

# VITALMAX 520

COMPACT, DIGITAL  
VITAL SIGN MONITOR

## OPERATOR'S MANUAL

CAUTION: Federal law (U.S.) restricts this  
device to sale by or on the order of a physician.

Pace Tech, Inc

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## SECTION 1 - INTRODUCTION

### **A. About This Manual**

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This operators manual has been prepared to provide information on the correct use of the *Vitalmax 520* compact, digital vital sign monitor. It contains performance specifications and information for routine installation, operation and maintenance. It is intended for health care professionals trained in monitoring cardiovascular and respiratory activity.

It is up to the user to ensure that any applicable regulations respecting the installation and operation of the monitor be observed. The operator should read this manual carefully and thoroughly before attempting to use the monitor.

If the monitor is being used for the first time, follow each section in the manual sequentially. Each section builds on descriptions from the previous . Since this manual describes a full-featured monitor, disregard any descriptions that refer to features not installed in your monitor. If the monitor is set up, and you are already familiar with its operations, then proceed to the section that describes those functions you will use.

### **B. Warranty**

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Pace Tech, Inc., warrants each monitor to be free of defects in materials and workmanship for a period of one (1) year from the date of purchase. The warranty on all cuffs, probes, printers, and accessories is three (3) months.

If you discover a defect, Pace Tech will, at its option, replace or repair the product at no charge provided the monitor is returned to Pace Tech during the warranty period, transportation charges prepaid.

This warranty does not apply if the product:

- has been damaged from improper operation (misuse) or failure to follow operating instructions provided with the product (misapplication or negligence).
- has been damaged because it has been improperly connected to other equipment.
- has been damaged by accident.
- has been tampered with or modified without the express permission of Pace Tech.
- has had the serial number removed or defaced. This is the only warranty from Pace Tech, and supersedes all other warranties, expressed or implied otherwise.

This warranty is non-transferable and applies only to the original purchaser and does not extend to subsequent owners of the product.

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*Please fill out the self-addressed warranty registration card enclosed in the back of this Operators Manual and return it to Pace Tech, Inc. Also, save the original shipping container for service and repair returns.*

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For technical and service information, refer to the Service Manual, your dealer, or the Customer Service Department at Pace Tech, Inc.

## **C. General Safety**

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### **1. INDICATIONS**

The *VITALMAX 520* is intended for use by persons trained in professional health care to measure and monitor the following parameters:

- Blood oxygen saturation (SpO<sub>2</sub> or Pulse oximetry)
- Pulse (SpO<sub>2</sub> and NIBP) signal strength
- Pulse rate (SpO<sub>2</sub> and NIBP)

Additional options offered are:

- Add-on 27 column thermal printer
- RS-232 option
- Carrying case
- Mobile cart with accessory compartment
- Pole mount assembly

**2. CONTRAINDICATIONS** - *Situations where risks associated with the use of the monitor are greater than the benefits.*



This monitor is not intended to be used as an apnea monitor.



This monitor is not intended to be used during MRI (Magnetic Resonance Imaging).

**3. NOTES** - *Supplemental information which is relevant to the equipment but should not be used to direct action*

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NOTE:

- Notes will appear throughout the operators manual in this format.
-

**4. WARNINGS** - *Indicate the possibility of injury due to patient or operator associated with the use or the misuse of the monitor.*



Federal law restricts this device to sale by or on the order of a physician.



Use only accessories supplied with this monitor or specifically intended to be used with this monitor.



Do not use this device in the presence of flammable anesthetics.



Electrical shock hazard may occur when covers are removed. Do not remove covers or panels. Refer servicing to qualified personnel.



There is no defibrillator synchronization output on this monitor. Make no connections between this monitor and a defibrillator.



Enclosure leakage current is limited internally by this monitor's adapter to less than 100 micro amperes ( $\mu\text{A}$ ); however, always consider additional leakage current that can be caused by other equipment used on the patient at the same time as this monitor.



To ensure that the leakage current protection remains within the specifications, use only the AC adapter supplied with, or specifically intended to be used with this monitor.



Connection of non-isolated devices to the RS-232 connector may cause chassis leakage to exceed the specification standards.



To prevent electrical hazards to all personnel, this monitor must be properly grounded. The AC adapter supplied with the equipment provides for this protection. Do not attempt to defeat this protection by modifying the cords or using ungrounded adapters.



Patient connections are Type B. Use insulated probes for all connections. Do not let patient connections contact other conductive parts, including earth. See instructions for patient connections in this manual.

**5. CAUTIONS** - *Indicate a condition that may lead to equipment damage or malfunction.*















This monitor is intended to be operated from a main power source of nominally 110-120V/50-60 Hz or 220-240V/50-60 Hz AC through the external AC adapter or from the internal battery.



Do not autoclave, ethylene oxide sterilize, or immerse the monitor in liquid. Unplug the monitor before cleaning or disinfecting.

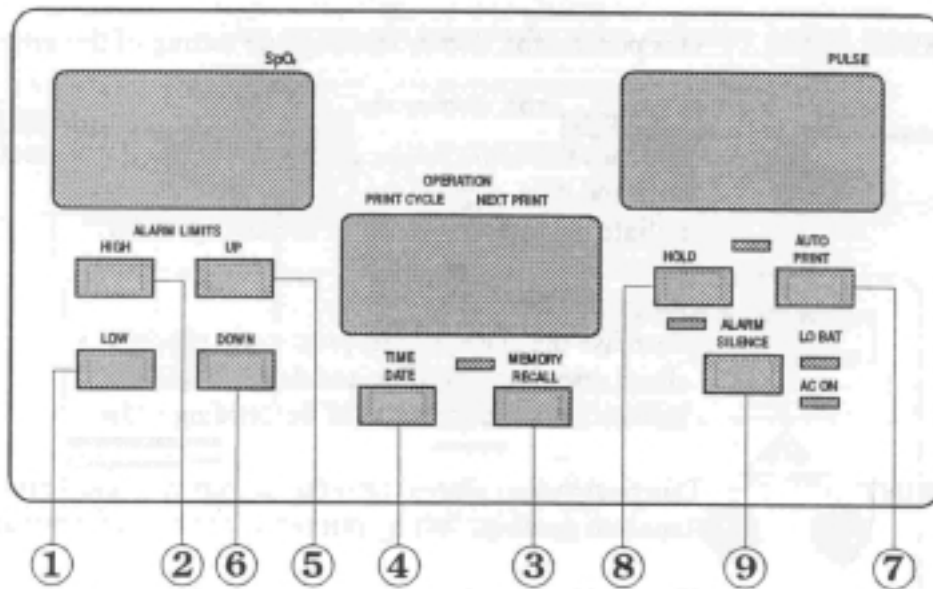
# D. Symbols Chart

The following symbols are used on the monitors to mark equipment functions and/or features.

