot Key

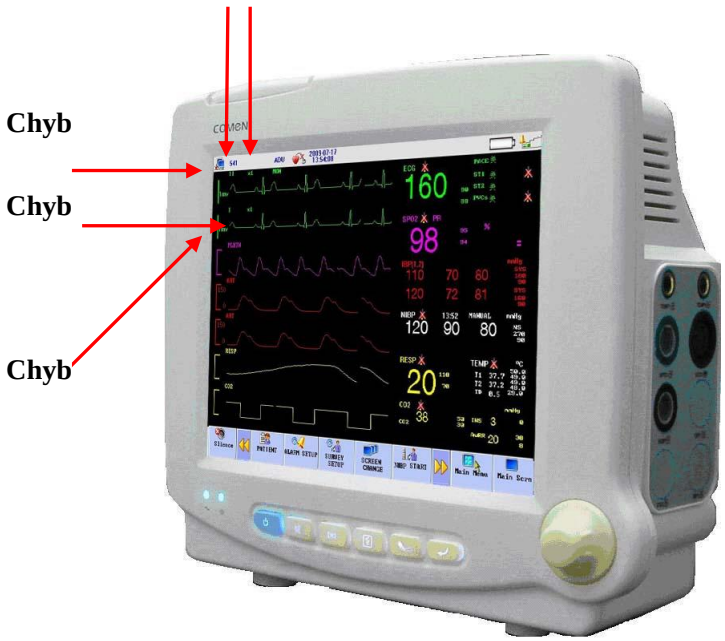


Figure 10-2 ECG Hot Key

Name of the First ECG Lead ○,1:

ECG using 5-lead, the selectable leads include I, II, III, aVR, aVL, aVF and V;

ECG using 3-lead, the selectable leads include I, II and III. (For neonate)

The leads on the ECG waveform should not have the same name, otherwise the system will automatically change the similar name into another.

The 1st-ECG Waveform Gain ○,2: used to adjust the amplitude of ECG waveform.

The gain of each calculation channel can be selected, which has such columns as ×0.25, ×0.5, ×1 and ×2 as well as auto mode. Auto mode means that the monitor can automatically adjust the gain. On the right side of each ECG waveform there is a 1-mv rod of which height and amplitude are proportional.

′

Attention′

The input signal being too strong, the wave crest may be truncated. At this time users can manually change the gain column of ECG waveform by reference to the actual waveform for fear of incompleteness of waveform.

Filtering Mode ○,3: The cleaner or precise waveform can be obtained through filtering.

There are three filtering modes for option. The unfiltered ECG waveform is shown in the diagnostic mode; the monitoring mode will possibly lead to the artifact filtering; the operation mode used in the surgery can reduce the artifact and interference from the electrosurgery unit. The filtering mode can be used in two channels and displayed on the upper part of the first ECG waveform.

⚠**Warning**⚠

Only in the diagnostic mode can the system provide the real signal that has not been treated. In the filtering modes such as "Monitoring" and "Operation", the ECG waveform will abnormally occur to the different extents. At this time the system can only provide the basic ECG status, and will produce greater influence on the analysis result of ST Segment. The analysis result of ARR may partially be affected in the operating mode, so it is suggested that efforts are made to monitor patients in the diagnostic mode when the interference is small.

The Name of 2nd-ECG Waveform Gain: for details, please refer to ○,1。

The 2nd-ECG Waveform Gain: for details, please refer to ○,2。

′ Attention′

The detected pacing signal displays on the upper part of the ECG waveform in the waveform area, which is expressed as " ˈ ".

10.5 ECG Menu

10.5.1 ECG setting menu

Use turn knob and move cursor on the main screen to the ECG hot keys in the parameter area, then press the knob to pop up the ECG Setting menu:

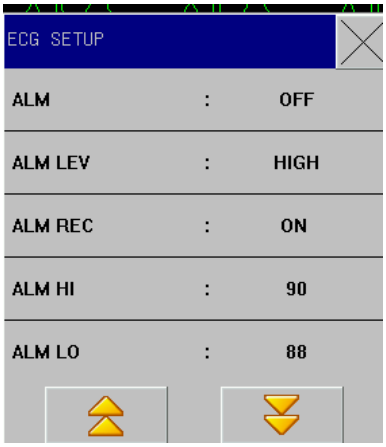


Figure 10-3 ECG Setup

- Alarm: Select “ON” to give alarm prompt and storage when the heart rate alarm happens.  will be prompted beside ECG.
- Alarm level: three options: High, MED and Low, and high is for the most serious alarm.
- Alarm record: Users can select “On” to print HR alarms when they happen
- Alarm upper limit: used for users to set the upper limit for HR alarms
- Alarm lower limit: used for users to set the lower limit for HR alarms

Alarms will happen once the HR values exceed the upper or lower limit.
Adjustable ranges for HR alarm upper & lower limits are as follows:

	Highest upper limit	Lowest lower limit	Adjustment step length
HR adult	300	15	1
HR infant	350	15	1
HR newborn	350	15	1

'Attention'

Users should set the alarm upper & lower limits based on the clinical conditions of every patient. Setting of the HR alarm upper limit is very important, and users should not set it too high but consider fluctuation factors. The set HR alarm upper limit should not be over 20 beats/ minutes than patient HR.

10.5.2 ECG setting in waveform area

Turn the knob to waveform area,press the knob to enter ECG waveform setting

Figure 10-4 ECG Setup

- Lead Name：
  ECG using 5-lead, the selectable leads include I, II, III, aVR, aVL, aVF and V;
  ECG using 3-lead, the selectable leads include I, II and III.

- Gain: used to adjust the amplitude of ECG waveform. The gain of each calculation channel can be selected, which has such columns as ×0.25, ×0.5, ×1 and ×2 as well as auto mode. Auto mode means that the monitor can automatically adjust the gain. On the right side of each ECG waveform there is a 1-mv rod of which height and amplitude are proportional.
- Sweep: ECG Waveform scanning wave has four levels for option, such as 6.25, 12.5, 25.0 and 50.0mm/s.
- Filtering Mode: The cleaner or precise waveform can be obtained through filtering. There are three filtering modes for option. The unfiltered ECG waveform is shown in the diagnostic mode; the monitoring mode will possibly lead to the artifact filtering; the operation mode used in the surgery can reduce the artifact and interference from the electrosurgery unit. The filtering mode can be used in two channels and displayed on the upper part of the first ECG waveform.
- Wave Color: green, cyan, red, yellow, white, blue, violet.

10.5.3 ECG setting in measurements

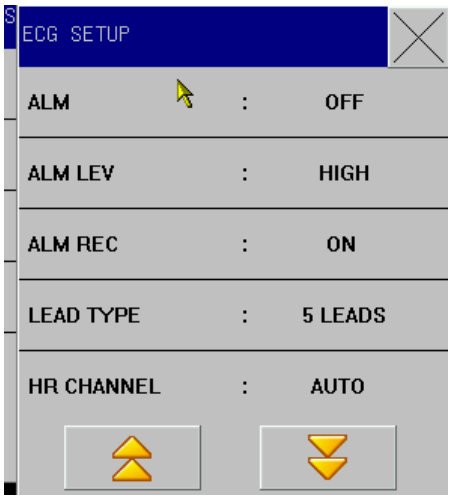


Figure 10-5 ECG Setting menu

1. When the heart rate alarm happens. Select “OFF”  will be prompted beside ECG.
2. Alarm level: three options: High, MED and Low, and High is for the most serious alarm.
3. Alarm record: Users can select “On” to print HR alarms when they happen
4. Lead type: 5-lead or 3-lead
5. Selection of HR calculation channel
   “Channel 1” means the HR is calculated according to the first ECG waveform data.
   “Channel 2” means the HR is calculated according to the second ECG waveform data.
   “Auto” means the monitor will automatically select the channel of calculating HR.
6. HR Source

   Users can select to check HR through ECG or PLETH (blood-oxygen volume recording waveform); if users select “Automatic”, the monitor will decide HR source based on signal quality; if users select “All”, the monitor will concurrently display HR and PR. In case PLETH is taken as the HR source, the PULSE reminder will be displayed together with pulse voice.
   In case PLETH is taken as HR source, no alarm judgment on HR but alarm judgment on PR will be conducted. In case “All” is selected, PR measurement values will be displayed in the right to SpO_2 on the main screen, and HR & PR make alarms at the same time. Pulse voice will give priority to HR, as long as there is HR data, voice reminder will be there; only when there is no HR data, voice reminder will be subject with PR.
7. ST Segment Analysis Select this item and enter the “ST Segment Analysis” menu.

Arrhythmia Analysis

Press SURVEY in main interface, one submenu pop up; choose ECG SETUP, Arrhythmia analysis information inside.

Arrhythmia analysis is used in clinically monitoring the ECG of patients, detecting the HR change and PVB, saving the arrhythmia events and producing alarm messages. Besides, it can be used to monitor the patients with or without the pacemaker. The qualified personnel can evaluate the patient's status (such as HR, PVCS (PVB), frequency, rhythm and abnormal HB) according to arrhythmia analysis and make a diagnosis and give treatment. In addition to detect the ECG change, arrhythmia analysis can monitor patients and give a suitable alarm.

The default of arrhythmia monitoring function is off. Users can start this function as needed.

Arrhythmia monitoring can arouse the doctor's attention to the patient's cardiac rhythm and give an alarm through test and classification of arrhythmia and HB abnormality.

This monitor can support 13 kinds of arrhythmia analysis.

In arrhythmia analysis, the system will save the latest 60 alarm events (the single-channel ECG waveform four seconds before and after alarm). The operator can edit the arrhythmia events through this menu.

Arrhythmia Analysis

In the "ECG SETUP" menu, select the "Arrhythmia Analysis" to enter the following submenu

（1）Arrhythmia Analysis: During monitoring it can be set at "ON" and during default, "OFF"

（2）Alarm Switch: Select the "ON" and the alarm prompt and saving will proceed; select the "OFF" and PVCs alarm won't start, but prompting  do beside PVCs in the screen parameter area.

（3）Alarm Level: There are such three options as "high", "middle" and "low". "High" means the most serious PVCs alarm.

（4）Alarm Record: Select the "ON" and the recorder will output during PVCs alarm.

（5）Alarm Upper Limit: PVCs alarm is based upon the set alarm upper limit. The alarm will happen when PVCs exceeds the upper limit.

（6）ARR self-learning: Press this button to trigger a learning course and the screen information area will show "Learning ARR"

（7）ARR Alarm Setting: Set the Arrhythmia Alarm.

（8）Arrhythmia Recall: Select this option and you can view and edit the patient's arrhythmia information.

The latest saved arrhythmia events are listed in the window (one page can show 10 events and at most 6 pages can display).

1. Press  or  to observe the list of arrhythmia events in other pages.

2. Cursor Movement: to move the cursor to select the arrhythmia events in the list.

Figure 10-6 Arrhythmia Events Review

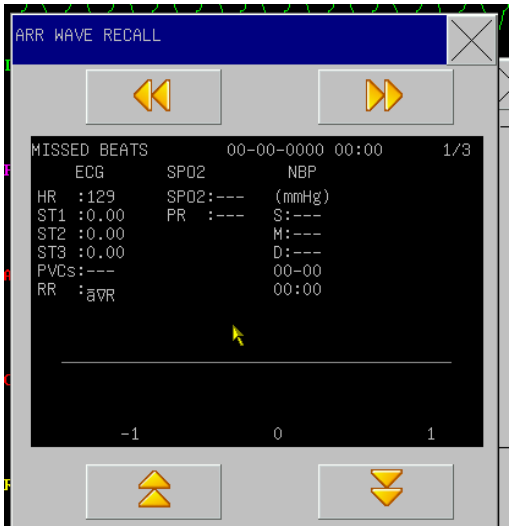


Figure 10-7 Arrhythmia Waveform Review

′ Attention′

In the event that the number of arrhythmia event is more than 200, the monitor will retain the latest instead of the earliest. As for the monitor with the power-fail saving function, it can save 200 arrhythmia events with power-fail.

PVCs Alarm Message and Prompt Message:

When the alarm record switch in the related menu is turned on, the physical alarm arising out of that the parameters exceeds the alarm limit will make the recorder automatically output the alarm parameter values and related waveforms.

Chapter11 RESP Measurement

11.1 Measure RESP

11.1.1 How to measure RESP

This monitor measures RESP values from the breast impedance values at two electrodes; impedance change between such electrodes (due to breast activities) will generate a RESP waveform on the screen.

11.1.2 Setting of RESP monitoring

For RESP monitoring, no additional electrodes are required, but how to install electrode is critical. For some patients, especially with clinical condition that negative breast internal pressure will be generated if their breast is horizontal expanded. In that case, users should put the two RESP electrodes respectively at middle line of the right axilla and left side to the breast, where there are largest activities during respiration, so as to obtain the best RESP wave.

′ ′Attention′

RESP monitoring is not applicable for patients with active activities otherwise may generate wrong alarms.

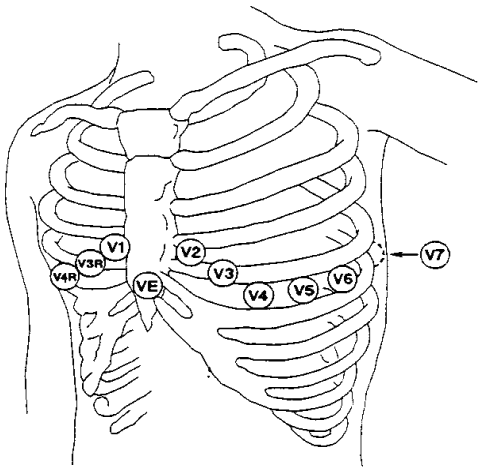
RESP monitoring checks:

Take patient skin preparation before installation of electrodes;

Install spring clamp or snap for electrodes, and follow the later-introduced method to install electrodes on patient body;

Turn on power supply for the monitor system.

Install electrodes for RESP monitoring



′Attention′

Install the white and red electrodes in a diagonal line so as to obtain the best RESP wave. Need keep the liver and heart area out of the line formed by such electrodes, so as to avoid artificial discrepancy generated from heart cover or pulsatile blood, which is very important for newborns.

11.2 RESP Setting menu (RESTP SETUP)

Users can rotate the knob and move the cursor to the RESP hotkey on the parameter area of the main screen, then press the knob to enter the RESP Setting menu.

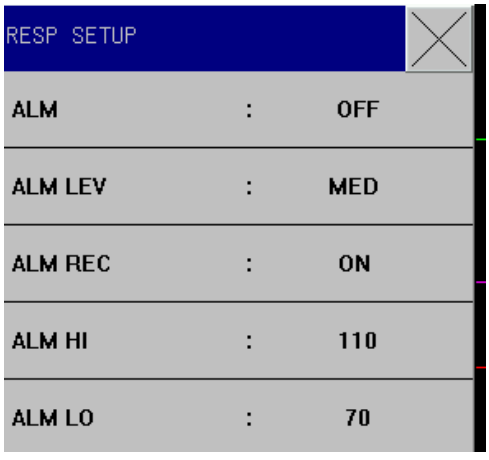


Figure 11-1 RESP Setup

1. Alarm Switch: select the “ON” and the alarm prompt and saving will proceed during RR alarm; select the “OFF” and “ ” will be prompted beside RESP in the screen parameter area.

2. Alarm record: If users select “On”, upon RESP alarming, the recorder will output the alarm.
3. Alarm levels: High, MED or Low to be selected, and High for the most serious alarm.
4. Alarm HI: used to be set with the upper limit for RR alarm.
5. Alarm LO: used to be set with the alarm lower limit.

RESP alarming takes the set upper & lower limits as standard, and once the RESP values exceed such limits there will be alarms.

Adjustable range of RESP alarm upper & lower limits:

	Max upper limit	Min lower limit	Adjusted amount per time
RR adult	120	6	1
RR infant/ newborn	150	6	1

Choke alarm: Users can set the time to judge patient choke; 10-40 seconds are optional, each rotation of knob will increase/ decrease 5 seconds.

11.3 RESP setting in waveform area

Users can rotate the knob and move the cursor to the RESP hotkey on the parameter area of the main screen, then press the knob to enter the RESP Setting menu.

Figure 11-2 RESP Setup

Waveform speed: Three optional speeds, 6.25mm/s, 12.5mm/s and 25.0mm/s

Waveform amplitude: Users can set enlarged display of RESP waveforms under five optional enlargement rates: 0.25, 0.5, 1, 2 and 4.

Wave Color: green, cyan, red, yellow, white, blue, violet.

11.4 RESP setting in measurements

Users can rotate the knob and move the cursor to the RESP hotkey on the parameter area of the main screen, then press the knob to enter the RESP Setting menu.

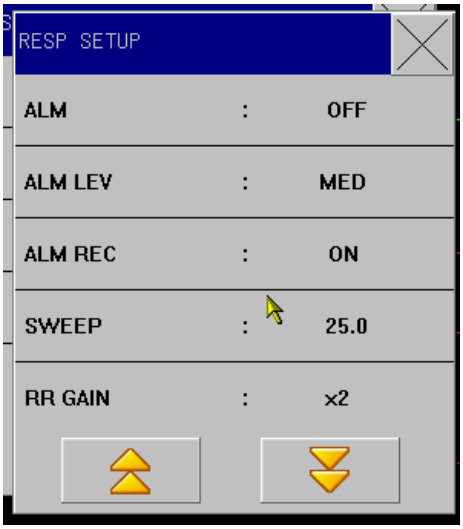


Figure 11-3 RESP Alarm Setup

1. ALM: see reference in RESP Setting menu
2. ALM LEV: see reference in RESP Setting menu
3. ALM REC see reference in RESP Setting menu
4. SWEEP: Waveform speed, Three optional speeds, 6.25mm/s, 12.5mm/s and 25.0mm/s
5. RR Gain: Users can set enlarged display of RESP waveforms under four optional enlargement rates: 0.25, 0.5, 1.0, 2.0 and 4.0.

