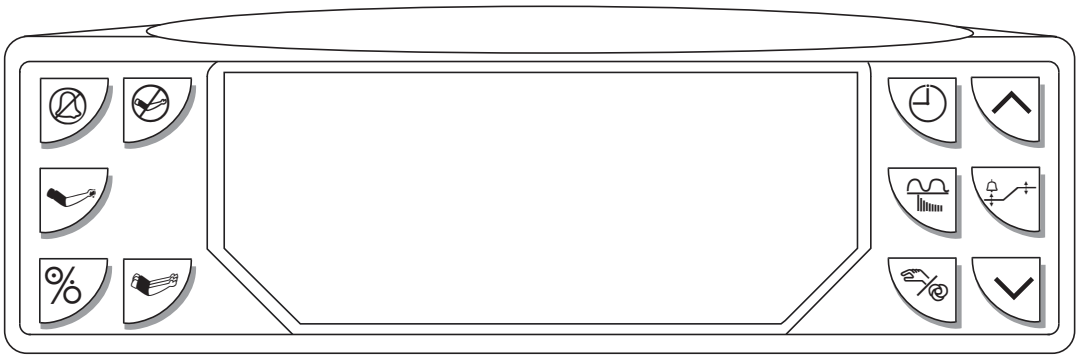
SurgiVet™

SurgiVet® V6004
NIBP Monitor

Operation Manual



en English
Catalog Number V1876
Version 8, February 2008

smiths medical

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The serial autocorrelation technology in the monitor is covered by U.S. Patent No. 5,558,096.

Warranty and Service Information

Proprietary Notice

Information contained in this document is copyrighted by Smiths Medical PM, Inc. and may not be duplicated in full or part by any person without prior written approval of Smiths Medical PM, Inc. Its purpose is to provide the user with adequately detailed documentation to efficiently install, operate, maintain and order spare parts for the device supplied. All information contained in this document is believed to be current and accurate as of the date of publication or revision, but does not constitute a warranty.

Warranty

Limited Warranty

Smiths Medical PM, Inc. ("Seller") warrants to the original purchaser that the Product, not including applicable accessories, shall be free from defects in material and workmanship under normal use, if used in accordance with its labeling, for two years from the date of shipment to the original purchaser.

Seller warrants to the original purchaser that the reusable oximeter sensors supplied as accessories, shall be free from defects in materials and workmanship under normal use, if used in accordance with its labeling, for one year from the date of shipment to the original purchaser (USA only).

Seller warrants to the original purchaser that the AC Power supply/charger supplied, with the exception of part number 3005, shall be free from defects in materials and workmanship under normal use, if used in accordance with its labeling, for 1 year from the date of shipment to the original purchaser (USA only).

Seller warrants to the original purchaser that the reusable temperature cable supplied as accessories shall be free from defects in materials and workmanship under normal use, if used in accordance with its labeling, for 6 months from the date of shipment to the original purchaser (USA only).

Seller warrants to the original purchaser that the reusable ECG leads, reusable invasive pressure cable, reusable NIBP purple hose, disposable temperature probe, disposable invasive pressure transducer and disposable sample lines supplied as accessories, shall be free from defects in materials and workmanship under normal use, if used in accordance with its labeling, for 90 days from the date of shipment to the original purchaser (USA only).

Blood pressure cuffs carry a (6) six month warranty, pending evaluation by Smiths Medical PM, Inc. (SMPM) Technical Services. Cuffs that are contaminated, have liquid in them, have been misused/abused or are older than (6) months will not be covered under warranty. The sole obligation of SMPM under this warranty will be to repair or replace, at its option, products that prove to be defective during the warranty period.

The foregoing shall be the sole warranty remedy. Except as set forth herein, seller makes no warranties, either expressed or implied, including the implied warranties of merchantability and fitness for a particular purpose. No warranty is provided if the products are modified without the express written consent of Smiths Medical Pm, Inc. and seller shall not be liable in any event for incidental or consequential damage. This warranty is not assignable.

Warranties are subject to change. Please contact Smiths Medical PM Inc. for current warranty information.

Loaner Device (Domestic Sales Only)

Smiths Medical PM, Inc. (SMPM) will, for the period of warranty, make loaner devices available at no charge (domestic sales only) if, in the opinion of SMPM, the repair of the customer's device would require an unreasonable period of time to repair, and there is a suitable loaner available during the time of the repair.

SMPM may make available a loaner device, for a fee, should it be requested while an out of warranty device is in for service.

Disclaimer of Warranties

THE FOREGOING EXPRESS WARRANTY, AS CONDITIONED AND LIMITED, IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED, BY OPERATION OF LAW OR OTHERWISE, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Seller disclaims responsibility for the suitability of the Product for any particular medical treatment or for any medical complications resulting from the use of the Product. This disclaimer is dictated by the many elements which are beyond Seller's control, such as diagnosis or patient, conditions under which the Product may be used, handling of the Product after it leaves Seller's possession, execution of recommended instructions for use and others.

Conditions of Warranty

This warranty is void if the Product has been altered, misused, damaged by neglect or accident, not properly maintained or recharged, or repaired by persons not authorized by Seller. Misuse includes, but is not limited to, use not in compliance with the labeling or use with accessories not manufactured by Seller. This warranty does not cover normal wear and tear and maintenance items.

Limitation of Remedies

The original purchaser's exclusive remedy shall be, at Seller's sole option, the repair or replacement of the Product. **THIS IS THE EXCLUSIVE REMEDY. In no event will Seller's liability arising out of any cause whatsoever (whether such cause is based in contract, negligence, strict liability, tort or otherwise) exceed the price of the Product and in no event shall Seller be responsible for consequential, incidental, or special damages of any kind or nature whatsoever, including by not limited to, lost business, revenues and profits.**

Warranty Procedure

To obtain warranty service or repair of SurgiVet® equipment in the USA, please contact Veterinary Clinical Support to obtain a Return Authorization Number. Please provide the serial number of all equipment that will be returned. Any equipment returned for evaluation must be cleaned and decontaminated prior to being handled by our service technicians. For cleaning instructions, please refer to the appropriate section in the operation manual. If equipment is returned prior to cleaning, and in our opinion it represents a potential biological hazard, the equipment will be returned to the sender as is.

Reference the return authorization number when returning your Product, freight and insurance prepaid by Purchaser, to:

Smiths Medical PM, Inc.	Veterinary Clinical Support
Attn: Repairs / return #	Telephone: 1-262-513-8500
N7W22025 Johnson Drive	Toll-Free: 1-888-745-6562 (USA only)
Waukesha, WI 53186	Fax: 1-262-513-9069
	Web: www.surgivet.com

Seller will not be responsible for unauthorized returns or for loss or damage to the Product during the return shipment. The repaired or replaced Product will be shipped, freight prepaid by Seller, to Purchaser.

To obtain warranty information outside the USA, contact your local distributor.

NOTE! Shipments received without a return number will be returned to sender.

Keep all original packing material, including foam inserts. If you need to ship the device, use only the original packaging material, including inserts. Box and inserts should be in original condition. If original shipping material in good condition is not available, it should be purchased from Smiths Medical PM, Inc.

Damages occurred in transit in other than original shipping containers are the responsibility of the shipper. All costs incurred returning devices for repair are the responsibility of the shipper.

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Chapter 1: Introduction

About this Manual

The Operation Manual provides installation, operation, and maintenance instructions for the veterinary professional trained in monitoring cardiovascular activity.

Definition of Symbols

SYMBOL	DEFINITION
	On/Off
	NIBP Start
	Alarm Silence
	Cancel
	Stat
	Up and Down Arrows
	Manual/Auto
	Recall
	Alarm Set
	Printer Output or Print Key
	Print feed
	Alarm silence LED
	High Priority Alarm (red) or Low Priority Alarm/Alert (yellow) LED
	Low battery LED
●	Small animal patient mode LED
	Interval
SYS	Systolic blood pressure
DIA	Diastolic blood pressure
MAP	Mean arterial pressure
❤bpm	Pulse Rate LED (beats per minute)
%SpO2	Percent Oxygen Saturation

SYMBOL	DEFINITION
Rx ONLY	Federal (U.S.A.) law restricts this device to sale by or on the order of a veterinarian.
	Type CF equipment
	Defibrillator-proof type CF equipment.
	Attention, see instructions for use.
	Refer servicing to qualified service personnel.
	Output Voltage
	Input Voltage
	Date of Manufacture
	Catalog Number
	Serial Number
	Moisture Sensitive
IPX1	Drip Proof (monitor only)
	Non AP Device
	Direct Current
	Loudspeaker
 Collect Separately	**Disposal (EU Countries)** Under the Waste Electrical and Electronic Equipment (WEEE) Directive 2006/96/EC and implementing regulations, all devices and service items within the scope of the Directive purchased new after August 13, 2005 must be sent for recycling when ultimately becoming waste. Devices and items must not be disposed of with general waste. If purchased before that date, they may also be sent for recycling if being replaced on a one-for-one, like-for-like basis (this varies depending on the country). Recycling instructions to customers using Smiths Medical products are published on the internet at: **http://www.smiths-medical.com/recycle**
	**Disposal (other countries)** When disposing of this device, its batteries or any of its accessories, ensure that any negative impact on the environment is minimized. Contact your local waste disposal service and use local recycling or disposal schemes. Separate any other parts of the equipment where arrangements can be made for their recovery, either by recycling or energy recovery. The main batteries are potentially harmful and will require separate disposal according to manufacturer's instructions or local regulations. **Note: If applicable, EU, national or local regulations concerning waste disposal must take precedence over the above advice.**

KEYWORD	DEFINITION
WARNING!	Tells you about something that could hurt the patient or hurt the operator.
CAUTION!	Tells you about something that could damage the monitor.
NOTE!	Tells you other important information.

General Warnings

WARNING! This product is intended for veterinary use only.

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

WARNING! ELECTRICAL SHOCK HAZARD when cover is removed. Do not remove covers. Refer servicing to qualified personnel.

WARNING! Do not use this device in the presence of magnetic resonance imaging (MR or MRI) equipment.

WARNING! Operation of this device may be adversely affected in the presence of computed tomograph (CT) equipment.

WARNING! Operation of this device may be adversely affected in the presence of conducted transients or strong electromagnetic (EM) or radiofrequency (RF) sources, such as electrosurgery and electrocautery equipment, x-rays, and high intensity infrared radiation.

WARNING! Do not plug the monitor into an outlet controlled by a wall switch.

WARNING! This device is intended for use by persons trained in veterinary health care. The operator must be thoroughly familiar with the information in this manual before using the monitor.

WARNING! This device must be used in conjunction with clinical signs and symptoms. This device is only intended to be an adjunct in patient assessment.

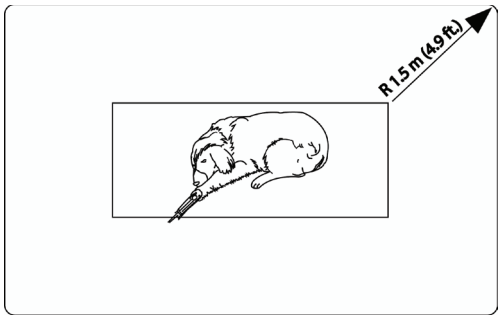
WARNING! If the accuracy of any measurement is in question, check the patient's vital sign(s) by an alternative method and then check the monitor for proper functioning.

WARNING! The monitor should not be used in the presence of electrosurgical equipment. The device has no protective mechanisms to prevent patient burns when used with high frequency surgical equipment.

WARNING! Equipment is protected against defibrillator discharge. Rate meters and displays may be temporarily affected during defibrillation, but will rapidly recover.

WARNING! The vital signs monitor is suitable for use within the patient environment IEC 60950 approved equipment must be placed outside of the patient environment. The patient environment is defined as any volume in which intentional or unintentional contact can occur between the patient and parts of the system or between the patient and other persons touching parts of the system.

Figure 1.1: Patient Environment (Dimensions are not prescriptive)



WARNING! When connecting this monitor to any instrument, verify proper operation before clinical use. Refer to the instrument's user manual for full instructions. Accessory equipment connected to the monitor's data interface must be certified according to the respective IEC standards, i.e., IEC 950 for data-processing equipment or IEC 601-1 for electromedical equipment. All combinations of equipment must be in compliance with IEC 601-1-1 systems requirements. Anyone connecting additional equipment to the signal input port or signal output port configures a medical system, and, therefore, is responsible that the system complies with the requirements of the system standard IEC 601-1-1.

WARNING! Any monitor that has been dropped or damaged should be checked by qualified service personnel to insure proper operation prior to use.

WARNING! This monitor will not operate effectively on patients who are experiencing convulsions or tremors.

WARNING! Patient safety can be compromised by the use of a power supply not supplied by Smiths Medical PM, Inc. Use only the power supply included with your monitor, or one approved by Smiths Medical PM, Inc.

WARNING! Disconnect the AC power supply from the outlet before disconnecting it from the monitor. Leaving the AC power supply connected to an AC power outlet without being connected to the monitor may result in a safety hazard.