<u>Symbol</u>	<u>Description</u>	<u>Symbol</u>	<u>Description</u>
	On - only for a part of the equipment		Attention, consult accompanying documents
	Off - only for a part of the equipment; battery will continue to charge even if power is turned "off."		Contains lead-acid battery, please dispose of properly in recycle container. Do not incinerate or throw in the trash.
	Type B Equipment provides a particular degree of protection against electric shock, especially regarding the following: 1. allowable leakage current 2. reliability of the protective earth connection (if present).		Adjust sound volume
	Type BF Equipment is isolated from all other parts to a degree so that patient leakage current is below F-type standards.		Fuse information
	Defibrillator proof BF Equipment		Functional Earth
			Direct Current (DC) power supply
			Fuse information

## SECTION 2 - CONTROLS and CONNECTORS

### A. Front Panels



1. **LOW** This pushbutton will display the previously programmed lower alarm limits
2. **HIGH** This pushbutton will display the previously programmed upper alarm limits.
3. **MEMORY RECALL** This pushbutton will recall previous readings in the memory while monitoring in the *Auto* or *Stat* modes.
4. **TIME DATE** This pushbutton allows viewing and setting of the time and date.
5. **UP** This pushbutton will:  
increase the alarm limits, print cycle time, alarm reset interval,  
time and date, or  
initiate the memory recall in ascending order
6. **DOWN** This pushbutton will:  
decrease the alarm limits, print cycle time, alarm reset interval,  
time and date, or  
initiate the memory recall in descending order

**7. AUTO** This pushbutton places the monitor into the *Auto Print* mode of operation. Repeated readings will be printed at desired set intervals of time.

**8. HOLD** This pushbutton places the monitor on *Hold* and aborts the *Auto Print* mode. The **PRINT CYCLE** and **NEXT PRINT** LED displays will blink as long as the monitor is on *Hold*.

**6. ALARM SILENCE**

This pushbutton will:  
Silence the alarms for a selected period of time, or  
program the automatic alarm reset interval.

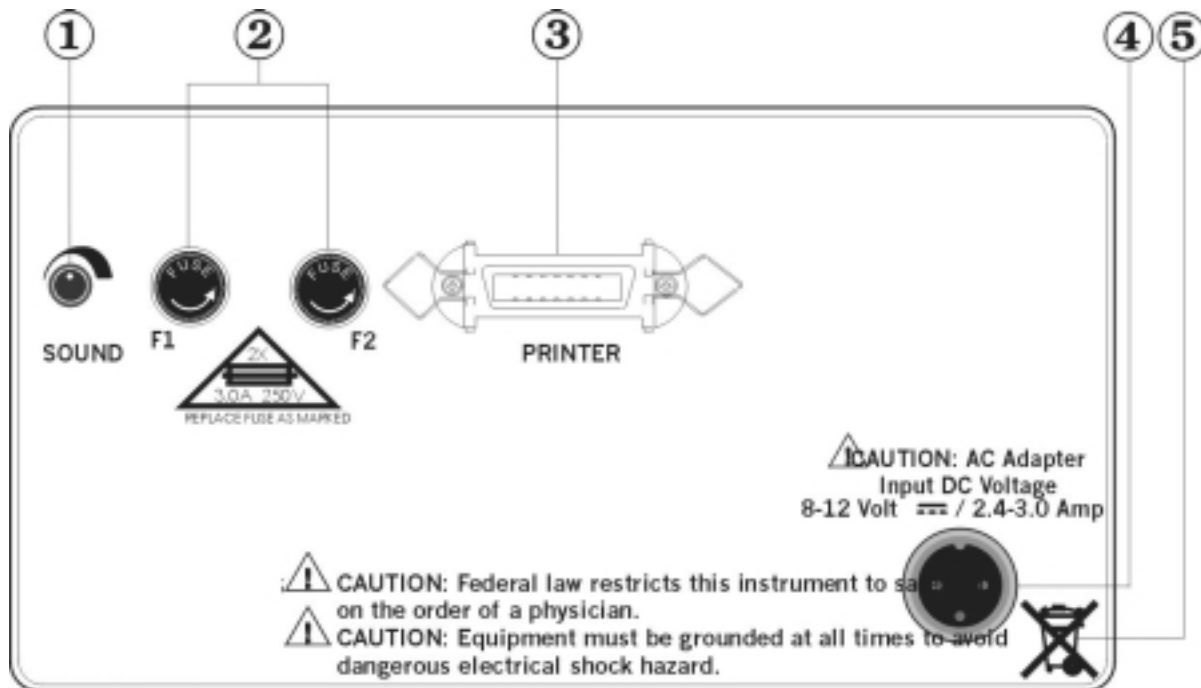
**B. Side Panel**

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**1. SpO<sub>2</sub>** This receptacle accepts the pulse oximetry extension cable plug.

**C. Rear Panels**

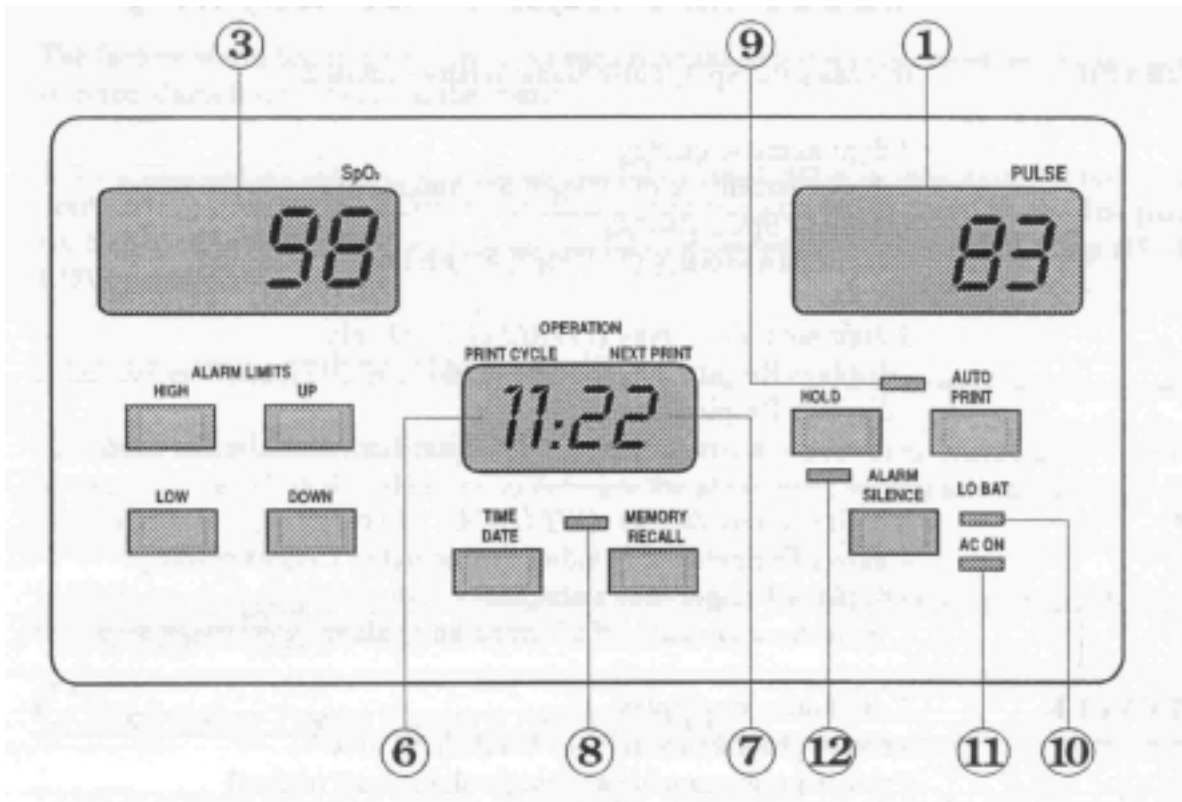
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- 1. SOUND** This control knob adjusts the volume of the pulse sounds; turning the knob clockwise will increase the volume, turning the knob counter-clockwise will decrease the volume. This knob does not adjust the audio alarm.
  