11.5 Maintenance & Cleaning

Note and Cleaning

Warning

Before cleaning the monitor or sensor, users must turn of the equipment and break the AC power supply. In case of any appearance of ECG cable damage or aging, users should change with new cables.

Cleaning

Surface of the monitor and sensor can be swept by medical alcohol, naturally dried or cleaned

by clean and dry clothes.

Disinfection

To avoid long-term damage to the equipment, we recommend you to disinfect the products only when deemed as necessary under the maintenance plan of your hospital. We also recommend you to clean the products before disinfection.

Recommended disinfection materials for the monitor:

1.1.2 Ethanol: 70% alcohol, 70% isopropyl

1.1.3 Glyoxyl

Sterilization

To avoid long-term damage to the equipment, we recommend you to sterilize the products only when deemed as necessary under the maintenance plan of your hospital. We also recommend you to clean the products before sterilization

Chapter 12 SpO2 Monitoring

12.1 Definition of SpO2 Monitoring

The SpO_2 volume recording parameter is used to measure arterial SpO_2, i.e., percentage of oxyhemoglobin. For example, if there are 97% of hemoglobin molecules combining with oxygen out of the arterial red blood cells, the blood will be described as SpO_2 97%, and the SpO_2 reading on the monitor will be 97%. SpO_2 values thus can show the percentage of oxygen-attached hemoglobin molecules (will form oxyhemoglobin), meanwhile, SpO_2 volume recording parameters can also provide the PR signals and volume recording waves.

12.1.1 Principle for Measurement of SpO_2 Volume Recording Parameter

BOS (blood oxygen saturation) is measured and determined in the method of pulse oximetry, which is a method of measuring and determining the oxyhemoglobin saturation continuously and without any hurt, mainly used to measure and determine how many rays from the light source of the sensor penetrate the patient's tissue (such as fingers or ears) and reach another receiver.

As for the wave length measurable by the sensor, generally the red LED is 660nm and the infrared LED, 940nm. The maximum selectable output power of LED is 4mW.

The number of penetrated rays rests with many factors where most are constant, but one of these factors means the arterial flow changes through time because it is pulsant. The arterialized blood's BOS can be obtained through measurement of absorbed rays during pulsation. A "volume recording" waveform and PR signal can be given through detection of pulsation.

"SpO2" value and "Volume Recording" waveform can display on the main screen.

Warning

Where there is carboxyhemoglobin, ferrihemoglobin ordye dilution chemicals, SpO2 value will have a deviation.

12.1.2 BOS/Pulse Monitoring

Warning

The cable for the equipment of electrosurgery can't be twisted together with the sensor cable.

Warning

Please don't place the senor on the limb with arterial duct or vein injection syringe.

′Attention′

Please don't place SpO_2 detector and cover on the same limb for measurement of blood pressure, because in the course of measuring blood pressure the vascular obstruction will affect the BOS reading.

12.2 Precautions in SpO_2/Pulse Monitoring

′ Attention′

Guarantee the nail can shut out the light.

The detector cable should be fixed on the back of hand.

′Attention′

SpO2 value always displays at the fixed place.

Only in the following cases PR will appear:

- In ECG menu, set "HR Source" as SPO2 or all.
- In ECG menu, set "HR Source" as "AUTO" and there is no ECG signal at this time.

′Attention′

SpO_2 waveform and pulse are out of proportion.

Warning

Prior to monitoring, the first inspection should be given to whether the sensor cable is normal. SpO2 sensor cable being pulled out of the jack, the screen will display the "Sensor Off" mistaken information, and trigger the sound alarm.

Warning

Where the sensor packing or the sensor has the sign of damage, please don't use this SpO_2 sensor, but return it to the manufacturer.

Warning

Continuous and overlong monitoring may increase the undesirable dangers that skin features change, such as extraordinary sensitivity, reddening, blistering or pressure necrosis, which are especially easy to happen to the newborns or the patients with perfusion disorder or immature skin. In such a case special attention should be given to aiming the correct beam path at detection of sensor position according to the change of skin quality. Regular inspection should also be given to the laid-on position of sensor and the change of such a position when the skin quality goes worse. It is possible to require for the more frequent inspection due to different patient status.

12.3 Monitoring Procedures

SpO_2 volume recording measurement:

Turn on the monitor;

Paste the sensor on a proper position of the patient finger;

Insert the connector at the other side of the sensor cable into the SpO_2 hole of the SpO_2 module.

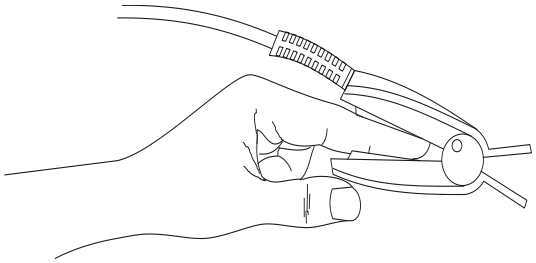


Figure 12-1 placement of senseor

Neonate SPO_2 measurements

The measurement method for neonate is almost the same with adult, the sensor is introduced below.

1. neonate SPO_2 sensor

Neonate SPO_2 sensor includes Y type SPO_2 sensor and SPO_2 sensor jacket, put the LED end of Y type SPO_2 sensor into the SPO_2 sensor jacket, refer to the Figure below

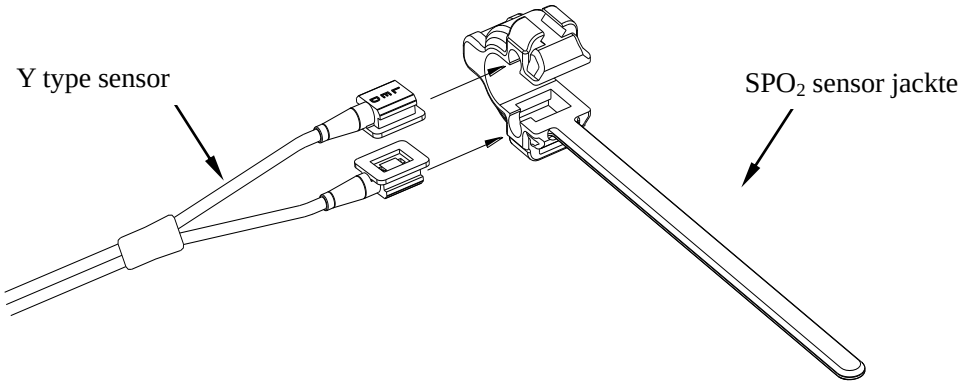


Figure 12-2 neonate SPO_2 sensor（1）

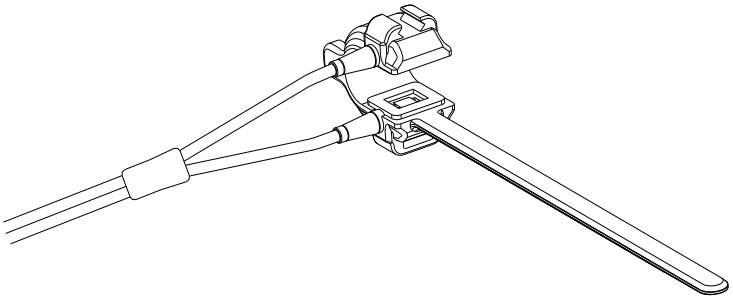


Figure 12-3 neonate SPO_2 sensor（2）

2. The placement for the neonatal SPO_2 sensor

Put the neonatal SPO_2 sensor on hand or foot of neonate patients (Figure11-4). Fix the SPO_2 sensor in the right position.

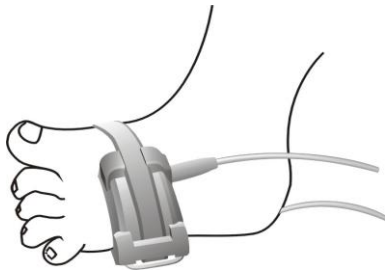
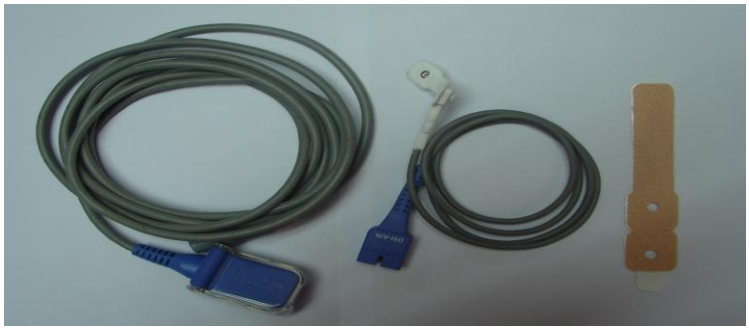


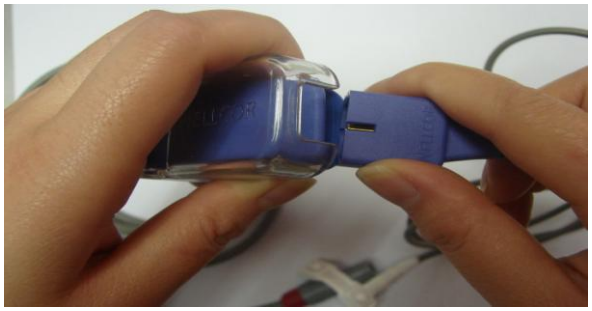
Figure 12-4 The placement for the neonatal SPO_2 sensor

Nellcor SpO2

NELLCOR SpO2 transducer is consist of Nellcor SpO2 connection cable, Nellcor infant SpO2 sensor, and wraps, as picture shown:

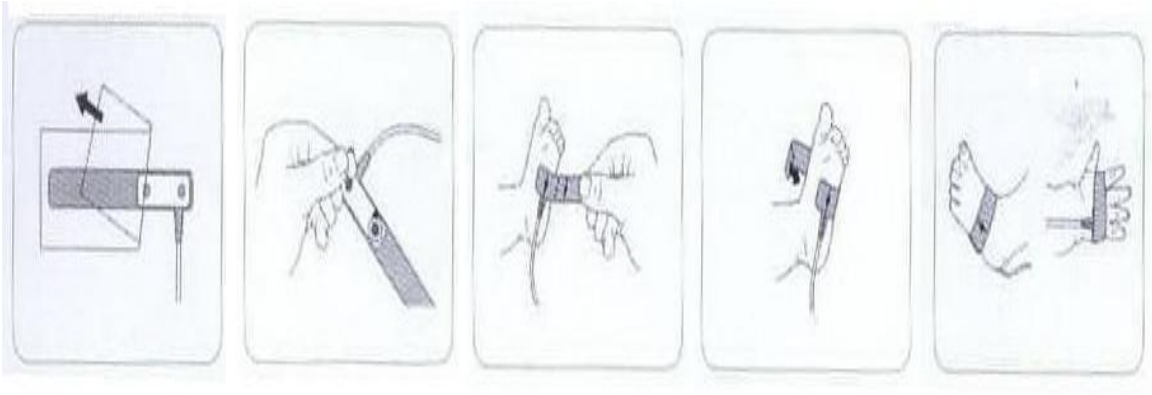


Consist of Nellocr SpO2



Connection between extension cable and sensor

Fix Nellcor SpO2 sensor



12.4 Measurement restriction

Measurement restriction

During operation, the following factors may affect accuracy of SpO_2 measurement:

High-frequency electric disturbance, such as disturbance generated from the system itself or electrosurgery equipments connected with the system;

A photo-oximeter and SPO_2 sensor are used during MRI process, as the inductive current may cause burns;

Intravenous Dye;

Frequent movement by patient;

Light radiation from outside;

Improper installation of the sensor or improper touching position with objects;

Improper sensor temperature (ideal temperature should be 28℃-42℃);

The sensor is put onto body with blood pressure cuff, arterial duct or vein tube;

Contents of non-functional Hb such as COHb and MetHb;

SPO_2 over low;

Bad microvascular perfusion at the test position;

Shock, anemia, low temperature and application of vessel shrinking medicines, which all can reduce the arterial blood flow to a non-measurable level;

Measurement is also up to absorption of lights with special wavelengths by oxyhemoglobin and deoxygenated hemoglobin. Existence of other materials that absorbs the same wavelengths, such as carbonated hemoglobin, hemoglobin, methylene blue and indi carmine, will make artificial or low SPO_2 values.

SPO_2 sensor introduced in the accessory is recommended.

12.5 SpO_2 Setting menu

Users can rotate the knob and move the cursor onto the SPO_2 hotkey in the parameter area, then press the knob to enter the SpO_2 Setting menu.

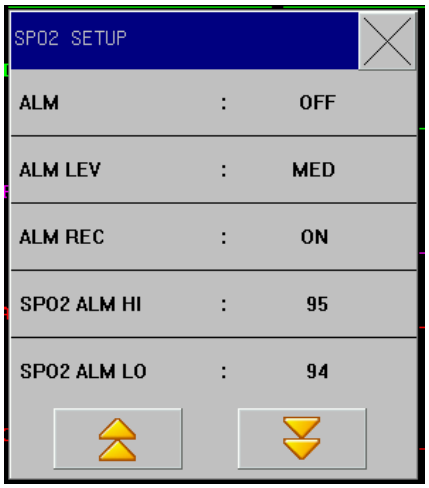


Figure 12-5 SPO_2 Setup

Warning

Setting the SpO_2 alarm upper limit to be 100% means to release the upper limit. However, high SpO_2 level will make early-born infants infected with retrolental fibroplasias, thus the SpO_2 alarm upper limit must be carefully selected based on common acknowledged clinical practice.

Alarm Switch: Where "ON" is selected, the alarm prompt and saving will proceed when SpO2 (BOS) is alarmed; where "OFF" is selected, alarming will not happen, but  will be prompted beside SpO_2 in the screen parameter area.

Alarm level: used to set alarm levels and, during SpO_2 alarming, for alarm reminder and saving. Options include "High", "Middle", and "Low"; "High" for the most serious alarm.

Alarm record: If "On" is selected, the recorder will output during SpO_2 alarming.

SpO_2 Alarm Upper/Lower Limit: according to the set upper/lower limit, alarm will happen when SpO_2 is higher than upper limit or lower than lower limit.

PR Alarm Upper/Lower Limit: according to the set upper/lower limit, alarm will happen when PR is higher than upper limit or lower than lower limit.

SpO_2 & PR adjustable limits:

Parameter	Max upper limit	Min lower limit	Adjustable amount each time
SpO_2	100	0	1
PR	254	0	1

12.6 SPO2 setting in waveform area

Users can rotate the knob and move the cursor onto the SPO_2 hotkey in the parameter area, then press

the knob to enter the SpO_2 Setting menu.

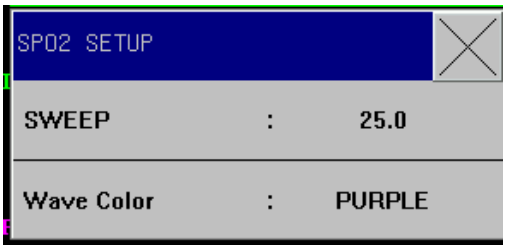


Figure12-6 SPO_2 Setting

SWEEP: Waveform Speed, the scanning speed of SpO_2 volume recording waveform is provided with 12.5 and 25.0mm/s for option.
Waveform Colour: green, cyan, red, yellow, white, blue, violet.
1

12.7 Alarms & Reminders

SpO_2 alarm information

When the alarm record function under certain menus is on, those physical alarms caused because relevant parameters exceed the specified alarm limits will automatically output alarm parameter values and relevant measurement waveforms.

12.8 Maintenance & Cleaning

⚠Warning⚠

Users must turn off the equipment and shut down the AC power supply before cleaning the monitor or the connected sensor.

⚠Careful⚠

Please don't sterilize the senor with pressure.
Please don't soak the sensor in the liquid.
Use of the senor or cable is prohibited if they are damaged or degenerated.

Cleaning:

Having cleansed the surface of the sensor with the cotton ball or cotton cloth soaked with medical alcohol, dry it with the dry cloth. The luminotron and receiver of the sensor can be cleaned in the same method. The cable can be cleaned and sterilized with 3% of hydrogen peroxide or 70% of isopropyl alcohol. Active reagent can also be used for this purpose. However, the joint can't be soaked in the above solution.

Chapter13 NIBP Monitoring

13.1 General Information

NIBP measurement can be performed in the oscillation method;
It can be used in adults, children and newborns;
Measurement mode: manual, automatic and continuous measurement. Each mode can show NS, NM and ND.

- □ "Manual" mode: measurement can only be done once.
- □ "Auto" mode: measurement can be repeated. The interval time can be set as 1/2/3/4/5/10/15/30/60/90/120/180/240/480 minutes.
- □ "Continuous" mode: measurement can continuously be done within 5 minutes.

⚠Warning⚠

Don't apply NIBP measurement onto a patient with sickle cell disease or any skin damage or expected to have skin damage.
For patients with serious DIC, users should decide whether to apply NIBP measurement based on clinical assessment, as there may have blood tumor at the touching area between body and cuff.
In case of measurement on infants and newborns, users must ensure to select the correct mode setting (refers to Patient Information Menu setting). A wrong mode may threaten patient safety, as adult blood pressure levels are too high to be applied on infants and newborns.

