



**CREATIVE
MEDICAL**

Vital Signs Monitor

PC-900

User Manual

Shenzhen Creative Industry Co., Ltd.

This Manual is written and compiled in accordance with the IEC 60601-1 (Medical electrical equipment Part1: General requirements for safety) and MDD 93/42/EEC. It complies with both international and enterprise standards and is also approved by State Technological Supervision Bureau. The Manual is written for the current PC-900 Vital Signs Monitor.

The Manual describes, in accordance with the Vital Signs Monitor's features and requirements, main structure, functions, specifications, correct methods for transportation, installation, usage, operation, repair, maintenance and storage, etc. as well as the safety procedures to protect both the user and equipment. Refer to the respective chapters for details.

The Manual is published in English and we have the ultimate right to explain the Manual.




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Marks in the Manual:

-  **Warning: must be followed to avoid endangering the operator and the patient.**
-  **Attention: must be followed to avoid causing damage to the monitor.**
-  **Note: some important information and tips about operations and application.**

Instructions to User

Dear Users,

Thank you very much for purchasing our product. Please read the following information very carefully before using this device.

Read these instructions carefully before using this monitor. These instructions describe the operating procedures to be followed strictly. Failure to follow these instructions can cause monitoring abnormality, equipment damage and personal injury. The manufacturer is NOT responsible for the safety, reliability and performance issues and any monitoring abnormality, personal injury and equipment damage due to user's negligence of the operation instructions. The manufacturer's warranty service does not cover such faults.

- ☼ Do not use this device in an environment with ignitable or inflammable gas.
- ☼ Do not place the monitor in any position that may cause it to fall on the patient.
- ☼ Check the safety and performance of this monitor every time before using it to ensure it works normally and safely
- ☼ Ensure the monitor is grounded reliably before using it, if the integrity of grounding connection is in doubt, the monitor should work by using the built-in battery.
- ☼ Equipment connected with this monitor should be IEC 60601-1 complied.
- ☼ Turn off the monitor and take away the sensors from the patient during MRI scanning. Otherwise it may cause burn to the patient and the quality of MRI image or the measurement accuracy of the monitor may be affected.
- ☼ Although biocompatibility tests had been done to all the applied parts, some exceptional allergic patients may still have anaphylaxis. Do NOT apply to those who suffer from anaphylaxis.
- ☼ All the cables and hoses of the applied parts should be kept away from the patient's neck to prevent any possible choke of the patient.
- ☼ All the parts of the monitor should NOT be replaced at will. If necessary, please use the components provided by the manufacturer or those of the same model and standards as the accessories along with the monitor which are provided by the same factory, otherwise negative effects concerning safety and biocompatibility, etc. may be caused.
- ☼ If the monitor falls off accidentally, please do NOT operate it until its safety and performance have been carefully tested and positive testing results obtained.
- ☼ Dispose of the device and its accessories, the local law should be followed.

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Chapter 1 Overview

1.1 Features

- ✧ Blood Pressure, SpO₂ and Pulse Rate are displayed by big, bright digital LEDs;
- ✧ ECG waveform, SpO₂ plethysmogram and system parameters are displayed on dot matrix LCD screen;
- ✧ Accurate NIBP measurement with hardware and software over-pressure protection;
- ✧ Unique SpO₂ measuring technique ensures sensitive and accurate SpO₂, Pulse Rate and Perfusion Index measurement;
- ✧ HR and SpO₂ trend curve display for last 12, 24 or 96 hours;
- ✧ Up to 400 groups of NIBP measurements can be stored and reviewed by list;
- ✧ Audible & visible alarm with 3 levels of alarm events;
- ✧ Nurse call output is available;
- ✧ With tourniquet function;
- ✧ NIBP measurement is applicable to adult, pediatric and neonate by patient selection;
- ✧ Built-in printer is optional to print out waveforms, and text information.

1.2 Product Name and Model

Name: Vital Signs Monitor


Model: PC-900

1.3 Intended Use





















PC-900 Vital Signs Monitor is intended for using in hospitals to monitor patient's ECG, blood pressure, SpO₂, pulse rate and temperature.

1.4 Conformation

PC-900 Vital Signs Monitor is module designed product, it consists of the main control unit, ECG/TEMP module (optional), NIBP module (optional), SpO₂ measuring module (optional), printer module (optional), display panel, and power supply block etc. and the related accessories for ECG, NIBP, SpO₂ and Temperature measurement.

 According to different needs, you can customize the module configuration by choosing necessary modules. Therefore, your monitor may not have all the monitoring functions and accessories.

1.5 Symbols on the Monitor

	Adult Patient		Waveform Freeze
	Pediatric Patient		Pulse sync indicator
	Neonatal Patient		Setup Menu
	NIBP Start/Cancel		AC Power
	Alarm Silence		DC Power
	Print		Type BF applied part
	Up		Type CF applied part with defibrillator protection
	OK		Warning, refer to User Manual.
	Down		Equal potential terminal
	ECG Lead Selection		Nurse call output

Chapter 2 Operating Principle

2.1 Overall Structure

The overall structure of the monitor is shown in Fig. 2.1.

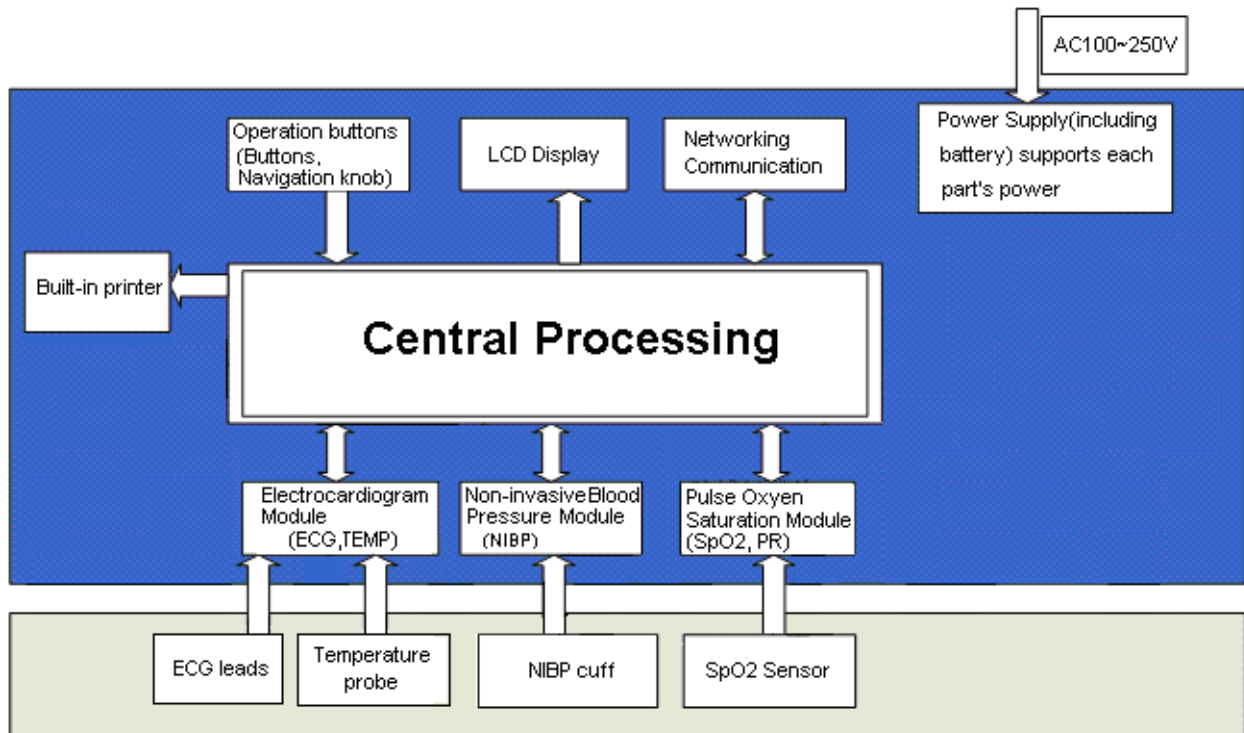


Figure 2.1

PC-900 Vital Signs Monitor is module designed product; it consists of ECG/TEMP module (optional), NIBP module (optional), SpO₂ module (optional), main control unit, printer module (optional), display panel, and power supply block etc.

1. ECG/TEMP module measures ECG signal and detects heart rate with ECG lead wires and electrodes, it also measures temperature with temperature probe.
2. The SpO₂ module detects and calculates pulse rate and oxygen saturation (SpO₂), and provides plethysmogram and perfusion index as well.
3. The NIBP module performs the measurement of blood pressure by non-invasive way of oscillometric technology, including the diastolic, systolic and mean arterial pressure. The cuffs are designed for adult, pediatric and neonate respectively.
4. The main control unit is in charge of LED and LCD display, keyboard input, data storage, printing, and networking function.