- 2. FUSE HOLDERS** The monitor is equipped with two fuses, designated F1 and F2, which each protect a different power input:
  - F1- This fuse protects the internal battery. If it is blown, then the monitor can continue to operate on the AC power supply. Battery operation is not possible until the fuse is replaced.
  - F2- This fuse protects the AC power supply line. If it is blown, then the monitor can continue to operate under battery power. However, the monitor cannot be recharged until this fuse is replaced.
  
- 3. PRINTER** This receptacle provides parallel signal lines to the optional add-on 27 column thermal printer.
  
- 4. AC ADAPTER** This receptacle accepts the AC adapter used for continuous AC operation or to charge the battery.
  
- 6. BATTERY DISPOSAL SYMBOL**  
Contains lead-acid battery, please dispose of properly in recycle container. Do not incinerate or throw in the trash.”

## SECTION 3 - DISPLAYS and INDICATORS

### A. Front Panel



- 1. PULSE** 3 digit numeric display
- shows Pulse rate per minute
  - displays Pulse alarm limits
  - indicates a violation of a Pulse alarm limit by flashing.
- 3. SpO<sub>2</sub>** 2 digit numeric display
- shows percentage of Oxygen Saturation (SpO<sub>2</sub>) in the blood
  - displays SpO<sub>2</sub> alarm limits
  - indicates a violation of an SpO<sub>2</sub> alarm limit by flashing.
- 6. PRINT CYCLE** 2 digit numeric display
- shows programmable *Auto Print* Cycle time
  - shows programmable automatic alarm reset interval
  - displays real time and date
  - flashes when the *Auto Print* cycle is on *Hold*

- 7. NEXT PRINT**     2 digit numeric display
- shows the time left before the next *Auto Print* Cycle begins
  - displays real time and date
  - flashes when the *Auto Print* cycle is on *Hold*

**8. MEMORY RECALL**     LED which lights up when *Memory Recall* is initiated.

**9. AUTO PRINT**     LED which lights up when the *Auto* mode is initiated

**10. LO BAT**     LED which lights up when the battery is discharged and indicates the need of charging with AC current.

**11. AC ON**     LED which lights up when the monitor is connected to AC current.

**12. SILENCE**     LED which lights up when the alarm audio indicator is turned off

## SECTION 4 - ALARM LIMITS SETUP and VIOLATIONS

### **A.** Determining Previously Selected Alarm Limits

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The factory alarm limits are not in effect each time the monitor is powered up; the previously selected alarm limits remain in the memory.

The alarm limits are checked by pressing the **HIGH** pushbutton to determine the upper alarm limits and by pressing the **LOW** pushbutton to determine the lower alarm limits. The parameters are displayed individually on the respective display as either the **HIGH** or **LOW** pushbutton is pressed:

### **B.** Changing / Setting Alarm Limits

---

The alarm limits are set or changed by pressing the **UP** pushbutton to increase the alarm limit or by pressing the **DOWN** pushbutton to decrease the alarm limit while each parameter is displayed in the respective display.

If no change is desired, or after a change has been made, wait five (5) seconds and the monitor will return to normal operations.

### **C.** Activating Preset Factory Alarm Limits

---

To set or activate the preset factory alarm limits, simultaneously press the **HIGH** and **LOW** pushbuttons for two (2) seconds. A beep will sound and immediately all the alarms limits will set to the factory default limits.

The factory alarm limits and range of programmable limits (non-overlapping) are:

PARAMETERS	FACTORY LIMITS		RANGE OF PROGRAMMABLE LIMITS	
	LOWER LIMIT	UPPER LIMIT	LOWER LIMIT	UPPER LIMIT
SpO <sub>2</sub>	90%	100%	0-99%	0-100%
Pulse	40 bpm	120 bpm	0-249 bpm	0-250 bpm

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NOTE:

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- The high SpO<sub>2</sub> limit will be displays as “00” since the SpO<sub>2</sub> LED numeric display is a two digit display.

## **D. Violations**

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When a parameter reading violates an alarm limit, the audible alarm will sound and the display will continue to flash until:

- another reading is taken which is within the alarm limits
- the alarm limit is changed or
- the monitor is turned off.

In addition, the audible alarm will sound until the **SILENCE** pushbutton is pressed.

## **E. Sensor Off Alarm**

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The monitor will alert the operator if:

- the SpO<sub>2</sub> probe becomes disconnected from the patient,
- there is no data input, or
- the extension cable becomes disconnected from the monitor.

Immediately the **SpO<sub>2</sub>** display will register "0" and the alarm will sound. When the pulse signal is restored, the monitor will resume normal operations.

## **F. Alarm Silence**

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### **1. AUTO MODE**

When the **SILENCE** pushbutton is pressed, the **SILENCE** LED just above the pushbutton will light up indicating that the audible alarm has been silenced. The LED indicator will remain lit until the **SILENCE** pushbutton has been pressed again, or the programmed interval time for the audible alarm has passed. The audible alarms are reactivated at that time.

### **2. MANUAL MODE**

When you follow the above procedure in Manual mode, the LED indicator will remain lit until the **SILENCE** pushbutton has been pressed again, or the programmed interval time for the audible alarm has passed, but the audible alarm will not be reactivated automatically.

## **G. Programmable Automatic Alarm Reset**

---

The monitor is programmed for the audible alarm to be reactivated after a selected interval of time. There is no factory set interval for the automatic alarm reset. The previously selected alarm reset interval will be displayed. This interval can be set to a selected interval of time form 10 seconds to 5 minutes, or 99 minutes.

To change this interval of time from 10 seconds to 5 minutes:

1. Press and hold down the **SILENCE** pushbutton for 6 seconds until you hear the second beep sound. The previously selected alarm reset interval then will be displayed in the **CYCLE TIME** display.
2. Press the **UP** or **DOWN** pushbutton until the desired interval is displayed in the **CYCLE TIME** display (between ten seconds and five minutes.)

To obtain a selected interval of 99 minutes:

1. Press only the **DOWN** pushbutton until 99 is displayed in the **CYCLE TIME** display.

Ten seconds after the **UP** or **DOWN** pushbutton is released, the monitor will resume normal operations.

## **H. Alarm Override**

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The operator may choose to override the programmed alarm intervals if he or she is in full time attendance. To override the programmed alarm intervals, simply push the **SILENCE** pushbutton twice.

To re-establish the alarm, follow the programmable automatic alarm reset instructions in the previous paragraph.