13.2 NIBP Monitoring

13.2.1 NlBP Measurement

⚠Warning⚠

Before measurement, users must make sure the selected monitoring mode is applicable for the patients (adult, infant or newborn).
Don't install a cuff on a body part with vein duct or other tubes. During cuff pumping, slow infusion or infusion blocking may cause damage to the surrounding body area.

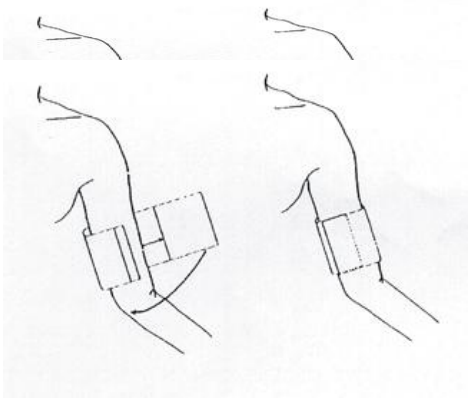
⚠Warning⚠

The pumping pipe connecting blood pressure cuff and the monitor must be smooth,

without any entanglement.

1. Insert the pumping pipe into the interface of a blood pressure cuff and turn on the power supply.
2. In accordance with the following method (Pic 14-1), tie the blood pressure cuff on upper arm of upper leg of a patient.
   - Confirm the cuff is fully vented.

Select a cuff in proper size for the patient, and make sure the mark is just along the proper vein and

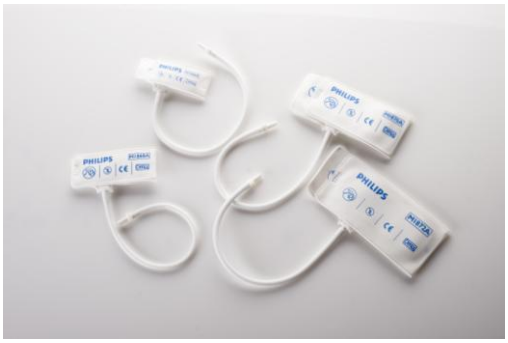


cuff tie the body non-toughly, otherwise remote body part may have color change or even ischaemia.

Figure 13-1 Use of a Cuff

Neonate NIBP cuff

Different four size of Philips NIBP cuff for neonate monitoring



′ Attention′

Cuff width should be 40% of arm perimeter (50% in case of newborns) or 2/3 of upper arm length. Width of the pumping part of a cuff should be as long as to surround 50%~80% of the arm. Cuffs in improper size will generate wrong readings. In case of size problem with a cuff, users should change it with a bigger one so as to reduce mistakes.

Neonate/Pediatric Reusable NIBP cuff

Patient Type	Body Perimeter	Cuff width	NIBP extension tube

Neonate	10 ~19 cm	8 cm	1.5 m or 2m
Pediatrc	18 ~ 26 cm	10.6 cm	
Leg	46 ~ 66 cm	21 cm	

neonate/pediatric/adultone-time cuff：

size	Circular of arm	Cuff width	Tube length
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	

- Check the cuff edges are between the "<->" marks; otherwise users should change with a more proper cuff.

3. Connect the cuff with a pumping pipe. Make sure the body part used for pressure measurement is at the same horizontal level with patient heart, and if failing to realize this, users should apply the following correction method to correct the measurement results:

- In case horizontal level of cuff is higher than that of heart, add 0.75mmHg (0.10kPa) onto the displayed value for each cm difference.
- In case horizontal level of cuff is lower than that of heart, deduct 0.75mmHg (0.10kPa) onto the displayed value for each cm difference.

4. Confirm correctness of the monitoring mode (as displayed on the information area); if requiring to change the monitoring mode, users need go to the "Patient Information Setting" item under the Main menu and change "Patient Type".

5. Select the measurement mode under the NIBP menu. Refer to the following Operational Guide for details.

6. Press the START button on the front panel to start pressure measurement.

Operational guide

1. Conduct one time of Automatic measurement

Enter the "NIBP Setting" menu, select a proper time interval at the "Time Interval" item, and press the "START/STOP" button on the front panel. Then the system will start automatic pumping measurement in the specified time interval.

⚠Warning⚠

If NIBP measurement under the Automatic mode lasts too long, body touching with the cuff may have allergic purpuras, ischemia and neural injury. During monitoring on

patients, users should often check color, warmness and sensitiveness of remote body parts. Once any abnormal phenomenon is found, users should put the cuff at another location or immediately stop measuring blood pressure.

2. Stop automatic measurement

At any moment during the automatic measurement process, press the START/STOP button will stop the automatic measurement.

3. Conduct one time of manual measurement

- Enter the "NIBP Setting" menu, select the "Time Interval" item and set its value as "Manual", then press the START/STOP button on the front panel so as to start manual measurement.
- During spare time of an automatic measurement, press the START/STOP button will start a manual measurement; then if users press the START/STOP button again, the manual measurement will stop and the automatic measurement will continue.

4. Conduct a manual measurement during automatic measurement process

Just press the START/STOP button on the control panel.

5. Stop a manual measurement

Re-press the START/STOP button on the control panel.

6. Conduct a continuous measurement

Enter the "NIBP Setting" menu and select the "Continuous" item to start a continuous measurement, which will always last 10 minutes.

⚠**Warning**⚠

If NIBP measurement under the Automatic mode lasts too long, body touching with the cuff may have allergic purpuras, ischemia and neural injury. During monitoring on patients, users should often check color, warmness and sensitiveness of remote body parts. Once any abnormal phenomenon is found, users should put the cuff at another location or immediately stop measuring blood pressure.

7. Stop continuous measurement

At any moment during the continuous measurement process, press the START/STOP button will stop the continuous measurement.

′Attention′

In case of suspecting reading accuracy, users should take possible methods to check life signs of patients before checking the monitor,

⚠**Warning**⚠

In case any liquid is sprayed onto the equipment or its accessories, especially when the liquid may enter the tube or monitor, please contact with the maintenance department of

your hospital.

Measurement restriction

Vibration measurement has its restriction subject with patient conditions. This measurement method looks for regular pulse waves generated from arterial pressure, so when patient conditions make this wave detection method hard to work, measured values are no more reliable and measurement time last longer. Users must understand the following cases will disturb the measurement method, making measured press unreliable or measurement time extended. In such cases, patient conditions disable measurement to be continued.

- Patient movement

In case a patient is moving, shaking or convulsing, measurement will be unreliable or even impossible; as such scenarios will disturb detection of arterial pulse and extend measurement time.

- Arrhythmia

In case a patient shows irregular heartbeats resulted from arrhythmia, measurement will be unreliable or even impossible, while measurement time will also be extended.

- Heart-lung machine

If a patient is connected with an artificial heart-lung machine, measurement can’t be realized.

- Pressure change

Within certain time if the patient blood pressure immediately changes while users are analyzing arterial pulse so as to obtain measurement values, measurement will be unreliable or even impossible.

- Serious shock

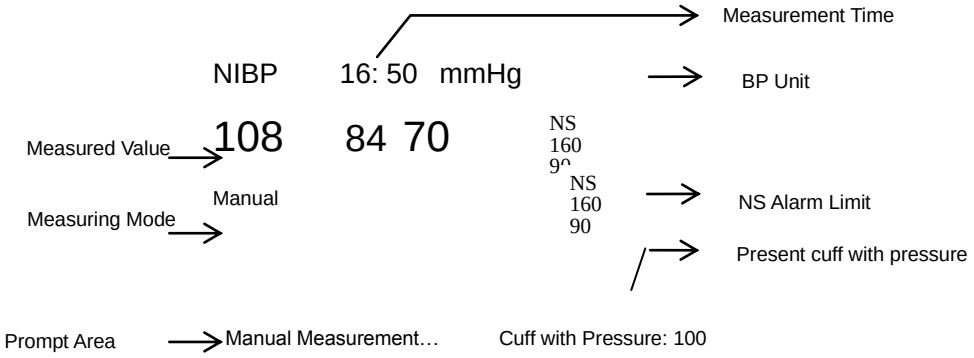
In case a patient is under serious shock or extreme low temperature, measurement will be unreliable as reduction in blood flowing peripherally will result reduction in arterial pulse.

- HR limits

In case of HR lower than 40bpm or higher than 240bpm, no blood pressure measurement can be done.

13.2.2 NIBP Parameter Setting & Adjustment

NIBP measurement results and relevant information are laid on screen as follows:



13.3 NIBP setting in parameter area

Rotate the knob, move the cursor onto the NIBP hotkey in the parameter area, and then press the knob to enter the NIBP Setting menu.

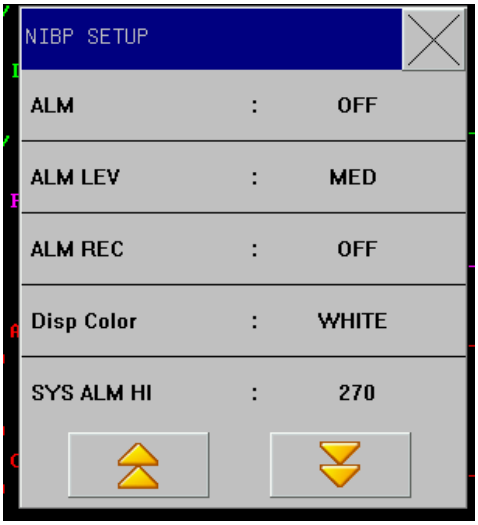


Figure 13-2 NIBP Setup

- Alarm switch: Where “ON” is selected, the alarm prompt and saving will proceed when the pressure is alarmed; where “OFF” is selected, alarming will not happen, but  will be prompted beside NIBP in the screen parameter area.
- Alarming levels: Optional levels are “High”, “Middle” and “Low” , where “High” is the highest alarm.
- Alarm record: Users can select “On” to output through recorder when blood pressure

alarms happen

- Waveform Colour: green, cyan, red, yellow, white, blue, violet.
- NS, ND, NM upper/lower limits

Adult:

NS: upper limit: 42-270 mmHg lower limit: 40-268 mmHg
ND: upper limit:12-210 mmHg lower limit:10-208 mmHg
NM: upper limit:22-230 mmHg lower limit:20-228 mmHg

Pediatric:

NS: upper limit: 42-200 mmHg lower limit: 40-198 mmHg
ND: upper limit:12-150 mmHg lower limit:10-148 mmHg
NM: upper limit:22-165 mmHg lower limit:20-163 mmHg

Neonate:

NS: upper limit: 42-135 mmHg lower limit: 40-133 mmHg
ND: upper limit:12-95mmHg lower limit:10-93 mmHg
NM: upper limit:22-110 mmHg lower limit:22-108 mmHg

13.4 NIBP setting in measurements

Users can rotate the knob and move the cursor onto the SPO_2 hotkey in the parameter area, then press the knob to enter the NIBP Setting menu.

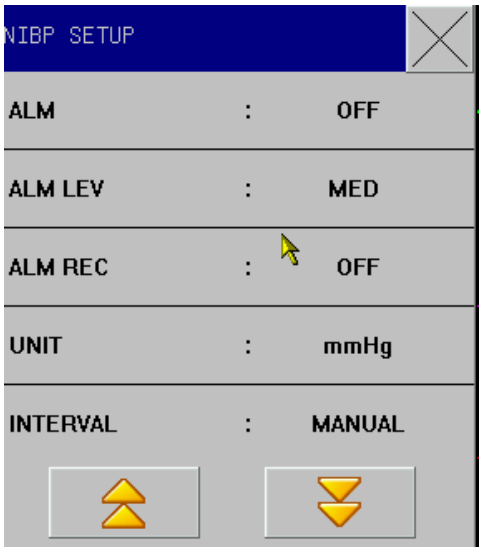


Figure 13-3 NIBP Setup

- Alarm switch: Where “ON” is selected, the alarm prompt and saving will proceed when the pressure is alarmed; where “OFF” is selected, alarming will not happen, but 

will be prompted beside NIBP in the screen parameter area.

- Alarming levels: Optional levels are “High”, “Middle” and “Low” , where “High” is the highest alarm.
- Alarm record: Users can select “On” to output through recorder when blood pressure alarms happen
- Unit: mmHg/kPa
- Time interval: Time interval (Unit: minute) for automatic measurement: 1, 2, 3, 4, 5, 10, 15, 30, 60, 90, 120, 180, 240, 480 minutes, Manual, and Continuous. After users select an interval, there will be a display of “Please press the ‘START/STOP’ button” in the NIBP reminder area, then users just press the button to start pumping for the first time of automatic measurement. To end the automatic measurement and return to the manual mode, users need only select “Manual” during the measurement interval.
- Waveform Colour: green, cyan, red, yellow, white, blue, violet.

Calibration

The manufacturer recommends to use pressure meter or mercurial sphygmomanometer with calibrated precision higher than 1mmHg for calibration. Users can select the Calibration item to start calibration, while this item turns to be “Stop calibration”; if at such moment press the button, the system will stop calibration.

⚠**Warning**⚠

Calibration for NIBP measurement should be done every two years (or conducted following the maintenance plan of your hospital). Please follow the following details to check its performance.

13.5 NIBP alarm information

Provided that the alarming record function under relevant menu is turned on, those physical alarms activated because parameters exceed alarming limits may activate the recorder to automatically output alarming parameter values and the relevant measurement waveforms. The following table lists various possible alarms during NIBP measurement process.

13.6 Maintenance & Cleaning

⚠**Warning**⚠

Don’t compress the rubber pipe on a cuff.
Keep water or cleaning liquids out of the connector socket in the front of the monitor, otherwise the equipment may be damaged.

During monitor cleaning, users need only sweep the outer surface of the connector socket instead of its inner surface.

In case a recyclable cuff is disconnected with the monitor or being cleaned, users should locate the cover cap above the rubber pipe so as to prevent any liquids from entering the rubber pipe and being absorbed into the module.

One-time blood pressure cuff

Cuffs for one-time use can only be used for one patient. Don’t use the same cuff with different patients. Don’t take one-time cuffs for disinfection or high-pressure vapor sterilization. However, users can use soap to clean one-time cuffs for infection control purpose.

′Attention′

To protect the environment, one-time blood cuffs after use must be recycled or properly treated.

Chapter14 TEMP Monitoring

14.1 TEMP Monitoring

The monitor has two TEMP measuring channels. The temperature data can be measured with the TEMP detector. Teperature is not a standard configuration for the neonatal monitor.

TEMP measurement setting

For one-time TEMP detectors, users must insert the TEMP cables into slots and then connect the detectors with such cables; for reusable TEMP detectors, users can directly insert them into slots.

Closely paste TEMP detectors with patient body.

Turn on the system power supply.

⚠Warning⚠

Before monitoring users should check status of detector cables by plugging out the TEMP detector cable from the hole, then the screen will display the error information "T sensor disconnected" and make voice alarming.

′Attention′
A one-time TEM detector can only be used once.

⚠Warning⚠

Be careful to use or store TEMP detector and cables; spare detectors and cables should be wrapped into loose rolls. Tough wires inside the detector and cables, if any, may cause mechanical injury.

⚠Warning⚠

Calibration of a TEMP detector must be done for every two years or comply with your hospital's specified schedule. When requiring calibration, please contact the manufacturer.

′Attention′
During monitoring process a TEMP detector will self-detect once per hour; such self-detection last for 2 seconds and will not affect normal work of the TESP monitor.

14.2 TEMP setting in parameter area

Users can use the knob to move the cursor onto the TEMP hotkey in the parameter area and press the knob to enter the TEMP Setting menu.

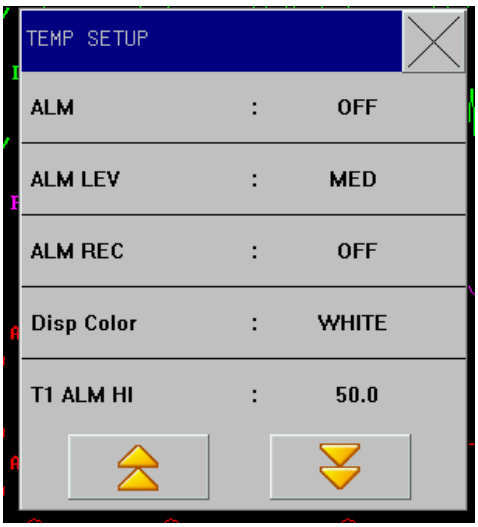


Figure14-1 TEMP setting

- Alarm Switch: Select “ON” and the alarm prompt and saving will proceed when TEMP is alarmed; select “OFF” and no alarm will happen, but  will be prompted beside TEMP in the screen parameter area.
- Alarming levels: High, Middle or Low to be selected by users to set alarming levels.
- Alarm Record: it is mainly used in starting/closing the output function of TEMP alarm record. If “On” is selected, the present TEMP alarm will be outputted through the recorder.
- Disp Color: green, cyan, red, yellow, white, blue, violet.
- T1\T2\TD ALM HI/LO
- TEMP unit: ℃or ℉

14.3 TEMP setting in measurements

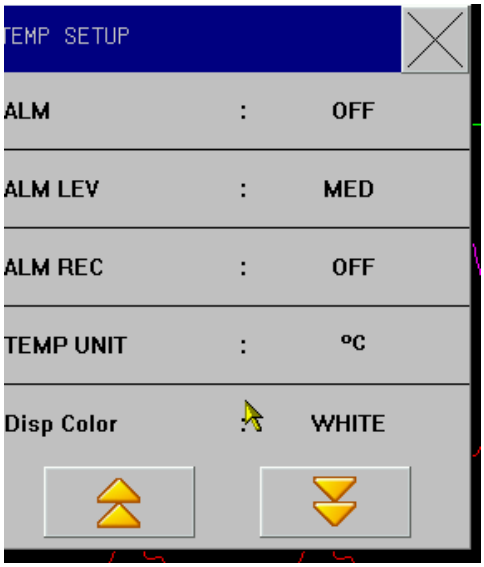


Figure14-2 TEMP setting

■ TEMP unit: ℃or ℉

■ Default Setting: Please refer to the “ECG Default Setting” in the “ECG/TEMP Monitoring”.