WARNING! Do not allow any moisture to touch the AC power supply connectors or a safety hazard may result. Ensure that hands are thoroughly dry before handling the AC power supply.

WARNING! Do not place the monitor in the patient's bed. Do not place the monitor on the floor.

WARNING! Failure to place the monitor away from the patient may allow the patient to turn off, reset, or damage the monitor, possibly resulting in the patient not being monitored. Make sure the patient cannot reach the monitor.

WARNING! Failure to carefully route the cable from the sensor to the monitor may allow the patient to become entangled in the cable, possibly resulting in patient strangulation. Route the cable in a way that will prevent the patient from becoming entangled in the cable. If necessary, use tape to secure the cable.

WARNING! If there is a risk of the AC power supply becoming disconnected from the monitor during use, secure the cord to the monitor several inches from the connection.

WARNING! Medical electrical equipment, including this device, needs special precautions regarding electro-magnetic compatibility (EMC) and needs to be installed and put into service according to the EMC information provided in this manual.

WARNING! The monitor should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the monitor should be observed to verify normal operation in the configuration in which it will be used.

WARNING! Use only original manufacturer or recommended patient cables. Use of accessories other than those specified may result in increased electro-magnetic (EM) emissions or decreased EM immunity of the device. To avoid potential electro-static discharge interference, do not use cables which incorporate metal or metal-coated connectors.

WARNING! It is the operator's responsibility to set alarm limits appropriately for each individual patient.

WARNING! Verify that all LEDs (light emitting diodes) on the display light up upon startup of the device.

NIBP Warnings

WARNING! Readings may be difficult to obtain in animals smaller than five (5) pounds.

WARNING! Blood pressure measurements may be inaccurate if cuffs and/or hoses are used other than those specified by Smiths Medical PM, Inc. (Veterinary).

WARNING! Make sure that hoses are not kinked, compressed, or restricted.

WARNING! Check that operation of the equipment does not impair the circulation of the monitored patient.

WARNING! Repeated use of the stat mode for periods longer than 15 minutes should be avoided to reduce the patient's risk for soft tissue or nerve damage. When using the monitor for long periods of time, select the longest clinically appropriate measurement interval and periodically examine the patient for signs of injury and ensure proper cuff placement.

WARNING! Blood pressure measurements may not be accurate for patients experiencing moderate to severe arrhythmias.

Oximetry Warnings

WARNING! Use only SpO_2 sensors supplied with, or specifically intended for use with, this device.

WARNING! Incorrectly applied sensors may give inaccurate readings. Refer to the sensor insert for proper application instructions.

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

WARNING! When attaching SpO_2 sensors with Microfoam® tape, do not stretch the tape or attach the tape too tightly. Tape applied too tightly may cause inaccurate readings and blisters on the animal's skin (lack of skin respiration, not heat, causes the blisters).

WARNING! Dyes introduced into the bloodstream, such as methylene blue, indocyanine green, indigo carmine, patent blue V (PBV), and fluorescein, may adversely affect the accuracy of the SpO_2 reading.

WARNING! Any condition that restricts blood flow, such as use of a blood pressure cuff or extremes in systemic vascular resistance, may cause an inability to determine accurate pulse and SpO_2 readings.

WARNING! Significant levels of dysfunctional hemoglobins, such as carboxyhemoglobin (with CO-poisoning) or methemoglobin (with sulfonamide therapy), will adversely affect the accuracy of the SpO_2 measurement.

WARNING! SpO_2 measurements may be adversely affected in the presence of high ambient light. If necessary, shield the sensor area (with a surgical towel, for example).

WARNING! Dark skin tone or fur pigment may cause an inability to determine accurate pule rates and SpO_2 readings. Seeking the most appropriate site for sensor placement is advisable.

WARNING! Optical cross-talk can occur when two or more sensors are placed in close proximity. It can be eliminated by covering each site with an opaque material.

WARNING! Under certain clinical conditions, pulse oximeters may display dashes if unable to display SpO_2 and/or pulse rate values. Under these conditions, pulse oximeters may also display erroneous values. These conditions include, but are not limited to: patient motion, low perfusion, cardiac arrhythmias, high or low pulse rates, or a combination of the above conditions. Failure of the clinician to recognize the effects of these conditions on pulse oximeter readings may result in patient injury.

General Cautions

CAUTION! Ensure the device's AC rating is correct for the AC voltage at your installation site before using the monitor. The monitor's AC rating is shown on the external power supply. If the rating is not correct, do not use the monitor; contact Smiths Medical PM, Inc. Veterinary Clinical Support for help.

CAUTION! Do not allow water or any other liquid to spill onto the monitor. Evidence that liquid has been allowed to enter the monitor voids the warranty.

CAUTION! Unplug the external power supply from the monitor before cleaning or disinfecting the monitor.

CAUTION! Chemicals used in some cleaning agents may cause brittleness of plastic parts. Follow cleaning instructions in this manual.

CAUTION! Should the device become wet, wipe off all moisture and allow sufficient time for drying before operating. For devices with the optional electronic thermometer or printer, servicing is required for proper function after accidental wetting.

CAUTION! Pressing front panel keys with sharp or pointed instruments may permanently damage the keypad. Press front panel keys only with your finger.

CAUTION! Do not disassemble the unit. The unit is not user serviceable. ⚠ Refer to qualified service personnel.

CAUTION! Operation of this device may be adversely affected in the presence of portable and mobile communications equipment.

NIBP Cautions

CAUTION! Verify the proper cuff size before each measurement.

CAUTION! Extremity and cuff motion should be minimized during blood pressure determinations.

CAUTION! Proper blood pressure cuff size and placement are essential to the accuracy of the blood pressure determination.

CAUTION! Any blood pressure recording can be affected by the position of the patient, his or her physiologic condition, and other factors.

CAUTION! Blood pressure measurements should be interpreted by a veterinarian.

General Notes

NOTE! All user and patient accessible materials are non-toxic.

NOTE! The equipment is suitable for connection to public mains.

NOTE! To tear paper off gently, pull paper towards you tightly against the cutter and use the cutter to tear it off. Use caution not to pull paper through the printer as this might damage the paper feed rollers.

NOTE! Connect the AC Charger to the AC Power Connector of the monitor first and the AC Charger to the Wall Outlet second.

NOTE! Alarm limits are retained during power cycles, except for the following note.

NOTE! If the low alarm limit for SpO_2 is set to a value lower than 80 when the monitor is powered down, then this low alarm limit will be reset to 80 at power up.

NIBP Notes

NOTE! Systolic and Diastolic blood pressure measurements determined with this device are equivalent to those obtained by a trained observer using the cuff/stethoscope auscultation method, within the limits prescribed by the American National Standard, *Electronic or Automated Sphygmomanometers*. AAMI SP10-1992.

NOTE! Mean Arterial blood pressure measurements determined with this device are equivalent to those obtained by an intra-arterial blood pressure measurement device as determined by Smiths Medical PM, Inc.

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Chapter 2: Intended Use and General Information

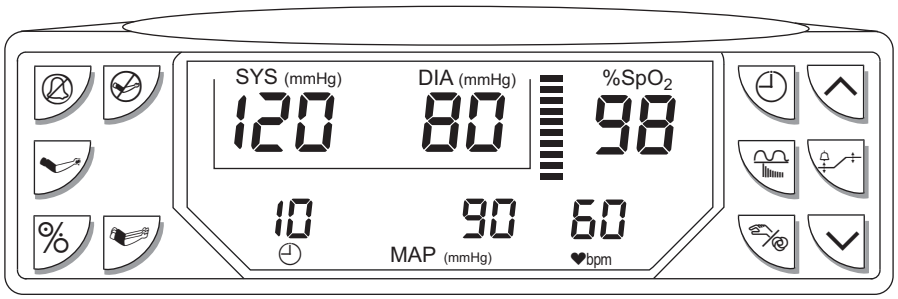
Intended Use

The V6004 monitor is a non-invasive blood pressure monitor with optional SpO_2 and printer. It is intended for spot checking or monitoring a patient's systolic, diastolic, and mean arterial pressure (MAP), pulse rate, and SpO_2 with the oximetry option. The NIBP monitor may be used in the hospital or clinical environment. The oximetry option works with all SurgiVet® oximetry sensors, providing SpO_2 and pulse rate on all patients. The V6004 monitor permits continual patient monitoring with adjustable alarm limits as well as visible and audible alarm signals. The V6004 will operate accurately over an ambient temperature range of 0 to 55°C (32 to 131°F).

The V6004 is for veterinary use only.

General Description

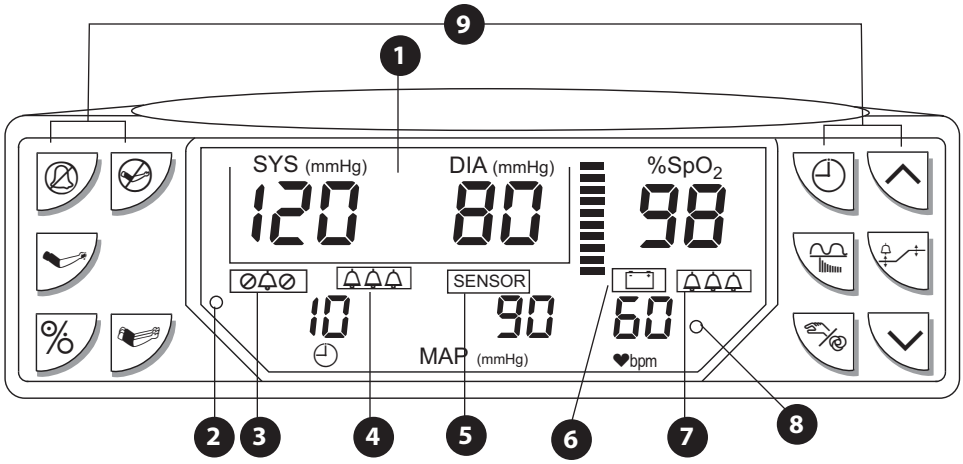
Figure 2.1: Monitor Front



Parameters	The V6004 is a Non-Invasive Blood Pressure (NIBP) monitor with optional oximetry. NIBP parameters include systolic, diastolic, and mean arterial pressures and pulse rate. Alarm limits can be set on all monitored parameters.
NIBP	The NIBP function of the monitor is designed for use with large and small animals. A variety of disposable and reusable cuffs are available for monitoring small to large animals. **The NIBP function of the monitor must be in small animal mode (SA) to be used on small animals.**
Oximeter (optional)	The monitor also supports oximetry, which continuously measures and displays arterial blood oxygen saturation (SpO_2) and Pulse Rate (♥bpm). Oximetry includes the display of a pulse strength bar. The monitor beeps with each pulse beat. The volume of the pulse beep is adjustable. The pitch of the pulse beep varies with the SpO_2 value. A variety of veterinary specific sensors are available.
Audio	The monitor uses a multi-frequency speaker for beeps and alarm and alert sounds. Volumes are adjustable.
Serial Output	An RS-232C interface allows serial output of text data to a compatible device. There is no waveform data on the serial output.
Power	The V6004 operates on power from an external power supply. In addition, the monitor contains an internal battery that allows operation for approximately six hours.
Printer (optional)	An optional printer may be installed, which prints Data Log and Trend information.

Front Panel

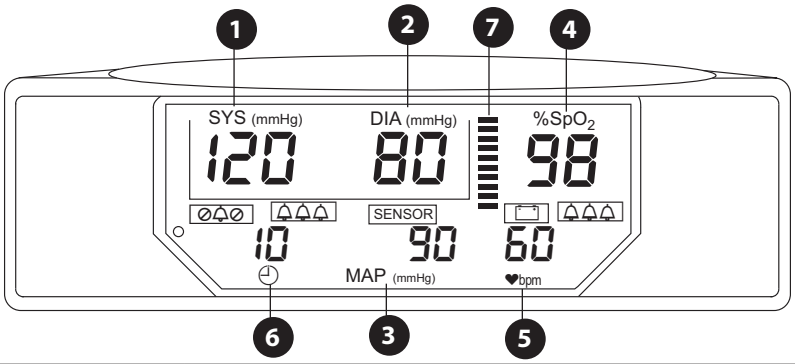
Figure 2.2: Monitor Front Panel



	DISPLAY NAME	DESCRIPTION
1	Display	The display provides continual, real-time updates of all measured values, and alarm or alert messages and/or indications. The display also shows a pulse strength bar (if the oximeter is installed).
2	Charge LED (green)	Is on steady while external power is applied and battery is fully charged. Indicates battery is charging by blinking very slowly while external power is applied. If there is no external power, then this LED is off.
3	Silence LED (yellow)	This Silence LED flashes during two-minute alarm silence. Stays on steady during indefinite alarm silence.
4	ALERT LED (yellow)	The Alert LED is illuminated during a system alert.
5	SENSOR LED (yellow)	"SENSOR" is illuminated when the sensor is not connected to the monitor, the sensor is not attached to the patient, or to indicate a "searching too long" warning. **WARNING! While "SENSOR" is illuminated, the monitor cannot measure the patient's SpO_2 or pulse rate. You must immediately check the patient's condition. After you have checked the patient's condition, you must correct the "SENSOR" low priority alarm/alert.**
6	Low Battery Indicator	The low battery indicator is illuminated and a short burst of beeps occurs when about 30 minutes of battery use remains. The monitor will work until the battery becomes very weak, after which the monitor will turn itself off. **WARNING! When is illuminated, you must immediately charge the monitor's battery. Otherwise, the monitor turns itself off after about 30 minutes.**
7	ALARM LED (red)	The Alarm LED flashes during patient alarms.
8	SA Mode (Small Animal Mode)	When light is illuminated, the NIBP function is in the Smaller Animal Mode. This is the suggested mode for animals under 10 pounds.
	LA Mode (Large Animal Mode)	When light is not illuminated, the NIBP function is in the Larger Animal Mode. This is the suggested mode for animals greater than 10 pounds. **NOTE! Start with the LA Mode for all animals, and if you have difficulty obtaining a reading, switch to the SA Mode.**
9	Keys	The front panel keys control the monitor's functions. Dedicated keys are provided for turning the monitor on and off, silencing alarm and alert tones, selecting menus, and additional NIBP functions.