## SECTION 5 - MONITOR OPERATION

### **A.** Modes of Operation

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The *Vitalmax 520* has four operating modes: *Manual*, *Auto Print*.

#### 1. MANUAL

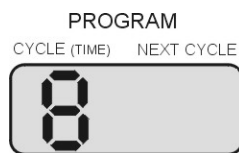
Manual is the normal power-up mode of operation for the monitor.

The Manual mode is entered automatically by powering up the monitor. The monitor will detect if the SpO<sub>2</sub> probe has been applied and will initiate the first reading automatically.

#### 3. AUTO

The *Auto Print* mode is used only when a printer is connected to the monitor and a printout is desired at intervals called “*Cycle Times*”.

- a. After pressing the **POWER** switch, press the **AUTO** pushbutton. The previously selected cycle time will appear on the **PRINT CYCLE** display.
- b. To change the cycle time, press either the **UP** or **DOWN** pushbutton until the desired cycle time appears on the **PRINT CYCLE** display.
- c. After either the **UP** or **DOWN** pushbutton is released, the first reading of the cycle will begin.
- d. If the previously selected cycle time is desired and changes are not required, it is unnecessary to do anything after first pressing the **AUTO** pushbutton.



- e. There are no factory preset cycle times. The **PRINT CYCLE** display will indicate the cycle time in the memory from the previously selected cycle time.

The choices of cycle times are:

Seconds	:10,	:20,	:30,	:40,	:50
Seconds displayed as	.1	.2	.3	.4	.5
Minutes	1 through 99				

The **NEXT Print** display indicates the minutes remaining until the next cycle will begin (10, 5, 2, etc.). The time will be displayed in minutes until there is less than one minute left; then the time remaining will be displayed in seconds such as (.5, .4, .3, etc.).

## B. Hold

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If for some reason Auto Print cycle must be canceled, the cycle can be aborted at any time by pressing the **HOLD** pushbutton.

The **Print CYCLE** and **NEXT Print** displays will blink until the **HOLD** pushbutton is again pressed to revert to the previous mode.

The **NIBP/HOLD** pushbutton does not affect the readings that may be in progress for temperature, respiration, pulse or SpO<sub>2</sub> since the auxiliary readings always operate in the semiautomatic *Hands Off* mode.

## C. Memory Recall

---

The readings are stored in memory when the monitor is in the *Auto Print* mode only.

The previous readings in the memory can be recalled by pressing the **MEMORY RECALL** pushbutton. The **MEMORY RECALL** LED will light up as long as the monitor is in the *Memory Recall* mode indicating observation of previous readings.

The first (initial) reading of the patient will be displayed in the respective displays readouts and the number "1" will be displayed in the **NEXT PRINT** display to indicate display of the first reading.

To recall other readings:

1. Press the **MEMORY RECALL** pushbutton.
2. Press the **UP** pushbutton to sequence through the readings in ascending order.



3. The readings of the patient will be displayed in the respective displays and the corresponding number of the reading (2, 3, 4, etc.) will be indicated in the **NEXT PRINT** display.
4. The readings can be recalled in ascending order (forward) by pressing the **UP** pushbutton in descending order (backward) by pressing the **DOWN** pushbutton (4, 3, 2 etc.)
5. During the *Memory Recall* mode, the monitor will continue to take readings without interruption.

- When the **MEMORY RECALL** pushbutton is pressed again, the monitor will revert to normal operations and display the current readings.

Up to 250 readings can be recalled in ascending or descending order.

All readings are lost when the monitor is turned OFF.

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**NOTE:**

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- Patient readings are stored in the memory only when the **AUTO** pushbuttons are pressed and the respective LED indicator is lit.

## **D. Time and Date**

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The monitor has a built-in time and date microchip (clock chip) which displays the time of day in military time or a 24-hour clock. This microchip has its own battery backup time keeper, which will not lose time when the monitor is turned off. The clock chip is set in the factory to the correct time and date, but it will have to be changed for daylight savings time, leap year or change of time zones.

When the monitor is powered up, the time will be displayed in the 4 digit LED display labeled **PRINT CYCLE TIME** and **NEXT PRINT** in the following format: 16:10



To check or change the time or date:

- Press the **TIME/DATE** pushbutton.
- Press the **UP** pushbutton to increase or the **DOWN** pushbutton to decrease the number.

The readings will cycle in the following sequence each time the **TIME/DATE** pushbutton is pressed:

:10	minute
16:	hour
5	Day
1	month
1996	year
16:10	military time or 24-hour clock

If you check or change the time and do not continue the cycle to another reading, after ten seconds the monitor will revert to normal operations and again display the time of day (16:10).

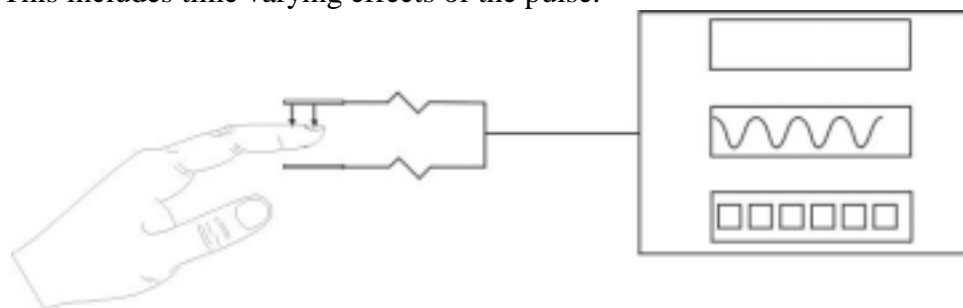
When the monitor is in the *Hold* mode, the readout in the **PRINT CYCLE** and **NEXT PRINT** display will continue to blink until the **HOLD** pushbutton is pressed again.

## SECTION 6 - OXYGEN SATURATION MONITORING

### A. Theory of Operation

---

The monitor uses the infrared method (IR) to determine the SpO<sub>2</sub> and pulse rate. Two wavelengths of light, one red and one infrared, are passed through body tissue to a photo detector. Plethysmographic (waveform) techniques are used to identify the pulse. Spectrophotometric oximetry principles, which are used for each light source, are dependent upon the color and thickness of body tissue, sensor placement, intensity of light sources and absorption of arterial and venous blood in the body tissue during measurement. This includes time varying effects of the pulse.



To identify the pulse and calculate oxygen saturation, the monitor processes these signals, separating the time-invariant parameters (venous blood, tissue thickness, and skin color) from the time-varying parameters (arterial volume). Blood saturated with oxygen predictably absorbs less red light than oxygen depleted blood, thus oxygen saturation calculations are obtained. Measurements are displayed both visibly and audibly. Oxygen saturation and pulse rate measurements are displayed digitally and are updated with each pulse beat. Pulse amplitude is displayed qualitatively. Additionally, the tone that signals each pulse beat varies in pitch to reflect the increase or decrease in oxygen saturation, rising and falling proportionately as saturation increases and decreases.