Chapter 3 Installation and Connection

3.1 Appearance

3.1.1 Front Panel

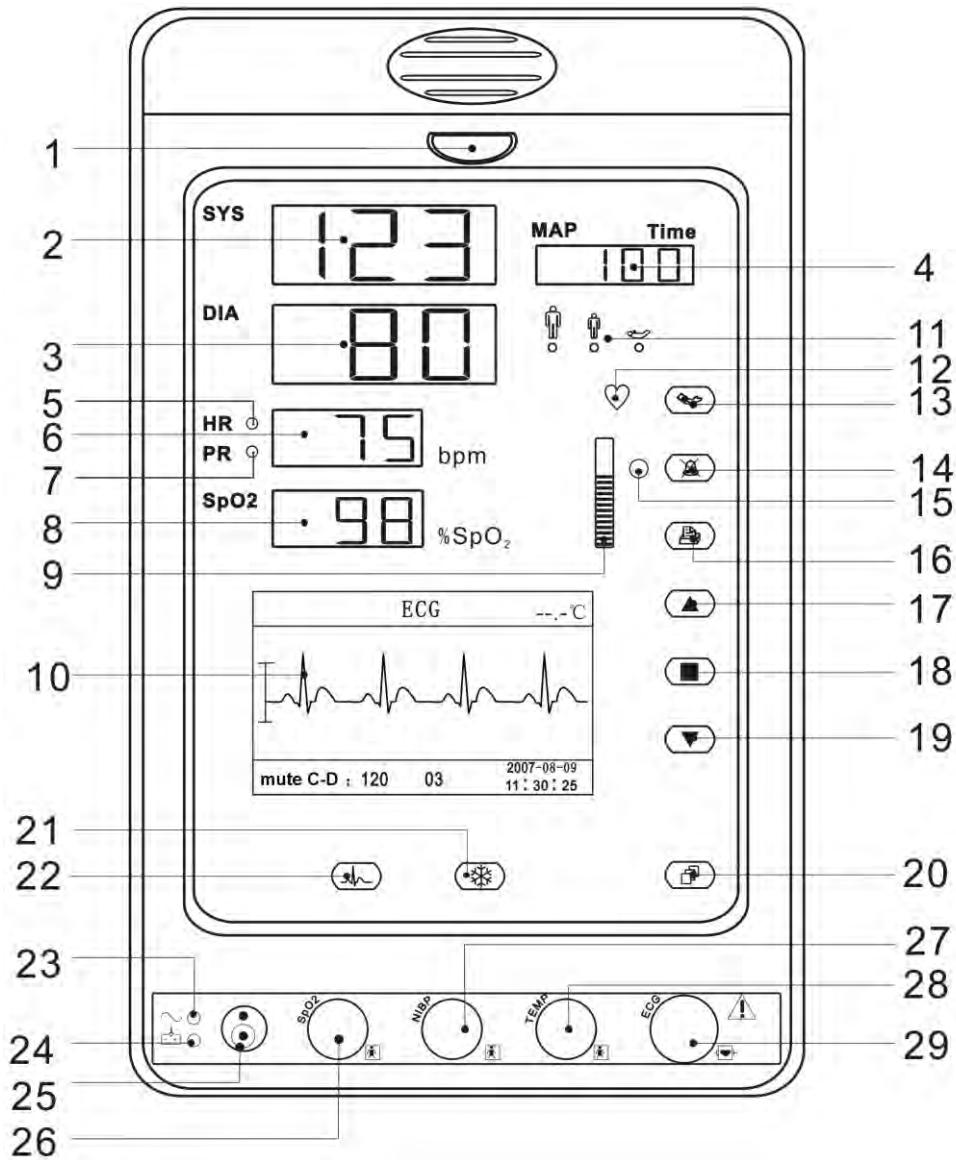


Figure 3.1 Front panel illustration

Description:


1 Alarm indicator

Indicator	Alarm Level	Alarm Event
Red flashing	High priority alarm	Exceeding the limits, low battery voltage
Orange flashing	Medium priority alarm	Leads or probe off
Green light	Normal	




- 2 **SYS:** display systolic pressure value
- 3 **DIA:** display diastolic pressure value.
- 4 **MAP:** Display mean arterial pressure or measuring time of the latest group of NIBP measurement; they will be displayed alternately. The format of NIBP measuring time is “hh:mm”. If the tourniquet is in use, the cuff pressure will be displayed here.

Note: two formats to display NIBP value: “×××mmHg” and “××.×kPa”. Refer to section “4.4.2 NIBP Setup” to set the unit of NIBP value; the conversion relation between “mmHg” and “kPa”: 1mmHg=0.133kPa.


- 5 **HR(priority indicator):** if HR indicator is on, it indicates that the numerical value beside is HR measuring value;
- 6 **Display HR or PR value:** when the set of “Setup Menu→System→priority” is “HR”, it shows HR value here preferentially; if the set is “PR”, PR value will be shown preferentially.
- 7 **PR(priority indicator):** if PR indicator is on, it indicates that the numerical value beside is pulse rate value; Unit: “bpm (beats per minute)”.
- 8 **SpO₂:** Display SpO₂ value; Unit: “%”


- 9 : Bar-graph of pulse intensity

10 LCD panel


- 11 **Pulse sync indicator/patient category indicator:**  for adult;  for pediatric;  for neonate; Patient category is selected under sub-menu “Patient Info” within the setup menu.

- 12 **Pulse sync indicator:** Cardio-pulse/pulse sync indicator. When HR priority indicator is on, its flashing is synchronized with heart beat; When PR priority indicator is on, its flashing is synchronized with pulse.

- 13  **NIBP:** start/cancel NIBP measurement

- 14  **Alarm silence key:** Enable/disable alarm silence function. When the alarm silence indicator on the left of keys is on, it means the system is in alarm silence status and it lasts this status for 2 minutes. When finishing counting down, the system will resume normal alarm status automatically, if alarm event occurs at this time the alarm sound will be effective again.


- 15 **Alarm silence indicator:** When it is on, it indicates that the monitor stays in alarm silence status.




- 16  **Print:** the internal printer is optional, press this key to print the current measuring data;

- 17 ▲ Up: shift cursor forward/upward


- 18 ■ OK: to confirm selection or modification

- 19 ▼ Down: shift cursor backward/downward

- 20  Display: shift LCD display modes

- 21  Waveform Freeze: freeze the current displayed waveform.
- 22  ECG Lead Selection: select ECG leads among I, II, III, aVR, aVL, aVF and V.
- 23 ~: AC Power indicator
- 24 : DC Power indicator

	AC Power indicator	DC Power indicator	Descriptions
Status	ON (green)	ON (green)	this device is using mains power supply
	ON (green)	ON (orange)	this device is using mains power supply and the battery is being recharged.
	OFF	ON (green)	the battery is being used
	OFF	ON (orange, blinking)	the battery is being used, but battery voltage is low, the beeper also gives warning.
	ON (green)	OFF	the battery is being recharged while the device is off

- 25 : Power button: Press power button for 3 seconds to start the monitor or shut off the monitor.

Note: Short time pressing power button for entering the Power Saving Mode screen, then according to your need to make the device stay in the power saving mode or exit from power saving mode (this function is optional and needs hardware support).

- 26 **SpO₂**: SpO₂ sensor connector
- 27 **NIBP**: NIBP hose connector
- 28 **TEMP**: TEMP probe connector
- 29 **ECG**: ECG cable connector

3.1.2 Side Panel

The built-in thermal printer is in the left panel. It is easy for user to print waveform and data.

3.1.3 Rear Panel

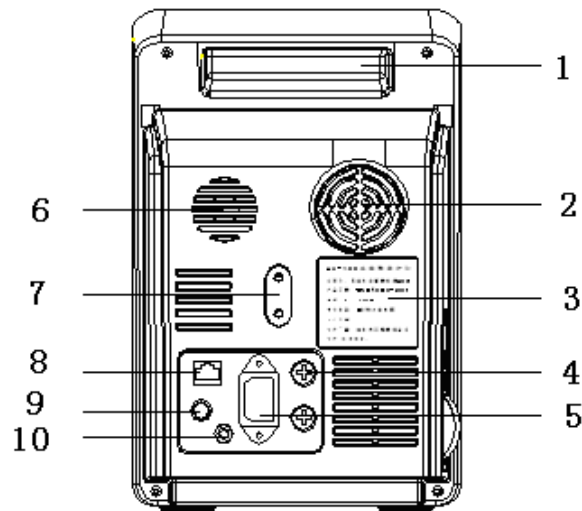


Figure 3.2 Rear Panel

Introduction to the rear panel:

- 1 **Handle**
- 2 **Fan**
- 3 **Nameplate**
- 4 **“FUSE T3.15 A”**: Fuse holder. Fuse specification: T3.15AL/250V $\Phi 5 \times 20$ mm.
- 5 **“AC100~250V”** : AC power supply socket
- 6 **Loudspeaker**
- 7 **Mounting hole for hanging the monitor**
- 8 **NET**: serial communication port which is used to network with central monitoring system (optional);
- 9 **Nurse-call connector**
- 10 **⚡**: Equipotential ground terminal

3.2 Installation

3.2.1 Opening the Package and Check

1. Open the package, take out the monitor accessories from the box carefully and place it in a safe stable and easy to watch position.
2. Open the accompanying document to sort the accessories according to the packing list.
 - ◆ Inspect the monitor for any mechanical damages
 - ◆ Check all the accessories for any scratch or deformity, especially on connector, wire and probe parts

If in doubt, please contact the local dealer or our company in case of any problems. We are to offer you the best solution for your satisfaction.

3.2.2 Connecting the Power Supply

1. When powered by AC mains power supply:

- ◆ Make sure that the AC mains power supply is within 100-250VAC with 50Hz or 60Hz.
- ◆ Use the power cord provided by the manufacturer. Insert one end of it to the power port of the monitor and the other end to the single-phase mains power outlet with protected earth.
- ◆ Caution: if necessary, make the monitor grounded properly by the provided grounding wire.

2. When powered by built-in battery

- ◆ Install battery: refer to Chapter 3.3.5 Battery Installation.
- ◆ Caution: it's better to recharge the battery after it is used up, the charging time should be 13~15 hours long.

3.2.3 Starting the Monitor

The system performs self-test and enters initial display after switching on the monitor, and the orange alarm indicator blinks to inform that the user can begin operating it.

- ◆ Check all the applicable functions to make sure that the monitor works normally.
- ◆ If the battery is applied please recharge it after using the monitor to ensure sufficient power storage.

🔔 Do not use the device to monitor the patient if there are indications of damage or reminders of error. Please contact the local dealer or our company.

🔔 It's recommended to delay 1 minute to start it again.

3.3 Sensor Placement and Connection

3.3.1 ECG Cable Connection

ECG measurement is to collect the ECG signal via the ECG electrodes. Electrode connects the patient and the lead. The lead connects the monitor. The locations of the electrodes are very important for obtaining accurate

ECG signals.

1. Connect the cable to the right-panel connector marked with the ECG icon.
2. Select electrodes to be used. Use only one type of electrode on the same patient to avoid variations in electrical resistance. For ECG monitoring, it is strongly recommended to use silver/silver chloride electrodes. When dissimilar metals are used for different electrodes, the electrodes may be subject to large offset potentials due to polarization. Using dissimilar metals may also increase recovery time after defibrillation.
3. Prepare the electrode sites according to the electrode manufacturer's instructions.

The locations of the electrode are in the following Figure:

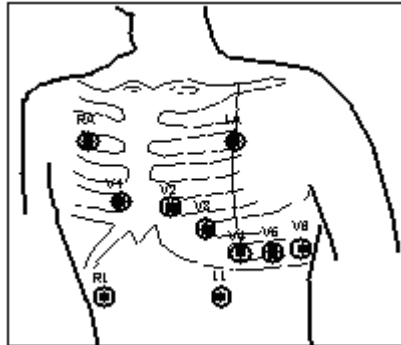


Figure 3.3 Electrode Location

Note: If skin rash or other unusual symptoms develop, remove electrodes from patient.

4. After starting the monitor, if the electrodes become loose or disconnected during monitoring, the system will display “LEAD OFF” on the screen to alarm the operator.