Display

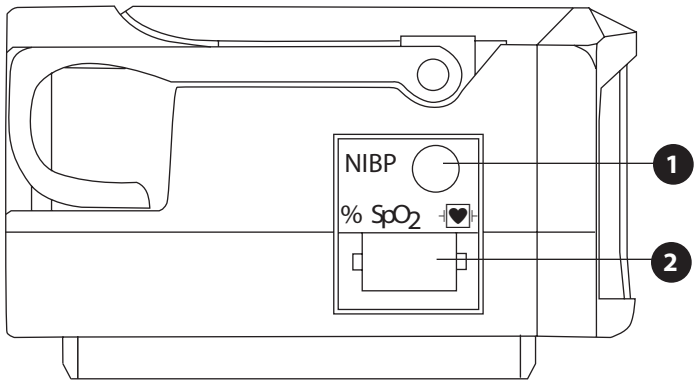
Figure 2.3: Monitor Front Panel Parameter Items



	PARAMETER	DESCRIPTION
1	SYS (mmHg)	This area displays the systolic pressure in mmHg. (millimeters of Mercury)
2	DIA (mmHg)	This area displays the diastolic pressure in mmHg.
3	MAP (mmHg)	This area displays the mean arterial pressure in mmHg.
4	%SpO_2	This area displays the SpO_2 measurement.
5	♥bpm	This area displays the pulse rate measurement in bpm. **NOTE! Dashes displayed in any parameter indicate the measurement is invalid or unavailable.**
6	(INTERVAL)	Periodically indicates the time since the last NIBP reading, up to 99 minutes. For more than 99 minutes, the interval display section will show "99." (with a trailing decimal point). In Auto NIBP mode, alternates between the NIBP interval and the time since the last NIBP reading.
7	Pulse Strength Bargraph	Indicates the patient's pulse activity and strength. The bargraph is logarithmically scaled to indicate a wide range of pulse strengths.

Side Panel

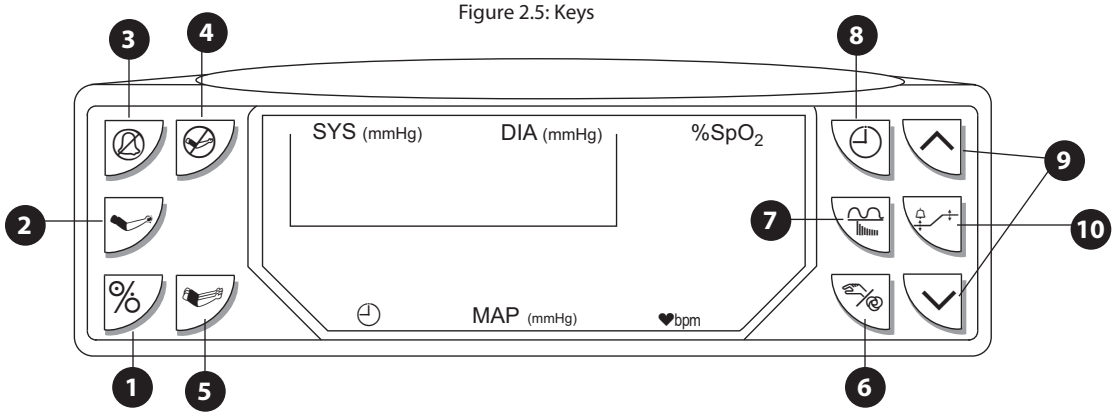
Figure 2.4: Monitor Side Panel



	CONNECTOR	DESCRIPTION
1	NIBP Connector	The NIBP hose is connected here.
2	SpO_2 Connector	The oximeter sensor and/or the extension cable is connected here.

Keys

Figure 2.5: Keys



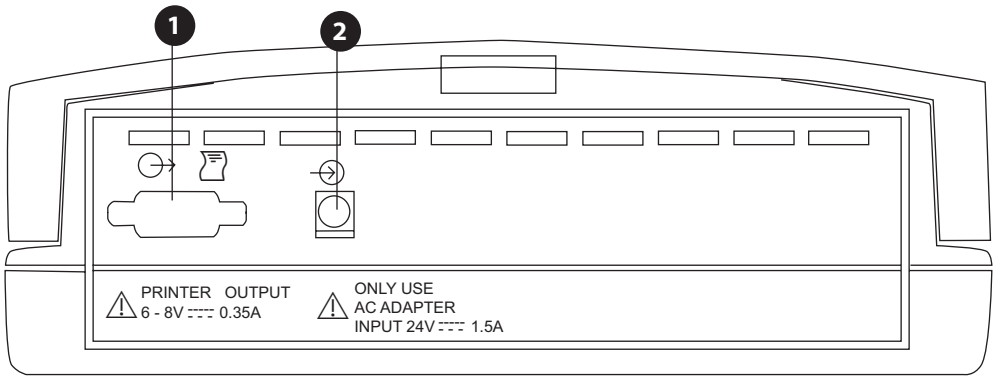
WARNING! Verify that all LEDs (light emitting diodes) on the display light up upon startup of the device.

	KEY NAME	DESCRIPTION
1	%	**ON/OFF** Press this key turns the monitor ON and OFF.
2		**START** Press this key to start a manual NIBP measurement, or, when in a user menu, to save current settings and exit.
3		**ALARM SILENCE** Press this key to disable the audible alarm tone for two minutes. (Yellow silence ⌀🔔⌀ LED flashes.) Pressing and holding this key for about three seconds disables the alarm tone indefinitely. (Yellow silence ⌀🔔⌀ LED is lit and not flashing.) Pressing this key momentarily cancels either alarm silence condition. The monitor defaults to two minute alarm silence at power up.
4		**CANCEL** Press this key to stop an NIBP measurement that is in progress. The cuff will automatically deflate when this key is pressed. Pressing for (3) three seconds restores the initial cuff inflation pressure to 200 mmHg* in SA mode or 175 mmHg in LA mode, and causes the NIBP display areas to show dashes. This key is also used to exit user menus without saving new settings, and to acknowledge NIBP alarms and alerts. * *Note: In Japan, the initial cuff inflation pressure is reset to 150 mmHg when in SA mode.*
5		**STAT** Press this key to begin Stat mode, in which NIBP readings are taken continuously for 5 minutes. Upon exiting Stat mode (either after 5 minutes of Stat mode readings, or when the user presses to exit Stat mode), the monitor will resume normal operation in Auto mode with a 5 minute interval.
6		**MANUAL/AUTO** Press this key to toggle between Manual and Auto NIBP mode. In Auto mode, NIBP measurements are made at regular, user-selectable intervals. In Manual mode, the user must initiate each NIBP measurement by pressing the key
7		**RECALL** Press this key once to enter Recall mode. Saved NIBP and SpO_2 data will be displayed along with the time at which each measurement was taken. Press for 6 seconds to show "Clr" steady on the display and clear the trend memory. If the key is released while "Clr" is flashing, trend is not cleared.
8		**INTERVAL** Press this key once to set the NIBP measurement interval. Press and hold for 3 seconds to set the time and date.

	KEY NAME	DESCRIPTION
9	^ v	**ARROWS** During normal operation, the ARROW keys (^ v)are used to set Alarm/Alert volume when alarms are not silenced, and pulse beep volume when alarms are silenced. The ARROW keys are used to set the NIBP measurement interval, the time and date, alarm limits, and system settings, in various user modes. During normal operation, pressing and holding the ^ (UP) key for 3 seconds initiates a data log to the printer or serial port. When in Recall mode, pressing the ^ and v keys scrolls through saved data, and pressing and holding the ^ key for 3 seconds causes all saved data (trends) to be sent to the printer or serial port.
10		**ALARM SET** Press this key to enter the System Settings menu and Alarm Limits menu. While menus are displayed, press to select a menu item or to accept a value which has been adjusted. Press this key once to enter the Alarm Limits menu. Use the ^ v keys to adjust the limit values and the to cycle through the alarm limits. Press and hold the key for 3 seconds to enter the System Settings menu. The following system settings may be changed: initial cuff inflation pressure, data log/trend output destination, and display intensity.

Rear Panel

Figure 2.6: Monitor Rear Panel



	CONNECTOR NAME	DESCRIPTION
1	Serial I/O	An external RS-232C communication device can be connected to the monitor through this port.
2	Power Input	The external power supply attaches to this connector.

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Chapter 3: Setting Up the Monitor

Unpacking the Monitor and Checking the Shipment

Carefully remove the monitor and accessories from the shipping carton. Save the packing materials in case the monitor or accessories must be shipped or stored. Compare the packing list with the accessories received and make sure the shipment is complete.

CAUTION! If damage has occurred to the package, a calibration needs to be done at an authorized service center.

Turning Alarm and Alert Tones On and Off

When the monitor is turned on, the alarm and alert tones are silenced for two minutes. The SILENCE ⊘🔔⊘ LED flashes during the two minute time-out.

- To silence the alarm and alert tones indefinitely: Press and hold 🔔 for about three seconds; the ⊘🔔⊘ LED lights steady.
- To silence the alarm and alert tones for two minutes: Momentarily press 🔔; the ⊘🔔⊘ LED flashes. If tones are already silenced, press 🔔 twice (the first press cancels alarm silenced; the second press silences the alarms for two minutes).
- To cancel either two minute or indefinite alarm silence and enable alarm and alert tones: Momentarily press 🔔; the ⊘🔔⊘ LED turns off.

Working With System-Wide Settings

This section describes working with system-wide settings using the System Settings mode.

1. To enter the System Settings mode press and hold the ALARM SET 🔔/+ key for 3 seconds.
2. The patient mode, "LA" will display in the systolic and diastolic display areas. This is the mode of choice for animals 10 pounds or larger. "SA" is used for animals under 10 pounds.
3. Press the 🔔/+ key again to edit the initial cuff inflation pressure that is displayed in the systolic display area. Use the ∧ and ∨ keys to set this value.
4. Pressing the 🔔/+ key again displays the data logging/trends output destination in the MAP display area. Use the ∧ and ∨ keys to toggle between "Prnt" for optional integral printer output and "Port" for serial port data output.

NOTE! If the printer has not been factory installed, this setting will always show "Port."

5. Press the 🔔/+ key again to view the display intensity in the INTERVAL 🕘 area. Use the ∧ and ∨ keys to change the intensity.
6. Press START 🚀 or 🔔/+ to save the new settings and exit. Pressing CANCEL ⊘ exits without saving the new settings.

Setting the Time or Date

The monitor has a real-time clock and calendar. It remembers the time and date, even when the monitor is turned off or is not connected to the external charger. The time and date are used for the trends and printouts.

To set the time and/or date, do the following:

1. Press and hold the INTERVAL key for 3 seconds.
2. The system time will be displayed in the MAP display area (HH.MM), and the date will be displayed in the SYS and DIA display areas (MM.DD.YY).
3. Use the key to select the time or date item to be changed.
4. Use the ^ and v keys to adjust the value. Pressing and holding the ^ and v key changes the value faster.
5. Press the key to accept the value and move on to the next.
6. When the year is flashing, press the key to accept the changes and exit. Pressing the key also saves the new settings and returns the monitor to normal operation. Pressing the key exits without saving the new settings.

Optional Printer

1. Press the FEED ( ) key to advance/install paper.
2. Press the PRINT ( ) key to begin printing.

AC Power

CAUTION! Ensure the device's AC rating is correct for the AC voltage at your installation site before using this monitor. The monitor's AC rating is shown on the external power supply. If the rating is not correct, do not use the monitor; contact the Smiths Medical PM, Inc. Service Department, or your local distributor, for help.

Refer also to *Chapter 11: Optional Supplies and Accessories* to verify the proper AC power supply for your application.

NOTE! Connect the AC Charger to the AC Power Connector of the monitor first and the AC Charger to the Wall Outlet second.

NOTE! Do not plug the monitor into an outlet controlled by a wall switch.