14.4 Alarm information and prompt information

In case the alarm record function under relevant menus is enabled, those physical alarms caused because relevant parameters exceed relevant alarming limits will activate the recorder to automatically output alarming parameter values and relevant measurement waveforms. The physical alarms, technical alarms and reminders possible happening during TEMP measurement are listed as follows:

14.5 Maintenance & Cleaning

⚠Warning⚠

Users must turn off the equipment and shut down the AC power supply before cleaning the monitor or the connected sensor.

This monitor is compatible with YSI400 series TEMP detectors, whose cleaning procedures are as

follows:

Reusable TEMP detectors:

Heating onto a TEMP detector can not be over 100^{o}C (212$^{\cdot}$F), as such detector can only undertake 80^{o}C (176$^{\cdot}$F) --100^{o}C (212$^{\cdot}$F) within short period.

Detectors can not be vapor disinfected.
Only cleaning agents with alcohol can be used for disinfection.
During use of straight detectors, users should cover them with protective adhesive.

When cleaning detectors, users should use one hand to hold on one end and the other hand to downward hold wet lint-free cloth to wash detectors towards the connector direction.

′Attention′
If you are using a one-time TEMP detector, this detector is allowed to be re-disinfected or reused.

′Attention′
To protect the environment, one-time TEMP detectors should be recycled or properly treated.

Chapter 15 CO2 Monitoring

15.1 General information

8000H Monitor adopts Sidestream and Mainstream CO2 measurement modes. The module measures CO2 pressure (PCO2) to get end-tidal CO2 (EtCO2), inspiratory CO2 (InsCO2) and air way respiration rate (AWRR) and displays pressure waveform of CO2.

Warning

Avoid hit or vibration of carbon dioxide as far as possible.

Attention

Don't use the instrument in an environment with inflammables or anesthetic gas.

The instrument can only be operated by professionals having received career training and possessed a good knowledge of the Manual.

Select the "Module Setup" option in the "monitor setup" menu and set the CO2 on-off to be on. The following figure (the present figure is in demonstrating mode) will come out:

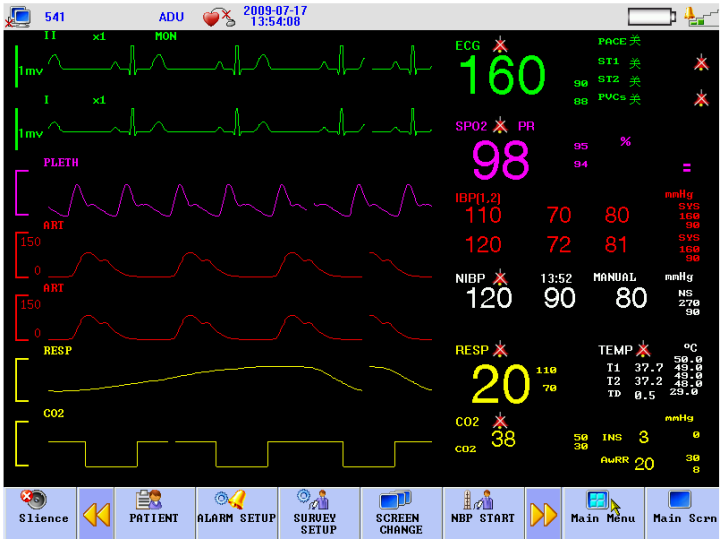


Figure 15-1 Main interface of CO2 module

15.2 Measuring principle and working procedure

The measurement is done based on the characteristic that CO2 can absorb infrared rays with a wavelength of 4.3um. The measurement procedure includes first delivering CO2 into the measurement chamber and then irradiating it with infrared rays at one side and, at the other side, using a sensor to determine the attenuation degree of received infrared rays. The attenuation degree is in positively proportional to CO2 concentration.

The conversion relation between CO2 partial pressure and CO2 concentration is:

CO2 partial pressure (mmHg) = CO2 concentration (%) * Pamp (atmosphere pressure)

CO2 module adopts automatic (Autorun) command measuring modes with a waveform sampling rate of once per 31msc.

15.3 CO2 Settings

Figure 15-2 CO2 Setup

- CO2 switch: On; Off.
- Alarm switch: Select “On”, and alarm prompt will be provided in case of CO2 alarms; select “Off”, and no alarm will be given.
- Alarm level: Three options, “High”, “Middle” and “Low”, are provided. “High” means the most serious alarms.
- Gain: ×0 .25, ×0.5, ×1, ×2, ×4 and Auto
- CO2 alarms are done according to set upper and lower limits. When CO2 is higher than the upper limit or lower than the lower limit, alarms will be sent out.
- Pressure unit: mmHg, kpa or %.
- Oxygen compensation: 5~100
- Atmospheric pressure: 400~850 mmHg (may be adjusted according to local geographic positions)
- Zero calibration: Zero calibration should be done before monitoring CO2. Select “Autozero” and then “Wait for 30 seconds” will appear on the interface; after 30 seconds, the system will automatically cancel “Wait for 30 seconds”. Then CO2 monitoring data will be more precise.

′ Attention ′

To guarantee higher precision of CO2 data, “Zero calibration” should be done each time after the module is plugged into the monitor.

′ Attention ′

If CO2 is not monitored, the CO2 module should be turned to Off state so as to prolong the service life thereof.

CO2 Operation Instructions

After the user fits CO2, There will be a CO2 sensor on the side panel of the monitor, the connection is shown in to figure below:

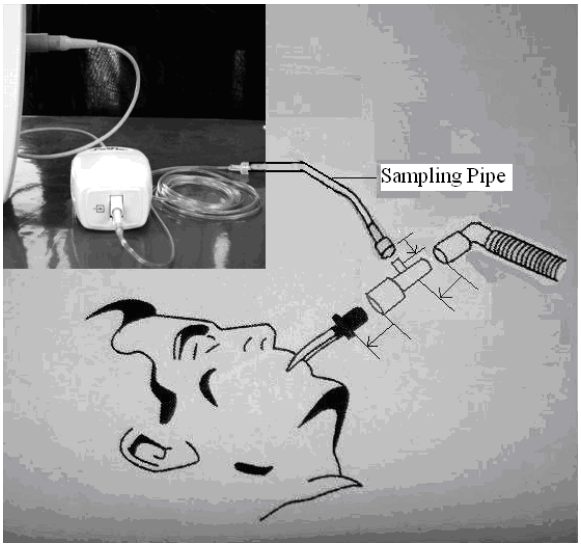


Figure 15-3 CO2 Setup

⚠Warning⚠

Turn off the CO2 when it is not in use, or the CO2 module will keep working and have a shorter service life.

⚠Warning⚠

If you find too much humidity or too many secretions in the airway, or the CO2 waveform has an unexpected change when the patient is in steady condition, please replace the airway adapter.

⚠Warning⚠

Only use the disinfected or one-off airway adapter, in order to avoid any infection.

⚠Warning⚠

Check the airway adapter before use and reject it in case of any external damage or breakage.

15.4 CO2 Settings in Parameter Area

Rotate the rotary shuttle button to move the cursor on the display interface to the CO2 hotkey in the parameter area, and then press the rotary shuttle button to enter the menu “CO2 Settings”.

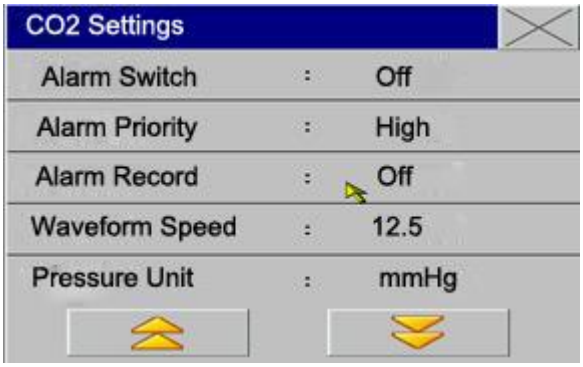


Fig. 15-4 CO2 Settings

- Alarm Switch: select “On" to enable CO2 alarms, or select “Off" to disable CO2 alarms with the icon “  ” appearing beside “CO2” in the parameter area on the screen.
- Alarm Priority: High, Medium, or Low; “High” is most serious.
- Alarm Record: select “On” to enable the recorder output when there is any CO2 alarm.
- Alarm Speed: 12.5mm/s~25.0mm/s.
- Pressure Unit: mmHg/kpa.
- CO2 Switch: On or Off; select "On" to monitor the CO2.
- Oxygen Compensation: 5~100.
- Balance Gas: Indoor Air, Laughing Gas, or Helium.
- Altitude: 120~4920 mmHg (adjustable based on the geographical location).
- Atmospheric Pressure: 400~850 mmHg (adjustable based on the geographical location: either Altitude or Atmospheric Pressure, not both).
- Upper Limit of CO2 Alarm: adjust the upper limit of CO2 alarm; if the measured CO2 value exceeds the upper limit, there will be an alarm and prompting.
- Lower Limit of CO2 Alarm: adjust the lower limit of CO2 alarm; if the measured CO2 value exceeds the lower limit, there will be an alarm and prompting.
- Upper Limit of INS Alarm: adjust the upper limit of INS alarm; if the measured INS value exceeds the upper limit, there will be an alarm and prompting.
- Upper Limit of AWRR Alarm: adjust the upper limit of AWRR alarm; if the measured AWRR value exceeds the upper limit, there will be an alarm and prompting.
- Lower Limit of AWRR Alarm: adjust the lower limit of AWRR alarm; if the measured AWRR value exceeds the lower limit, there will be an alarm and prompting.
- Zero: zero before monitoring the CO2, in order to obtain a more accurate measured value.
- CO2 Default Settings: override the original settings.

15.5 CO2 Settings in Waveform Area

Rotate the shuttle button to move the cursor on the display interface to the CO2 hotkey in the waveform area, and then press the shuttle button to enter the menu “CO2 Settings” as below:

Fig. 15-5 CO2 Settings

- Waveform Speed: 12.5mm/s~25.0mm/s.
- Waveform Color: Green, Cyan, Red, Yellow, White, Blue, or Purple.
- Waveform Pattern: Line or Fill.

15.6 CO_2 Settings in Measurement Setup

Select “CO2 Settings” in the menu “Measurement Setup" or rotate the shuttle button to move the cursor to CO2 hotkey in the parameter area on the main screen, and then press the shuttle button to enter the menu “CO2 Settings” as below:

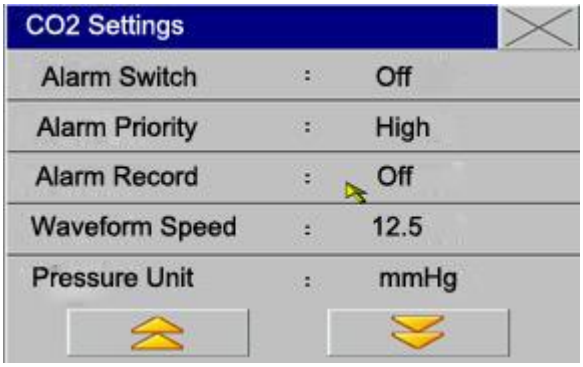


Fig. 15-6 CO2 Settings

Note: Refer to the section “CO2 Settings in Parameter Area” for the specific options of the menu “CO2 Settings” in “Measurement Setup”.

⚠Warning⚠

This monitor does not provide auto atmospheric pressure compensation. Please set a correct altitude before the first use of the CO2 for measuring. Any wrong altitude could result in an inaccurate CO2 reading: a reading error of 5% for each altitude deviation of 1000m.

Chapter 16 IBP Monitoring

16.1 General information

This chapter mainly introduces invasive blood pressure (IBP) monitoring methods and contents relevant to maintenance and cleaning of accessories.

STAR8000H portable-type multi-parameter monitor can be directly used for measuring vascular pressures (diastolic pressure, systolic pressure and mean blood pressure). The following waveforms can be displayed:

Waveform Name	Definition
ART	arterial pressure
PA	pulmonary arterial pressure
CVP	central venous pressure
RAP	right atrial pressure
LAP	left atrial pressure
ICP	intracranial pressure

Remark: IBP monitoring part is an optional component.

16.2 Considerations of IBP monitoring

⚠Warning⚠

The chosen accessory, if applied, should confirm to safety requirements of medical equipment.

⚠Warning⚠

In connection and application, accessories should be avoided from contacting metal parts connected with electric apparatus.

⚠Warning⚠

Users, when connecting the monitor with a high-frequency surgical instrument, should avoid the sensor and cable of the monitor from contacting the high-frequency surgical instrument so as to prevent patients from being burnt in case of electricity leakage.

⚠Warning⚠

The disposable pressure sensor should not be reused.

′ Attention ′

Only the pressure sensor specified in the Manual can be used.

The specified sensor has shock-proof function (with resistance to leakage current) and can prevent influence of cardiac defivrillators. It can be used in surgeries. When the patient is in the defibrillation period, the pressure wave may exhibit temporary disorders; but after defibrillation, the monitor will work normally and the operation mode and user configuration of it won't be affected.

⚠Warning⚠

Before monitoring, the sensor should be examined for normality assurance. If the sensor is pulled out of the jack, an error-warning message, "IBP sensor detached", will appear on the screen and alarm sounds will be sent out.

′ Attention ′

Sensors, new or used, should be regularly calibrated according to hospital practice.

⚠Warning⚠

If liquid (not solution applied to the pressure pipe and the sensor) is splashed on the instrument or accessories, especially when the liquid may enter the sensor or the monitor, place contact with the maintenance department of your hospital.

16.3 Monitoring procedure

Measurement preparation:

1 Insert cables into corresponding sockets and check to ensure the monitor has been plugged in.

2 Have the pressure pipe and the sensor prepared. Fill the system full with physiological saline solution to make sure no bubble exists therein.

3 Connect the patient catheter to the pressure pipe and make sure that there is no air in the catheter and the pressure pipe or the sensor.

⚠Warning⚠

If bubbles are found in the pressure pipe or the sensor, flush the system with the perfusion liquid.

4 Position the sensor on the same level as the heart, approximately on the midaxiallary line

5 Confirm correct ruler names have been chosen. See the following section for details.

6 Do zero-adjustment of the sensor. See the following section for details.

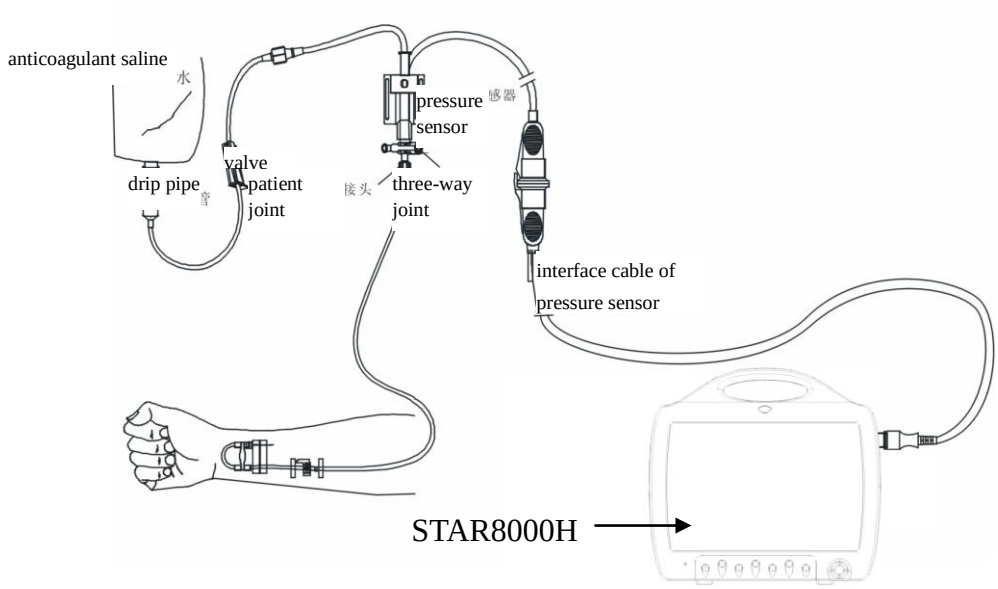


Figure 16-1 IBP Monitoring

16.4 IBP Menu

Select the “Module Setup” option in the “monitor setup” menu and set the CO2 on-off to be on. The following figure (the present figure is in demonstrating mode) will come out:

Rotate the knob and move the cursor to the IBP hotkey in the parameter area of the screen.

Press the knob to enter the “IBP selection” menu.

