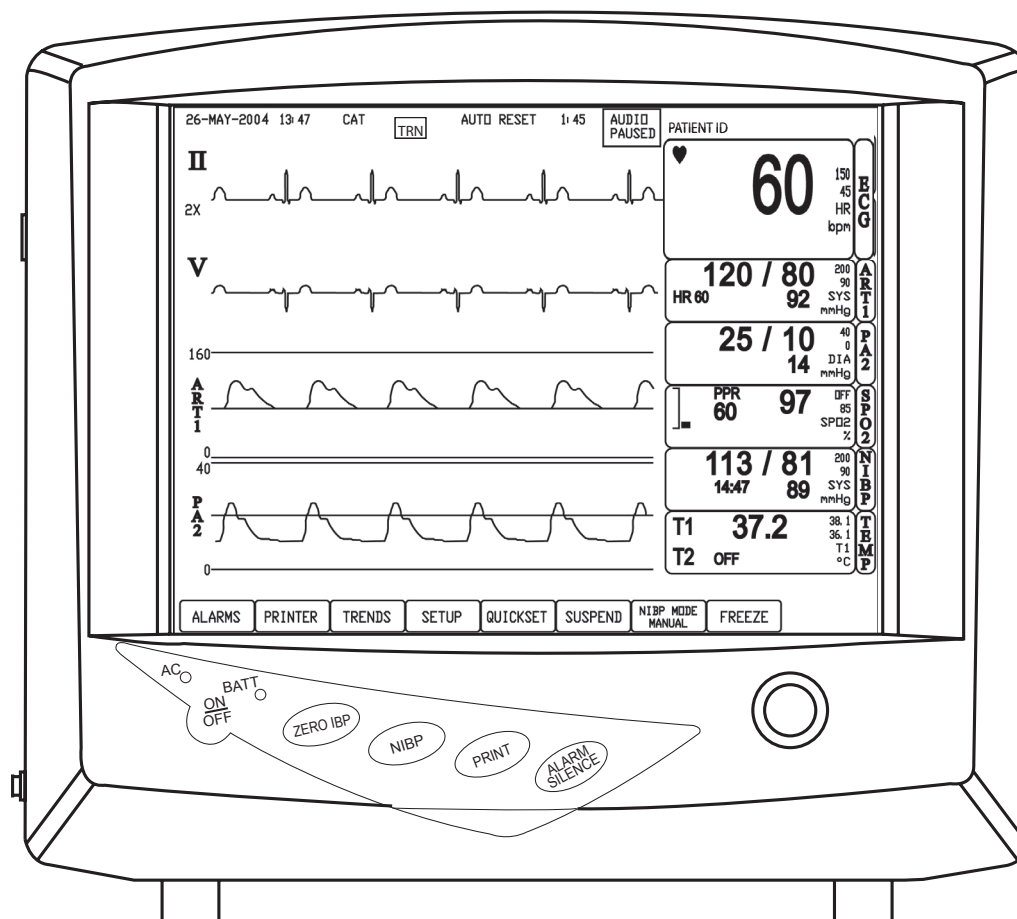


Advisor® Vital Signs Monitor

Operation Manual



en English

Catalog Number V1886R

Version 4, March 2009

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

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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) Veterinary Division 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 but 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 - 1856, USA	Fax: 1-262-542-0718
	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 any 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 occurring 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.

CE Notice

Marking by the symbol  indicates compliance of this device to the Medical Device Directive 93/42/EEC.

 Authorized Representative (as defined by the Medical Device Directive):

Smiths Medical International Ltd.	Tel: (44) 1923 246434
Colonial Way, Watford, Herts,	Fax: (44) 1923 240273
WD24 4LG, UK	

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Chapter 1: Introduction

About This Manual

This manual provides installation, operation, and maintenance instructions for the equipment supplied. This manual is intended for healthcare professionals trained in monitoring respiratory and cardiovascular activity.

Conventions

This manual uses visual clues to help convey messages. The following examples show the conventions used throughout the manual. References to other sections in the manual are shown in italics, like this: See *Controlling Alarms* in *Chapter 6: Alarms* for more information. Graphics are numbered according to the chapter in which they are found, such as Figure 7-3.

Using the Manual

The monitor allows you to choose the measurement capabilities you need. A measured value refers to a derived or calculated value; a parameter refers to one or more specific measured values. For example, pulse rate and %SpO₂ are measurements; the Oximeter parameter consists of both these measured values. Operation of the monitor is the same regardless of the number of parameters you use.

If you are not familiar with the operation of this monitor, follow each chapter in the manual in order. Each chapter builds on the information from the previous chapter. If the monitor is already set up, or if you are familiar with its operation, turn to the chapter that describes the features you will use.