1614	AC power supply 105-125V, 60 Hz
1615	AC power supply 208-252V, 50/60 Hz
1616	AC power supply 90-110V, 50 Hz

NOTE! When using AC power, the Oximeter is a class II device with functional earth. This earth connection is for device electromagnetic compatibility and does not provide protection to the patient or user.

WARNING! Disconnect the AC power supply from the outlet before disconnecting it from the monitor. Leaving the AC power supply connected to an AC power outlet without being connected to the monitor may result in a safety hazard.

WARNING! Do not allow any moisture to touch the AC power supply connectors or a safety hazard may result. Ensure that hands are thoroughly dry before handling the AC power supply.

WARNING! Do not place the monitor in the patient's bed. Do not place the monitor on the floor.

WARNING! Failure to place the monitor away from the patient may allow the patient to turn off, reset, or damage the monitor, possibly resulting in the patient not being monitored. Make sure the patient cannot reach the monitor.

WARNING! Failure to carefully route the cable from the sensor to the monitor may allow the patient to become entangled in the cable, possibly resulting in patient strangulation. Route the cable in a way that will prevent the patient from becoming entangled in the cable. If necessary, use tape to secure the cable.

WARNING! If there is a risk of the AC power supply becoming disconnected from the monitor during use, secure the cord to the monitor several inches from the connection.

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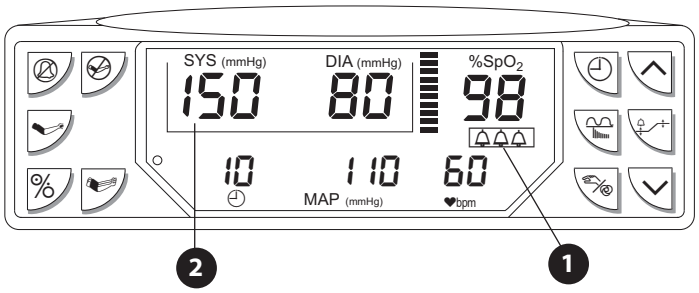
Chapter 4: Alarms and Alerts

Alarms

An *alarm* warns you when a patient's measurement matches or exceeds the high or low alarm limit for that measurement. For example, if the high SYS alarm limit is set to 150, and the patient's measured SYS is 150 or higher, an alarm is triggered. During an alarm:

Figure 4.1: Alarm Example



1 The LED flashes.

2 The digits for the violated alarm limit flash.
The alarm tone sounds (if not silenced).

NOTE! The alarm actions occur for each violated alarm, even if more than one alarm is violated at the same time.

NOTE! Alarms can be tested while the monitor is in use by setting alarm limits such that the measured parameter reading is outside the alarm limits. Be sure to restore alarm limits to the required settings after testing.

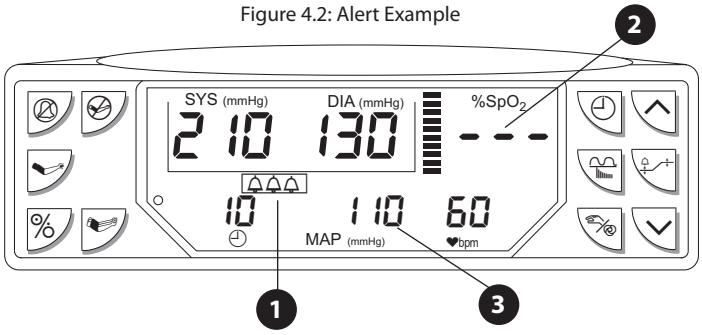
Manually Reset NIBP Alarms

The NIBP alarms require a manual reset. The alarm actions stop when the alarm is no longer violated and the CANCEL key is pressed.

Alerts

An *alert* warns you about a condition that prevents the monitor from taking a measurement. For example, if the SpO_2 sensor is not connected to the monitor, the monitor cannot measure the patient's pulse rate or SpO_2 value. In this case, an alert is triggered. During an alert:

Figure 4.2: Alert Example



1 The LED is illuminated.

2 Dashes indicate a measurement is unavailable.
The alert tone sounds (if not silenced).

3 A message, "E-nn", ("nn" is an error number), is displayed in the MAP area (for NIBP only).

Adjusting or Viewing Alarm Limits

1. Press the key once to enter the Set Alarms mode.
2. Using the key, select the alarm limit to be changed.
3. Use the arrow keys to adjust the value. Press the key to set the value. High alarm limits may be set to OFF by scrolling past the highest setting. Low alarm limits may be set to OFF by scrolling past the lowest setting

NOTE! The SpO_2 function, the monitor may be disabled by scrolling its high alarm limit to 100, then OFF, and then to "-d-."

4. Press to access other alarm limits.
5. Press the key to toggle through the menu or press the key to save the new settings and exit. Pressing exits without saving the changes.

NOTE! Alarm limits are retained during power cycles, except for the following note.

NOTE! If the low alarm limit for SpO_2 is set to a value lower than 80 when the monitor is powered down, then this low alarm limit will be reset to 85 at power up.

Alarm and Alert Tones

The alarm tone is a two tone, continuous sound (dee doo dee doo). The tone for all alerts except low battery is a single tone sound with a pause (beep beep, pause, beep beep).

- The alarm and alert tones sound at the same volume.
- The volume can be adjusted by doing the following:

  a. Make sure the alarms are not silenced.

  b. Press the ^ or v keys to either increase or decrease the volume. The volume level will be displayed in the lower left corner of the display.

- This volume can not be set to OFF.
- All alarm and alert tones except the Low Battery alert can be silenced with the key.

Turning Alarm and Alert Tones On and Off

When the monitor is turned on, the alarm and alert tones are silenced for two minutes. The LED on the key flashes during the two minute time-out.

- To silence the alarm and alert tones indefinitely: Press and hold for about three seconds. The LED lights steady, and you will hear a beep.
- To silence the alarm and alert tones for two minutes: Momentarily press ; the LED flashes. If tones are already silenced, press twice (the first press cancels alarm silenced; the second press silences the alarms for two minutes).
- To cancel either two minute or indefinite alarm silence and enable alarm and alert tones: Momentarily press ; the LED turns off.

System Alert Condition: Low Battery

A low battery condition will be detected when the battery has about 30 minutes remaining. When the condition is detected:

- The LED is illuminated.
- This message remains displayed until the monitor is connected to power.
- A unique alert tone, a burst of 5 beeps at mid-volume, sounds as soon as the low battery condition is detected, and every 30 seconds thereafter while the condition persists.
- The volume of the low battery alert tone is not adjustable.
- The low battery audible cannot be disabled by the key.

Audible and Visual Indicators

Each audible indicator is assigned a priority level, so only one tone sounds at a time. The monitor also provides visual indication of alarm conditions via on-screen displays and front panel indicators. The indicator tones and visual responses are described below.

INDICATION TYPE	DISPLAY INDICATOR	LED INDICATOR	EFFECT	AUDIO
ALARMS (High Priority)	Numbers flash that correspond to the parameter alarm (SYS, DIA, MAP, SpO_2, and/or Rate)	Red ALARM ( )LED flashes	Overrides ALERT (audio tones)	Alarm tone sounds ten pulses, repeated every ten seconds.
ALARMS (Medium priority)	N/A (not applicable)	N/A	N/A	N/A
ALERTS (Low priority)	N/A	Yellow ALERT ( )LED is illuminated	Overrides pulse beeps	Low priority alarm/ Alert tone sounds two pulses, repeated every 20 seconds
ALERTS (Low priority)	N/A	Yellow SENSOR LED is illuminated	Overrides pulse beeps	Low priority alarm/ Alert tone sounds two pulses, repeated every 20 seconds
ALERTS (Low priority)	N/A	Yellow BATT ( ) LED is illuminated	Overrides all audio (one shot)	6 beeps that occur once every 30 seconds
Pulse	10 segment bar graph	N/A	N/A	Beeps with each heart/pulse beat. The beep pitch corresponds to the SpO_2 value. As the SpO_2 value increases, the beep pitch increases. Conversely, as the SpO_2 value decreases, the beep pitch decreases.
Key click	N/A	N/A	N/A	Clicks when a key is pressed.

Chapter 5: NIBP

Theory of Operation

The monitor uses oscillometric principles to calculate the systolic, diastolic, and mean arterial pressure (MAP) values. The MAP is calculated as the lowest cuff pressure that provides the maximum cuff oscillations. Therefore, the MAP is the largest signal received and is the most accurate reading using oscillometric methods. Systolic pressure is calculated as the cuff pressure when an increase in perceived cuff oscillations begins. The diastolic pressure is the cuff pressure when oscillations are no longer decreasing as pressure is released from the cuff.

The first and fourth Korotkoff sounds were used to determine the overall efficacy.

Using the NIBP Parameter

If you are not familiar with this monitor and the NIBP parameter, then follow this chapter's sections in order:

- *Connecting the Cuff and Hose:* Connect the cuff to the patient and the hose to the cuff and monitor.
- *Verifying the Initial Cuff Inflation Pressure:* Verify the initial cuff inflation pressure setting.
- *Taking NIBP Measurements:* Describes how to take Manual, Automatic, and Stat measurements, and how to cancel measurements.
- *NIBP Alerts and Messages:* Defines the NIBP alerts and messages.
- *Application Note:* NIBP Cuff Inflation Method: Describes the method used to determine the cuff inflation pressure for each measurement.

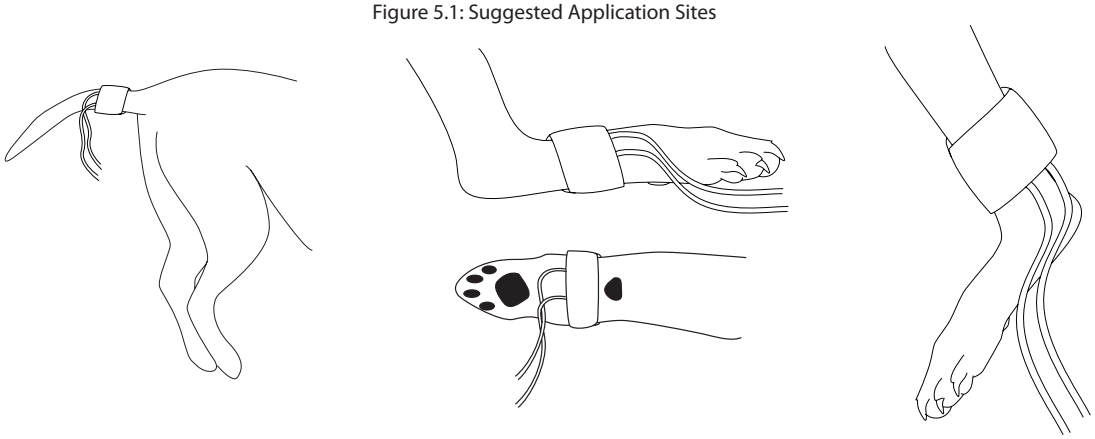
Connecting the Cuff and Hose

Choose the appropriate size cuff. Below are the ranges to use when deciding which seize cuff to use.

PATIENT	DESCRIPTION
Small Mammals, Cats, & Small Dogs (or similar size animals)	31543B1: Extra Small Cuff
Small-Medium Dogs (or similar size animals)	315432B2: Small Cuff
Medium-Large Dogs (or similar size animals)	31543B3: Medium Cuff
Large Dogs (or other large animals)	31543B4: Large Cuff

Suggested Application Sites

Figure 5.1: Suggested Application Sites



Cuffs can be placed on a variety of locations, including:

- Median palmar artery (proximal to the metacarpal pad)
- Over the dorsal pedal artery (on the dorsomedial aspect of the hind limb below the hock)
- Over the coccygeal artery on the ventral aspect of the base of the tail
- Over the femoral artery on the medial aspect of the thigh (use this location last, the other locations usually give better readings)

Connect the Cuff and Hose

1. Attach the hose to the monitor.
2. Select the appropriate cuff for your patient. See table on page 5-1 for guidance.
3. Place the cuff on the limb with the SurgiVet® logo facing up, away from the patient. The width of the cuff should be approximately 30-60% of the circumference of the limb. Remember that you do not need to align along an artery.
4. Secure the Hook & Loop closure. The cuff should be snug.
5. Attach the cuff to the hose and initiate the inflation of the cuff.
6. Lift the Hook & Loop closure tap to remove the cuff.

NOTE! The Hook & Loop closure system is designed so that it will not come apart, unless the cuff is placed incorrectly or is too small for the patient.

Verifying the Initial Cuff Inflation Pressure

NOTE! The NIBP parameter uses a special method for determining the cuff inflation pressure. For details on this method, see *Application Note: NIBP Cuff Inflation Method* later in this chapter.

1. Verify that the cuff is on the correct setting. To access the initial cuff inflation pressure setting, press and hold the key for 3 seconds. Either SA (for all cats and dogs under 10 lbs.) or LA (for all dogs and animals, other than cats, 10 lbs. or larger) will display in the systolic area of the screen. Use the arrow key to adjust between SA and LA Mode.