 **It might not display ECG wave with 3 leads. The 5 leads should be used to have ECG wave.**

5. The ECG leads and their corresponding locations are as follows:

Symbol		Position
RA		The intersection between the centerline of the right clavicle and Rib 2
LA		The intersection between the centerline of the left clavicle and Rib 2
LL		Left part of the upper abdomen
RL		Right part of the upper abdomen
C (V) Chest electrode	C1(V1)	The electrodes are placed in different places, the different lead forms will display.
	C2(V2)	
	C3 (V3)	
	C4 (V4)	
	C5 (V5)	
	C6 (V6)	

Table 3-1

Safety Instructions for ECG Monitoring

- Use the same type electrode on a patient. If skin rash or other unusual symptom occurs, remove electrodes from patient. Do not attach electrodes on the patient with an inflammation of the skin or sores on skin.
- 🔔 PC-900 Vital Signs Monitor can only be equipped with ECG leads provided by our company; using ECG leads supplied by other companies may cause improper performance or poor protection while using defibrillator.
- 🔔 Electric parts of electrodes, leads and cable are forbidden to contact any other conductive parts (including ground).
- 🔔 PC-900 Vital Signs Monitor can resist against defibrillator and electrosurgical unit. Readings may be inaccurate for a short time after or during using defibrillator or electrosurgical unit.
- 🔔 Transient caused by cable circuitry blocks while monitoring may be similar to the real heartbeat waveform, as a result resistance heart rate alarm rings. If you put the electrodes and cable in proper places according to this manual's instructions and the instructions for using electrode, the chance of this transient occurring will be decreased.
- To the patient with pacemaker, due to that this device has been designed to provide resistance to pacemaker signal interference, generally the pacemaker pulse is not counted in heart rate measurement and calculation, but when the cycle time of pacemaker pulse is over 2ms, it may be counted. In order to reduce this possibility, observe the ECG waveforms on the screen carefully and do NOT rely entirely on the heart rate display and alarm system of this monitor when monitoring this kind of patients.
- Besides the improper connection with electrosurgical unit may cause burns, the monitor may be damaged or arouse deviations of measurement. You can take some steps to avoid this situation, such as do NOT use small ECG electrodes, choosing the position which is far away from the estimated Hertzian waves route, using larger electrosurgical return electrodes and connecting with the patient properly.
- 🔔 ECG leads may be damaged while using defibrillator. If the leads are used again, please do the functional check first.
- 🔔 When removing the ECG cable, hold the head of the connector and pull it out.
- 🔔 When the monitor is inoperable due to an overload or saturation of any part of the amplifier, it will prompt "Lead off" to remind operator.
- 👉 No predictable hazard will be caused by the summation of leakage currents when several item of monitor are interconnected.

3.3.2 Blood Pressure Cuff Connection

1. Select a cuff of appropriate size according to the age of the subject. Its width should be 2/3 of the length of the upper arm. The cuff inflation part should be long enough to permit wrapping 50-80% of the limb concerned. See the table below for the dimensions:

Cuff Type	Arm circumference	Cuff width
Neonate Cuff	6.0cm~9.5cm	3cm
Small-sized Cuff for Pediatric	6cm~11cm	4.5cm
Middle-sized Cuff for Pediatric	10cm~19cm	8cm
Large-sized Cuff for Pediatric	18cm~26cm	10.6cm
Adult Cuff	25cm~35cm	14cm

Table 3-2

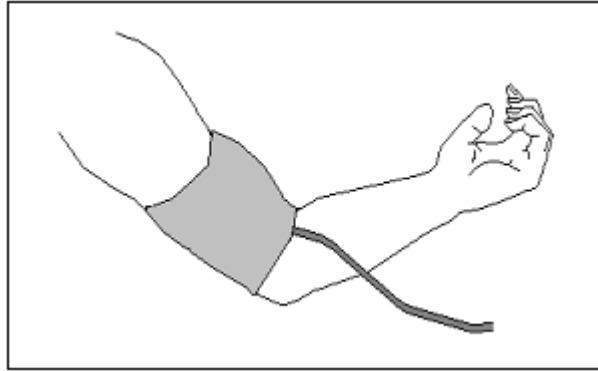


Figure 3.4 Cuff Placement

2. Connect the cable to connector marked with the NIBP icon.

Safety Instructions for NIBP Monitoring

- ^{*} When taking the measurement of a pediatric or neonate's (less than 10 years old) blood pressure, do NOT operate in the adult mode. The high inflation pressure may cause lesion or even body putrescence.
- ^{*} It is recommended to take the blood pressure measurement manually. Automatic measurement should be used at the presence of a doctor/nurse.
- ^{*} NIBP monitoring is prohibited to those who have severe hemorrhagic tendency or with sickle cell disease, or partial bleeding will appear.
- ^{*} Pay attention to the color and sensitivity of the limb when measuring NIBP; make sure the blood circulation is not blocked. If blocked, the limb will discolor, please stop measuring or remove the cuff to other positions. Doctor should examine this timely.
- ^{*} Confirm your patient category (adult, pediatric or neonate) before measurement.
- ^{*} Do NOT bind NIBP cuff on limbs with transfusion tube or intubations or skin lesion area, otherwise, damages may be caused to the limbs.
- 🔔 Prior to use of the cuff, empty the cuff until there is no residual air inside it to ensure accurate measurement.
- 🔔 Do NOT twist the cuff tube or put heavy things on it.
- 🔔 When unplugging the cuff, hold the head of the connector and pull it out.

3.3.3 SpO₂ Sensor Connection

SpO₂ sensor is a very delicate part. Please follow the steps and procedures in operating it. Failure to operate it correctly can cause damage to the SpO₂ sensor.

Operation procedure:

1. Connect the SpO₂ sensor to the connector labeled “SpO₂”. **When unplugging the probe, be sure to hold the head of the connector and pull it out.**
2. If the finger clip SpO₂ sensor is used, insert one finger into the sensor (index finger, middle finger or ring finger with short nail length) as shown in the figure below.

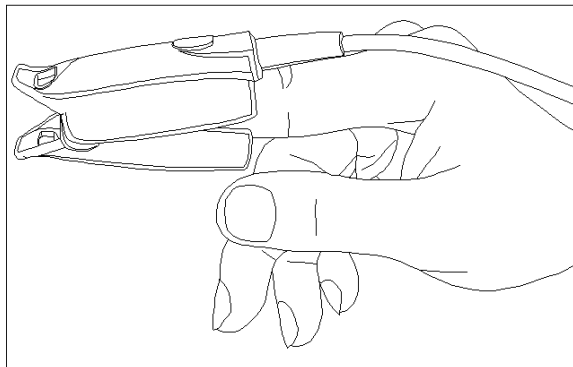


Figure 3.5 Finger clip SpO₂ sensor placement

3. If the neonate SpO₂ sensor is used, please follow Figure 3.6 to connect.

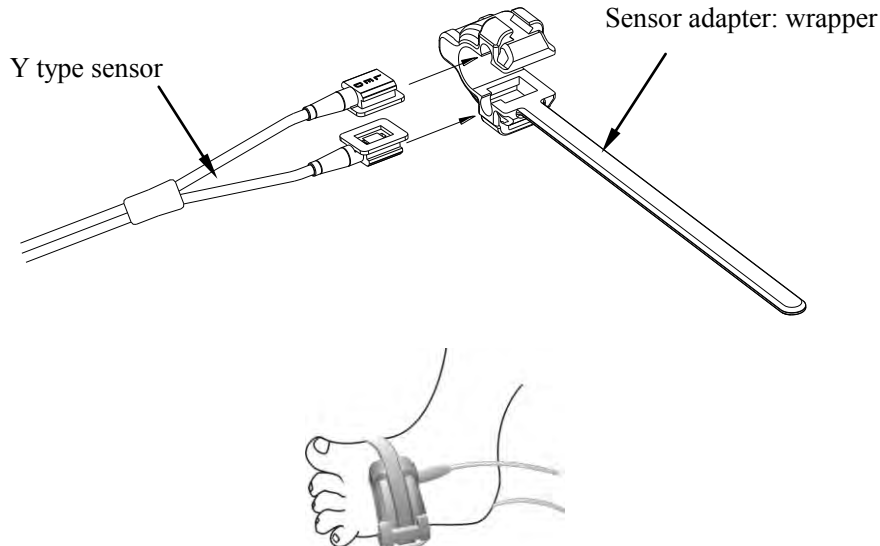


Figure 3. 6 Neonate SpO₂ sensor placement

Safety Introductions for SpO₂ Monitoring

- * Continuous use of finger clip SpO₂ sensor may result in discomfort or pain, especially for those patients with microcirculatory problem. It is recommended that the sensor should NOT be applied to the same finger for over two hours.
- * SpO₂ measuring position must be examined more carefully for some special patient. Do NOT place the SpO₂ sensor on the finger with edema or fragile tissue.

- 🔔 Please do not allow the cable to be twisted or bended.
- 🔔 Do NOT put the SpO₂ sensor and pressure cuff on the same limb, otherwise the NIBP measuring will affect SpO₂ measuring and cause the alarm error.
- 🔔 Using nail polisher or other cosmetic product on the nail may affect the accuracy of measurement.
- 🔔 The fingernail should be of normal length.
- 🔔 Do NOT use the damaged SpO₂ sensor.
- 🔔 The SpO₂ sensor can not be immersed into water, liquor or cleanser completely, because the sensor has no capability of waterproofness.

3.3.4 TEMP Transducer Connection

Connecting methods:

1. Attach the transducers to the patient firmly;
2. Connect the cable to TEMP probe connector in the front panel.

Note: When unplugging the probe, be sure to hold the head of the connector and pull it out.

3.3.5 Loading printing paper

Operation procedures for loading printing paper:

1. Press both “OPEN” notches with force on printer shield with two thumbs to open it.
2. Move the tab of rubber roller lock at the left 90° upwards to unlock it, refer to the following figure with mark ①.
3. Cut one end of the paper into triangle, and load the paper from the underside of the rubber roller.
4. Turn the roller clockwise to get the paper rolled, and put the paper roll into the compartment.
5. Pull the paper out of paper slot on the shield.
6. Move the tab of the rubber roller lock 90° downwards to lock it.
7. Put the shield back in position and secure it.

Operation procedures for taking out printing paper roll:

- 1~2 steps are the same with the 1~2 steps mentioned above for loading printing paper.
3. Roll the loading roller anti-clockwise and pull the paper out.
- 4~5 steps are the same with the 6~7 steps mentioned above for loading printing paper.