### B. Patient Connections

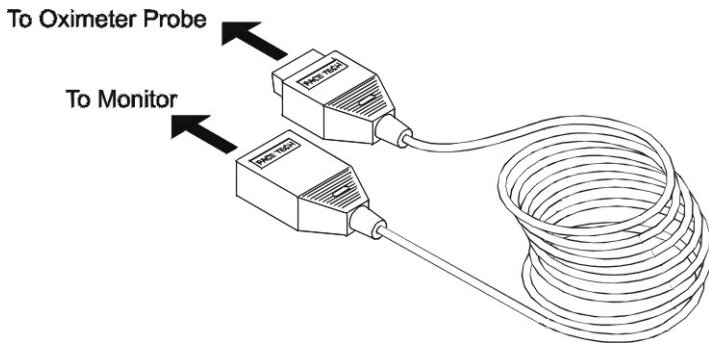
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To ensure conformance with all safety and performance specifications, use only the recommended accessories. These are available from Pace Tech using the following part numbers:

Pulse Oximeter Accessories	Quantity	Order No.
Finger Probe, Reusable	One	4510
Universal 'Y' Probe, Reusable	One	4520
Patient Extension Cable, 6 ft	One	4536
Infant Wrap Probe, Reusable	One	4550
Adult/Neonatal Wrap Probe, Reusable	One	4555
Micorfoam® Surgical Tape (1" x 5.5 yds)	2 Rolls	4535
Ear Lobe Clip (use w/Universal 'Y' Probe)	One	4565
Adult Wrap Probe, Disposable	Pack of 10	4588
Pediatric Wrap probe, Disposable	Pack of 10	4589

## 1. CONNECTING A PROBE

- a. Properly align the connector on the patient cable with the SpO<sub>2</sub> receptacle located on side panel of the monitor.
- b. Push in firmly until the connector fully seats.



## 2. DISCONNECTING A PROBE

Holding the patient cable collar, gentle pull on the cable.



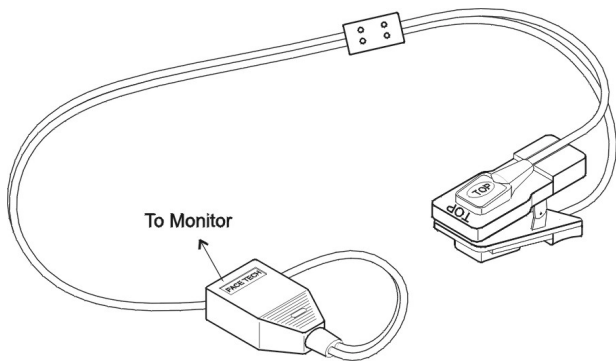
Select the appropriate oximeter probe and application technique from the following pictures and descriptions:

### Earlobe Clip (#4565) and Universal “Y” Probe (#4520), Reusable

Attach the optional Earlobe clip to the Universal “Y” probe by sliding the “Y” probe’s light source side (labeled “top”) into the earlobe clip’s open side (labeled “top”) and the “Y” probe’s detector side into the earlobe clip’s opaque side

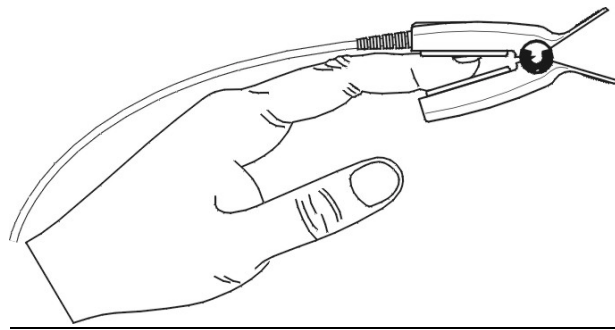
### Earlobe Clip Application for Adults

Rub the patients earlobe with an alcohol prep for 1-2 minutes. Then attach the probe and earlobe clip to a fleshy portion of the patient’s earlobe with the light source to the outside.

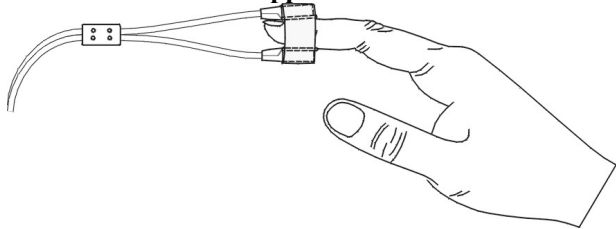


**Finger Probe Application for Adults (#4510), Reusable**

Attach the finger probe to the patient as shown. Be sure to fully insert the patient's finger into the probe. Run the cable along the back of the hand. For patients with long fingernails, use the Universal "Y" probe or adult/neonatal wrap probe.

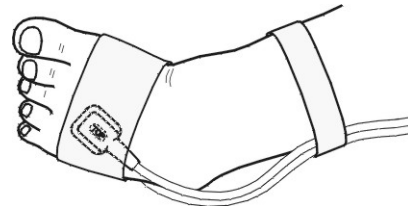
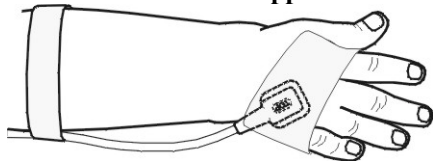


**Universal "Y" Probe Application for Adult or Pediatric Finger (#4520), Reusable**



Attach the Universal "Y" probe to the finger with the light source side to the fingernail. Line up the light source side with the detector side, so the source and detector are in the same plane. Secure the probe and cable with Microfoam® tape, being careful not to overly tighten the tape.

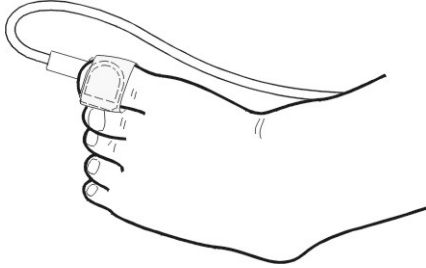
**Universal "Y" Probe Application For Infants- Hand/Foot (#4520), Reusable**



Attach the Universal "Y" probe to a fleshy portion of the infant's hand/foot. Attach the probe with the light source side on the top or outside of the hand/foot to keep the detector side away from ambient light. Line up the light source side with the detector side, so the source and detector are in the same plane. Secure the probe with Microfoam® tape, being careful not to overly tighten the tape.

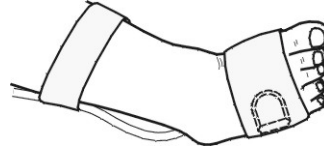
**Infant Wrap Probe Application - Toe (#4550), Reusable**

Attach the optional Infant Wrap probe with the light source side to the toenail.



**Infant Wrap Probe Application - Foot (#4550), Reusable**

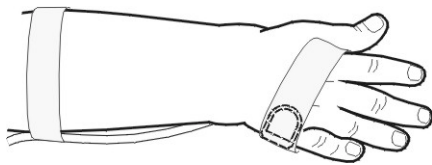
Attach the optional Infant Wrap probe with the light source side to the fleshy portion of the foot.



Attach the probe with the light source side on the top or outside of the toe/foot to keep the detector side away from ambient light. Line up the light source side with the detector side, so the source and detector are on the same plane. Secure the probe with Microfoam® tape, being careful not to over tighten the tape.