Definition of Symbols

SYMBOL	DEFINITION
	Caution, Federal (U.S.A.) law restricts this device to sale by or on the order of a veterinarian.
	Defibrillator-proof type CF equipment
	Attention, see instructions for use.
	Dangerous voltage.
	Refer servicing to qualified service personnel.
	Output
	Loudspeaker
	Fuse
	Date of Manufacture
	Catalog Number
	Serial Number
IPX1	Drip Proof
	Non AP Device
	Graphical Recorder
	Use by
	On/Off *
	IBP Zero All *
	NIBP Start/Stop *
	Print Start/Stop *
	Alarm Silence *
	AC Power LED *
	Battery Charge LED *

* International Symbols

 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 something that could hurt the patient or hurt the operator.
CAUTION	Tells you something that could damage the device.
NOTE	Tells you other important information.

General Warnings, Cautions, and Notes

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

WARNING! ELECTRICAL SHOCK HAZARD when covers are removed. Do not remove covers.



Refer servicing to qualified personnel.

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

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

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! Do not autoclave, ethylene oxide sterilize, or immerse the monitor and other accessories in liquid. Evidence that liquid has been allowed to enter the monitor voids the warranty.

WARNING! In the event that earth ground integrity is lost, the performance of this device and/or other devices nearby may be affected due to excessive RF emissions.

WARNING! Where HF (diathermy) is used there is no danger of burning to the patient provided recommended components are used. Rate meters may be temporarily affected.

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.

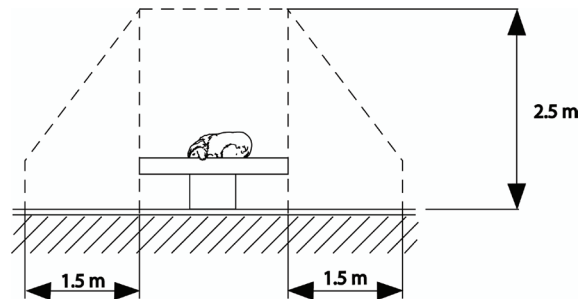


Figure 1.1: Patient Environment (side)
The dimensions are not prescriptive.

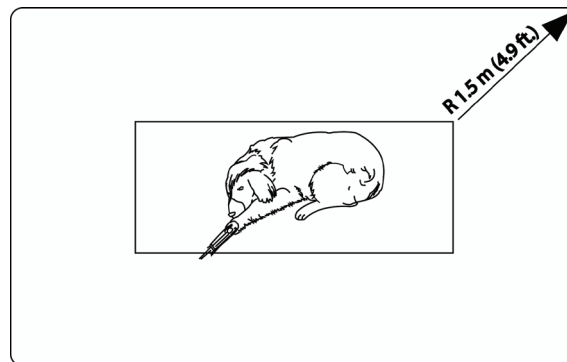


Figure 1.2: Patient Environment (top)
The dimensions are not prescriptive.

WARNING! When connecting this monitor to any instrument, verify proper operation before clinical use. Use only equipment meeting specifications given in this manual. 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 IED standards, i.e. IEC 60950 for data processing equipment or IEC 60601-1 for electro medical equipment. All combinations of equipment must be in compliance with IEC 60601-1-1 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 60601-1-1.

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

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 that incorporate metal or metal-coated connectors.

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!** There is no defibrillator synchronization output on the monitor. Make no connections between the monitor and a defibrillator.
- WARNING!** This monitor will not operate effectively on patients who are experiencing convulsions or tremors.
- WARNING!** This monitor is not for home use.
- 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!** This monitor is not for apnea detection. The monitor has not been tested or validated for use in apnea detection.
- WARNING!** Verify proper operating mode before attaching patient. See *Select the Patient Type* in Chapter 4: *Setting Up the Monitor*.
- WARNING!** Default alarm limits are provided for convenience. Verify that alarm limits are appropriate for given patient and condition, and adjust according to institutional policy.
- WARNING!** Ensure the monitor'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 rear panel rating plate. If the rating is not correct, do not use the monitor.
- 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 from their bed.
- 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!** This device is intended for use by trained healthcare professionals. The operator must be thoroughly familiar with the information in this manual before using the device.
- WARNING!** ⚠ Do not disassemble the unit. The unit is not user serviceable. Refer to qualified service personnel.
- WARNING!** It is the operator's responsibility to set alarm limits appropriately for each individual patient.
- 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!** Operation of this device may be affected in the presence of strong portable and mobile communications equipment.

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

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

CAUTION! Do not allow water or any other liquid to be spilled onto the monitor. Unplug the AC power cord from the monitor before cleaning or disinfecting the monitor.

CAUTION! This unit contains a lithium ion battery and a rechargeable alkaline battery. These batteries are not user replaceable.



Refer servicing to qualified personnel.

CAUTION! This unit may contain a nickel-metal-hydride battery. Disposal of this battery should be conducted in accordance with local or federal guidelines. Smiths Medical PM, Inc. cannot dispose of this battery.