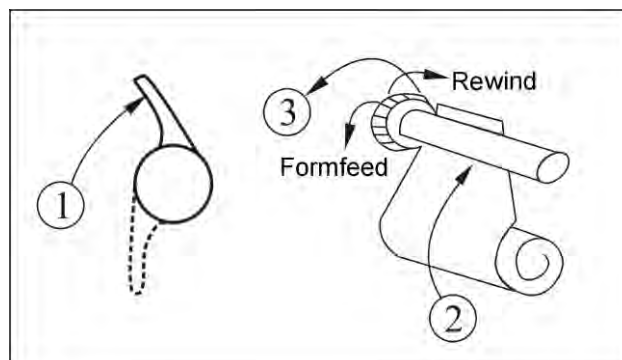


Figure 3.7 Loading and taking out printing paper

3.3.6 Battery Installation

1. Ensure that the monitor is not connected to AC power supply and the monitor is turned off.
2. Open the battery cover and place the battery in the direction as shown in Fig. 3.8 to insert the battery into any one of battery compartments. Do not insert battery with their polarities reversed.
3. Move the battery baffle to secure battery.
4. Close the battery cover.

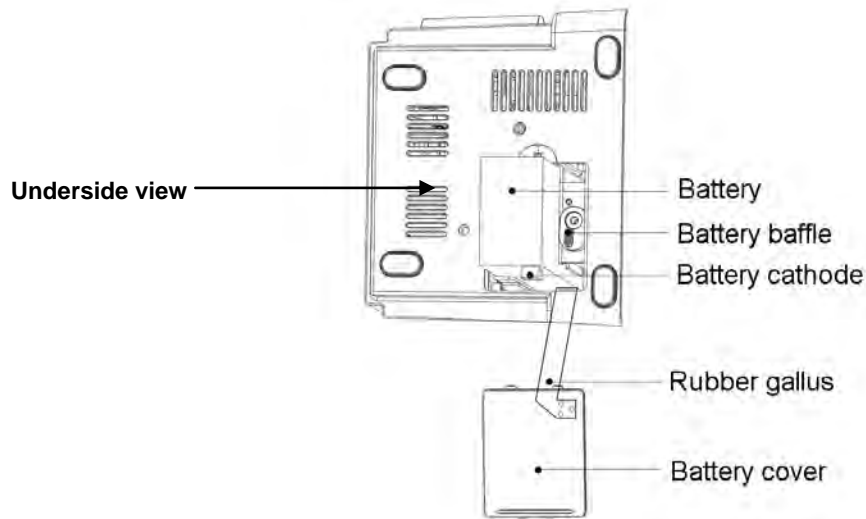


Figure 3.8 Battery Installation

Note:

- Do not insert battery terminal with its polarities reversed, or the monitor can not be started.
- Please take out the battery before transport or storage.

Chapter 4 Operations

4.1 Initial Monitoring Screen

When the parameter configuration of monitor is “ECG+SpO₂+NIBP”, insert the ECG cable into the socket labeled “ECG” and attach the ECG leads to the electrodes placed on human body, once powered up, the LCD will display the initial monitoring screen, this is the default display screen as well.

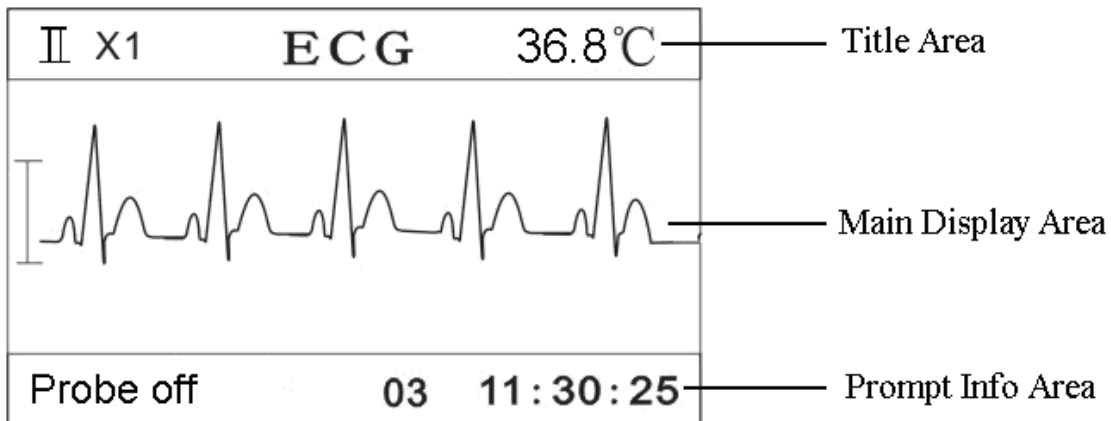


Figure 4.1 Default Display Screen

If the ECG cable is disconnected from the monitor or leads off from the patient, the ECG waveform will become a base line in main display area and “Lead off” will appear at the left side of prompt info area (as shown in Figure 4.2).

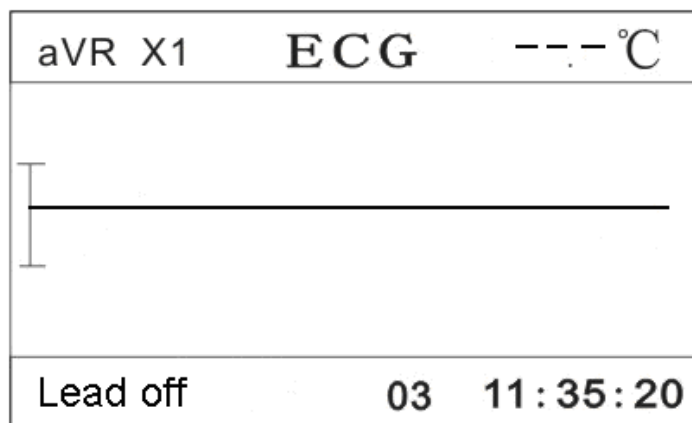




Figure 4.2 Lead off

The LCD screen will display the information by different display views, short pressing “” key to shift screen display among 4 display views: ECG waveform screen (default screen), SpO₂ plethysmogram screen, SpO₂ trend graph screen, HR trend graph screen and NIBP list screen. Long pressing “” key will enter the setup menu screen. For every display view, the display area is divided into 3 parts: title area, main display area, and prompt info area (see Figure 4.1). The prompt info area contains 3 segment of information: status or event indication at the left, patient ID number in the middle, real time clock at the right (also see Figure 4.1).

4.1.1 Default Display Screen Description

Title area:

- ✧ **II ×1**: ECG lead status and ECG waveform scale.
- ✧ **“ECG”**: indicate the current monitoring parameter is ECG.
- ✧ **“36.8°C”**: temperature numerical value

Main display area:

- ✧ When ECG leads is attached on the patient and connected to the monitor well, ECG waveform will be displayed in the main display area.

Prompt Info:

- ✧ Status or event indication segment:

This segment will display the ECG leads status, probe status, alarm silence counting-down timer, automatic NIBP measurement counting-down timer, over limit warning and other error messages for technical warning. If more than one event occurs or more status appears, the indication message will be displayed alternately at this segment.

“NIBP C-D: XXX”: the counting-down timer of NIBP measurement is XXX seconds. This prompt message appears only when the NIBP measuring mode is set as “AUTO X”.

“mute C-D: XXX”: the counting-down timer of alarm silence is XXX seconds. This prompt message appears only when the alarm silence is enabled.







- ✧ Patient ID segment:

“03”: Patient ID number.


- ✧ Real time clock segment:

“11:30:25”: the current time.

4.1.2 Operation Instructions

- ✧  **key**: select ECG lead. When ECG is monitored, press this key to switch the ECG lead among I, II, III, aVR, aVL, aVF and V.
- ✧  **key**: freeze ECG waveform or Plethysmogram on the screen.
- ✧  **key**: shift display mode.
- ✧  **key**: print ECG waveform. Press it again to stop printing.
- ✧  **key**: start/cancel NIBP measurement.
- ✧  **key**: Alarm silence switch, press it to enable/disable alarm silence.
- ✧ **“▲”/“▼”key**: change ECG waveform scale.

4.2 SpO₂ Monitoring Screen

Short time press “ Display” key to shift the screen view to SpO₂ monitoring screen, as shown in Figure 4.3.

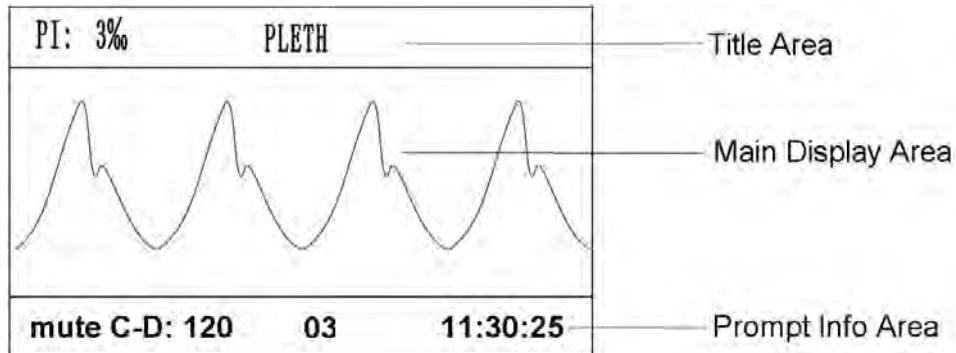


Figure 4.3 SpO₂ Monitoring Screen

4.2.1 Screen Description

Title area:

- ✧ “**PI: 3%**”: the perfusion index is 3‰; it displays only when “Setup Menu→SpO₂→PI Display” is set as “ON”.

Note: PI display function is optional and it needs hardware support.

- ✧ “**PLETH**”: Mark of SpO₂ plethysmogram, when “PLETH” displays in title area, the main display area will be SpO₂ plethysmogram, and this display screen is the default screen.
- ✧ “**36.8°C**”: temperature numerical value

Main display area:

When SpO₂ sensor is placed on the patient and connected to the monitor well, a trace of sweeping waveform (plethysmogram) will be displayed in the main display area (as shown in Figure 4.3).

If the SpO₂ sensor is disconnected from the monitor or off from the patient, the plethysmogram will become a base line in main display area and “Probe off” will appear at the left side of prompt info area (as shown in Figure 4.4).

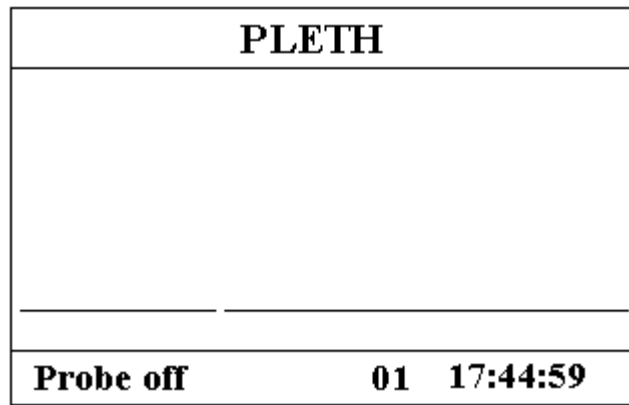







Figure 4.4 Probe Off

4.2.2 Operation Instructions

- ◇ “” key: press this key to shift to next display view (SpO₂ trend graph).
- ◇ “” key: Press it to print a trace of SpO₂ plethysmogram, press it again to stop printing.
- ◇ “” key: start/cancel NIBP measurement.
- ◇ “” key: Alarm silence switch, press it to enable/disable alarm silence.