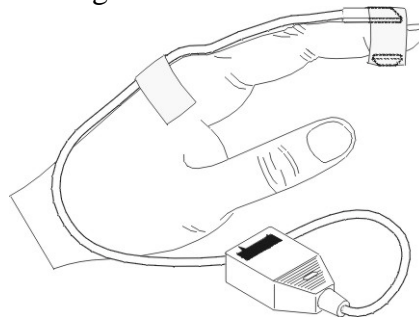
**Adult / Neonatal Wrap Probe Application – Hand (#4555)**

Attach the optional Adult/Neonatal Wrap probe to the fleshy part of the hand.



**Adult / Neonatal Wrap Probe Application – Finger (#4555), Reusable**

Attach the optional Adult/Neonatal Wrap probe to the finger with the light source side to the fingernail.



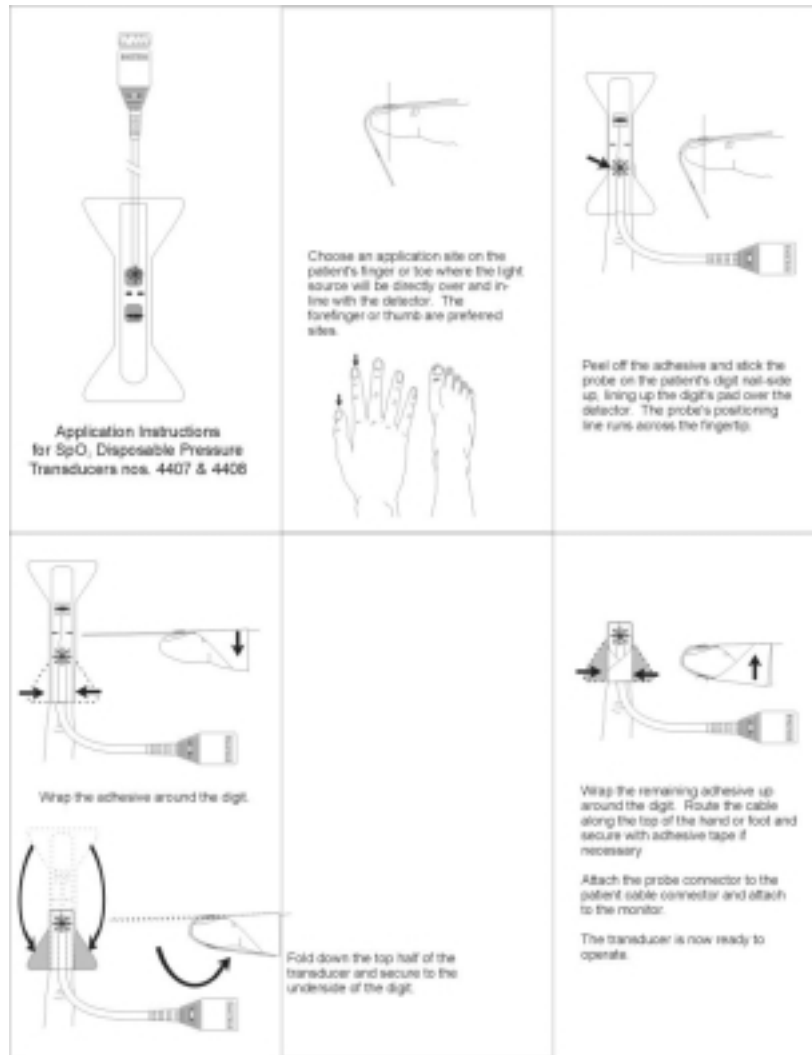
Line up the light source side with the detector side, so the source and detector are in the same plane. Secure the wrap probe and cable with Microfoam® tape, being careful not to over tighten the tape.

**Application of the Disposable Adult Wrap Probe Order # 4588 and Disposable Pediatric Wrap Probe Order # 4589**

Step 1: Choose an application site on the patient's finger or toe where the light source will be directly over and in-line with the detector (as shown to the right).

Step 2: Peel off the adhesive backing and place on the patient's foot or hand.

Step 3: Then fold down the top half of the transducer and secure to the underside of the foot or hand, making sure that the emitter lights align properly.



Step 4: Finally, route the cable along the top of the hand or foot and secure with adhesive tape if necessary.

## C. SpO<sub>2</sub> Monitoring

### 1. OPERATING INSTRUCTIONS

- a. Connect the patient extension cable to the receptacle on the side panel of the monitor.
- b. Select an SpO<sub>2</sub> transducer based on application requirements and connect the appropriate probe to either the patient extension cable or directly to the monitor. (Refer to the illustration of SpO<sub>2</sub> accessories for the correct probe application on the previous pages.)
- c. Turn the **POWER** switch on the front panel to "on". When powered up, all display digits will momentarily show "8" to give visual assurance that the display is fully functional.


d. Set alarms according to instructions listed previously in Section 4 of this manual.


The monitor will immediately proceed to continuously monitor the SpO<sub>2</sub>. The percentage of oxygen saturation is averaged over eight beats and the pulse rate is averaged over eight seconds.


The LED bar graph will indicate the SpO<sub>2</sub> pulse signal strength with variable height display.

The pulse beep sounds as each pulse beat is detected. When a drop in SpO<sub>2</sub> value is detected, a lower beep tone will sound. The volume of the SpO<sub>2</sub> tone and other non-alarm sounds can be adjusted by the **SOUND** knob located on the side panel.


## 2. CAUTIONS AND WARNINGS

 Stretching the Microfoam® tape and attaching the tape too tightly to the skin may generate inaccurate readings and cause blisters on the patient's skin. Lack of skin respiration, not heat, causes the blister.


 Reposition the probe to another site at least once every 18-20 hours (maximum 24 hours) to allow the patient's skin to respire.

 Loss of pulse signal can occur if:

- the sensor is too tight,
- there is excessive illumination (e.g., a surgical or bilirubin lamp or direct sunlight),
- the sensor is placed on an extremity with a blood pressure cuff, arterial catheter, or intravascular line, or
- the patient experiences shock, hypotension, severe vasoconstriction, severe anemia, hypothermia, arterial occlusion proximal to the sensor, or cardiac arrest.

 Inaccurate measurements may be caused by:

- incorrect application or use of a sensor,
- significant levels of dysfunctional hemoglobins, such as carboxyhemoglobin or methemoglobin,
- significant levels of indocyanine green, methylene blue or other intravascular dyes,
- exposure to excessive illumination, such as surgical lamps, especially ones with a xenon light source; bilirubin lamps; fluorescent lights; infrared heating lamps; or direct sunlight
- excessive patient movement,
- venous pulsations
- electrosurgical interference, or
- placement of the sensor on an extremity that has a blood pressure cuff, arterial catheter, or intravascular line.

 Do not attach a probe to the same limb with a blood pressure cuff. The data received will not be valid when the cuff is inflated. Attach the probe to the limb opposite the site used for the blood pressure cuff.

## **D. Pulse Beep**

---

The monitor is programmed to beep with each pulse signal.