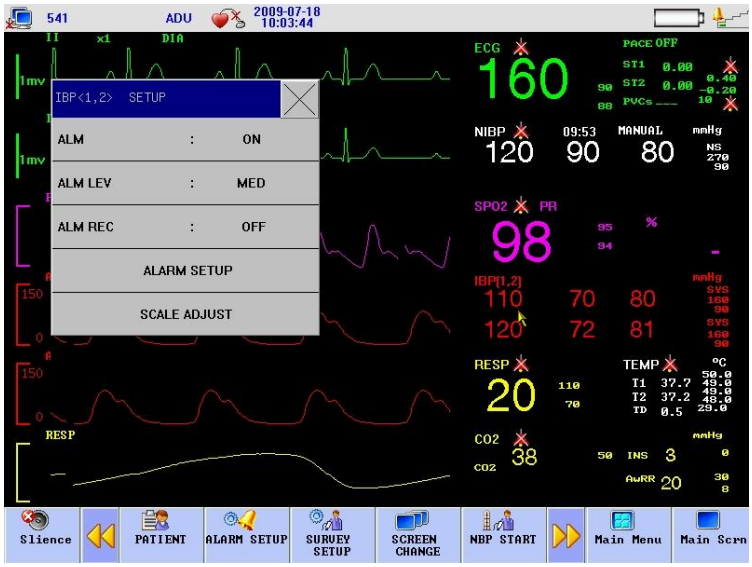


Figure 16-2 IBP Parameter Setting Menu

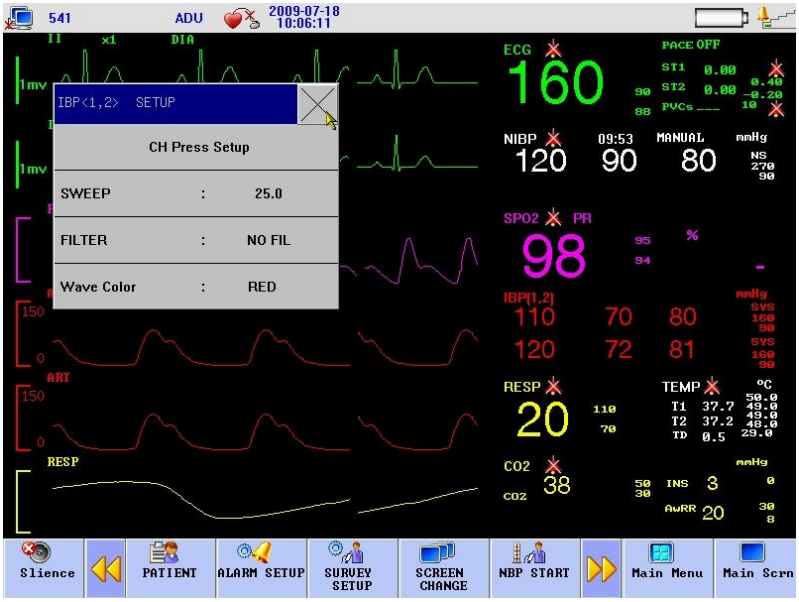


Figure 16-3 IBP Parameter Setting Menu

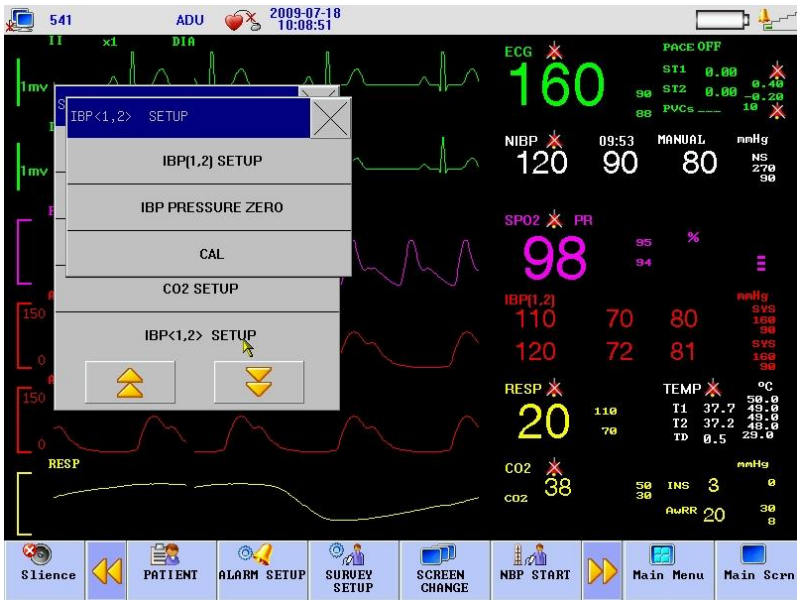


Figure 16-4 IBP Parameter Setting Menu

Settings can be done on the following items:

Alarming switch: Where “ON” is selected, the alarm prompt and saving will proceed when the IBP (invasive blood pressure) is alarmed; where “OFF” is selected, alarming will not happen, but will be prompted beside IBP in the screen parameter area.

Alarming levels: Optional levels are “High”, “Middle” and “Low”.

Channel 1 pressure name: Six options including ART, PA, CVP, RAP, LAP and ICP are provided. In the IBP measurement range, the waveform position in the screen is adjusted by users through the “Upper Scale Limit” or the “Lower Scale Limit” item.

Channel 1: Upper SP alarm limit: used for setting the upper alarm limit;

Lower SP alarm limit: used for setting the lower alarm limit.

Upper MP alarm limit: used for setting the upper alarm limit;

Lower MP alarm limit: used for setting the lower alarm limit.

Upper DP alarm limit: used for setting the upper alarm limit;

Lower DP alarm limit: used for setting the lower alarm limit.

Channel 2 pressure name: Six options including ART, PA, CVP, RAP, LAP and ICP are provided. In the IBP measurement range, the waveform position in the screen is adjusted by users through the "Upper Scale Limit" or the "Lower Scale Limit" item.

Channel 2: Upper SP alarm limit: used for setting the upper alarm limit;

Lower SP alarm limit: used for setting the lower alarm limit.

Upper MP alarm limit: used for setting the upper alarm limit;

Lower MP alarm limit: used for setting the lower alarm limit.

Upper DP alarm limit: used for setting the upper alarm limit;

Lower DP alarm limit: used for setting the lower alarm limit.

Pressure unit: Two options, mmHg and kPa, are available.

Zero calibration: Perform IBP zero calibration and prompt "IBP Zero Calibration" at the left upper corner of the screen.

Exit: Select this item to return to the main screen.

⚠Warning⚠

When setting alarm limits, users should confirm the item to be set.

′ Attention ′

Users should guarantee that zero calibration has been done on the sensor before the measurement; otherwise the instrument has no effective zero value, which may lead to inaccuracy of measured data.

Once the measured data exceed the alarm limits, the alarm will be triggered.

IBP alarm limits:

Pressure Scale Name	Max Upper Limit (mmHg)	Min Lower Limit (mmHg)	Adjustable Single-Step Length （mmHg）
ART	300	0	1
PA	120	-6	1
CVP	40	-10	1
RAP	40	-10	1
LAP	40	-10	1
ICP	40	-10	1

Zero calibration of sensor:

Press the "IBP zero calibration" key with the rotary knob and the system will begin zero calibration.

Zero calibration consideration:

Before zero calibration, close the three-way stop cock at the patient side.

Before zero calibration, the sensor should communicate with the atmosphere.

The sensor must be positioned at the same level with the heart, approximately on the midaxillary line.

Zero calibration should be done before monitoring start and at lease once per day (zero

calibration must be done each time after the cable is plugged or pulled.)

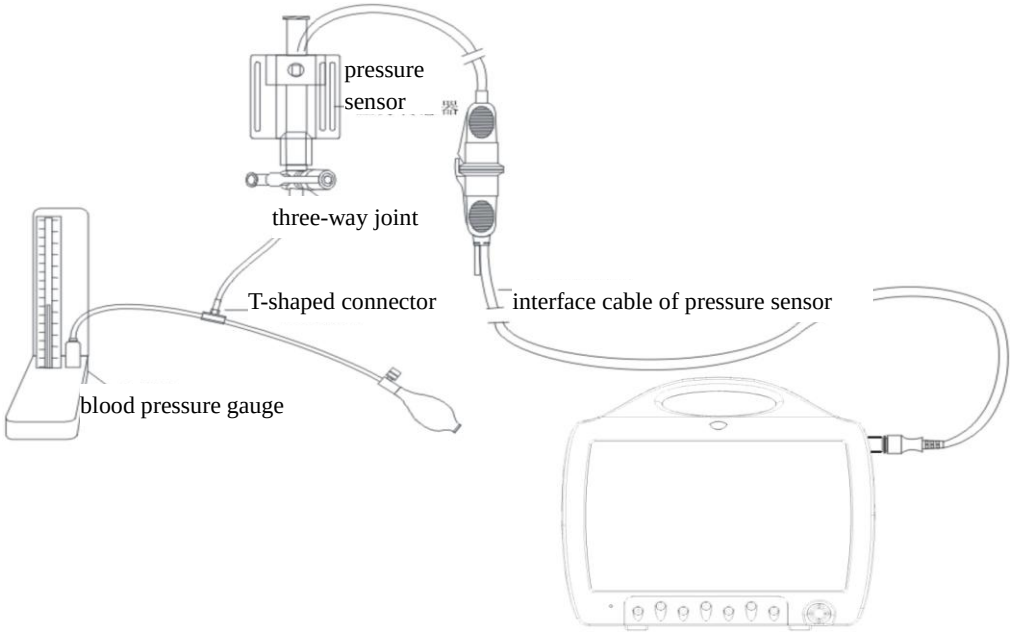


Figure 16-5 Connection layout of IBP pressure calibration

Calibration of the mercury manometer should be done when a new sensor is being started to use or at the specified cycle in the hospital practice.

The purpose of calibration is to ensure the system to provide accurate measured results.

Before calibration of the mercury manometer, pressure zero calibration should be done.

If the procedure is to be carried out by yourself, you should have the following devices.

- standard blood pressure gauge
- three-way stop cock
- pipeline with a length of about 25cm

Mercury manometer calibration procedures:

⚠Warning⚠

The following operation should never be done when a patient is being monitored.

1. Close the three-way stop cock which is opened to the atmosphere for zero calibration.
2. Connect the pipeline with the blood pressure gauge.
3. Confirm that connection to the patient has been off.
4. Connect a three-way stop cock with the three-way joint that hasn't been connected to the patient catheter (when the patient is being monitored). Connect a syringe to one end of the three-way stop cock and connect the blood pressure gauge and the pipeline with the other end.
5. Open the end open to the blood pressure gauge.
6. Select the channel to be calibrated in the pressure calibration menu and adjust the

pressure values of the channel to be calibrated.

7. Charge gas to raise the scale of the mercury column to the set pressure value in the menu.
8. Repeatedly adjust until values in the menu equal to pressure values in the blood pressure gauge.
9. Press once the calibration button in the calibration menu to command the instrument to begin calibration.
10. Wait until the calibration ends. Make corresponding countermeasures to be taken according to prompt information.
11. Detach the pipeline of the blood pressure gauge and the added three-way stop cock after completion of the calibration.

The IBP waveform area provides scales for waveforms. Two dash line of each IBP waveform, from the upper to the lower, respectively represents the upper-limit scale and the lower-limit scale of the waveform. Values of the two scales may be set. The detailed setting method is introduced in the current menu.

- IBP pressure scale name: ART, RA, CVP, RAP, LAP and ICP are available for selection in the hotkey area of the IBP menu;
- Upper scale: The pressure value represented by the upper scale limit. The choice range is the measurement range of the current pressure.

′ Attention ′

The upper scale limit value should not be lower than the lower limit value.

- Lower scale: The pressure value represented by the lower scale limit. The choice range is the measurement range of the current pressure.

′ Attention ′

The lower scale limit value should not be higher than the upper limit value.

′ Attention ′

The lower pressure limit, the upper pressure limit, the reference scale and the waveform are displayed simultaneously on the screen so that users can observe waveform changes after the scales are adjusted.

16.5 Alarm information and prompt information

Alarm information

When alarm record switches in related menus are turned on, physiological alarms given when parameters exceeds alarm limits will trigger the recorder to automatically output alarmed parameters and related measured waveforms.

Possible physiological alarms, technical alarms and prompt messages in IBP module measurement are listed in the following tables:

Physiological alarms：

PROMPT MESSAGE	CAUSE	ALARM LEVEL
IS too high	Measured SP value is higher than the set upper alarm limit.	User Optional

IS too low	Measured SP value is lower than the set lower alarm limit.	User Optional
ID too high	Measured DP value is higher than the set upper alarm limit.	User Optional
ID too low	Measured DP value is lower than the set lower alarm limit.	User Optional
IM too high	Measured MP value is higher than the set upper alarm limit.	User Optional
IM too low	Measured MP value is lower than the set lower alarm limit.	User Optional

Technical alarms:

PROMPT MESSAGE	CAUSE	ALARM LEVEL	SOLUTION
IBP lead detached	IBP cable is detached from the monitor	Low	Make sure the cable is connected reliably.
IBP module initialization wrong	IBP measurement module has faults	High	Suspend the IBP measurement function and inform biomedical engineers or COMEN maintenance workers.

Chapter 17 Measurement of Anesthetic Gases

17.1 Overview

Anesthetic gas (AG) is used to measure the anesthetic gases and breathing gases for the patients under anesthesia. This module provides the end-tidal value (et) and inhalation value (in) of the following gases:

- CO2 —— measure EtCO2 (maximum exhalation value – measured in respiration).
- N2O —— laughing gas.
- O2 —— optional.
- AwRR —— respiration per minute (rpm)

The system can display four waveforms for an anesthetic gas at a time, including CO2 waveform, O2 waveform, N2O waveform, and anesthetic agent gas waveform. By default, the CO2 waveform is displayed.

The system can display such parameters as CO2, N2O, O2, and AA (the anesthetic agent being monitored: DES, ISO, ENF, SEV, or HAL), including both the inhalation and exhalation value, and also display the MAC (minimum alveolar concentration), BAL (balance gas), and AwRR.

Names of Parameters:

CO2: carbon dioxide.

N2O: nitrous oxide (laughing gas).

O2: oxygen.

AwRR: airway respiration rate (respiration per minute: rpm).

Halothame: HAL.

Isoflurane: ISO.

Enflurane: ENF.

Sevoflurane: SEV.

Desflurane: DES.

Caution

Only the waveform and value of a single anesthetic agent are displayed at a time.

17.2 Measurement Principle and Work Process

Measurement Principle for Anesthetic Gases:

Measure the AG concentration based on the AG ability of absorbing infrared rays. All gases to be measured by the AG module should be able to absorb infrared rays, and each gas has its own absorption characteristics. The gas is transmitted to a sampling room and passed through by the

infrared rays of a specific frequency band selected by an infrared ray filter. When you measure more than one gas, there will be more than one infrared ray filter. The higher the gas concentration within the given volume is, the more infrared rays will be absorbed and the smaller transmission amount of infrared rays will pass through the gas. You can work out the gas concentration by measuring the transmission amount of infrared rays.

Measurement Principle for Oxygen:

Since oxygen can not absorb infrared rays, you can measure the oxygen concentration based on its paramagnetic characteristics. Inside the sensor of oxygen module, there are two crystal balls filled with nitrogen hung in symmetrical magnetic fields with the help of a torsion device. In case of different oxygen concentrations, the crystal balls will have different deviations under the action of magnetic fields and there will be different moments acting on the torsion device. You can work out the oxygen concentration by measuring the moment.

17.3 AG Display

Select “Module Switch” from “Monitor Setup” in the main menu to set the AG module as “On", and then return to the main menu to select “AG Interface” from “Work Interface”. See the figure below:

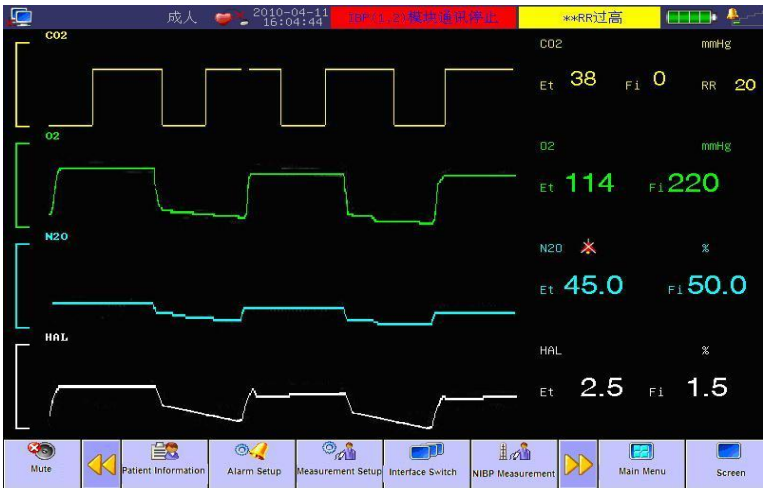


Fig. 17-1 AG Display Interface

The AG module can display all the measured waveforms and parameters on the screen of the monitor, including:

- CO2, O2, N2O, and AA waveform;
- AWRR: airway respiration rate;
- MAC: minimum alveolar concentration;
- CO2, O2, N2O, and AA end-tidal (Et) value and inhalation (Fi) value.

“AA” stands for one of such five anesthetic gases as Des, Iso, Enf, Sev, or Hal.

17.4 MAC Value

As a basic index reflecting the depth of inhalation anesthesia, MAC (minimum alveolar concentration)

is defined by the standard ISO21647 as the alveolar concentration of an inhalational anesthetic agent in balanced state in the absence of any other anesthetic agent, which can prevent the body movements of 50% patients under a standard surgical stimulation.