2. Press the key again to see the current initial cuff inflation pressure for the patient. Use the arrow key to adjust the initial cuff inflation pressure.

Taking NIBP Measurements

Decide which measurement mode you want to use:

- Manual: In the Manual mode, a single NIBP measurement is taken when is pressed.
- Automatic: In the Automatic mode, NIBP measurements are taken at regular intervals, according to the interval setting when MANUAL/AUTO is pressed and INTERVAL selected.
- Stat: In the Stat mode, five minutes of successive NIBP measurements are taken when is pressed.

Manual NIBP Measurement

In Manual mode, a single NIBP measurement is taken when is pressed.

1. If the unit is in Auto mode, press the key to place the unit in Manual mode. The INTERVAL display section will periodically display the time since the last NIBP reading, up to 99 minutes. For more than 99 minutes, the INTERVAL display section will show "99." (i.e., with the trailing decimal point).

2. Press to begin the measurement. A digital manometer will display the current cuff pressure in the SYS display section during the measurement. If the measurement is successful, the systolic, diastolic, and MAP measured values are updated. Pulse Rate is also updated if the oximeter is disabled, not installed, or oximetry Pulse Rate is invalid.

3. If the measurement is unsuccessful, dashes are shown for the measured values and the monitor stops taking measurements until is pressed again. An error message will be displayed in the MAP area. A message, "E-nn", ("nn" is an error number), is displayed in the MAP area (for NIBP only).

Automatic NIBP Measurement

In the Auto mode, NIBP measurements are taken at the auto measurement interval setting.

1. If the unit is in Manual mode, press the key to enter Auto mode. The measurement interval will be displayed in the INTERVAL area, alternating with the time since last NIBP reading.

2. Press the key to begin a single NIBP measurement immediately; the automatic mode continues after the single measurement. If the measurement is successful, the measured systolic, diastolic, MAP, and pulse rate values are updated. When the automatic measurement interval time has elapsed, another automatic measurement is taken.

3. If the measurement is unsuccessful, dashes are shown for the measured values and the monitor stops taking measurements until the measurement interval has elapsed. A message, "E-nn", ("nn" is an error number), is displayed in the MAP area. (for NIBP only)

Manual measurements may be initiated using the key in Auto mode, provided that the cuff has been deflated for at least 30 seconds; otherwise, the interval display will flash for a few seconds to indicate that the monitor is in Auto mode and the cuff has been recently inflated. A Manual measurement will take the place of an Auto measurement if the measurement was scheduled to occur during the manual measurement. The NIBP interval counter will be reset at the conclusion of a successful manual measurement.

NOTE! After (10) ten minutes of Auto mode measurements at 1 minute intervals, the monitor will switch to an interval of 5 minutes.

Stat NIBP Measurement

In Stat mode, five minutes of successive NIBP measurements are taken.

1. Press the key.

2. The digital manometer will not be displayed, and "- -" will be displayed in the INTERVAL display section to indicate Stat mode.

3. When the key is pressed, a five-minute time-out is started. NIBP measurements are taken successively until the five-minute time-out has elapsed, or until the key is pressed. If an NIBP alarm or alert is occurring, the first press of the key will acknowledge the alarm(s) and /or alert(s); the second press of the key will end Stat mode.

NOTE! When the Stat mode times out or is canceled, Stat NIBP measurements stop and the monitor is set to the Auto measurement mode with an interval setting of 5 minutes.

Canceling NIBP Measurements

Pressing performs these functions:

- Stops the current measurement. While in the automatic mode, pressing only stops the current measurement; another automatic measurement starts after the preset time interval has elapsed.

- Stops all NIBP alarm and alert actions, and erases displayed NIBP alerts and messages.

- Pressing for 3 seconds restores the initial cuff inflation pressure to 200 mmHg, in SA mode or 175 mmHg in LA mode. (In Japan, the initial cuff inflation pressure is reset to 150 mmHg if in SA mode). Pressing this key for three (3) seconds causes the NIBP display areas to show dashes.

Changing the Auto NIBP Measurement Interval

The automatic NIBP measurement interval setting is shown in the INTERVAL display area when Auto mode is chosen. This setting is the time interval between automatic NIBP measurements. Follow these steps to change the Auto NIBP measurement interval:

1. Press the key.
2. The Auto mode NIBP interval will display in the INTERVAL display area.
3. Use the and keys to change the Auto measurement interval setting.
4. Press either the key or the key to save the setting and exit. Pressing the key exits the mode without saving the new interval setting.

NOTE! If no key is pressed for 20 seconds while in SET INTERVAL mode, the unit will return to normal operation with the new interval setting.

NOTE! If the unit is in Auto mode when the interval setting is changed, the unit will continue to run in Auto mode with the new interval when the Set Interval mode is exited.

NOTE! If the INTERVAL was changed, the NIBP Auto mode interval will be restarted when the Set Interval mode is exited.

NOTE! If the unit is in Auto mode, and it is time to take a measurement, the unit will automatically exit the Set Interval mode, with the new interval setting, and start a measurement.

NIBP Alerts and Status Messages

The NIBP status messages are displayed in the MAP display area. Only one message can be shown at a time; therefore, they are prioritized to show what is most important on the display.

Status Messages

Press the ⊘ key to acknowledge the alert. The message disappears, the ALERT LED (△△△)turns off, and the alert tone silences. If the status message (i.e., "E-nn") does not disappear, the condition has not been removed and will require additional attention as described below.

ERROR CODE	MEANING	ACTION
E-11	Processor communication error.	Turn the unit off and then on. Try the reading again. If the message reappears contact Smiths Medical PM, Inc. Veterinary Clinical Support.
E-12	Measurement timed out.	Try the reading again. Check patient condition and cuff placement. Initial inflation pressure may need to be increased.
E-13	Cuff leak.	Check the cuff and hose assembly for leaks and try the reading again. If the message reappears, replace the cuff.
E-15	Excessive noise or inflation pressure too low.	Try the reading again. Check patient condition and cuff placement. Initial inflation pressure may need to be increased.
E-16	Weak signal.	Try the reading again. Reposition the cuff over the artery if necessary.
E-17	System error.	Turn the unit off and then on. Try the reading again. If the message reappears contact Smiths Medical PM, Inc. Veterinary Clinical Support.
E-18	Cuff overpressure condition.	Check patient condition. This message will appear if the pressure exceeds 315 mmHg.
E-19	Time error.	Turn the unit off and then on. Try the reading again. If the message reappears contact Smiths Medical PM, Inc. Veterinary Clinical Support
E-20	NIBP calibration out of range.	Contact Smiths Medical PM, Inc. Veterinary Clinical Support.
E-21	NIBP dump valve failure.	Contact Smiths Medical PM, Inc. Veterinary Clinical Support.
E-22	PIC pressure transducer error.	PIC pressure transducer is outside the specified range at initialization. Try the reading again. If the message reappears, contact Smiths Medical PM, Inc. Veterinary Clinical Support.
E-23	Pressure transducer error.	Pressure transducer is outside the specified range at initialization. Try the reading again. If the message reappears, contact Smiths Medical PM, Inc. Veterinary Clinical Support.

Application Note: NIBP Cuff Inflation Method

The NIBP cuff inflation pressure is determined by the following method.

If:

- you just turned on the monitor
- there is no valid systolic pressure reading
- you just changed the initial cuff inflation pressure setting

Then the cuff pumps up to the initial cuff inflation pressure setting in the SYSTEM SETTINGS menu.

If there is a valid systolic pressure reading, then the cuff pumps up to the previous systolic reading plus 35 mmHg.

Chapter 6: Using the Oximeter Option

General Description

The V6004's Oximeter option noninvasively and continuously monitors and displays arterial blood oxygen saturation (SpO_2) and pulse rate. The V6004 beeps with each pulse beat. The pitch of the pulse beep depends on the SpO_2 value; the higher (or lower) the SpO_2 value, the higher (or lower) the pulse beep pitch.

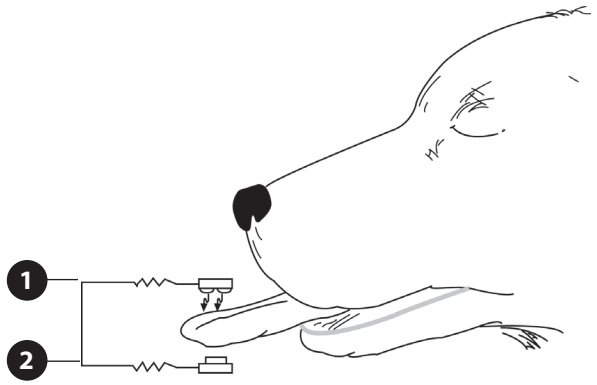
The V6004's flexible alarm system lets you choose alarm parameters and audible tone volumes. You can select the high and low alarm limits for SpO_2 and pulse rate, and independently choose the volume for alarm and pulse beep tones.

Pulse Oximetry Theory of Operation

The pulse oximeter determines %SpO_2 and pulse rate by passing two wavelengths of low intensity light, one red and one infrared, through body tissue to a photodetector. Information about wavelength range can be especially useful to clinicians. Wavelength information for this device can be found in the SpO_2 Specifications section of this manual.

Pulse identification is accomplished by using plethysmographic techniques, and oxygen saturation measurements are determined using spectrophotometric oximetry principles. During measurement, the signal strength resulting from each light source depends on the color and thickness of the body tissue, the sensor placement, the intensity of the light sources, and the absorption of the arterial and venous blood (including the time varying effects of the pulse) in the body tissues.

Figure 6.1: Pulse Oximetry Theory of Operation



1 Low intensity Red and Infrared LED light sources

2 Detector

Oximetry processes these signals, separating the time invariant parameters (tissue thickness, skin color, light intensity, and venous blood) from the time variant parameters (arterial volume and SpO_2) to identify the pulses and calculate functional oxygen saturation. Oxygen saturation calculations can be performed because blood saturated with oxygen predictably absorbs less red light than oxygen-depleted blood.

WARNING! Since measurement of SpO_2 depends on a pulsating vascular bed, any condition that restricts blood flow, such as the use of a blood pressure cuff or extremes in systemic vascular resistance, may cause an inability to determine accurate SpO_2 and pulse rate readings.

WARNING! Under certain clinical conditions, pulse oximeters may display dashes if unable to display SpO_2 and/or pulse rate values. Under these conditions, pulse oximeters may also display erroneous values. These conditions include, but are not limited to: patient motion, low perfusion, cardiac arrhythmias, high or low pulse rates or a combination of the above conditions. Failure of the clinician to recognize the effects of these conditions on pulse oximeter readings may result in patient injury.

NOTE! Pulse rate will be provided by the NIBP function. When the SpO_2 option is enabled and is providing valid data, its pulse rate will override the NIBP pulse rate.

Disabling the Oximetry Option

1. Press the key once to enter the Set Alarms mode.
2. Using the key, select the high oximetry alarm limit.
3. Use the arrow keys to adjust the value. The monitor may be disabled by scrolling the high alarm limit to 100, then OFF, and then to "-d-." Press the key to set the value.
4. Press the key to toggle through the menu or press the key to save the new settings and exit. Pressing exits without saving the changes. The oximetry functions are disabled, as denoted by the "-d-" in the %SpO_2 area, and may be re-enabled by repeating steps 1-3 and selecting either OFF or a specific high alarm limit value.

Adjusting the Pulse Beep Volume

1. Make sure that alarms are silenced.
2. Use the ^ and v keys to adjust the pulse volume. The pulse volume level will be displayed in the lower left corner of the display (in the INTERVAL area).

NOTE! The pulse beep sounds while adjusting the volume.

Attaching the Patient – Oximetry

Smiths Medical PM, Inc. manufactures a variety of SurgiVet® pulse oximetry sensors to allow you to accurately and reliably monitor all of your different types and weights of patients. It is very important to select the proper sensor for each patient based on their size, color, condition, and type of procedure you are performing.

Experience will quickly teach you which probes work best under different conditions. Well-perfused sites, with little or no hair are preferable. It is also important to note that some anesthetic drugs such as xylazine, acepromazine, and domitor, can affect peripheral pulse pressures causing very weak pulsations. All pulse oximeters require a good pulse to work properly. The sensors available to you for your SurgiVet® pulse oximeters include a mini clip sensor, a Lingual Sensor, a reflectance sensor, and a Universal 'C' sensor.

Choosing the Sensor

Choose the appropriate sensor from the following chart.

PATIENT	SITE	SENSOR #/DESCRIPTION
Small/Medium Animal up to 60 pounds	Tongue	V1703: Lingual Clip Set with 'Y' Sensor
	Pinna (ears), Toe Webbing, Tongue	V3078: Mini Clip Sensor
	Rectum/Tail	V1700: Reflectance Sensor
	Hock, Achilles Tendon, etc.	V1707: Universal 'C' Sensor
Large Animals over 60 pounds	Tongue	V1703: Medium/Large Animal Lingual Clip Set with 'Y' Sensor
	Pinna (ears), Toe Webbing, Tongue	V3078: Mini Clip Sensor
	Rectum/Tail	V1700: Reflectance Sensor
	Hock, Achilles Tendon, etc.	V1707: Universal 'C' Sensor
Equine	Tongue	V1707: Universal 'C' Sensor

NOTE! ⚠ Refer to sensor insert instructions for application directions.