The volume of the SpO<sub>2</sub> pulse beep can be adjusted but it cannot be turned off.

The pulse beep varies in pitch to reflect the increase or decrease in oxygen saturation, rising and falling proportionately as saturation increases and decreases.

## SECTION 8 - PRINTER OPERATION

A 27 column thermal printer is available for use with the Vitalmax 520 and will produce a hard copy of the patient's vital signs, time, and date.

### A. Printer Operation

---

#### 1. RECOMMENDED THERMAL PAPER

Thermal paper can vary considerably in thermal sensitivity and abrasiveness. Using the proper thermal paper helps to ensure that the print quality will be acceptably dark and reduces print-head wear. The recorder's warranty may be limited if an unspecified paper is used.

To ensure conformance with all safety and performance specifications, use only the recommended accessories. These are available from Pace Tech using the following part number:

Thermal Printer Paper - 27 Column (4 rolls) Order No. 3006

Thermal paper should be stored in the dark at an average ambient temperature of less than 25° C and a relative humidity of less than 65%. Under these conditions, the paper remains printable for at least 5 years. Also printed paper, when stored under these conditions, will retain its printed image legibility for a minimum of 7 years.

#### 2. LOADING THE PAPER

Cut the end of the paper horizontally as shown in Illustration 9-a.

To open the paper holder, place your thumb on the paper holder cover and pull the cover up and back as shown in Illustration 9-b.

Insert the tip of the paper into the insertion slot and press the **PAPER FEED** pushbutton. (The outside of the thermal paper is in the front.). Insert the paper as shown in illustration 9-a. Keep the **PAPER FEED** pushbutton depressed until the end of the paper comes out of the paper cutter.

Illustration 9-a

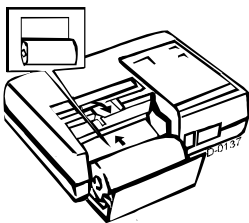
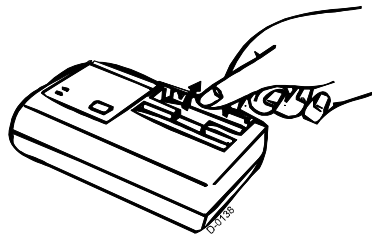


Illustration 9-b



## **B. Printing Mode Options**

---

### **1. TO PREPARE FOR USE**

Attach the connectors of the printer cable to the receptacles on the back of the printer and on the rear panel of the monitor.

Turn ON the power to both the printer and the monitor.

Remember to turn OFF the printer whenever the monitor is turned OFF so the printer will not deplete the battery of the monitor.

### **2. TO PRINT IN REAL TIME**

In order to obtain a print-out during the entire monitoring period, turn the printer ON at the beginning of the patient monitoring procedure. When the AUTO pushbutton is pressed, all parameters will be automatically displayed at the end of each determination cycle. Up to 250 readings can be printed.

```
patient _____ unit # _____
room # _____ bed # _____
=====
3-21-96
sys dia map pls o2 temp
resp etco2 inco2 time
=====
117 81 96 81
11:17
-----
119 82 97 81
11:18
```


D-00588


### **3. TO PRINT ONLY AT CONCLUSION OF MONITORING**


The printer should be in the OFF position during the Auto Print monitoring period. Then, at the end of the patient monitoring procedure, but before the monitor is turned off, turn the printer ON. Previously collected data, which has been stored in the unit, will then be down-loaded to the printer, providing one set of vitals for each programmed cycle.

### **4. TO OBTAIN A DUPLICATE PRINTOUT**

In order to obtain a duplicate copy of the printout (whether option 2. or 3. above was used), with the monitor still ON, turn the printer OFF, then turn the printer back ON again. A duplicate copy of the original vital sign data will be printed.

 As long as the monitor is not turned off, all programmed cycle data will remain stored in the unit; turning the monitor off clears the monitor's memory of all information.


 The printer operates from the battery of the monitor. Remember to turn the printer OFF when the monitor is turned OFF so the printer does not deplete the battery of the monitor.

 The printer will not print out any vital signs the monitor does not detect (i.e. temperature, respiration, SpO<sub>2</sub>) if that probe is not used.

## **C. RS-232 Output**

---

A RS-232 serial output connector on the rear panel is an option available which provides serial data to most RS-232 devices capable of receiving 9600 Baud. For the RS-232 protocol, please contact Pace Tech.

 Connection of non-isolated devices to the RS-232 connector may cause chassis leakage to exceed the specification standards.

## APPENDIX I - PRODUCT SPECIFICATIONS

### A. Mechanical Description

---

<b>Size</b>	3.25" high x 6.25" wide x 10.25" deep 8.26 cm high x 15.88 cm wide x 26.04 cm deep
<b>Weight</b>	7 lbs 5.4 oz (3.33 kg)
<b>Color</b>	Beige and Aqua

### B. Power Requirements

---

<b>Operation</b>	AC / DC
<b>Internal Battery</b>	6V 7.0 AH Sealed Lead Acid
<b>Battery operating time</b>	5-6 hours full charge
<b>Battery charge time</b>	8-10 hours minimum
<b>AC Adapter (Battery Charger)</b>	
<b>AC mains input</b>	Domestic AC Adapter, with 3 prong, Hospital grade plug 100-250 V/50-60 Hz 8-12VAC / 2.4-3.0 A Output, UL Listed International AC Adapter with unterminated plug 220-240V/ 50-60 Hz 8-12VAC / 2.4-3.0 A Output
<b>Vehicle battery input</b>	10-16 VDC via optional charging cable
<b>Fuses</b>	Two 3.0 A, 250 V, Fast Blow

### C. Performance Specifications

---

#### PULSE OXIMETRY (SpO<sub>2</sub>)

<b>Saturation range</b>	0-100%, adult/pediatric/neonate
<b>Saturation averaging</b>	8 beat average

<b>Saturation accuracy</b>	±2% (70-100%), ±3% (50-69%), (0-49% unspecified)
<b>Saturation alarm limits</b>	Upper: 0- 100% Lower: 0- 99%
<b>Pulse rate range</b>	30 – 254
<b>Pulse rate averaging</b>	8 second average
<b>Pulse rate accuracy</b>	±2 % 30 - 100 bpm
<b>Pulse alarm limits</b>	Upper: 0-250 bpm Lower: 0-249 bpm
<b>Pulse tone</b>	Pitch adjusts to SpO <sub>2</sub> value; Volume adjustable
<b>Pulse rate display</b>	Digital, pulse amplitude
<b>Sensor types</b>	Finger, Universal “Y”, ear lobe clip, disposable and reusable wrap probes

## **D.** Displays

---

<b>Parameters/Alarms/Limits</b>	High Intensity Red Led 0.56"
<b>Time and Date</b>	High Intensity Red Led 0.3"
<b>Pulse Strength</b>	10 segment Logarithmic Red LED bar graph
<b>Signal Indicators</b>	Yellow & Green Signal LED

## **E.** Printer

---

<b>Type</b>	Add-on 27 column thermal printer
<b>Output</b>	ASCII parallel
<b>Printing width</b>	46mm
<b>Printing speed</b>	Approx. 0.8 lines per second
<b>Paper requirements</b>	Thermal printer paper 7m (L) x 58mm (W)

25mm roll diameter

## **F. Environment Specifications**

---

<b>Temperature</b>	Operating	19.0° C to 30.0° C (66° F to 86° F)
	Storage	4.4° C to 43.3° C (40° F to 110° F)
<b>Relative humidity</b>	Operating	20-80% (non-condensing)
	Storage	10-90% (non-condensing)

*SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE*

## APPENDIX II - BATTERY OPERATION

### A. Battery

---

The monitor is equipped with an internal battery, 6V/ 7.0 AH sealed lead acid. This allows the monitor to operate for up to 6-8 hours under its own power.