Below are the 1MAC values for inhalational anesthetic agents:

Anesthetic Agent	DES	ISO	ENF	SEV	HAL	N2O
1MAC	7.3%*	1.15%	1.7%	2.1%	0.77%	105%**

*: This figure comes from a 25-year-old patient.

**: This 1MAC value for N2O is only obtained in a high-pressure chamber.

Caution

The above data of a 40-year-old healthy male patient comes from ISO21647 and is published by FDA.

In practice, such factors as age and weight may influence the effect of inhalational anesthetic agent.

Below is the formula to calculate the MAC value in the presence of one or more anesthetic agents:

$$MAC = \sum_{i=0}^{N-1} \frac{EtAgent_i}{AgentVol_i}$$

"N" stands for the number of all anesthetic agents (including N2O) detected by the AG module; "EtAgenti" stands for the end-tidal concentration of each inhalational anesthetic agent; and "AgentVoli" stands for the 1MAC value of each inhalational anesthetic agent.

For example, if the AG module finds that the end-tidal gas for the patient contains 4% DES, 0.5% HAL and 50% N2O, the MAC value will be:

$$MAC = \frac{4.0\%}{7.3\%} + \frac{0.5\%}{0.77\%} + \frac{50\%}{105\%} = 1.67$$

Caution

The above formula is applicable to adults.

17.5 Preparations for Measurement

1. Select a water tank appropriate for the patient type and install it onto the holder.
2. Connect one end of the gas sampling tube to the water tank.
3. Use the airway adapter to connect the other end of the gas sampling tube to the patient.
4. Connect a waste gas exhaust tube to the exhaust port on the AG module so as to discharge the sample gas into the waste gas treatment system.

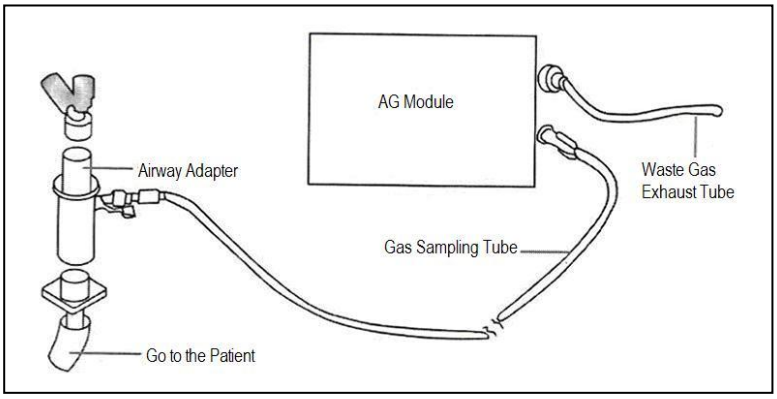


Fig. 17-2 Connection Diagram for Preparations

5. Select "Measurement Setup" from the main menu or menu bar to enter "AG CO2" and "AG N2O", and set the operation mode as "Measure" to enable AG.

Caution

The end of the airway adapter connected to gas sampling tube should face up, in order to prevent condensed water drops entering and blocking the gas sampling tube.

The water tank is used to collect the condensed water drops from the sampling airway and prevent them entering the module. Please pour the water in the water tank when it reaches a certain amount, or the airway could be blocked.

The water tank contains filtering materials to prevent the bacteria, moisture or patient's secretions entering the module. After a long-time use, the dusts or other external objects will reduce the air permeability of the filtering materials, which could block the airway if serious. In this case, please replace the water tank. It is better to replace the water tank every other month.

Warning

The water tank for adults is not applicable to any newborn patient, or it could hurt the patient.

Make sure all connections are secure and reliable. Any leakage could cause reading errors since the breathing gas for the patient is mixed with the ambient air.

17.6 AG Setup

17.6.1 AG CO2 Settings

1. AG CO2 Settings in Parameter Area

In the AG interface, rotate the shuttle button to move the cursor on the display interface to the CO2 hotkey in the parameter area, and then press the shuttle button to enter the menu "CO2 Settings".

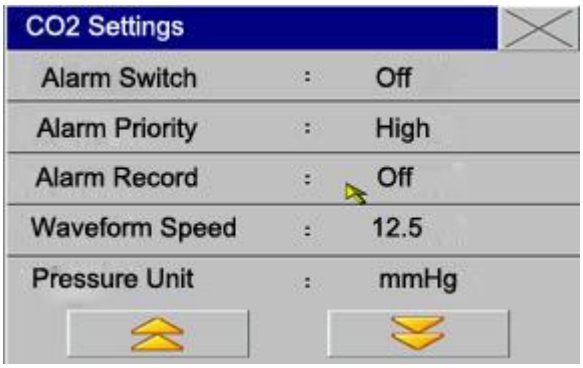


Fig. 17-3 CO2 Settings

- Alarm Switch: select “On" to enable CO2 alarms, or select “Off" to disable CO2 alarms with the icon “” appearing beside “CO2” in the parameter area on the screen.
- Alarm Priority: High, Medium, or Low; “High” is most serious.
- Alarm Record: select “On” to enable the recorder output when there is any AG CO2 alarm.
- Pressure Unit: mmHg, kpa, or %.
- Upper Limit of ET Alarm: adjust the upper limit of ET alarm; if the measured ET value exceeds the upper limit, there will be an alarm and prompting.
- Lower Limit of ET Alarm: adjust the lower limit of ET alarm; if the measured ET value exceeds the lower limit, there will be an alarm and prompting.
- Upper Limit of FI Alarm: adjust the upper limit of FI alarm; if the measured FI value exceeds the upper limit, there will be an alarm and prompting.
- Lower Limit of FI Alarm: adjust the lower limit of FI alarm; if the measured FI value exceeds the lower limit, there will be an alarm and prompting.
- Upper Limit of RR Alarm: adjust the upper limit of RR alarm; if the measured RR value exceeds the upper limit, there will be an alarm and prompting.
- Lower Limit of RR Alarm: adjust the lower limit of RR alarm; if the measured RR value exceeds the lower limit, there will be an alarm and prompting.
- Exhaust Speed: Low, Medium, or High.
- Oxygen Compensation: On or Off.
- Operation Mode: Measure or Standby.
- Default Settings: select “Yes” to enable the default settings to override the original settings.

2. AG CO2 Settings in Waveform Area

In the AG interface, rotate the shuttle button to move the cursor on the display interface to the CO2 hotkey in the waveform area, and then press the shuttle button to enter the menu “AG CO2” as below:

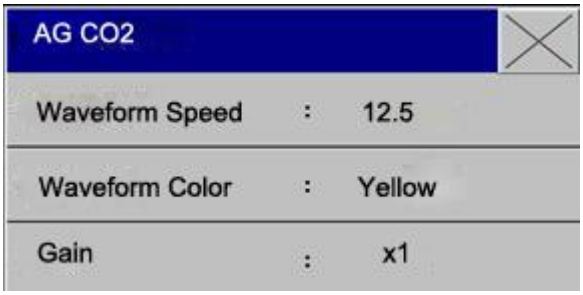


Fig. 17-4 AG CO2 Settings

- Waveform Speed: 12.5mm/s or 25.0mm/s.
- Waveform Color: Green, Cyan, Red, Yellow, White, Blue, or Purple.
- Gain: ×1, ×2, or ×4, to adjust the wave amplitude of the CO2 waveform.

3. AG CO2 Settings in Measurement Setup

In the AG interface, rotate the shuttle button to move the cursor on the display interface to “Measurement Setup" in the menu bar or enter “Measurement Setup" in the main menu to select “AG Setup” and “AG CO2”, and then press the shuttle button to enter the menu “AG CO2”. Refer to the section “AG CO2 Settings in Parameter Area” for the specific options of the menu “AG CO2” in “Measurement Setup”.

17.6.2 AG O2 Settings

1. O2 Settings in Parameter Area

In the AG interface, rotate the shuttle button to move the cursor on the display interface to the O2 hotkey in the parameter area, and then press the shuttle button to enter the menu “O2 Settings”.

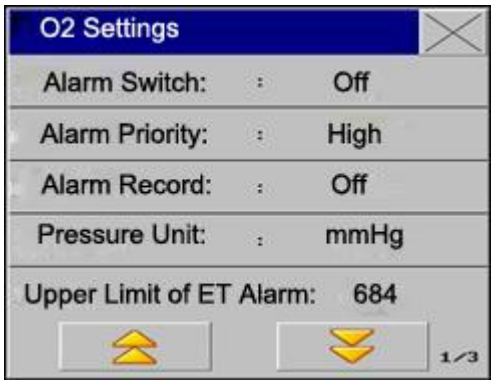


Fig. 17-5 O2 Settings

- Alarm Switch: select “On" to enable O2 alarms, or select “Off" to disable O2 alarms with the icon “  ” appearing beside “O2” in the parameter area on the screen.
- Alarm Priority: High, Medium, or Low; “High” is most serious.
- Alarm Record: select “On” to enable the recorder output when there is any O2 alarm.

- Pressure Unit: mmHg, kpa, or %.
- Upper Limit of ET Alarm: adjust the upper limit of ET alarm; if the measured ET value exceeds the upper limit, there will be an alarm and prompting.
- Lower Limit of ET Alarm: adjust the lower limit of ET alarm; if the measured ET value exceeds the lower limit, there will be an alarm and prompting.
- Upper Limit of FI Alarm: adjust the upper limit of FI alarm; if the measured FI value exceeds the upper limit, there will be an alarm and prompting.
- Lower Limit of FI Alarm: adjust the lower limit of FI alarm; if the measured FI value exceeds the lower limit, there will be an alarm and prompting.
- Exhaust Speed: Low, Medium, or High.
- Oxygen Compensation: On or Off.
- Operation Mode: Measure or Standby.
- AG Default Settings: select “Yes” to enable the default settings to override the original settings.

2. O2 Settings in Waveform Area

In the AG interface, rotate the shuttle button to move the cursor on the display interface to the O2 hotkey in the waveform area, and then press the shuttle button to enter the menu “AG O2” as below:

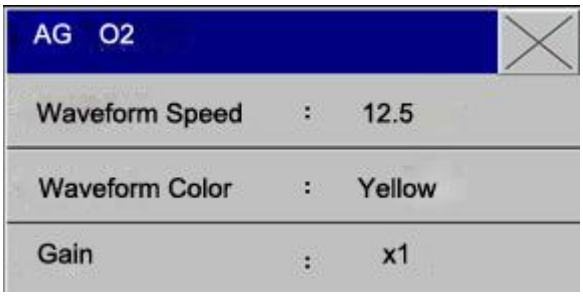


Fig. 17-6 AG O_2 Settings

- Waveform Speed: 12.5mm/s or 25.0mm/s.
- Waveform Color: Green, Cyan, Red, Yellow, White, Blue, or Purple.
- Gain: ×1, ×2, or ×4, to adjust the wave amplitude of the O2 waveform.

3. O2 Settings in Measurement Setup

In the AG interface, rotate the shuttle button to move the cursor on the display interface to “Measurement Setup" in the menu bar or enter “Measurement Setup" in the main menu to select “AG Setup” and “AG O2”, and then press the shuttle button to enter the menu “AG O2”. Refer to the section “O2 Settings in Parameter Area” for the specific options of the menu “AG O2” in “Measurement Setup”.

17.6.3 AG N2O Settings

1. N2O Settings in Parameter Area

In the AG interface, rotate the shuttle button to move the cursor on the display interface to the N2O hotkey in the parameter area, and then press the shuttle button to enter the menu “Laughing Gas Settings”.

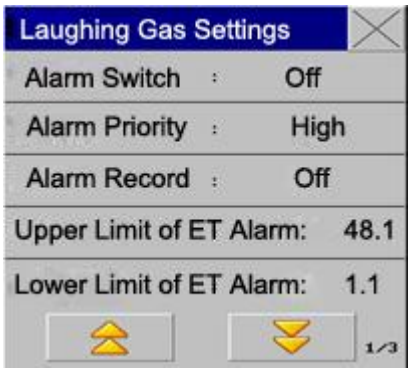


Fig. 17-7 Laughing Gas Settings

- Alarm Switch: select “On" to enable N2O alarms, or select “Off" to disable N2O alarms with the icon “  ” appearing beside “N2O” in the parameter area on the screen.
- Alarm Priority: High, Medium, or Low; “High” is most serious.
- Alarm Record: select “On” to enable the recorder output when there is any AG N2O alarm.
- Upper Limit of ET Alarm: adjust the upper limit of ET alarm; if the measured ET value exceeds the upper limit, there will be an alarm and prompting.
- Lower Limit of ET Alarm: adjust the lower limit of ET alarm; if the measured ET value exceeds the lower limit, there will be an alarm and prompting.
- Upper Limit of FI Alarm: adjust the upper limit of FI alarm; if the measured FI value exceeds the upper limit, there will be an alarm and prompting.
- Lower Limit of FI Alarm: adjust the lower limit of FI alarm; if the measured FI value exceeds the lower limit, there will be an alarm and prompting.
- Exhaust Speed: Low, Medium, or High.
- Oxygen Compensation: On or Off.
- Operation Mode: Measure or Standby.
- AG Default Settings: select “Yes” to enable the default settings to override the original settings.

2. N2O Settings in Waveform Area

In the AG interface, rotate the shuttle button to move the cursor on the display interface to the N2O hotkey in the waveform area, and then press the shuttle button to enter the menu “AG N2O” as below:

Fig. 17-8 AG N2O Settings

- Waveform Speed: 12.5mm/s or 25.0mm/s.
- Waveform Color: Green, Cyan, Red, Yellow, White, Blue, or Purple.
- Gain: ×1, ×2, or ×4, to adjust the wave amplitude of the N2O waveform.

3. N2O Settings in Measurement Setup

In the AG interface, rotate the shuttle button to move the cursor on the display interface to “Measurement Setup" in the menu bar or enter “Measurement Setup" in the main menu to select “AG Setup” and “AG N2O”, and then press the shuttle button to enter the menu “AG N2O”. Refer to the section “N2O Settings in Parameter Area” for the specific options of the menu “AG N2O” in “Measurement Setup”.

17.6.4 AG X Settings

1. AG X Settings in Parameter Area

In the AG interface, rotate the shuttle button to move the cursor on the display interface to the hotkey “AG X” in the parameter area, and then press the shuttle button to enter the menu “AG X”.

Fig. 17-9 AG Settings

- Anesthetic Agent: HAL, ENF, ISO, SEV, or DES; please set this option manually before feeding the anesthetic gas, since the AG module can not auto recognize the anesthetic gas.
- Alarm Switch: select “On" to enable AG alarms, or select “Off" to disable AG alarms with

the icon “  ” appearing beside “AG X” in the parameter area on the screen.

- Alarm Priority: High, Medium, or Low; “High” is most serious.
- Alarm Record: select “On” to enable the recorder output when there is any AG X alarm.
- Upper Limit of ET Alarm: adjust the upper limit of ET alarm; if the measured ET value exceeds the upper limit, there will be an alarm and prompting.
- Lower Limit of ET Alarm: adjust the lower limit of ET alarm; if the measured ET value exceeds the lower limit, there will be an alarm and prompting.
- Upper Limit of FI Alarm: adjust the upper limit of FI alarm; if the measured FI value exceeds the upper limit, there will be an alarm and prompting.
- Lower Limit of FI Alarm: adjust the lower limit of FI alarm; if the measured FI value exceeds the lower limit, there will be an alarm and prompting.
- Exhaust Speed: Low, Medium, or High.
- Oxygen Compensation: On or Off.
- Operation Mode: Measure or Standby.
- AG Default Settings: select “Yes” to enable the default settings to override the original settings.

2. AG X Settings in Waveform Area

In the AG interface, rotate the shuttle button to move the cursor on the display interface to the hotkey “AG X” in the waveform area, and then press the shuttle button to enter the menu “AG X” as below:

Fig. 17-10 AG X Settings

- Waveform Speed: 12.5mm/s or 25.0mm/s.
- Waveform Color: Green, Cyan, Red, Yellow, White, Blue, or Purple.
- Gain: ×1, ×2, or ×4, to adjust the wave amplitude of the AG X waveform.

3. AG X Settings in Measurement Setup

In the AG interface, rotate the shuttle button to move the cursor on the display interface to “Measurement Setup" in the menu bar or enter “Measurement Setup" in the main menu to select “AG Setup” and “AG X”, and then press the shuttle button to enter the menu “AG X”. Refer to the section “AG X Settings in Parameter Area” for the specific options of the menu “AG X” in “Measurement Setup”.

17.7 Exhaust Speed Settings

In the AG CO2 settings, O2 settings, N2O settings and HAL AG X settings, you can set the exhaust speed for patient gas sampling:

- High: 200ml/min for adults and children;
- Medium: 150 ml/min for adults and children;
- Low: 120 ml/min for adults and children.

17.8 Influential Factors for Measurement

The following factors could influence the accuracy of measurement:

- Leakage or internal sampling gas leakage;
- Mechanical shock;
- Circulating pressure exceeding 10KPa (100cmH2O);
- Other interference sources (if any).

17.9 Troubleshooting

If the AG airway is blocked, there will be a warning message “AG Airway Blocked” appearing on the screen which will not disappear until all the following blockages are cleared.

17.9.1 Entrance Blockage

If the entrance components (water tank, sampling tube, airway adapter) are blocked by condensed water, there will be a warning message “AG Airway Blocked” appearing on the screen.