4.3 Trend Graph Display

Short pressing “ Display” key to shift the screen view to trend graph display screen, as shown in Figure 4.5.

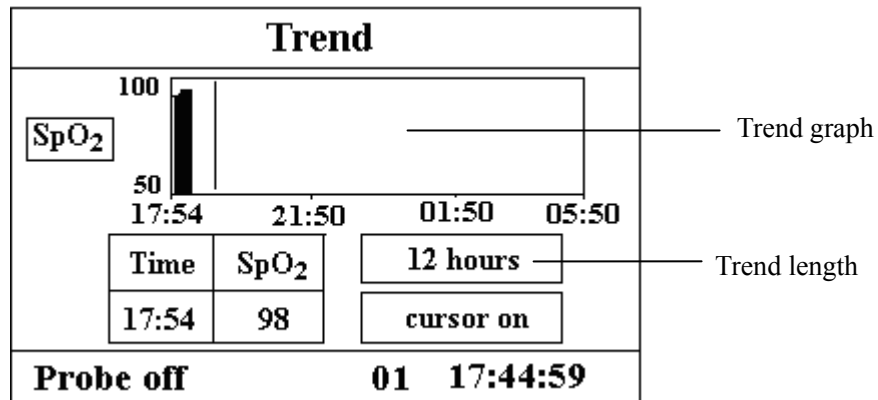


Figure 4.5 Trend Graph

4.3.1 Screen Description

- ◇ “**12 hours**”: **the trend length of trend graph**; three options: “12”, “24” or “96” hours; when the selection is 12 hours, the upper trend graph will display SpO₂ trend curve for last 12 hours.
- ◇ “**cursor on**”: **enable the display of cursor on trend graph**, i.e. the vertical cursor line displayed in trend graph, so the user can move the cursor to inspect the SpO₂ value at the given time.
- ◇ “**SpO₂**”: **indicate that the trend graph beside it is SpO₂ trend**. Let the cursor stay here and press“**■**”

key to confirm, then press “▲” key or “▼” key again to select trend graph type:

“**SpO₂**”: SpO₂ trend graph

“**HR**” HR trend graph


4.3.2 Operation Instructions


1. Press “▲” key or “▼” key to highlight “trend length” or “cursor on” selection.
2. Press “■” key to confirm.
3. Press “▲” key or “▼” key again to select value of trend length (12/24/96 hours) if the selecting box stays in “trend length” option, or to move the cursor if the selecting box stays in “cursor on” option.


Instructions for viewing the trend curve:


- Select “cursor on” and press “■” key to confirm, and “cursor on” becomes “cursor off”, then you can press “▲” key or “▼” key to move the vertical cursor, the list box below will display SpO₂/HR value and the time value at the point where the cursor stays. Move cursor back and forth this way, you can view the SpO₂/HR trend (12/24/96 hours long). Press “■” key again to exit trend viewing.
- When pressing “▲” key or “▼” key to move cursor, the moving step is variable. The rule is that the initial step is 1 point, after pressing “▲” or “▼” key towards the same direction for 5 times, the step becomes 5 points, and with 5 more pressing the step becomes 10, then 20. No matter what step is, as long as you press “▲” or “▼” key towards the other direction, the step becomes 1 and towards the other direction.

4. press:

“” key: press this key to shift to next display view.

“” key: Press it to print the current displayed trend graph.

“” key: start/cancel NIBP measurement

“” key: alarm silence switch; press it to enable/disable alarm silence.

4.4 NIBP List Screen

Short pressing “ Display” key to shift the screen to NIBP List screen, as shown in Figure 4.6.





SYS/DIA/MAP			PR
12-07	09:05	124/ 88/ 98	75
12-07	09:10	124/ 88/ 95	72
12-07	09:20	124/ 88/ 98	75
12-07	09:30	124/ 88/ 98	75
12-07	09:40	124/ 88/ 98	75
12-07	09:40	124/ 88/ 98	75
mute C-D:90		01	18:56:07

Figure 4.6 NIBP List


The first column is the date, the second column is NIBP measuring time, the third column is NIBP value, and the fourth column is pulse rate (measured by NIBP module). “SYS/DIA/MAP” indicates the value of “systolic pressure/diastolic pressure/mean arterial pressure”.

4.4.1 Operation Instructions

On NIBP List screen, if NIBP measurement is more than 6 groups, press “▲” key or “▼” key to scroll up or down through all the measurement values. If NIBP measurement is not more than 6 groups, the keys “▲” or “▼” are not effective.

- ◇ “” key: press this key to shift to next display view.
- ◇ “” key: print NIBP list.
- ◇ “” key: start/cancel measuring NIBP.
- ◇ “” key: alarm silence switch; press it to enable/disable alarm silence.

4.5 Setup Menu Screen

At any display view screen, long time press “ Display” key to shift the screen to Setup Menu screen, as shown in Figure 4.7. All the functional parameters of the system can be set through Setup Menu.

Setup Menu	
ECG TEMP	System
SpO ₂	Patient Info
NIBP	Date / Time
Nurse Call	Default
Probe off	01 19:56:07

Figure 4.7 Setup Menu Screen

There are 8 functional groups for setting parameters: “ECG TEMP, SpO₂, NIBP, Nurse Call, System, Patient

Info, Date/Time and Default” on the Setup Menu Screen.

1. Press “▲” key or “▼” key to shift cursor to corresponding functional group setting.
2. Press “■” key to confirm and enter into corresponding functional parameter setup screen.
3. Press “🖨️” key under the setup menu will print ECG waveform.
4. Press “🏠” key to exist from Setup Menu Screen.

🖨️ At Setup Menu Screen or its submenu screen, when pressing “🖨️” key, the default display screen will be printed.

The following will cover each functional parameter’s setting up.

4.5.1 ECG and Temperature Setup

ECG/TEMP					
Lead	I	Gain	X1	1mV	on
HR	🔔	Hi	180	Lo	40
TEMP	🔔	Hi	180	Lo	40
Unit	°C	T probe	KRK		
Probe off		01 19:30:07			

Figure 4.8 ECG/TEMP Setup Screen

Screen Description:

- ✧ “Lead”: ECG lead selection: I , II ,III, AVR, AVL, AVF or V;
- ✧ “Gain”: ECG waveform scale:
 - “×1/2”- waveform reduced to half of nominal scale
 - “×1”- nominal waveform scale “×2”- waveform with doubled scale
- ✧ “1mV”: generating internal 1mV calibration signal. This signal is used to test the function of the machine. It is not used during normal operation. The default set is off.
- ✧ “HR 🔔”: HR alarm switch; “🔔” indicates HR alarm is on; “🔕” indicates HR alarm is off.
- ✧ “HR Hi/Lo”: high/low limit of HR alarm;
- ✧ “TEMP 🔔”: temperature alarm switch; “🔔” indicates temperature alarm is on; “🔕” indicates temperature alarm is off.
- ✧ “TEMP Hi/Lo”: high/low limit of temperature alarm;
- ✧ “Unit”: body temperature unit. Two options: “°C” or “°F”. Conversion relation: 1°F= (°C×1.8) +32.
- ✧ “T probe”: the type of temperature probe “KRK”;

4.5.2 SpO₂ Setup

SpO ₂					
SpO ₂	<input checked="" type="checkbox"/>	Hi	<input type="text" value="100"/>	Lo	<input type="text" value="90"/>
PR	<input checked="" type="checkbox"/>	Hi	<input type="text" value="180"/>	Lo	<input type="text" value="40"/>
PI display	<input type="text" value="off"/>				
Probe off		01	19:30:07		

Figure 4.9 SpO₂ Setup Screen

Screen Description:

- ◇ “SpO₂ ”: SpO₂ alarm switch; “” indicates SpO₂ alarm is on; “” indicates SpO₂ alarm is off.
- ◇ “SpO₂ Hi”: high limit of SpO₂ alarm; range: “1~100”.
- ◇ “SpO₂ Lo”: low limit of SpO₂ alarm; range: “0~99”.
- ◇ “PR ”: pulse rate alarm switch; “” indicates PR alarm is on; “” indicates PR alarm is off.
- ◇ “PR Hi”: high limit of PR alarm; range: “22~250”.
- ◇ “PR Lo”: low limit of SpO₂ alarm; range: “0~248”.
- ◇ “PI display”: “on” means PI display is enabled; “off” means PI display is disabled.

Operation Instructions

1. Press “▲” key or “▼” key to move cursor to select parameter.
2. Press “■” key to confirm and active this parameter setting.
3. Press “▲” key or “▼” again to adjust or modify parameter value.
4. Press “■”key again to confirm and save the setting.
5. Press “” key to return to upper level screen.

4.5.3 NIBP Setup










NIBP					
SYS	<input checked="" type="checkbox"/>	Hi	<input type="text" value="100"/>	Lo	<input type="text" value="90"/>
DIA	<input checked="" type="checkbox"/>	Hi	<input type="text" value="180"/>	Lo	<input type="text" value="40"/>
MAP	<input checked="" type="checkbox"/>	Hi	<input type="text" value="180"/>	Lo	<input type="text" value="40"/>
Mode	<input type="text" value="manual"/>		unit	<input type="text" value="mmHg"/> >>	
Probe off		01	19:44:50		

Figure 4.10A NIBP Setup

Tourniquet	
pressure	<input type="text" value="140"/> duration <input type="text" value="40"/>
Alert T	<input type="text" value="05"/>
<input type="text" value="Start"/>	
Probe off 01 19:44:50	

Figure 4.10B Tourniquet Setup

NIBP Setup Screen Description:

- ✧ “**SYS** ”: systolic pressure alarm switch; “” indicates systolic pressure alarm is on; “” indicates systolic pressure alarm is off.
- ✧ “**SYS Hi**”: high limit of systolic pressure alarm; range: “32~250” mmHg.
- ✧ “**SYS Lo**”: low limit of systolic pressure alarm; range: “30~248” mmHg.
- ✧ “**DIA** ”: diastolic pressure alarm switch; “” indicates diastolic pressure alarm is on; “” indicates systolic pressure alarm is off.
- ✧ “**DIA Hi**”: high limit of diastolic pressure alarm; range: “22~230” mmHg.
- ✧ “**DIA Lo**”: low limit of diastolic pressure alarm; range: “20~228” mmHg.
- ✧ “**MAP** ”: mean arterial pressure alarm switch; “” indicates mean arterial pressure alarm is on; “” indicates mean arterial pressure alarm is off.
- ✧ “**MAP Hi**”: high limit of mean arterial pressure alarm; range: “28~242” mmHg.
- ✧ “**MAP Lo**”: low limit of mean arterial pressure alarm; range: “26~240” mmHg.
- ✧ “**Mode**”: NIBP measuring mode, “manual”, “AUTO 1”, “AUTO 2”, ...“AUTO 240” and “STAT” etc. options. “AUTO 1” means NIBP measurement takes once every one minute automatically; “AUTO 60” means NIBP measurement takes once every 60 minutes automatically; In AUTO mode, the counting-down timer is displayed in the “Prompt Info” area, as shown in Figure 4.1.
- ✧ “**unit**”: unit of the blood pressure value;
“mmHg” or “kPa” can be selected. Conversion: 1kPa=7.5mmHg.
- ✧ “>>”: Page down icon. When cursor stays in the “unit” filed, press “▼” key to enter Tourniquet Setup.