Clean or Disinfect the Sensors

Clean or disinfect the sensor before attaching a new patient.

WARNING! Do not autoclave, ethylene oxide sterilize, or immerse the sensors in liquid.

CAUTION! Unplug the sensor from the monitor before cleaning or disinfecting.

Clean the sensor with a soft cloth moistened in water or a mild soap solution. To disinfect the sensor, wipe the sensor with isopropyl alcohol.

Checking the Sensor and Oximetry Cable

Follow these instructions each time before you attach the sensor to the patient. This helps ensure the sensor and oximetry cable are working properly.

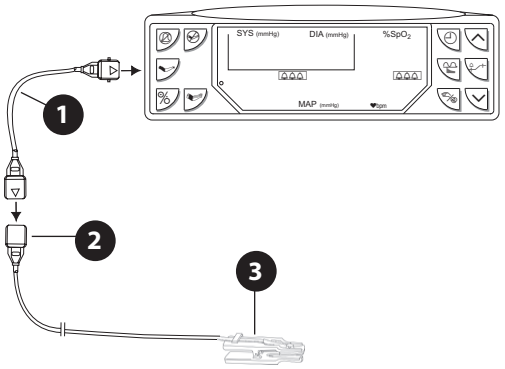
WARNING! Using a damaged sensor may cause inaccurate readings. Inspect each sensor. If a sensor appears damaged, do not use it. Use another sensor or contact your authorized repair center for help.

WARNING! Using a damaged oximetry cable may cause inaccurate readings. Inspect the oximetry cable. If the oximetry cable appears damaged, do not use it. Contact your authorized repair center for help.

Carefully inspect the sensor to make sure it does not appear damaged.

If using the oximetry cable, carefully inspect the oximetry cable to make sure it does not appear damaged.

Figure 4.3: Attaching Sensor And Oximetry Cable To Monitor.



1. **Oximetry Cable**
2. **Connector Retaining Clip**
3. **Sensor**

If using the oximetry cable:

1. If the sensor is not already connected to the oximetry cable, connect the sensor to the oximetry cable as shown. Push the connectors together firmly and close the latch to secure the connectors.

2. If the oximetry cable is not already connected to the monitor, connect the oximetry cable to the monitor as shown. Push the connector firmly into the monitor.

3. You are now ready to attach the sensor to the patient.

WARNING! Failure to carefully route the cable from the sensor to the monitor may allow the patient to become entangled in the cable, possibly resulting in patient strangulation. Route the cable in a way that will prevent the patient from becoming entangled in the cable. If necessary, use tape to secure the cable.

If not using the oximetry cable:

1. Connect the sensor to the monitor. Push the connector firmly into the monitor.

WARNING! If any of the integrity checks fail, do not attempt to monitor the patient. Use another sensor or oximetry cable, or contact the equipment dealer for help if necessary.

Attach the Sensor to the Patient

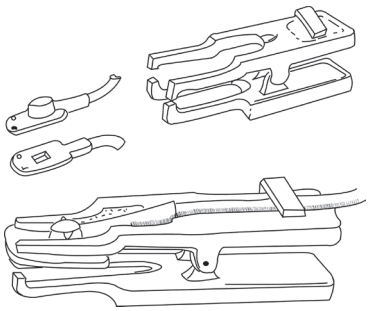
WARNING! Prolonged use or the patient's condition may require changing the sensor site periodically. Change sensor site and check skin integrity, circulatory status, and correct alignment at least every 4 hours.

WARNING! When attaching sensors with Microfoam® tape, do not stretch the tape or attach the tape too tightly. Tape applied too tightly may cause inaccurate readings and blisters on the animal's skin (lack of skin respiration, not heat, causes the blisters).

Application Guide

Universal 'Y' (Lingual) Sensor

Figure 6.2: Universal 'Y' Sensor

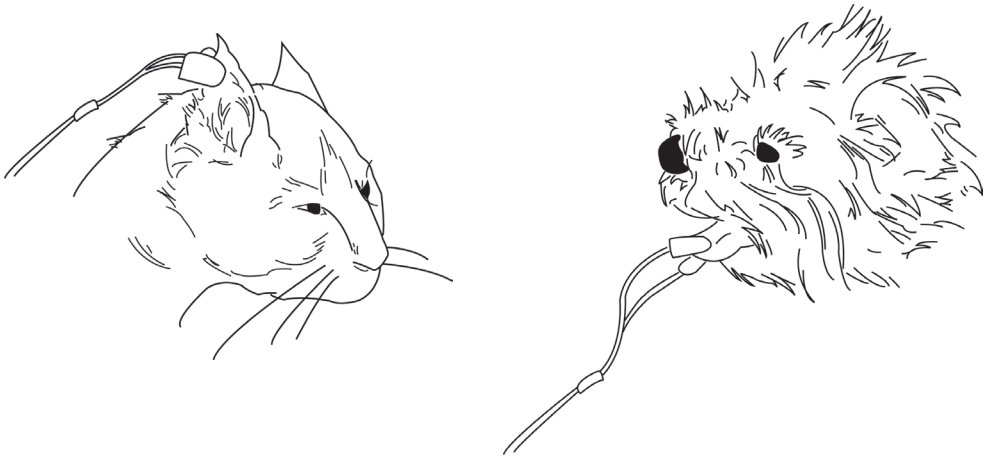


Your monitor is equipped with a lingual sensor. Position the lingual clip on the base of the tongue, and placement is dependent on the thickness of the tongue. Start at the tip and work your way towards the base. Always direct the light downward (towards the floor) regardless of the animal's position to reduce the effects of ambient light. Keep the tongue moist during longer procedures and monitor for significant temperature loss. Ensure that there is a minimum of 2 pulse strength bars displayed on the pulse oximeter.

If necessary, the lingual clip may also be positioned on lips, cheeks, prepuce, vulva and hocks. Moisten the hock area with isopropyl alcohol, water, and clip hair if needed. To get better reading on the smaller tongues, fold the sides of the tongue up into a taco shape and pass the light through both layers. Don't fold the tip of the tongue back because you will restrict blood flow to the tongue.

Mini Clip

Figure 6.3: Mini Clip



The Mini Clip is much like the Universal 'Y' lingual sensor, but less than a quarter of the size of the lingual clip. The smaller clip proves effective on the small breeds and especially on smaller cats. The clip will work on a cat's ear, tongue, and toe webbing. The Mini Clip also works well on larger animals.

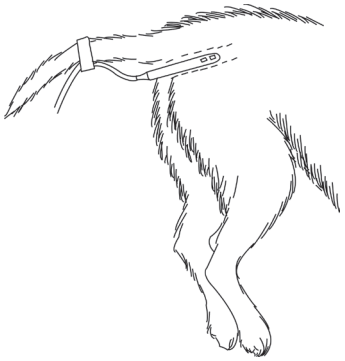
Universal 'C' sensor

Figure 6.4: Universal 'C' Sensor

The 'C' sensor is designed specifically for use in the larger tissue areas. It has brighter LED's and therefore will shine through thicker tissues. The 'C' sensor can effectively be applied to the tongue or lip of larger dogs and equine. It can also be applied across the Achilles tendon, across the metatarsals or metacarpals of cats and dogs, on vulva, tails and across the front leg of smaller animals. The 'C' has a space between the two LED's. The tissue needs to be at least that thick to get an SpO_2 reading.

Reflectance Sensor

Figure 6.5: Reflectance Sensor

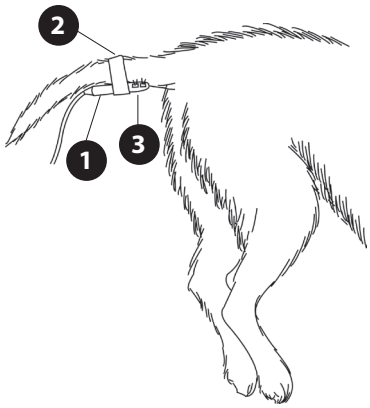


The reflectance sensor is an excellent sensor to use if you are doing dental procedures or other oral work that precludes you from using the lingual clip.

Clean the reflectance sensor by wiping it down with isopropyl alcohol or chlorhexidine. A thin coating of lubricant can be used, ensuring that the two LED's are kept clean and free of lubricant. This sensor may be used in the esophagus or cloaca of reptiles and large avians.

The animal does not need to be anesthetized when using the reflectance sensor, making it very useful in critical care or post operative settings and for spot checking. A simple glove swipe to remove existing feces may be needed. The sensor is placed very shallow, just so the 2 LED's are covered, reading the perfusion around the sphincter. A slight rotation may be needed to insure that the LED's are up against tissue and not in fecal material.

Figure 6.6: Reflectance Sensor



1 Reflectance Sensor

2 Secure the sensor to the tail with a non-adhesive wrap

3 Lights should be positioned as shown

The reflectance sensor may also be placed on the ventral base of the tail. The LED's should be positioned dorsally. You may need to clip a small patch of hair, only large enough for the LED's to lay on the skin, and clean surface. Hold the sensor snugly against the tail and wrap with non-adhesive wrap.

Pulse Oximeter Sensor Application Tips

There is some variation depending on the manufacturer, but there are three basic types of pulse oximeter sensors made for the small animal patient:

- Lingual sensor
- 'C' sensor
- Reflectance (rectal, esophageal)

It is very important to have a variety of sensors in order to monitor the majority of the small animal patients. It is also important to select the proper sensor for animals based on their size, color, fur type, medical condition, and type of procedure.

Testing Sensor Function

1. **To test the lingual clip function**, turn on the monitor with the lingual sensor attached. View the sensor to make sure a red light is being emitted, then place the sensor on a small finger (without nail polish). Rest the hand with the sensor on it on a table to minimize motion. Note that in most cases the red light should be shining in the same direction as the overhead or surgical lights. It is important that the light receptor is shielded in order to avoid interference from ambient light. Once placed on a patient site, the red light should be shining continuously. In some cases a blinking light indicates that the tissue thickness is either too thin or thick. Once the sensor is placed properly, both the SpO_2 and pulse rate should appear in a short period of time (10-15 seconds).

2. **Testing the 'C' sensor is performed in the same manner.** This is a stronger sensor and can be used with greater tissue thickness.

3. **Testing the reflectance sensor is performed in the same manner**, but it should be pressed between thumb and index finger or into the palm of your hand.

Primary Applications for Sensors

Lingual Sensor (Lingual and Mini Clip)

- The primary application site is the tongue for most animals. On cats and small dogs, fold the tongue like a taco or use a wet gauze pad of single thickness folded over the tongue, and then place the sensor over the gauze.
- Other sites include the prepuce or vulva of larger dogs, the achilles tendon of a cat or small dog, ears, or toe webbing.

C Sensor

- For cats and small breed dogs, place the sensor on the thigh, metatarsal or metacarpal, or hock near the saphenous vein.
- For larger breed dogs, place the sensor over the Achilles tendon, tongue, prepuce or vulva, or through toe webbing.
- It may be necessary to wet and part the fur with water in order to get the sensor closer to the skin of the patient.

Reflectance Sensor

- In most animals, wet and part the fur at the ventral tail base and non-adhesive tape (not tape) in place. It may be necessary to shave a small spot on the ventral tail base in patients with a thick undercoat, such as a Husky.

Limitations

Experience will quickly tell you which probes work best under different conditions. Fur, dark pigmentation, poor perfusion, and movement can all affect the sensors ability to obtain accurate readings. Well-perfused sites with little or no hair are preferable. It is also important to note that some anesthetic drugs, such as Xylazine (Rompun), Acepromazine, or Medetomidine (Domitor) can affect peripheral pulse pressures causing very weak pulsations. All pulse oximeters require a good quality pulse to work properly. Other drugs, such as ketamine, can cause the tongue to twitch, limiting the use of a lingual clip on that site.

Checking the Oximeter's Performance

Pulse oximeters do not require user calibration. If checking the function of the device is desired, an optional Oximeter Patient Simulator (SMPM catalog number 1606) is available as an accessory. The simulator attaches to the oximeter in place of the sensor or oximetry cable. It provides a known SpO_2 and pulse rate signal to the oximeter. This allows the oximeter's performance to be checked.

NOTE! The 1606 Oximeter Patient Simulator does not calibrate the monitor; the monitor does not require calibration. The 1606 provides a known SpO_2 and pulse rate to the monitor that allows you to check the monitor's performance.

NOTE! The 1606 Oximetry/ECG Patient Simulator cannot be used to assess the accuracy of a pulse oximeter and/or sensor.

NOTE: ⚠ Follow the instructions included with the Oximeter Patient Simulator.

Chapter 7: Trends

Trended data will be stored every time a valid NIBP measurement is made. Trended data includes NIBP, SpO_2, Pulse Rate, and Signal Pulse Strength. The following descriptions outline the trend display's features.