To clear this blockage, you’d better:

- Check whether the airway adapter is blocked. If so, please replace the airway adapter.
- Check whether the sampling tube is blocked or twisted. If necessary, please replace the sampling tube.
- Check whether the water tank contains too much water or is blocked. If the water tank is still blocked when you pour the water, please replace it.

17.9.2 Internal Blockage

If the AG module is polluted internally by condensed water, there will be also a warning message “AG Airway Blocked” appearing on the screen.

To clear this blockage, you can:

- Follow normal steps to check the entrance or outlet components.
- If the warning message is still displayed, there is probably an internal blockage. Please contact our maintenance personnel.

17.10 Waste Gas Exhaust

⚠**Warning**⚠

Anesthetic agent: when you measure the anesthetic agent in use or measure a patient having just used an anesthetic agent, the vents on the module should be connected to the waste gas treatment system, anesthesia machine or ventilator, in order to avoid the medical personnel inhaling the anesthetic agent.

Connect a waste gas exhaust tube to the vents on the module to discharge the sample gas into the waste gas treatment system.

Chapter 18 Non-invasive Cardiac Output

18.1 Overview

The ICG measurement is an indirect measurement based on the thoracic impedance rheogram (Thoracic Electrical Bioimpedance: TEB): calculate the storke volume based on the change of thoracic impedance caused by cardiac ejection and then calculate the cardiac output and other hemodynamic parameters.

The ICG module injects high-frequency AC signals into the thoracic cavity of the patient to obtain the thoracic impedance rheogram based on the impedance change caused by the cyclic change of blood flow.

18.2 Safety Information

⚠Warning⚠

ICG monitoring is only applicable to adults with a height between 122~229cm and a weight between 30~159Kg (67~341 pounds).

ICG monitoring is not applicable to any patient equipped with a MV pacemaker with the MV sensor function enabled.

In the monitoring process, the conductive gel on the sensor is not allowed to contact any electrically conductive object.

The ICG sensor is only allowed to serve one patient at a time.

18.3 ICG Parameters

18.3.1 Measuring Parameters

Abbreviation	Unit	Full Name in English
ACI	/100s²	acceleration index
VI	/1000s	velocity index
PEP	ms	pre-ejection period
LVET	ms	left ventricular –ejection time
TFI	Ω	thoracic fluid index
TFC	/kΩ	thoracic fluid content
HR*	bpm	heart rate

18.3.2 Calculating Parameters

Abbreviation	Unit	Full Name in English
BSA	m²	body surface area
C.O.	L/min	cardiac output
C.I.	L/min/m²	cardiac index
SV	ml	storke volume
SI	ml/m²	storke index
SVR	DS/cm	systemic vascular resistance
SVRI	DS.m²/ cm	systemic vascular resistance index
PVR	DS/cm	pulmonary vascular resistance
PVRI	DS.m²/ cm	pulmonary vascular resistance index
LCW	Kg.m	left cardiac work
LCWI	Kg.m/m²	left cardiac work index
LVSW	g.m	left ventricular stroke work
LVSWI	g.m/m²	left ventricular stroke work index
STR	None	systolic time ratio
VEPT	ml	volume of electrically participating tissue

18.4 Non-invasive Cardiac Output (ICG) Display

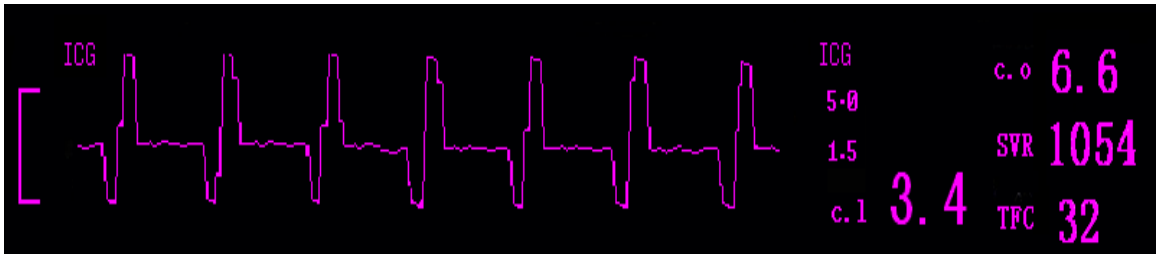


Fig. 18-1 ICG Monitoring

18.5 Influential Factors

The following factors could influence the ICG monitoring data:

- Septic shock;
- Aortic regurgitation;
- Severe hypertension (mean arterial pressure exceeding 130mmHg);
- The patient's height or weight goes beyond the limit;
- The aortic balloon pump is inserted;
- The patient is moved with tremor;
- There are signal interferences caused by the cable connection or power cord;
- A thoracotomy causing changes to the normal blood or current in the thorax.

18.6 Monitoring Procedure

1. Enter “Monitor Setup” in the main menu to select “Module Switch" and set the ICG module as “On”, and then return to the main interface (ICG monitoring interface);
2. Set the patient information;
3. Connect the patient cable to the ICG module;
4. Make full skin preparations for the patient, and then install the sensor onto the patient;
5. Connect the connection leads to the sensor installed on the patient, according to the numbers marked on them.

18.6.1 Skin Preparations

The quality of the ICG information displayed on the monitor depends on the quality of the electrical signals received by the sensor. It is necessary to make full skin preparations for the patient so that the sensor can receive high-quality signals.

Select a part of the patient's skin as the location for sensor, and then follow the steps below:

1. Remove the body hair from the selected skin surface;
2. Rub the selected skin surface lightly to remove the dead skin cells;
3. Clean the selected skin surface thoroughly to remove all the oil residuals, dead cells, and abrasives. Any remaining abrasive particle could become an interference source;
4. Dry the selected skin surface before installing the sensor.

18.6.2 Sensor Installation

In order to obtain a good signal quality and accurate data, it is very important to install the sensor properly. See the figure below:

1. Put the neck sensor vertically below the two earlobes.
2. Put the upper chest sensor at the location where the ensisternum plane intersects with the midaxillary line;
3. Two sensors must be right opposite to each other (180°).

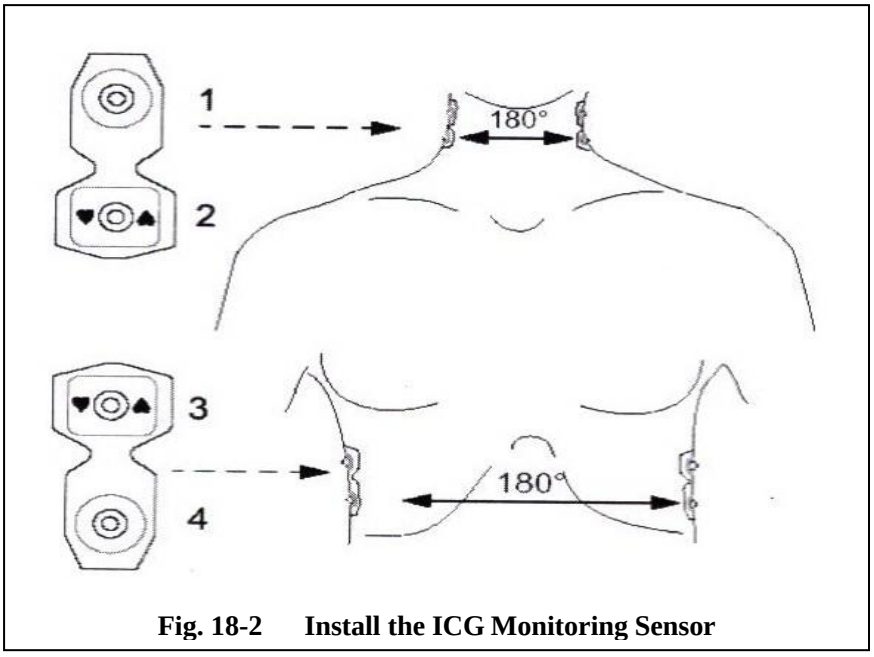


Fig. 18-2 Install the ICG Monitoring Sensor

18.7 Non-invasive Cardiac Output (ICG) Settings

1. ICG Settings in Parameter Area

In the main interface, rotate the shuttle button to move the cursor on the display interface to the hotkey "ICG" in the parameter area, and then press the shuttle button to enter the menu "ICG Settings".

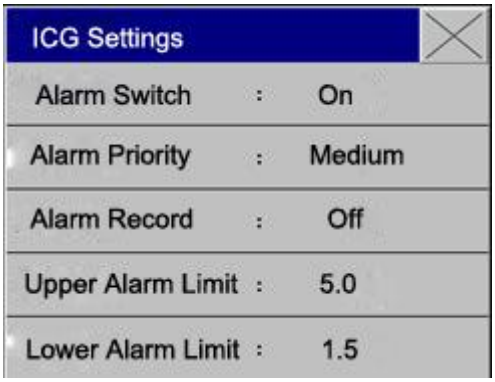


Fig. 18-3 ICG Settings in Parameter Area

- Alarm Switch: select “On" to enable ICG alarms, or select “Off" to disable ICG alarms with the icon “” appearing beside “ICG” in the parameter area on the screen.
- Alarm Priority: High, Medium, or Low; “High” is most serious.
- Alarm Record: select “On” to enable the recorder output when there is any ICG alarm.
- Upper Alarm Limit: adjust the upper alarm limit; if the measured value exceeds the upper alarm limit, there will be an alarm and prompting.
- Lower Alarm Limit: adjust the lower alarm limit; if the measured value exceeds the lower alarm limit, there will be an alarm and prompting.

2. ICG Settings in Waveform Area

In the main interface, rotate the shuttle button to move the cursor on the display interface to the hotkey “ICG” in the waveform area, and then press the shuttle button to enter the menu “ICG Settings” as below:

Fig. 18-4 ICG Settings in Waveform Area

- Waveform Speed: 6.25mm/s, 12.5mm/s, or 25.0mm/s.
- Waveform Color: Green, Cyan, Red, Yellow, White, Blue, or Purple.

3. ICG Settings in Measurement Setup

In the main interface, rotate the shuttle button to move the cursor on the display interface to “Measurement Setup" in the menu bar, or enter “Measurement Setup" in the main menu, and then select “Non-invasive Cardiac Output Settings” and “ICG Settings”. Refer to the section “AG X

Settings in Parameter Area”.

Chapter 19 Accessories

Please use the accessories below for this patient monitor, as recommended by the manufacturer:

⚠Warning⚠

Only use our cardiac electric cable and other accessories, or the instrument may be damaged or has poor performance and safety.

Standard accessories：

No	Code	Name	Quantity
1	803-184001-000	C50 user manual	1PCS
2	803-000000-022	Warranty Card	1PCS
3	801-000000-039	Certificate of Quality	1PCS
4	803-000000-052	Instrument Acceptance Certificate	1PCS
5	801-000000-010	Ground cord	1PCS
6	801-000000-013	220V power cord	1PCS
7	801-000000-001	ECG 5-leads cable	1PCS
8	801-000000-012	Electrodes	1PACKET
9	801-000000-018	Adult finger SPO2 probe_A1	1PCS
10	801-000000-025	Adult NIBP cuff	1PCS
11	801-000000-017	BP catheter	1PCS
12	801-000000-046	Adult TEMP probe	1PCS

Optional accessories:

No	Code	Name	Quantity
1	801-000000-052	50mm×20m paper reocrd	1PCS
2	801-104400-100	PHILIPLS disposable non-invasive blood pressure cuff for Neonatals 1#	1PCS
3	801-104400-200	PHILIPLS disposable non-invasive blood pressure cuff for Neonatals 2#	1PCS
4	801-104400-300	PHILIPLS disposable non-invasive blood pressure cuff for Neonatals 3#	1PCS
5	801-104400-400	PHILIPLS disposable non-invasive blood pressure cuff for Neonatals 4#	1PCS
6	801-000000-023	Infant NIBP cuff	1PCS
7	801-000000-041	Infant Electrode	1PACKET
8	801-101032-100	ECG 3-leads cable	1PCS
9	801-000000-009	IBP probe	1PCS
10	801-000000-020-1	Soft Adult SPO2 probe_A1	1PCS
11	801-000000-005	Infant finger probe_A1	1PCS
12	801-103001-022	Adult TEMP probe_A1	1PCS
13	402-000000-035	ETCO2 mainstream module REF:1015928	1PCS
14	402-000000-001	ETCO2 sidestream module REF:1022054	1PCS
15	801-109001-001	ETCO2 mainstream airway adapter REF:3472ADU-00	1PCS
16	801-109001-002	ETCO2 sidestream airway adapter REF:3473ADU-00	1PCS
17	801-000000-009	ETCO2 sidestream nasal sample tube REF:3468/NF-00	1PCS

Appendix I Specification

Classification

Conformity/Classification:	IIb According to Directive 93/42/EEC as amended by 2007/47/EC
Anti- electric-shock type:	Class I according to IEC/EN60601-1 (with internal power supply)
Anti-electroshock degree:	CF
Harmful Ingress of Water proof degree:	Ordinary equipment (sealed equipment without liquid proof)

Product specification

Size and weight

Size: 344.5mm×291 mm×165mm

Weight: 2.5kg

Power environment

Rated Voltage：a.c.100V~250V

Rated Frequency：50Hz/60Hz

Built-in Battery：12V Rechargeable Lithium Battery

Power Supply：Built-in Rechargeable Battery，or external power supply

Rated Power：70VA

Resolution： 1024×768

Transportation and Storage

a) Temperature：-20℃～+40℃；

b) Relative Humidity：≤80%；

c) Atmospheric pressure：50kPa～106kPa

Normal Operation

a) Temperature：5℃～40℃；

b) Relative Humidity：≤80%；

c) Atmospheric pressure：86kPa～106kPa；

LCD specification:

Dispiay	12.1'' color TFT
Display information	6 channels waveform display
	1 Alarm LED (Yellow/Red)
	1work LED (Blue)
	1 AC-Power LED (Blue)

Battery

Rechargeable Lithium Battery	14.8V 4000mah
Operating time under the normal condition	240(minutes)
Operating time after the first alarm of low battery	5 (minutes)

Record (optional)

Record Width	48 (mm)
Paper Speed	12.5/25/50 (mm/S)
Trace	2
Recording types:	
	Continuous real-time recording
	8s real-time recording
	8s Automatic recording
	Parameter alarm recording
	Freeze waveform recording
	Recall & memory
Trend recall	
	Short 1 (hrs), 1 Second Resolution
	Long 96(hrs), 1 Min. Resolution
	NIBP Measurement Recall 400 NIBP measurement data

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, and MCL for calibration
Waveform	2 ch
Lead mode	3 Leads (R, L, F or RA,LA,LL)
Lead selection	I, II, III
Waveform	1 ch

Gain □2.5mm/mv , □5 mm/mv , □10 mm/mv , x20 mm/mv , auto

HR and Alarm

	Range
paediatric	15 ~ 350 (bpm)
Adult	15 ~ 300 (bpm)

Accuracy	+/- 1%
Resolution	1 (bpm)
Sensitivity	> 200 (uV) P-P

Differential Input Impedance > 5 (Ω)

CMRR

Filtered Mode	> 110 (dB)
Unfiltered Mode	> 90 (dB)

Electrode offset potential □300mV

Baseline Recovery < 3 (S) After Defi.

ECG Signal Range □8 (mV) p-p

Bandwidth

Surgery	1 ~ 20 (Hz)
Monitor	0.5 ~ 40 (Hz)
Diagnostic	0.05 ~ 130 (Hz)

Calibration Signal 1 (mV) p-p, □3% Accuracy

ST Segment Monitoring Range

Measure and Alarm -2.0 ~ +2.0 (mV)

ARR Detecting

TypeASY, VTA/VFIB, ROT, RUN, CPT, VPB, BGM, TGM, TAC, BRD, PNC, PNP, MIS

Alarm	Available
Review	Available

RESP

Method	Impedance between RA-LL
Differential Input Impedance	>2.5 (Ω)
Bandwidth	0.3 ~ 2.5 (Hz)
Resistance range	100Ω~2500Ω

Resp.Rate

Measuring and Alarm Range

paediatric 7 ~ 150 (rpm)

Adult 7 ~ 120 (rpm)

Alarm range upline 7~150bpm , offline 6~149 bpm

Resolution 1 (rpm)

Accuracy □2 (rpm)

Apean Alarm 10 ~ 40 (S)

NIBP

Method Oscillometric

Mode Manual, Auto, STAT

Measuring Interval in AUTO Mode

1 ~ 90 (Min)

Measuring Period in STAT Mode 5 (Min)

Pulse Rate Range 0-250 (bpm)

Alarm

Type SYS, DIA, MEAN

Measuring Range

Adult Mode

SYS 25 ~ 270 (mmHg)

DIA 10 ~ 220 (mmHg)

MEAN 15 ~ 235 (mmHg)

Pediatric Mode

SYS 25 ~ 220 (mmHg)

DIA 10 ~ 150 (mmHg)

MEAN 15 ~ 160 (mmHg)

Neonatal Mode

SYS 20 ~ 135 (mmHg)

DIA 10 ~ 110 (mmHg)

MEAN 15 ~ 125 (mmHg)

Measuring Range

Adult Mode

SYS 25 ~ 270 (mmHg)

DIA 10 ~ 220 (mmHg)

MEAN 15 ~ 235 (mmHg)

Pediatric Mode

SYS 25 ~220 (mmHg)

	DIA	10 ~150 (mmHg)
	MEAN	15 ~ 160 (mmHg)
Neonatal Mode		
	SYS	25 ~135 (mmHg)
	DIA	10 ~ 110 (mmHg)
	MEAN	15 ~ 125 (mmHg)
Resolution		
	Pressure	1mmHg
	Maximum Mean error	±5mmHg
	Maximum Standard deviation	8mmHg
	Overpressure Protection	
Adult Mode		300 (mmHg)
Pediatric Mode		220 (mmHg)
Neonatal Mode		150 (mmHg)

SPO2

Measuring Range	0 ~ 100 %
Alarm Range	50 ~ 100 %
Resolution	1 %
Accuracy	70% ~ 90%
	90% ~ 100%(□1)
Actualization interval	about 1(Sec.)
Alarm Delay	10 (Sec.)
Pulse Rate	
Measuring and Alarm Range	20~300bpm
Resolution	1bpm
Accuracy	1bpm
Alarm Delay	10 (Sec.)