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

CAUTION! Blocking the ventilation holes on the monitor's rear panel can prevent air circulation inside the monitor, possibly resulting in damage to the monitor. Leave an air gap behind the monitor to allow air to circulate through the ventilation holes.

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

CAUTION! If the device becomes wet, wipe off all moisture and allow sufficient time for drying before operating.

CAUTION! The monitor should be operated from its internal power source (if fitted) if the integrity of the protective earth conductor is in doubt.

CAUTION! Follow local governing ordinances and recycling instructions regarding disposal and recycling of device components and packaging.

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

NOTE! Each input and output connection of the monitor is electrically isolated. Connection of this monitor to other equipment will not increase leakage current.

ECG Warnings, Cautions, and Notes

WARNING! Connect only three-lead or five-lead ECG lead wires from the patient to the ECG patient cable. Do not connect any other signal source to the ECG patient cable.

WARNING! This monitor does not identify or interpret arrhythmia events. The indication of heart rate may be adversely affected by the presence of cardiac arrhythmias.

WARNING! Line isolation monitor transients may resemble actual cardiac waveforms and thus inhibit heart rate alarms.

CAUTION! A three-lead ECG cable must be used if 3-Lead processing is selected. A five-lead ECG cable must be used if 5-Lead processing is selected. Using the incorrect cable for the selected mode might lead to a floating reference or additional noise on the ECG signal.

NOTE! Follow institutional standards when applying ECG electrodes. Silver/Silver Chloride disposable electrodes are strongly recommended to avoid polarization effects that result in large input offset potentials. Use of “squeeze bulb” type electrodes is not recommended.

NOTE! Use only standard AAMI three-lead or five-lead ECG cables.

Oximetry Warnings, Cautions, and Notes

WARNING! Prolonged use or the patient’s condition may require changing the sensor site periodically. Change the 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 patient’s skin (lack of skin respiration, not heat, causes the blisters).

WARNING! Using a damaged sensor may cause inaccurate readings, possibly resulting in patient injury or death. 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 patient cable may cause inaccurate readings, possibly resulting in patient injury or death. Inspect the patient cable. If the patient cable appears damaged, do not use it. Contact your authorized repair center for help.

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

WARNING! Do not autoclave, ethylene oxide sterilize, or immerse the sensors in liquid. Evidence that liquid has been allowed to enter the monitor voids the warranty.

WARNING! Use only SpO₂ sensors supplied with, or specifically intended for use with, this device.

WARNING! SpO₂ measurements may be adversely affected in the presence of high ambient light. Shield the sensor area (with a surgical towel, for example) if necessary.

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 SpO₂ 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 SpO₂ and pulse rate readings.

WARNING! Under certain clinical conditions, pulse oximeters may display dashes if unable to display SpO₂ 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.

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

NOTE! Obstructions or dirt on the sensor's red light or detector may cause a sensor failure. Make sure there are no obstructions and the sensor is clean.

NOTE! If the oximeter parameter is being monitored, the pitch of the pulse beep is determined by the SpO₂ value. The higher the SpO₂ value, the higher the pulse beep pitch; the lower the SpO₂ value, the lower the pulse beep pitch.

NOTE! The low SpO₂ alarm limit minimum test value is 85. If you change the low SpO₂ alarm limit to a value less than 85 and then change the patient type, add a new patient, or power down/power up the monitor, a minimum value of 85 takes the place of the value you entered.

Non-invasive Blood Pressure Warnings, Cautions, and Notes

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

WARNING! Repeated use of 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! 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! Blood pressure measurements may not be accurate for patients experiencing arrhythmias.

WARNING! Do not verify the Non-Invasive Blood Pressure calibration while the cuff is attached to a patient.

WARNING! Verify cuff size is correct for the selected patient mode on the monitor.

CAUTION! To ensure that the unit remains in calibration, perform a calibration verification on a yearly basis.

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.

NOTE! There are no user-serviceable adjustments for the Non-Invasive Blood Pressure calibration verification. If the monitor appears to be out of calibration, contact your authorized repair center for help.

NOTE! Systolic and diastolic blood pressure measurements determined with this device are equivalent to those obtained by the 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.

Invasive Blood Pressure Warnings, Cautions, and Notes

WARNING! Avoid conductive connection with any metal parts.

NOTE! The IBP ZERO NEEDED message is displayed when the monitor is turned on, when the site label is changed, or when the transducer is connected to the monitor (even if the same transducer is disconnected then reconnected to the monitor).

NOTE! Use only invasive pressure transducers and interface cables specifically intended for use with this device and its side panel connectors.

NOTE! The IBP1 and IBP2 waveforms must be visible and adjacent in order to be overlaid.