Tourniquet Setup Screen Description:

- ✧ “**Pressure**”: when you use Tourniquet function, you need to preset a cuff pressure for hemostasia. The pressure is adjustable, and its adjusting limit is different for different patient category:
for neonates: preset range: 70~100mmHg, default value: “90” mmHg;
for infants: preset range: 80~130 mmHg, default value: “110” mmHg;
for adults: preset range: 80~180mmHg, default value: “140” mmHg.
 If the pressure drops down slowly under 10mmHg compared with the preset value due to little air leakage in the pneumatic system when time passes by, the monitor will re-inflate to maintain the cuff pressure close to the preset pressure value.

Note: the unit of cuff pressure is the same with the NIBP unit in NIBP Setup.
- ✧ “**Duration**”: After presetting the cuff pressure, you need to set the time period for maintaining the preset pressure after inflation. “5, 6, 7, ...120” minutes adjustable. The default value is “40” minutes.
 If the set value is “xx” minutes, the monitor will count down from “xx” minutes automatically when starting cuff inflation. When time is up, it will deflate automatically.
- ✧ “**Alert T**”: the alert time for reminding user that the operation of tourniquet is going to be end after this time period. 1 to 60 minutes adjusting range with 1 minute step, the default value is “5” minutes. If the set value is “xx” minutes, the monitor will produce alarm sound until ending deflation when

counting down time reaches to “xx” minutes. The alarm type is high priority alarm. (For example: the duration is 40 minutes, the alert time is 5 minutes, the alarm will ring for prompt when the duration counting down to 5 minutes. The Prompt Info area starts to prompt: TOUR C-D 300 seconds.)

- ✧ **“Start”**: shift cursor to “Start” and press “■” key, “Start” becomes “Stop” and meanwhile the blood cuff starts being inflated; Pressing “Stop” button can stop using this function. After deflation, it will change to “Start” again.

4.5.4 Nurse Call

Nurse Call	
Output level	<input type="text" value="low"/>
Source: ALM	<input type="checkbox"/> H <input type="checkbox"/> M <input type="checkbox"/> L
Duration	<input type="text" value="pulse"/>
Probe off	01 20:14:50

Figure 4.11 Nurse Call Setup Screen

Screen Description:

- ✧ **“Output level”**: two options “low” or “high” output levels are available.
When the calling system in hospital works in “Normal Open” mode, “low level” should be selected.
When the calling system in hospital works in “Normal Close” mode, “high level” should be selected
- ✧ **“Source”**: three kinds of alarm sources can trig the nurse call: high level alarm, medium level alarm and low level alarm (multi-optional). If you don’t make choice, nurse call signal will not be sent out.
- ✧ **“Duration”**: two options “pulse” or “continuous” output modes are available;
“continuous”: the continuous mode of output means the nurse call signal will keep until the selected alarm source(es) disappear, i.e. the signal will last from starting alarm to stopping alarm.
“pulse”: the output nurse call signal is pulse signal which lasts for 1 second. When several alarms occur at the same time, only one pulse signal will be sent out.

Note:

Nurse Call function can not be regarded as main alarm notice method, please do not entirely rely on it. You should combine parameter values with alarm level and patient’s clinical behavior and symptom to determine patient’s status.

4.5.5 System Setup

System			
Vol	<input type="text" value="00"/>	key beep	<input type="text" value="off"/>
LANG	<input type="text" value="ENG"/>	priority	<input type="text" value="HR"/>
backlite	<input type="text" value="on"/>	contrast	<input type="text" value="07"/>
care mode	<input type="text" value="Demo"/>	BT SD	<input type="text" value="on"/>
Probe off		01	20:14:50

Figure 4.12 System Setup Screen

Screen Description:

- ✧ **“Vol”**: set beeper volume, “0~7” level adjustable, the set “0” i.e. no sound.
- ✧ **“key beep”**: to turn on/off key beep;
- ✧ **“LANG”**: language selection. “ENG” for English.
- ✧ **“priority”**: priority of “PR” value or “HR” value display. The default set is “HR”.
- ✧ **“backlite”**: turn on/off backlight;
- ✧ **“contrast”**: adjust LCD display contrast, “0~31” level adjustable;
- ✧ **“care mode”**: “Demo” shows the demo waveforms and data. In the demo state, all the signals and data are generated from the monitor for demonstration and testing purpose. “Real” shows the real time waveform, i.e. normal monitoring status;
- ✧ **BT SD**: turn on/off the pulse beeping sound.

4.5.6 Patient Info

Patient Info	
ID	<input type="text" value="01"/>
category	<input type="text" value="adult"/>
Probe off	
01	12:14:50

Figure 4.13 Patient Info Screen

Screen Description:

- ✧ **“ID”**: change or set current patient’s ID number, 0~100 adjustable;
- ✧ **“category”**: change or set the category of current patient; three options “adult”, “pediatric” and “neonate”, the default is “adult”.

Note: If the patient ID is changed, all the history data will be cleared, that means SpO₂ trend graph, HR trend graph and NIBP list will become empty.

4.5.7 Date/Time

Date / Time					
yy	<input style="width: 30px;" type="text" value="07"/>	mm	<input style="width: 30px;" type="text" value="09"/>	dd	<input style="width: 30px;" type="text" value="21"/>
hh	<input style="width: 30px;" type="text" value="10"/>	mm	<input style="width: 30px;" type="text" value="15"/>	ss	<input style="width: 30px;" type="text" value="20"/>
Probe off		01 12:17:50			

Figure 4.14 Data/Time Setup Screen

Screen Description:

- ◇ “yy **07** mm **09** dd **21**”: date setting, “07-09-21” shows the date is September 21st, 2007.
- ◇ “hh **10** mm **15** ss **20**”: time setting, “09: 20: 21” shows the time is 10:15:20.

4.5.8 Recover Default Settings

On Setup Menu screen, press “▲” button or “▼” button to shift cursor to “**Default**”, and then press “■” button, all the setting parameters will be reset to factory default setting value.

4.6 Power Saving Mode

On the initial display screen, you can make the monitor stay in power saving mode for power saving. Short time press power button to shift screen to “Power Saving Mode” display screen, as shown in Figure 4.12.

Power Saving Mode	
Enter into power saving mode?	
<input style="width: 50px;" type="text" value="yes"/>	<input style="width: 50px;" type="text" value="no"/>
Probe off	
01 20:14:57	

Figure 4.12 Power Saving Mode

Press “▲” button or “▼” button to shift cursor to “yes” or “no” and press “■” button to confirm. If your selection is “yes”, all the numerical values displayed on digital LEDs display become darker and the monitor stays in power saving mode.

Short time press power button again to shift screen to “Power Saving Mode” display screen for exiting the sleeping mode.

Chapter 5 Technical Specifications

5.1 ECG Monitoring

1. Input signals range in amplitude: $\pm(0.4\text{mVp} \sim 5\text{mVp})$
2. Heart rate display range: 20bpm~300bpm
3. Heart rate display accuracy: $\pm 1\%$ or $\pm 2\text{bpm}$, whichever is greater.
4. Heart rate alarm delay time: $\leq 10\text{s}$
5. Sensitivity selection:
 - $\times 1/2$, 5mm/mV tolerance: $\pm 5\%$
 - $\times 1$, 10mm/mV tolerance: $\pm 5\%$
 - $\times 2$, 20mm/mv tolerance: $\pm 5\%$
6. Sweeping speed: 25mm/s tolerance: $\pm 10\%$
7. ECG noise level: $\leq 30\mu\text{VP-P}$.
8. ECG input loop current: $\leq 0.1\mu\text{A}$
9. Differential input impedance: $\geq 5\text{M}\Omega$
10. Common-mode rejection ratio (CMRR): $\geq 89\text{dB}$
11. Time constant $\geq 0.3\text{s}$
12. Frequency response: 0.5 Hz~40Hz($+ 0.4 \text{ dB}$, $- 3.0 \text{ dB}$)

5.2 TEMP Monitoring

1. TEMP measuring range: 25.0°C~45.0°C
2. TEMP measuring accuracy: $\pm 0.2^\circ\text{C}$
3. TEMP responding time: $\leq 150\text{s}$

5.3 NIBP Monitoring

1. Measuring method: Oscillometric Technique
2. Pneumatic pressure measuring range: 0 mmHg~300mmHg
3. Accuracy of pressure measurement: $\pm 3 \text{ mmHg}$
4. Cuff inflation time: <10 seconds (typical adult cuff)
5. Measurement time on the average: < 90 seconds
6. Air release time while the measurement is canceled: <2 seconds (typical adult cuff)
7. Initial cuff inflation pressure
 - Adult: <180 mmHg; Infant: <120 mmHg; Neonate: <90 mmHg
8. Overpressure protection limit
 - Adult: 300 mmHg; Infan: 240mmHg; Neonate: 150 mmHg
9. NIBP measurement range:

press (unit)		Adult	Infant	Neonate
SYS	mmHg	40~255	40~200	40~135
MAP	mmHg	20~215	20~165	20~110
DIA	mmHg	10~195	10~150	10~95

10. NIBP accuracy:

Maximum mean error: ± 5 mmHg

Maximum Standard deviation: 8 mmHg

11. Measurement mode: Manual, Auto, STAT

5.4 SpO₂ Monitoring

1. Transducer: dual-wavelength LED
2. SpO₂ measuring range: 35%~100%
3. Low perfusion capability: 0.4%~5%
4. SpO₂ measuring accuracy:

50%~100% 3%

*NOTE: Accuracy of SpO₂ should be the root-mean-square(rms) of difference.