Trend Storage

1. When trend memory becomes full, newer data will overwrite the oldest data.
2. Trend memory will be retained when the monitor is turned off.
3. All trend records up to the maximum number (approximately 240 measurements at 5-minute intervals, about 20 hours) will remain in battery-backed memory until trend memory is cleared through the Recall mode, or trend memory writes over itself as mentioned above.

NOTE! The amount of elapsed time that the monitor was off does not affect stored trend records unless battery backed trend memory fails.

Each new trend gets a Time/Date Stamp.

It will be possible to dump the entire trend memory to the optional printer or out the serial port.

Recall Mode

This mode allows the user to review all recorded NIBP measurements. SpO_2, Pulse Rate, and Signal Pulse Strength are displayed with NIBP records.

1. Press the RECALL ( ) key to enter Recall Mode. The date of the most recent trend data will be displayed in the SYS/DIA display area, while the time will be displayed in the MAP area.
2. The arrow keys (^ or v) allow the user to scroll through all recorded measurements, alternating between the time and date stamp, and the trend data.
3. Pressing and holding the ^ key for 3 seconds, or pressing the PRINT ( ) key on the optional printer, initiates a trend printout, which will either be sent to the printer or the serial port (whichever is currently selected as the data logging/trend output destination). Refer to *Trend Printout* for a sample printout.
4. To stop the trend printout at any time, press and hold the up key (^) for three seconds, or press the PRINT ( ) key.
5. The Recall mode is exited when the RECALL ( ) key is pressed again, when no key is pressed for 20 seconds, when the CANCEL ( ) key is pressed, or when the monitor is in Auto mode and it is time to take a measurement.
6. If the START ( ) key is pressed while the monitor is in Recall mode, the monitor will immediately exit Recall mode and start a Manual NIBP measurement.
7. To clear the trend memory, the RECALL ( ) key is pressed and held for six seconds, while the monitor is in normal operation. After the RECALL ( ) key is held for more than one second, the message "CLr" flashes in the MAP display area. After six seconds, "CLr" stops flashing and trend memory is cleared.

Time Stamps

1. Each trend record will have a time and date stamp corresponding to the monitor's current real-time clock setting.
2. Time will be stored and displayed as military time (0.00-23.59 hours).
3. If the user changes the Time/Date setting, only new trend records (those recorded since the monitor was last turned on) will have the time/date stamp adjusted accordingly.

Trend Display

1. Trend records can be displayed by entering the Recall mode. Trend records containing NIBP data will be displayed. SpO_2, Pulse Rate, and Signal Pulse Strength are trended with each NIBP record. No records containing only SpO_2 data will be shown.

2. Trend records will be displayed in the order in which they were recorded, beginning with the youngest, most recent record. The user may scroll through the saved records using the arrow keys (^ or v). The up ^ key scrolls through older records.

3. For NIBP measurements, trend record data will be displayed alternately with the trend time/date stamp in phases. The first phase will be NIBP and SpO_2 data, the second will be the time/date stamp.

4. If SpO_2 is disabled, a "- d -" will be displayed for that trend record.

5. When the user has scrolled past the youngest or the oldest trend record, "End" will be displayed in the MAP parameter.

Trend Printout

The printout will contain only ASCII text (no graphics). The user may select one of two destinations for the trend printout: printer (if installed) or serial port. This selection is made in the System Settings menu. If no printer is installed, the trend data will always be sent to the serial port.

Trend records will be printed in the order in which they were stored, beginning with the youngest record. The trend printout format will be ASCII text, 16 characters per line, as follows:

For NIBP measurements:

```
----------------
TREND DATA

Time:   15:23:06
Date:   12/31/96
SYS:    117 mmHg
Dia:     76 mmHg
MAP:     96 mmHg
HR:      67 mmHg
SpO2:       98 %
Signal:        6
```

If the SpO_2 function was disabled within the trend interval preceding a trend record, the SpO_2 parameters for that trend record would read:

```
SpO2: DISABLED
```

NOTE! Only trend records containing NIBP data will be printed.

Clearing Trends

The trend memory may be cleared (reset) by pressing and holding the RECALL () key for 6 seconds or more, while in normal operation.

Chapter 8: Serial Output/Printer

Serial Output Requirements

FUNCTION	SPECIFICATION
I/O Port	serial RS-232C
Data Type	ASCII
Data Format	19200 baud, 1 start bit, 8 data bits, 1 stop bit, no parity, hardware handshaking
I/O Connector	DB-9 serial cable (catalog #3339: "null modem") (catalog #3362: "straight through - PC cable")
Approvals	IEC 950 or IEC 601-1

Data Logging Mode

The user enables Data Logging mode by pressing the PRINT key on the optional printer, or by pressing and holding the ^ key for 3 seconds while the monitor is in normal operation. A "DATA LOG ON" message will be printed to indicate entry into the Data Log mode. When the Data Logging mode is enabled, both the NIBP and the oximetry parameters will be printed, each time an NIBP measurement is completed.

The format of the printout will be as follows:

```
DATA LOG ON

PATIENT DATA
Name_____________
HH:MM   MM/DD/YY
SYS      117 mmHg
DIA       76 mmHg
MAP:      96 mmHg
HR:      120 bpm
SpO2:     98%
Signal:    6
-----------------
```

Dashes will be printed for invalid data. The SpO_2 values will be printed only if the SpO_2 function is installed and not disabled. The printout will be sent to either the printer or to the serial port, whichever has been selected in the System Settings mode. If the optional printer is not installed, the printout will always be sent to the serial port.

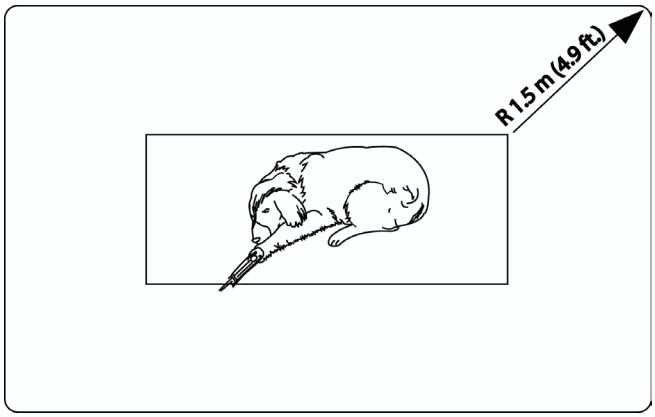
To turn off the Data Logging mode on the optional printer, press the PRINT key again, or press and hold the ^ key for 3 seconds. A "DATA LOG OFF" message will be printed to indicate that the Data Logging mode has been exited.

NOTE! To tear paper off, gently pull paper away from you tightly against the cutter and use the cutter to tear it off. Use caution not to pull paper through the printer as this might damage the paper feed rollers.

WARNING! The NIBP monitor is suitable for use within the patient environment. IEC 60950 approved equipment must by placed outside of the patient environment. The patient environment is defined as any volume in which intentional or unintentional contact can occur between the patient and parts of the system or between the patient and other persons touching parts of the system.

WARNING! When connecting this monitor to any instrument, verify proper operation before clinical use. Refer to the instrument's user manual for full instructions. Accessory equipment connected to the monitor's data interface must be certified according to the respective IEC standards, i.e., IEC 950 for data-processing equipment or IEC 601-1 for electromedical equipment. All combinations of equipment must be in compliance with IEC 601-1-1 systems requirements. Anyone connecting additional equipment to the signal input port or signal output port configures a medical system, and, therefore, is responsible that the system complies with the requirements of the system standard IEC 601-1-1.

Figure 8.1: Patient Environment



Chapter 9: Routine Maintenance

Charging the Battery

Charge the battery after the monitor is used under battery operation, when the low battery LED is illuminated, or after long term storage. Connect the external charger to the back of the monitor. Verify that the green LED next to the INTERVAL display area is illuminated.

After connecting the external charger, the unit automatically goes into "fast charge," which is indicated by a flashing green LED. After 4 hours, the battery is fully charged, indicated by a continuously lit LED.

WARNING! Using any charger other than the SurgiVet® charger supplied with the unit will cause damage to the monitor.

NOTE! NiCad batteries should always be fully charged and discharged to prevent shortened battery life. If the battery fails to hold a charge or otherwise becomes inoperable, the battery should be disposed of properly. NiCd batteries should not be disposed of in normal rubbish containers. They should be sent to the proper facilities so that the metals in them may be reclaimed and/or recycled. In the US, call 1-800-822-8837 to obtain information about the proper disposal of the NiCd battery. Regulations in Europe vary from country to country. Consult local authorities for information about the proper disposal of the NiCd battery.

NOTE! Smiths Medical PM. Inc. recommends that all Surgivet® monitors are used with the power supply whenever possible. Doing so will extend the life of the rechargeable battery which is ideally used for transport and field situations where AC is not available.

NOTE! Connect the AC charger to the AC power connector of the monitor first and the AC charger to the wall outlet second.

Cleaning and Disinfecting

CAUTION! Do not immerse the monitor or any of its accessories in liquid. Do not autoclave or ethylene oxide sterilize the monitor or any of its accessories. Unplug the external charger before cleaning or disinfecting the monitor or its accessories.

CAUTION! Chemicals used in some cleaning agents may cause brittleness of plastic parts. Follow cleaning instructions in this manual.

Clean the surfaces of the monitor and the accessories with a soft cloth moistened in a mild soap solution. If disinfection is required, wipe the surfaces with isopropyl alcohol, then wipe with a water moistened soft cloth.

Maintenance Chart

ITEM	ACTION	INTERVAL	PAGE
Battery	Charge	When  is lit. After continuous use under battery power. **NOTE! Use the AC Power Supply whenever possible. This will extend the life of the rechargeable battery.**	9-1
The monitor's surfaces	Clean or disinfect	As required	9-1
SpO_2 sensors	Clean or disinfect	When attaching a new patient.	6-3

Long Term Storage

Storage Facility:	Indoor
Temperature:	-40 to +70 °C (-40 to +158 °F)
Relative Humidity:	10 to 95%, non-condensing
Periodic Inspection:	None required.
Special Procedures:	Store the monitor and accessories in the original packing materials and shipping carton.

Chapter 10: Troubleshooting

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
SENSOR is illuminated.	Sensor not connected to monitor or patient	Connect the sensor to the patient cable and connect the patient cable to the monitor. Place sensor on patient.
	Sensor improperly positioned on patient.	Reposition the sensor on the patient.
	Incorrect sensor for application.	Choose the correct sensor for the application.
	Defective sensor or patient cable.	Change the sensor or contact Smiths Medical PM, Inc. Veterinary Clinical Support.
Unit operates when connected to external charger, but not on battery power.	Battery shelf life exceeded.	Contact Smiths Medical PM, Inc. Veterinary Clinical Support.
Display does not light.	If operating on battery, battery may need charging.	Recharge battery.
Green (charge) LED not lit.	External power supply disconnected.	Connect power supply.
	Malfunctioning power supply.	Connect power supply to different outlet, preferably on a different electrical circuit or replace with new power supply (Cat. No. 1614, 1615, 1616)
No pulse registering on bargraph.	Sensor or patient cable disconnected from monitor.	Check connections to patient cable and sensor.
	Sensor incorrectly positioned.	Reposition sensor on patient.
	Poor patient perfusion.	Reposition sensor on patient.
	Defective sensor or patient cable.	Try a new sensor or contact Smiths Medical PM, Inc. Veterinary Clinical Support.
Pulse rate erratic, intermittent, or incorrect.	Sensor incorrectly positioned.	Reposition sensor on patient.
	Poor patient perfusion.	Reposition sensor on patient.
	Patient motion.	Patient must be still for monitor to function properly. Place extremity on a pillow which will act as a "buffer" to motion.
	Ambient light	Shield with towel.

ERROR CODE	MEANING	ACTION
E-01 E-02 E-03 E-04	Unrecoverable errors.	Contact Smiths Medical PM, Inc. Veterinary Clinical Support.
E-05	Key press detected at powerup.	Turn the unit off and then on. If the message reappears contact Smiths Medical PM, Inc. Veterinary Clinical Support.
E-06	"SA" mode not allowed.	Turn the unit off and then on. If the message reappears contact Smiths Medical PM, Inc. Veterinary Clinical Support.
E-11	Processor communication error.	Turn the unit off and then on. Try the reading again. If the message reappears contact the Smiths Medical PM, Inc. Veterinary Clinical Support
E-12	Measurement timed out.	Try the reading again. Check patient condition and cuff placement. Initial inflation pressure may need to be increased.
E-13	Cuff leak.	Check the cuff and hose assembly for leaks and try the reading again. If the message reappears, replace the cuff.
E-15	Excessive noise or inflation pressure too low.	Try the reading again. Check patient condition and cuff placement. Initial inflation pressure may need to be increased.
E-16	Weak signal.	Try the reading again. Reposition the cuff over the artery if necessary.
E-17	System error.	Turn the unit off and then on. Try the reading again. If the message reappears contact the Smiths Medical PM, Inc. Veterinary Clinical Support.
E-18	Cuff overpressure condition.	Check patient condition. This message will appear if the pressure exceeds 315 mmHg.
E-19	Time error.	Turn the unit off and then on. Try the reading again. If the message reappears contact the Smiths Medical PM, Inc. Veterinary Clinical Support.
E-20	NIBP calibration out of range.	Contact the Smiths Medical PM, Inc. Veterinary Clinical Support.
E-21	NIBP dump valve failure.	Contact the Smiths Medical PM, Inc. Veterinary Clinical Support.
E-22	PIC pressure transducer error.	Contact the Smiths Medical PM, Inc. Veterinary Clinical Support.
E-23	Pressure transducer error.	Contact the Smiths Medical PM, Inc. Veterinary Clinical Support.