The battery is continuously charged whenever the AC power is connected to the monitor. Charging time when the battery is fully discharged is between 15 and 20 hours.

Continuous charging will not harm the battery's expected service life with daily on-battery use.

The **LO BAT** LED indicator lights up when the battery is discharged and should be charged with AC current. Do not turn the monitor on after the **LO BAT** LED indicator is lit without first connecting it to AC main power.

### B. Power Supply

---

The internal battery of the monitor is charged with an AC adapter. Two AC adapters are available in order to allow the battery to be charged from AC input voltage either 110-120V / 50-60 Hz or 220-240 / 50-60 Hz.

**CAUTION:** Equipment damage may result if an incorrect power supply is used. Excessively long power cords may affect the safety and effectiveness of the delivered power.

Be sure the power cord is suitably heavy-gauged and rugged for the application. Avoid a light-gauge power cord sharing a heavy load.

Replace an old, worn damaged, or kinked power cord with a new one suited for the application.

### C. Charging the Battery

---

Recharging is more rapid if it is done soon after on-battery use and even more so if the monitor is not turned on while charging.

1. Connect the AC Adapter to the receptacle on the rear panel of the monitor. Plug the power cord into a 100-250V / 50-60 Hz AC current, using a hospital grade (USA) grounding receptacle.
2. Verify that the AC ON LED comes on and stays on brightly and continuously after connecting to the power outlet. An unusually dim AC ON LED may indicate that the AC power is weak at the outlet. Unusual brightness may indicate excessive voltage. Either condition merits a checkup by a qualified technician.

3. After the battery has been charged, unplug the power cord, and turn the monitor on. If the display lights up and the number “8” appears momentarily, the monitor should be fully charged and is ready for normal operations.

Be aware that any power connection that is often cycled or flexed over an extended period of time will eventually wear out and thereby become unreliable or dangerous.

## **D. Optimizing The Battery Life**

---

### **1. DISCHARGE CYCLES AND DEPTH**

Each discharge cycle advances the battery’s age, in particular a deep discharge. Try to avoid deep discharges of the battery.

Try to charge the battery at every suitable opportunity, preferably before the LO BAT LED comes on.

### **2. TEMPERATURE**

Heat also accelerates the battery’s aging, becoming quite significant above 86°F (30°C).

Avoid storing the monitor in sun-exposed compartments. It is preferable to store the monitor in a cool environment.

### **3. STATE OF CHARGE**

A fully charged battery ages more slowly than a discharged battery. Charge the monitor promptly after using it on-battery.

If the monitor stands discharged for an extended period of time (days), the battery capacity may take either several charge/discharge cycles or an extended charge time (several days) to fully recover.

### **4. EXTENDED IDLE TIME**

Continuous charging will not harm the battery’s expected service life with daily on-battery use.

However, if the monitor is not going to be used for a long period of time (weeks or months), charge with the power switch turned “off” for about 16 hours. Then unplug the AC power and store the monitor in a cool dry area, protected from dust.

At least every month charge the battery for about 16 hours. When use is anticipated, again charge the battery about 16 hours in advance to develop full available charge.

While in storage protect the power switch from accidental activation. If the battery were to become discharged this way for an extended time (weeks), it would permanently lose capacity.

## E. Battery Disposal

---



This is the universal symbol which indicates that proper disposal is required for the lead-acid battery. Do not throw the battery in the trash or incinerate the battery. The lead acid battery should be placed in the recycling bin.

## F. Fuses

---

The monitor is equipped with two fuses which are located on the rear panel. Designated F1 and F2, each fuse protects a different power input.



F1 This fuse protects the internal battery. If this fuse is blown, the monitor will continue to operate on the AC Power supply. Battery operation is not possible until the fuse is replaced.

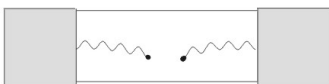


F2 This fuse protects the AC Power supply line. If it is blown, the monitor can continue to operate under battery power. However, the battery cannot be charged until this fuse is replaced.

To determine if a fuse is blown, look to see if it has a grey, dark, or shiny coating on the inside of the glass portion, or if the wire is broken, distorted, or melted, as illustrated to the right.

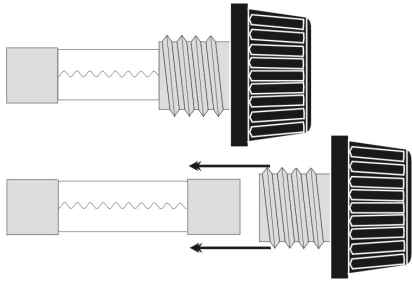


OR



To replace a blown fuse, follow these instructions.

1. Turn the fuse holder counter-clockwise until it comes free and remove it from the monitor's rear panel.
2. Remove the fuse from the fuse holder and replace it only with a 3.0A 250V fuse, fast blow.
3. Insert the fuse holder back into the rear panel and turn it clockwise until it is snug.



## APPENDIX III - MAINTENANCE

### A. Monitor

---

When necessary, clean the exterior surfaces of the monitor with a cloth or swab dampened with a warm and mild detergent solution. Do not allow liquids to enter the interior of the instrument.

**WARNING:** Electrical shock and flammability hazard - always turn the monitor off and disconnect it from AC main power before cleaning.

**CAUTION:** Do not autoclave or pressure sterilize this monitor. Do not stack or immerse this monitor in any liquid. Do not gas sterilize this monitor.

Do not touch, or rub the display panel with abrasive cleaning compounds, instruments, brushes, rough surfaced materials or make contact with anything that can scratch the panel.

### B. Probes (Pulse Oximetry, Temperature)

---

The probes are the only surfaces of this monitor that come in contact with the patient. Clean the probes after each patient use.

Clean the monitor's probes with a commercial cleaning solution before attaching a new patient. Probes should be cleaned until signs of wear or splitting occur. At this time, a new probe is required.

If disinfection is required, wipe the surfaces with Isopropyl alcohol or cidex and use a water rinse. When sterilization is required, use ethylene oxide and be sure to follow hospital procedures.

Inspect the probe for wear or splitting after every disinfection/sterilization process is completed. If wearing or splitting of the probe is found upon visual inspection, a new probe should be used.

### C. Patient Cables (Temperature, Pulse Oximetry)

---

Do not autoclave the patient cables.

Wipe the cables using soap and water or alcohol. Never submerge the cables in any liquid or allow liquids to enter the electrical connections.