5.5 Pulse Monitoring

1. Pulse rate measuring range: 30bpm~240bpm
2. Pulse rate measurement accuracy: ± 2 bpm or $\pm 2\%$, whichever is greater.

5.6 Data Recording

1. Sensitivity selection tolerance: $\pm 5\%$
2. Recording speed: 25mm/s

5.7 Other Technical Specifications

1. AC power supply voltage: 100~250VAC
2. AC power frequency: 50/60 Hz
3. Fuse specification: T3.15AL/250V $\Phi 5 \times 20$ mm.
4. Internal power supply: 12VDC (rechargeable)
5. Battery specification: 12V 2.3AH(sealed lead-acid battery)

5.8 Operating Environment

Working Environment

Ambient temperature range: 5°C ~ 40°C

Relative humidity: 30 ~ 80%

Atmospheric pressure: 70kPa ~106kPa

Transport and Storage Environment

Ambient temperature range: -20°C ~ 60°C

Relative humidity: 10 ~ 95%

Atmospheric pressure: 50.0kPa ~107.4kPa

5.9 Classification

Safety standard	IEC 60601-1
The type of protection against electric shock	Class I equipment.
The degree of protection against electric shock	Type BF, CF applied parts

Chapter 6 Packaging and Accessories

6.1 Packaging

The product is packed in high quality corrugated cartons with foam inside to protect the equipment against damage in the shipping and handling process.

Weight: Details see the indication on the outer package.

Dimension: 360(L)×320(W)×410(H) (mm)

6.2 Accessories

(1) ECG cable with lead wire	One set
(2) ECG electrodes	20 pieces
(3) NIBP cuff	One piece
(4) SpO ₂ probe	One piece
(5) Temperature probe	One piece
(6) Power cord	One piece
(7) Grounding wire	One piece
(8) User manual	One copy
(9) Quality Certificate	One copy
(10) Warranty	Two copies
(11) Packing list	Two copies

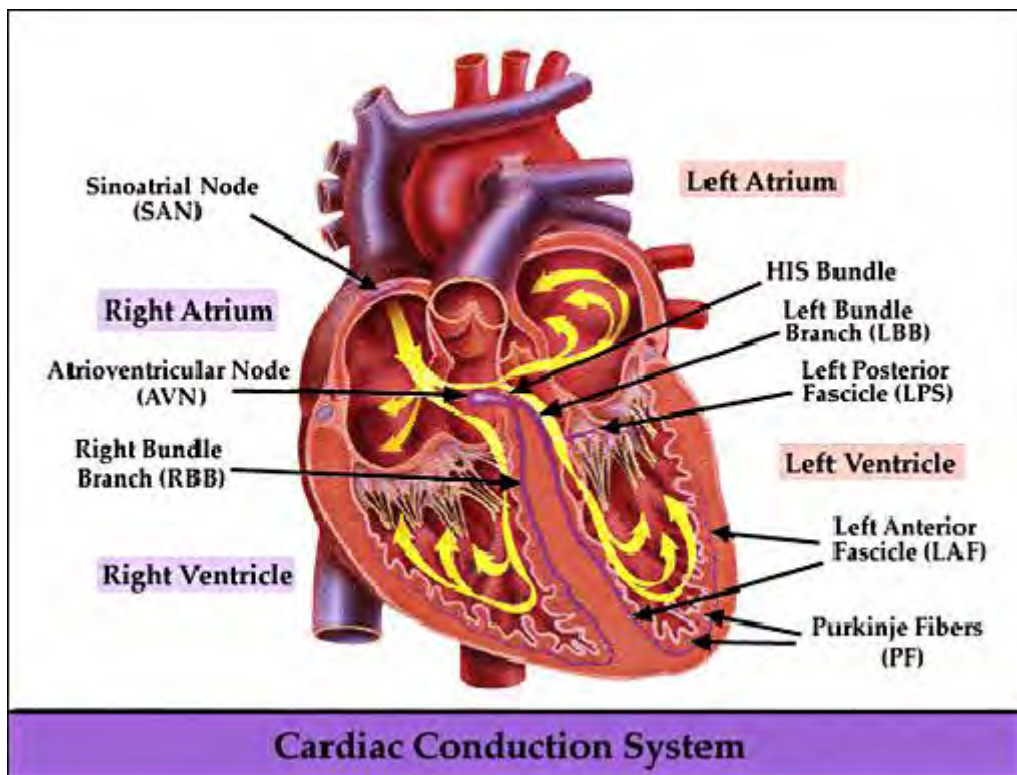
Note: The accessories are subject to change. Detailed items and quantity see the Packing List.

Chapter 7 Working Principle

7.1 How to Obtain High Quality ECG and Accurate Heart Rate

Value

The electrocardiogram (ECG or EKG) is primarily a tool for evaluating the electrical events within the heart. The action potentials of cardiac-muscle cells can be viewed as batteries that cause charge to move throughout the body fluids. These currents represent the sum of the action potentials occurring simultaneously in many individual cells and can be detected by recording electrodes at the surface of the skin. The figure below shows the system of the heart.



First of all, the hospital should be equipped with a 100~250V power supply system with a typical grounding wire. If big interference in ECG continues, connect one end of the grounding wire provided with this equipment to the grounding wire on the back panel of this monitor, and the other end to the special grounding wire, water pipe or radiator.

A common ECG plate electrode used together with this monitor has short shelf life. Generally, the shelf life is only one month after the package is opened. When outdated plate electrode is used, due to skin's contact impedance and big electrode potential, the chance of interference will be increased, and the ECG baseline will have an unstable inclination. Therefore, always use valid plate electrodes.

7.2 The Principle of NIBP Measurement

Blood pressure may be measured in an invasive way (whereby the sensor will be inserted into blood vessel directly) or a non-invasive way. The non-invasive way includes several methodologies, such as the Korotkoff

Sound Method and oscillating method. The Korotkoff Sound Method is used as a conventional way, whereby stethoscope is used to measure the blood pressure. By the oscillating method, an inflation pump will fill the air, and release it slowly. A computer will record change of the cuff pressure when the air is released. With this record, the blood pressure value will be determined. First of all, make sure the signal quality judgment by computer meets the requirements of accurate calculation (such as sudden limb movement or cuff being hit during the measurement). If the answer is negative, give up the calculation. If the answer is positive, proceed with calculation of the blood pressure value.

As change of the blood pressure is recorded by electric sensor, which sensitivity is much higher than that of human ears, the oscillating method uses different definitions for measurement of diastolic pressure, mean arterial pressure and systolic pressure from the Korotkoff Sound Method. When the oscillating method is used, the circuit in the measuring apparatus will separate the amplitude of the cuff pressure from its change with pulsation. With the oscillating method, the blood pressure at the maximum amplitude of cuff pressure is defined as the mean arterial pressure. The blood pressure at amplitude of cuff pressure forward reduced according to proper proportion is defined as systolic pressure, while the blood pressure at amplitude of cuff pressure backward reduced according to proper proportion is defined as diastolic pressure. The maximum change of pulse pressure occurs at these two points. They are equivalent to the point with pulse sound and the point without pulse sound respectively in the Korotkoff Sound Method.

When the risk of invasive monitoring method outweighs its advantage of accuracy, non-invasive monitoring method shall be used.

7.2.1 Points to be noted in NIBP Measurement

Like common non-invasive blood pressure measurement, improper operation may cause inaccurate or blank result or misunderstanding of the measuring information when the oscillating method is used to take the measure of blood pressure. This point needs particular attention of the operators.

1. Requirements of the cuff:
 - 1) Appropriate cuff should be selected according to the age of the subject.
 - 2) Remember to empty the residual air in the cuff before the measurement is commenced.
 - 3) Locate the cuff in such a way that the “φ” mark is at a location where the clearest pulsation of brachial artery is observed.
 - 4) The cuff should be tightened to a degree where insertion of one finger is allowed.
 - 5) The lower end of the cuff should be 2cm above the elbow joint.
2. The subject should lie on the back so that the cuff and the heart are in a horizontal position and the most accurate measure is taken. Other postures may lead to inaccurate measurement.
3. Do not speak or move before or during the measurement. Care should be taken so that the cuff will not be hit or touched by other objects.
4. The measures should be taken at appropriate intervals. Continuous measurement at too short intervals may lead to pressed arm, reduced blood flow and lower blood pressure, and resulting inaccurate measure of blood pressure. It is recommended the measure be taken at intervals of more than two minutes.
5. With the oscillating method, when blood pressure is measured, the inflation pressure of the cuff will be

automatically adjusted according to the previous measure. Generally, the initial inflation pressure is 180mmHg (for the adult mode) or 100mmHg (for the pediatric mode) or 80 mmHg (for the neonate mode) when it is powered on. Following that, 50mmHg (for the adult mode) or 30mmHg (for pediatric mode) or 10mmHg (for the neonate mode) will be added on the basis of the last measurement of systolic pressure. In this way, when the blood pressure rises or the subject is changed, the blood pressure meter may fail in giving the result after the first-time inflation. This monitor will automatically adjust the inflation pressure until the measure is taken, after that, up to four measures will be allowed.

6. When an adult subject is monitored, the machine may fail in giving the blood pressure measure if the pediatric or neonate mode is selected.

7.2.2 Clinical Limitations

1. Serious angiospasm, vasoconstriction, or too weak pulse.
2. When extremely low or high heart rate or serious arrhythmia of the subject occurs. Especially auricular fibrillation will lead to unreliable or impossible measurement.
3. Do not take the measurement when the subject is connected with an artificial heart-lung machine.
4. Do not take the measurement when the subject uses diuresis or vasodilator.
5. When the subject is suffering from major hemorrhage, hypovolemic shock and other conditions with rapid blood pressure change or when the subject has too low body temperature, the reading will not be reliable, for reduced peripheral blood flow will lead to reduced arterial pulsation.
6. Subject with hyperadiposis;

7.3 The Principle of SpO₂/Pulse Measurement

7.3.1 Working Principle

This monitor measures the pulse oxygen saturation (SpO₂) and pulse by means of the radiograph of infrared light and the red light emitted by LED through body's peripheral areas (such as fingers), whereby the photoelectric detecting circuits will analyze the absorptivity of the oxyhemoglobin and reduced hemoglobin respectively, and give the photoabsorption rates before and after pulsation. Using the measure of photoabsorption change due to pulsatory arterial blood flow caused by PLETH waveform, the SpO₂ can be obtained.

7.3.2 Points to be noted in SpO₂ and Pulse Measuring

1. The finger should be properly placed (see the attached illustration of this instruction manual), or else it may cause inaccurate measurement result.
2. Make sure that capillary arterial vessel beneath the finger is penetrated through by red and infrared lights.
3. The SpO₂ sensor should not be used at a location or limb tied with arterial or blood pressure cuff or receiving intravenous injection.