TEMP

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.)

CO2

Sidestream CO2

CO2 Measurement Range: 0 -150 mm Hg, 0 to 79%, 0 to 20kPa (at 760mmHg)

Accuracy: ± 2 mm Hg (0 – 40 mm Hg)
± 5% of reading (41 – 70 mm Hg)
± 8% of reading (71 –100 mm Hg)
± 10% of reading (101 –150 mm Hg)

Sampling Rate: 50ml/min. ±10ml/min

Sampling rate accuracy: 15%

Start-up time: ＜1 min, once the module starts up, it reaches ISO accuracy

Mode: 10 minutes after start-up, the module reaches full accuracy mode

Respiration rate: 0-120rpm

Respiration rate accuracy: ±2rpm (0-70rpm)
±5rpm (＞70rpm)

Response time: ＜240msec (10% to 90%)

Delay time: ＜2s (Sampling line length: 7 inches; internal diameter: 0.055 inches; sampling gas flow rate: 150ml/min)

Mainstream CO2

Method: Infrared Absorption

Measuring mode: Mainstream

Measurement range: 0 -150 mm Hg, 0 to 79%, 0 to 20kPa (at 760mmHg)

Resolution: 0.1 mmHg 0 to 69 mmHg
0.25mmHg 70 to 150mmHg

Accuracy: ± 2 mm Hg (0 – 40 mm Hg)
± 5% of reading (41 – 70 mm Hg)
± 8% of reading (71 –100 mm Hg)
± 10% of reading (101 –150 mm Hg)

Alarm range: Same as Measurement range

IBP 1/2

Channel 1/2 pressure ： ART、PA、CVP、LAP、ICP、RAP、P1、P2

Measurement unit ： mmHg、KPa
ART 0~300 mmHg
PA -6~120 mmHg
CVP -10~40 mmHg
RAP -10~40 mmHg
LAP -10~40 mmHg

	ICP	-10~40 mmHg
	P1- P2	0~300 mmHg
IBP Accuracy:	0～100mmHg	±4mmHg
Measurement Range:	-30mmHg～300mmHg	
IBP Accuracy:	0～100mmHg	±4mmHg
	100mmHg～300mmHg	±2%
Pulse Accuracy:	±1% or ±1bpm, whichever is greater	
Pressure transducer :	Sensitivity 5u V/V/ mmHg	
Resistance range:	300~3000Ω	

Appendix Ⅱ Description of System Alarm Prompt

PROMPT MESSAGE	CAUSES	SOLUTIONS

"XX is too high "	XX is higher than the upper limit value of alarm limit.	Check whether the alarm limit values are suitable, and the current status of the patient.
"XX is too low"	XX is lower than the lower limit value of alarm limit.	
XX means all parameter values in such systems as HR, ST1, ST2, RR, SPO2, IBP and NIBP.		
"ECG signal is too weak "	The patient's ECG signal is too small, so the system can't do ECG signal analysis.	Check whether the electrode and lead cable are connected correctly, and the current status of the patient.
"Pulse is not found "	The patient's pulse signal is too small, so the system can't do pulse signal analysis.	Check the connection of the sensor, and the current status of the patient.
"RESP apnea"	The patient's RESP signal is too small, so the system can't do RESP signal analysis.	Check the connection of the lead cable, and the current status of the patient.
"ASYSTOLE "	The patient suffers from arrhythmia of a systole.	Check the current status of the patient, and whether the electrode and lead cable are connected correctly.
"VFIB/VTAC "	The patient suffers from arrhythmia of VFIB/VTAC.	Check the current status of the patient, and whether the electrode and lead cable are connected correctly.
"COUPLET (two PVS)"	The patient suffers from arrhythmia of two PVS.	Check the current status of the patient, and whether the electrode and lead cable are connected correctly.
"BIGEMINY (PVS bigeminy)"	The patient suffers from arrhythmia of PVS bigeminy.	Check the current status of the patient, and whether the electrode and lead cable are connected correctly.
"TRIGEMINY (PVS trigeminy)"	The patient suffers from arrhythmia of PVS trigeminy.	Check the current status of the patient, and whether the electrode and lead cable are connected correctly.
"R ON T"	The patient suffers from arrhythmia of R ON T.	Check the current status of the patient, and whether the electrode and lead cable are connected correctly.
"PVC (single PVS)"	The patient suffers from arrhythmia of single PVS bigeminy.	Check the current status of the patient, and whether the electrode and lead cable are connected correctly.
"TACHY (tachycardia)"	The patient suffers from tachycardia.	Check the current status of the patient, and whether the electrode and lead cable are connected correctly.
"BRADY (bradycardia)"	The patient suffers from bradycardia.	Check the current status of the patient, and whether the electrode and lead cable are connected correctly.
"VT>2 (multiple PVS)"	The patient suffers from arrhythmia of multiple PVS.	Check the current status of the patient, and whether the electrode and lead cable are connected correctly.
"MISSED BEATS"	The patient suffers from arrhythmia of missed beat.	Check the current status of the patient, and whether the electrode and lead cable are connected correctly.
"PNP (Pacemaker not paced)"	The pacemaker doesn't pace.	Check the connection of the pacemaker, the current status of the patient, and whether the electrode and lead cable are connected correctly.
"PNC (Packer not captured)"	No pacemaker signal is captured.	Check the current status of the patient, and whether the electrode and lead cable are connected correctly.
"ECG lead disconnected"	ECG lead cable is not joined well.	Check the connection of ECG lead cable.
"ECG V lead disconnected"	ECG V-lead cable is not joined well.	Check the connection of ECG V-lead cable.
"ECG LL lead disconnected"	ECG LL-lead cable is not joined well.	Check the connection of ECG LL-lead cable.
"ECG LA lead disconnected"	ECG LA-lead cable is not joined well.	Check the connection of ECG LA-lead cable.
"ECG RA lead disconnected"	ECG RA-lead cable is not joined well.	Check the connection of ECG RA-lead

		cable.
"ECG C lead disconnected"	ECG C-lead cable is not joined well.	Check the connection of ECG C-lead cable.
"ECG F lead disconnected"	ECG F-lead cable is not joined well.	Check the connection of ECG F-lead cable.
"ECG L lead disconnected"	ECG L-lead cable is not joined well.	Check the connection of ECG L-lead cable.
"ECG R lead disconnected"	ECG R-lead cable is not joined well.	Check the connection of ECG R-lead cable.
"SPO2 sensors fall off "	SPO2 sensor is not joined well.	Check the connection of SPO2 sensor.
"Searching pulse"	SPO2 sensor is not joined well, or the patient moves his arms.	Check the connection of SPO2 sensor and the current status of the patient.
"TEMP sensors fall off "	TEMP sensor is not joined well.	Check the connection of TEMP sensor.
"IBP lead disconnected"	IBP sensor is not joined well.	Check the connection of IBP sensor.
"IBP needs zeroing"	IBP needs zeroing before measurement.	Zero pressure for IBP.
"ECG interference too strong "	Stronger interference signal appear in ECG signal.	Check the connection of ECG R-lead cable, the current status of the patient and whether more actions happen.
"XX module initialization wrong X"	Error X appears when XX module is initialized.	Restart the monitor for trial. If errors still exist, please contact the manufacturer for maintenance.
"XX module communication stop"	XX module can't communicate with the main system normally.	
"XX module communication wrong "	XX module can't communicate with the main system normally.	
XX means all parameter modules in the system such as ECG module, NIBP module, SPO2 module, IBP module and etc.		
"XX alarm limit wrong "	The alarm limit of XX parameter is changed accidently.	Contact the manufacturer for maintenance.
"XX measurement out of scope "	The measured value of XX parameter goes out of the range of measurement by the system.	Contact the manufacturer for maintenance.
XX means the names of all parameters in the system, such as HR, ST1, ST2, RR, SPO2, IBP, NIBP and etc.		
"The real-time clock needs resetting."	If the system time is 2000-1-1, the system will remind users that this time is wrong.	Reset the system time. After resetting, please restart the monitor for fear of unnecessary time error being saved.
"The real-time clock doesn't exist "	No button batteries exist in the system or the batteries have no charge.	Increase or change the button battery.
"System failure: software"		
" System failure: cmos full"		
" System failure: cmos err"		
" System failure: fpga"		
" System failure 2"		
" System failure 3"		
" System failure 4"		
" System failure 5"		
" System failure 6"		
" System failure 7"		
" System failure 8"		
" System failure 9"		
" System failure 10"		
" System failure 11"		
" System failure 12"		
"Keyboard unusable ";	The keys on the keyboard are unusable.	Please check whether the keys are held on to artificially or other articles. If no abnormal pressing is found, please contact the manufacturer for maintenance.
"Communication with keyboard wrong ";	The keyboard fails, so it is unusable.	Please contact the manufacturer for maintenance.
"Key wrong ";		

" Keyboard wrong 1";		
" Keyboard wrong 2";		
"Network initialization wrong (G.)"	Something wrong happens to the network of the system so the system can't start network function.	Please contact the manufacturer for maintenance.
" Network initialization wrong (Ram)"		
" Network initialization wrong (Reg)"		
" Network initialization wrong (Mii)"		
" Network initialization wrong (Loop)"		
" Network wrong (Run1)"		
" Network wrong (Run2)"		
" Network wrong (Run3)"		
"5V voltage too high"	Something wrong happens to the power supply of the system.	Please contact the manufacturer for maintenance if such a prompt appears frequently.
"5V voltage too low"		
"Power system wrong 3"		
" Power system wrong 4"		
"12V voltage too high "		
"12V voltage too low "		
" Power system wrong 7"		
" Power system wrong 8"		
"3.3V12V voltage too high "		
"3.3V voltage too low "		
" Button battery voltage too high"	Something wrong happens to the button battery.	Please replace the battery. If the fault still exists, please contact the manufacturer for maintenance.
"Button battery voltage too low. Please change it."	The button battery is short of charge or it is not fixed or the connection of button battery is loose.	
"Recorder self-check wrong "	The system fails in connection with the recorder module in self-check.	In the recorder-setting menu, start the record-deletion function that can make the upper machine and the lower machine reconnected. If the fault still exists, please contact the manufacturer for maintenance.
"Recorder voltage too high"	The recorder module voltage fails.	Please contact the manufacturer for maintenance.
" Recorder voltage too low"		
"Recorder head too hot "	Maybe the continuous recording time is too long.	After the recorder is fully cooled, do the record output. If the fault still exists, please contact the manufacturer for maintenance.
"The position of the recorder head wrong "	The paper-pressing handle of the recorder doesn't work.	Depress the paper-pressing handle of the recorder.
"Recorder short of paper "	There is no record paper in the recorder.	Install the record paper.
"Recorder having paper jam "	The recorder has a paper jam.	Place the recorder correct first and then start recording.
"Recorder communication wrong "	The recorder communication is not normal.	In the record setting menu, start the record-deletion function that can make the upper machine and the lower machine reconnected. If the fault still exists, please contact the manufacturer for maintenance.
"The serial port of recorder wrong in communication"		
"The paper position of recorder wrong "	The paper is not placed correctly in the recorder.	Re-place the corder paper rolls at the correct location.
"Recorder unusable "	The recorder can't be communicated.	In the record setting menu, start the record-deletion function that can make the upper machine and the lower machine reconnected. If the fault still exists, please contact the manufacturer for maintenance.
"NIBP initialization wrong "	NIBP initialization is wrong.	Select the resetting function in NIBP

"NIBP self-check wrong "		menu. If the error persists, please contact the manufacturer for maintenance.
"NIBP resetting wrong "	Abnormal resetting happens when NIBP is measured.	Please do measurement again after checking the air path of NIBP and whether there is air jam. If the error persists, please contact the manufacturer for maintenance.
"NIBP communication wrong "	Something wrong happens to the NIBP communication.	Select the resetting function in NIBP menu. If the error persists, please contact the manufacturer for maintenance.
"Cuff too loose or not joined "	NIBP cuff is not joined well.	Please reconnect the NIBP cuff.
"Cuff gas tube leaked "	NIBP cuff is not joined well, or the air path is leaked. .	Please check the connection of all parts or replace a cuff. If the error persists, please contact the manufacturer for maintenance.
"Air pressure wrong"	Something wrong happens to the measuring curve so that the system can do measurement, analysis and calculation.	Please check the connection of all parts or replace a cuff. If the error persists, please contact the manufacturer for maintenance.
"Signal too weak "	Something wrong happens to the measuring curve so that the system can do measurement, analysis and calculation.	After inspecting whether patient type is set correctly, please check the connection of all parts or replace a cuff. If the error persists, please contact the manufacturer for maintenance.
"Pressure out of scope "	Something wrong happens to the measuring curve so that the system can do measurement, analysis and calculation.	Please check the connection of all parts or replace a cuff. If the error persists, please contact the manufacturer for maintenance.
"Arms movement "	The patient’s arm moves.	Please do measurement again after checking the connection of all parts and the patient's condition. If the error persists, please contact the manufacturer for maintenance.
"Overpressure protection "	Maybe the air path has once been folded.	Please do measurement again after checking whether the air path is smooth and the patient’s condition. If the error persists, please contact the manufacturer for maintenance.
"Signal saturated "	Something wrong happens to the measuring curve so that the system can do measurement, analysis and calculation.	Please do measurement again after checking the connection of all parts and the patient's condition. If the error persists, please contact the manufacturer for maintenance.
"Measurement time-out "	Something wrong happens to the measuring curve so that the system can do measurement, analysis and calculation.	Please do measurement again after checking the connection of all parts and the patient's condition. If the error persists, please contact the manufacturer for maintenance.
"Cuff type wrong "	Maybe the cuff doesn’t accord with the set patient type.	After inspecting whether patient type is set correctly, Please check the connection of all parts or replace a cuff. If the error persists, please contact the manufacturer for maintenance.
"Pump with air leakage "	NIBP air path is leaked.	Please check the connection of all parts or replace a cuff. If the error persists, please contact the manufacturer for maintenance.
"NIBP measurement failure "	Something wrong happens to the measuring curve so that the system can do measurement, analysis and calculation.	Please do measurement again after checking the connection of all parts and the patient's condition. If the error persists, please contact the manufacturer for maintenance.
"NIBP system failure "	Something wrong happens to the measuring curve so that the system can do measurement, analysis and calculation.	Please do measurement again after checking the connection of all parts and the patient's condition. If the error persists, please contact the manufacturer for maintenance.

Appendix Ⅲ Symbols

COMEN

Multi-parameter patient Monitor

Production License No.: Yue 20010456
Product Registration No.: Yue SYJX (Z) [2009] No. 2210039
Registered Product Standard No.: YZB / Yue 0011-2009
Standard Registration No.: QB/440000 11 5954-2009
Dimension: 365mm (L) × 295mm (W) × 255mm (H)
N.W.: 3.5Kg G.W.: 5.5Kg
Shenzhen Comen Medical Instruments Co., Ltd
Add: 7F, Building 5, Nanyou Fourth Industrial Park, Nanshan District, Shenzhen
Tel: 0755-26431236 Customer Service Center: 4007009488

Monitor Packing Box Front

Product Name: Multi-parameter Patient Monitor
Model No.:
Manufacture No.: Manufacture Date:
Power Voltage: a.c. 100V-250V; d.c. 12V
Rated Frequency: 50Hz / 60Hz Input Power: 70VA
Production License No.: Yue SYJXSCX No. 20010456
Registered Product Standard No.: YZB / Yue 0011-2009
Standard Registration No.: QB/440000 11 5954-2009
Product Registration No.: Yue SYJX (Z) [2009] No. 2210039

Shenzhen Comen Medical Instruments Co., Ltd

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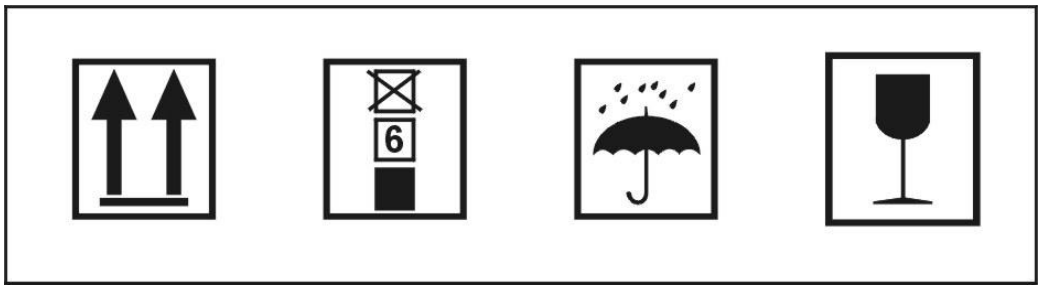

Marks on the Packing Box