Chapter 11: Optional Supplies and Accessories

CAT NO.	DESCRIPTION	QTY
1606	Oximeter Simulator	each
1614	AC Power Supply 205-125V, 60 Hz	each
1615	AC Power Supply 208-252V, 50/60 Hz	each
1616	AC Power Supply, 90-110V, 50 Hz	each
V1700	Sensor, Oximetry, reflectance R/E, Smaller	each
V1703	Sensor, Oximetry, Universal 'Y' with Clip	each
V1707	Sensor, Oximetry, Universal 'C' with Clip, Small	each
V1709	Clip, Replacement, for use with V1707 Package	10/pkg
V1720	Clip, Replacement, for use with V1703	each
V3078	Sensor, Oximetry, Mini Clip	each
V1876	Manual, Operation, (V6004)	each
3311	Cable, Oximetry, 1.5 m (5 ft)	each
3339	Cable, PC Adapter (null modem)	each
3362	Cable, PC Interface	each
6012	Paper, Printer	4/pkg
V6148SA	NIBP Kit; includes: 31545B1: Cap 31543B1: Cuff (3-9 cm) 31543B2: Cuff (5-15 cm) 31543B3: Cuff (9-25 cm) 31543B4: Cuff (17-41 cm) 31544B1: 6 ft Hose	each
31544B1	NIBP, Cuff Supply Hose, 1.8 m (6 ft)	each
31544B2	NIBP, Cuff Supply Hose, 0.9 m (3 ft)	each
31544B3	NIBP, Cuff Supply Hose, 3.0 m (10 ft)	each

Ordering Information

For ordering information, contact the customer service department at the address or phone number below:

Smiths Medical PM, Inc.
N7W22025 Johnson Drive
Waukesha, WI 53186

Phone: (262) 513-8500
Toll Free: (888) 745-6562 (USA only)
Fax: (262) 513-9069

Website: www.surgivet.com

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Chapter 12: Specifications

NIBP

Range:	20-250 mmHg
NIBP Accuracy:	Accuracy meets or exceeds SP10-1992 standard for non-invasive pressure accuracy (AAMI Standard: ± 5 mmHg mean error, 8 mmHg standard deviation).
Measurement Method:	The first and fourth Korotkoff sounds were used to determine the overall efficacy.
Cuff Pressure Accuracy:	± 3 mmHg or ±2%, whichever is greater (0-330 mmHg)
Determination Time:	30-50 seconds typical (max. 120 seconds)
Interval Times:	1, 2, 2.5, 5, 10, 15, 20, 30, 45, 60, 90 minutes
Calibration:	Factory calibrated
Inflation Pressure:	50-300 mmHg
"LA" Mode Inflation Pressure:	175 mmHg
"SA" Mode Inflation Pressure:	200 mmHg (150 mmHg in Japan)
Display:	Systolic & Diastolic Pressures: 3-digit, 0.400 inch tall LED's
	Mean Arterial Pressure: 3-digit, 0.300 inch tall LED's
Display Update Rate:	1 hertz

SpO_2

Range:	0-100% SpO_2 (functional)
Accuracy[1]:	± 2 counts at 70-100% SpO_2 less than 70% unspecified
Averaging:	8 beats
Pulse Tone:	Pitch corresponds to SpO_2 value. Value adjustable or OFF.
Display:	3-digit, 0.400 inch high LED's
Display update rate:	1 hertz
Maximum age of displayed data:	20 seconds
Calibration:	Factory-calibrated over 70 % to 100 % SpO_2 using human blood samples to functional saturation. Test methods available upon request. No in-service calibration required.

[1] Because pulse oximeter equipment measurements are statistically distributed, only about two-thirds of pulse oximeter equipment measurements can be expected to fall within the A_{RMS} of the value measured by the CO-oximeter. The 6004 has been validated in human desaturation studies on 10 adult volunteers that did not have health problems (i.e. diabetes, asthma) and were non-smokers. The study was conducted at oxygen concentrations evenly distributed over an SaO_2 range of 70-100%.

Pulse Rate

Range:	20-240 bpm (NIBP); 20-350 bpm (SpO_2)
Accuracy:	± 2% or 1 bpm, whichever is greater
Averaging:	8 seconds (Oximetry Only)
Display:	3-digit, 0.300 inch high LED's
Display Update Rate:	1 hertz

Pulse Strength

Range:	20-350 bpm
Display:	10 segment bargraph, 1.0 inch long (full-scale)
Display Update Rate:	60 Hertz

Audible Alarms

Volume:	45dBA - 85dBA at 1 meter distance (adjustable)

Alarm Limit Ranges

NIBP:	High:	15-285 mmHg (1 mmHg steps), and OFF
	Low:	10-280 mmHg (1 mmHg steps), and OFF
	Defaults: SYS	High = 200 mmH, Low = 90 mmHg
	DIA	High = 105 mmHg, Low = 40 mmHg
	MAP	High = 140 mmHg, Low = 50 mmHg
Pulse Rate:	High:	20-350 bpm (1 bpm steps), and OFF
	Low:	20-350 bpm (1 bpm steps), and OFF
	Defaults:	High = 150 bpm, Low = 45 bpm
SpO_2:	High:	50-100% (1% steps), and OFF
	Low:	50-99% (1% steps), and OFF
	Defaults:	High = OFF, Low = 85%

Serial Output

RS232C Data Format:	19200 baud, 1 start bit, 8 data bits, 1 stop bit, no parity
Options:	Text only, no graphics. Patient data log or trend tables

Power

AC Power Supply:	Input of 105-125VAC, 60 Hz
	Input of 90-110VAC, 50 Hz (optional)
	Input of 208-252VAC, 50/60 Hz (optional)
	Output of 24VDC @1.5A with 4kV isolation.
Battery:	NiCad, 6VDC
	Fully charged continuous use life of approximately 6 hours.
	Maximum full-time charging time is 4 hours.

Physical

Dimensions:	Width: 21.6 cm (8.5 inches)
	Height: 8.2 cm (3.24 inches)
	Depth: 14.0 cm (5.5 inches)
Weight:	1.6 kg (3.5 pounds)

Environment

Temperature:	Operation: 0 to 55° C (32 to 131° F)
	Storage: -40 to +70° C (-40 to +158° F)
Relative Humidity:	Operation: 15 to 95% (non-condensing)
	Storage: 10 to 95% (non-condensing)

Equipment Classification

Type of Protection:	Class II & Internally Powered
Degree of Protection:	Type CF (SpO_2 & Temp)
(Against Electric Shock)	Type CF defib protected (NIBP)
Mode of Operation:	Continuous
Degree of Protection:	IPX1, drip proof (Against Ingress of Liquids)
Degree of Mobility:	Portable
Safety Requirements:	EN60601-1: 1990

NOTE! The monitor might not meet its performance specifications if stored or used outside the temperature and humidity ranges listed above.

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Appendix A: Guidance and Manufacturer's Declaration

Guidance and Manufacturer's Declaration - IEC 60601-1-2 Requirements

The V6004 non-invasive blood pressure monitor is intended for use in the electromagnetic environment specified below. The customer or the user of the V6004 non-invasive blood pressure monitor should assure that it is used in such an environment.

Electromagnetic Emissions - Emissions Test

EMISSIONS TEST	COMPLIANCE	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
RF emissions CISPR 11	Group 1	The V6004 non-invasive blood pressure monitor uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The V6004 non-invasive blood pressure monitor is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/flicker emissions IEC 61000-3-3	Complies	

Electromagnetic Emissions – Immunity

IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
Electrostatic discharge (ESD) IEC 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	± 2 kV on 220 VAC power line ±1 kV on SpO_2 and temperature probe cables	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode Common mode not applicable as the device has no safety ground (functional ground only).	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions, and voltage variations on power supply input lines IEC 61000-4-11	<5 % U_T (>95 % dip in U_T) for 0.5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 sec	<5 % U_T (>95 % dip in U_T) for 0.5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the V6004 non-invasive blood pressure monitor requires continued operation during power mains interruption, it is recommended that the V6004 non-invasive blood pressure monitor be powered from an uninterruptible power supply or the internal battery.
Power frequency (50/60 Hz) IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE U_T *is the AC mains voltage prior to application of the test level.*			

IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
Conducted RF IEC 61000-4-6 Radiated RF IEC 61000-4-3	3 Vrms 150 kHz to 80 MHz 3 V/m 80 Mhz to 2.5 GHz	3 V 10 V/m	Portable and mobile RF communications equipment should be used no closer to any part of the V6004 non-invasive blood pressure monitor, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1.2\sqrt{P}$ $d = 0.35\sqrt{P}$ 80 MHz to 800 MHz $d = 0.7\sqrt{P}$ 800 MHz to 2.5 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[a] should be less than the compliance level in each frequency range.[b] Interference may occur in the vicinity of equipment marked with the following symbol: 

NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the V6004 monitor is used exceeds the applicable RF compliance level above, the V6004 monitor should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the V6004 monitor.
b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 10 V/m.

Recommended Separation Distances

The V6004 non-invasive blood pressure monitor is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the V6004 non-invasive blood pressure monitor can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the V6004 non-invasive blood pressure monitor as recommended below, according to the maximum output power of the communications equipment.

RATED MAXIMUM OUTPUT POWER OF TRANSMITTER (WATTS)	SEPARATION DISTANCES ACCORDING TO FREQUENCY OF TRANSMITTER (METERS)		
	150 kHz to 80 MHz $d = 1.2\sqrt{P}$	80 MHz to 800 MHz $d = 0.35\sqrt{P}$	800 MHz to 2.5 GHz $d = 0.7\sqrt{P}$
0.01	0.12	0.035	0.07
0.1	0.38	0.11	0.22
1	1.2	0.35	0.7
10	3.8	1.1	2.2
100	12	3.5	7.0
For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer. *NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.* *NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structure, objects and people.*			

Appendix B: Revision History

REVISION	DATE
Rev. 8	February, 2008

CHANGES

- Added design frame, Smiths Medical logo and new SurgiVet logo to front cover.
- Added Smiths design mark to trademark information.
- Added Patent information.
- Updated Warranty and Service Information section.
- Updated symbol table, and warnings, cautions and note.
- Added LED warning.
- Added AC Power section to Chapter 3.
- Added note about how to test alarms while monitor is in use.
- Added Audible and Visual Indicators section to Chapter 4.
- Changed Veterinary Technical Service to Veterinary Clinical Support everywhere.
- Updated Oximetry Theory of Operation in Chapter 6.
- Added Checking the Sensor and Oximetry Cable section to Chapter 6.
- Added Checking the Oximeter's Performance section to Chapter 6.
- Added note about tearing paper gently.
- Added display update rate to NIBP specs.
- Added display update rate, maximum age of data, calibration and desat study info to SpO2 specs.
- Added display update rate to Pulse Rate and Pulse Strength specs.
- Added alarm volume spec.
- Added Equipment Classification section to Specs chapter.
- Added Appendix A: Guidance and Manufacturer's Declaration.
- Moved Revision History from Appendix A to Appendix B.
- Added company address to back cover.

REVISION	DATE
Rev. 7	May, 2006

CHANGES

- Updated company name from SurgiVet to Smiths Medical PM, Inc. Veterinary Division.
- Added registered trademark information to table of contents.
- Updated Warranty and Service Information section to new Veterinarian Warranty.
- Added keys, SN symbol, REF symbol, IPX1 (monitor only) symbol, date of manufacturing symbol, Rx Only symbol, and Collect Separately symbol to the symbol chart in Chapter 1.
- Changed Default Cuff Pressure to 175 in LA and 200 in SA on pg 2-6 number 5.
- Added to page 3-1: Caution! If damage has occurred to package, a calibration needs to be done at an authorized service center.
- Removed NIBP Calibration Verification from Chapter 5, Section Using the NIBP Parameter.
- Updated Connecting the Cuff and Hose section of Chapter 5.
- Redrew pictures for suggested application sites.
- Updated Sensor Table in Chapter 6.
- Removed text talking about temperature from everywhere in the manual.
- Added note about using AC power supply whenever possible to Charging the Battery section and Maintenance Chart of Chapter 9.
- Changed Appendix A to Chapter 11: Supplies and Accessories and updated parts list.
- Changed Appendix B to Chapter 12: Specifications
- Added this Revision History

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