4. Do not fix the SpO₂ sensor with adhesive tape, or else it may result in venous pulsation and consequential inaccurate measurement result of SpO₂.
5. Make sure the optical path is free from any optical obstacles like adhesive tape.
6. Excessive ambient light may affect the measuring result. It includes fluorescent lamp, dual ruby light, infrared heater, and direct sunlight etc.
7. Strenuous action of the subject or extreme electrosurgical interference may also affect the accuracy.
8. Please do not use the SpO₂ sensor when having the MRI, or burn may be caused by faradism.

7.3.3 Clinical Limitations

1. As the measure is taken on the basis of arteriole pulse, substantial pulsating blood stream of subject is required. For a subject with weak pulse due to shock, low ambient/body temperature, major bleeding, or use of vascular contracting drug, the SpO₂ waveform (PLETH) will decrease. In this case, the measurement will be more sensitive to interference.
2. For those with a substantial amount of staining dilution drug (such as methylene blue, indigo green and acid indigo blue), or carbon monoxide hemoglobin (COHb), or methionine (Me+Hb) or thiosalicylic hemoglobin, and some with icterus problem, the SpO₂ determination by this monitor may be inaccurate.
3. The drugs such as dopamine, procaine, prilocaine, lidocaine and butacaine may also be a major factor blamed for serious error of SpO₂ measurements.
4. As the SpO₂ value serves as a reference value for judgement of anemic anoxia and toxic anoxia, the measurement result of some patients with serious anemia may also present as good SpO₂ value.

Chapter 8 Troubleshooting

8.1 No Display on the Screen

Shut down the machine and unplug the power. Use a universal meter to check if the outlet has proper voltage, if the power cable is in good condition, and if the power cable is properly connected with this apparatus or outlet. Remove the fuse from the back cover of this machine, and make sure it is in good condition.

8.2 Excessive ECG Signal Interference or Too Thick Baseline

1. Check if the plate electrodes are properly located, and if valid plate electrodes are used.
2. Check whether the lead wires are inserted properly. If no ECG curve is displayed, check if the ECG lead wires are broken.
3. Make sure the mains outlet has standard grounding wire.
4. Check if the grounding wire of the apparatus is properly grounded.

8.3 No Blood Pressure and Pulse Oxygen Measures

1. Check if the blood pressure cuff is properly wrapped around the arm according to the operating instructions, if the cuff leaks, and if the inlet is closely connected with the NIBP jack on the side panel. Check if the indicator of the pulse oxygen probe flashes and if the pulse oxygen probe is properly connected to the SpO₂ jack on the side panel.
2. If the problems still exist, please contact the local dealer.

8.4 Blank Printing Paper

1. Check whether the printing paper is installed with its face reversed. Please reinstall it and let the sensitive page face upward.
2. If the problems still exist, please contact the local dealer.

8.5 System Alarm

1. When the parameter value is higher or lower than the alarm limits, the alarm will ring. Please check whether the alarm limit value is proper or the condition of the patient.
2. Probe off. Please check the connection of the probes.

Note: In case of trouble of this machine in the service, follow the instructions below to eliminate the problem first. If the attempt fails, contact the dealer in your local area or the manufacturer. Do not open the cabinet without permission.

Chapter 9 Maintenance

9.1 Service and Examination

9.1.1 Daily Examination

Before using the monitor, the checks below should be carried out:

- Check the monitor for any mechanical damage;
- Inspect the exposed parts and the inserted parts of all the leads, and the accessories;
- Examine all the functions of the monitor that are likely to be used for patient monitoring, and ensure that it is in good working condition;
- Make sure that the monitor is grounded properly.
- Pay close attention to the fluctuation of the local power supply voltage. A manostat is recommended when necessary.
- In case any indication of damage about the function of the monitor is detected and proven, it is not allowed to apply it to the patient for any monitoring.

9.1.2 Routine Maintenance

After each maintenance or the yearly maintenance, the monitor can be thoroughly inspected by qualified personnel, including function and safety examinations.

- ⚠ **If the hospital fails to carry out a satisfactory maintenance program about the monitor, it may get disabled and harm the patient's safety and health.**
- ⚠ **In case of ECG leads damage or aging, please replace the lead.**
- ⚠ **If there is any indication of cable and transducer damage or they deteriorate, they are prohibited from any further use.**
- 🔔 **The adjustable units in the monitor such as potentiometer are not allowed to adjust without permission to avoid unnecessary failures that affect normal application.**

9.1.3 Battery Maintenance

- ⚠ **Please pay attention to the polarity of battery, do NOT insert it into battery compartment with reversed polarities;**
- ⚠ **Do NOT use the batteries manufactured by other companies, if being inserted, the device will may be damaged;**
- ⚠ **In order to avoid damaging the battery, do NOT use other power supply device to charge the battery;**

- ⚠ **After battery ageing phenomenon occurring, to avoid explosion risk do NOT throw the battery into fire.**
- ⚠ **Do not hit or strike it with force;**
- ⚠ **Do not use this battery on other devices;**
- ⚠ **Do not use this battery below -10°C or above 40°C;**
- ⚠ **Dispose of the battery, the local law should be followed.**
- 🔔 **It is recommended to use the battery once a month to ensure its strong power supply capacity and long service life, and recharge it after running out of the power.**
- 🔔 **In order to maintain battery supply time and prolong battery lifetime, please use the battery once a month and do not charge it until it is used up each time.**

Note: 1. when battery is used to supply power, user should not charge the battery until the low battery alarm rings. (After line-haul or long-time storing, using battery may not start the monitor, please charge the battery.)

2. The battery should be charged for 10 to 15 hours.

9.1.4 Service

If the monitor has functional malfunction or is not working, please contact the local dealer or our company, and we are to offer the best solution as soon as possible for your satisfaction. Only qualified service engineer specified by the manufacture can perform the service. Users are not permitted to repair it by themselves.

9.2 Cleaning, Sterilization and Disinfection

- Kept the monitor from dust.
- It is recommended to clean the outer shell and screen of the monitor to keep it clean. Only non-corrosive cleanser such as clear water is permitted.
- Use the cloth with alcohol to wipe the surface of the monitor and transducers, and dry it with dry and clean cloth or simply air-dry.
- The monitor can be sterilized and disinfected, please clean it first.
- ⚠ **Switch off the monitor and disconnect the power cable before cleaning.**
- ⚠ **Do not let the liquid cleanser flow into the connector jack of the monitor to avoid damage.**
- ⚠ **Clean the exterior of the connector only.**
- 🔔 **Dilute the cleanser.**
- 🔔 **Do not let any liquid flow into the shell or any parts of the monitor.**
- 🔔 **Do not let the cleanser and disinfectant stay on its surface.**
- 🔔 **Do not perform high pressure sterilization to the monitor.**
- 🔔 **Do not put any parts of the monitor in the liquid.**

⚠ Do not pour the disinfectant on its surface while sterilization.

9.3 Cleaning, Sterilization and Disinfection of Accessories

It is recommended to use a cloth dampened with isopropyl alcohol 70%, a 10% aqueous solution of sodium hypochlorite (bleach), a 2% glutaraldehyde solution, ammonia, mild soap or disinfectant spray cleaner to clean the accessories (including sensor, ECG cable and plugs).

⚠ Do not use damaged accessories.

⚠ Accessories can not be entirely immersed into water, liquor or cleanser.

⚠ Do not use radial, steam or epoxyethane to disinfect accessories.

9.4 Storage

If the equipment will not be used for long period of time, wipe it clean and keep it in the packaging, which shall be kept in a dry and good ventilation place free from dust and corrosive gases.

9.5 Transportation

This monitor should be transported by land (vehicle or railway) or air in accordance with the contractual terms. Do not hit or drop it with force.

Appendix

Prompt information explanations

Mute C-D: XXX seconds	Alarm silence count down: XXX seconds
NIBP C-D: XXX seconds	NIBP auto measuring cycle count down: XXX seconds
TOUR C-D: XXX seconds	Tourniquet alert count down: XXX seconds
Probe off	SpO ₂ probe falls off
PR over limit	PR value exceeds the high/low alarm limit
SpO ₂ over limit	SpO ₂ value exceeds the high/low alarm limit
SYS over limit	Systolic pressure value exceeds the high/low alarm limit
DIA over limit	Diastolic pressure value exceeds the high/low alarm limit
MAP over limit	MAP value exceeds the high/low alarm limit
NIBP error 1#	Sensor or other hardware error
NIBP error 2#	Very weak signal because of the cuff, or the patient has very weak pulse
NIBP error 3#	Blood pressure amplifier overflow due to excessive movement
NIBP error 4#	Leaking during the pneumatic device testing
Cuff error	Cuff is not wrapped correctly, or is not connected
NIBP error 5#	Abnormal condition of CPU, such as register overflow, divided by zero
Air leak	Air moving part, tube or the cuff leak air
NIBP over range	The measurement range exceeds 255mmHg (for neonates: over 135 mmHg)
Over motion	The repeated measurement due to moving, excessive noise during the stepping inflation and measuring pressure and pulse, e.g. during patient shaking motion
Over pressure	Cuff press exceeds the safety limit value of software. Limit value for adult: 290mmHg; Limit value for pediatric: 145mmHg; Or caused by cuff extrusion or flapping cuff with force.
NIBP timeout	Adult measurement is more than 120 seconds, neonate measurement is more than 90 seconds.

Default Alarming Values of All Parameters and Setup Range

Parameter \ Mode		Alarm range	Default		
			Adult	Pediatric	Neonate
HR	High	(21~250) bpm	180bpm	200bpm	220bpm
	Low	(20~249) bpm	40bpm	50bpm	50bpm
SYS	High	(32~250) mmHg	180mmHg	130mmHg	110mmHg
	Low	(30~248) mmHg	60mmHg	50mmHg	50mmHg
DIA	High	(22~232) mmHg	120mmHg	90mmHg	90mmHg
	Low	(20~230) mmHg	50mmHg	40mmHg	30mmHg
MAP	High	(28~242) mmHg	160mmHg	110mmHg	100mmHg
	Low	(26~240) mmHg	50mmHg	40mmHg	30mmHg
SpO ₂	High	1%~100%	100%	100%	100%
	Low	0%~99%	90%	85%	85%
Pulse rate	High	(22~250) bpm	180bpm	200bpm	220bpm
	Low	(20~248) bpm	40bpm	50bpm	50bpm
TEMP	High	(24.1~46.0) °C	39.0°C	39.0°C	39.0°C
	Low	(24.0~45.9) °C	34.0°C	34.0°C	34.0°C

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