NOTE! When IBP1 and IBP2 are overlaid, the scale settings for IBP1 and IBP2 are changed to the higher of the two scales.

NOTE! Dual channel simulators may affect verification of IBP operation. Use only single channel simulators.

NOTE! All specified transducers were tested for immunity to radiated radio frequency electromagnetic fields at a level of 3V/m in accordance with IEC 60601-2-34:2000. Additional validation at levels of 10V/m was performed using the pvb Critical Care GmbH xtrans® and Edwards Lifesciences TruWave transducers.

Temperature Warnings, Cautions, and Notes

NOTE! Use only temperature sensors and interface cables specifically intended for use with this device.

Capnograph Warnings, Cautions, and Notes

WARNING! The capnograph contains no compensation for barometric pressure; therefore, readings in mmHg and kPa are correct only under the pressure at which the capnograph is calibrated. Manual compensation can be made by performing a low calibration (low cal).

WARNING! Use of accessories other than those supplied by or recommended by the manufacturer may result in inaccurate readings, altered measurement response times or erroneous occlusion messages

CAUTION! Pump motors in the capnograph may adversely affect other medical equipment such as ECG tracings.

CAUTION! Use of the monitor during continuous nebulized medication delivery will result in damage to the monitor which is not covered by the factory warranty. Disconnect the ETCO₂ sample line from the patient circuit or power off during medication delivery.

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

NOTE! During the auto zero calibration (autocal) sampling, the CO₂ waveform and digits will disappear for 1-5 seconds. After this, breath detection restarts. This should happen only during extreme temperature changes, and not during normal patient monitoring or changes of ambient pressure.

NOTE! The auto zero calibration (autocal) is similar to a low calibration (low cal), excluding ambient pressure so as not to stop the pump.

NOTE! Capnometer patient attachments and sample lines are disposable, single-patient use items. Use a new patient attachment and sample line for each new patient.

NOTE! Discard and replace the patient attachment if it becomes occluded. If an air leak is noted, check all patient connections. If the air leak persists, discard and replace the patient attachment.

Chapter 2: Intended Use and General Information

Intended Use

This vital signs monitor is intended to be used in special procedure labs and other areas of a veterinary hospital or clinic where veterinary monitoring systems are needed. The basic monitor package includes 3-lead or 5-lead electrocardiography (ECG), non-invasive blood pressure (NIBP), pulse oximetry (SpO₂), and an internal rechargeable battery.

Optional parameters include two invasive blood pressures (BP1 and BP2), two temperature channels (T1 and T2), and capnography (CO₂). A two-inch internal graphic/alphanumeric printer and the Veterinary Data Logger patient data storage/analysis module are also provided as options.

The device permits patient monitoring with adjustable alarm limits as well as visible and audible alarm signals. The monitor provides fast, reliable measurements for patients ranging from cats to horses when using the appropriate SurgiVet® accessories. The monitor may be connected to the Life Sensing Instrument Company, Inc. HTS 820 Central Station for remote monitoring of patient status. The monitor is not intended for home use. The monitor is not intended to be an apnea monitor. It was not designed or validated for use as an apnea monitor.

WARNING! This monitor is not for apnea detection. The monitor has not been tested or validated for use in apnea detection.

WARNING! This monitor is not for home use.

WARNING! Verify proper operating mode before attaching patient. See *Select the Patient Type* in Chapter 4: *Setting Up the Monitor*.

Measurement Capabilities

Heart/Pulse Rate

Heart/pulse rate is measured with the ECG, oximetry, invasive blood pressure, and non-invasive blood pressure (NIBP) parameters. The measured values can be continuously displayed in the ECG and SPO₂ parameter boxes. Heart/pulse rate can also be displayed in the ART1 parameter box for invasive blood pressure, and in NIBP HISTORY, found in the TRENDS menu. You can choose the source (AUTO, ECG, SPO₂, or ART) of the heart/pulse rate displayed in the ECG parameter box. If you choose AUTO, the monitor will determine the best source depending on the quality of available data and selected source priority. See *Choose the Heart Rate Source* in Chapter 8: ECG for detailed information regarding the source of the heart/pulse rate displayed in the ECG parameter box.

Electrocardiography (ECG)

The monitor provides continuous three-lead or five-lead ECG processing, with standard lead selections, and filtering from electrocautery discharge. The ECG measured value (HR) and primary lead selection are displayed in the ECG parameter box, and an ECG waveform is continuously displayed.

Oximetry

The oximetry parameter provides the continuous non-invasive monitoring of oxygen saturation (%SpO₂) in the blood and peripheral pulse rate (PPR). The measured values for oximetry (%SpO₂ and PPR) and a pulse strength bar graph are displayed in the SPO₂ parameter box. A plethysmogram, or oxygen saturation waveform, can be continuously displayed. A variety of disposable and reusable sensors is available for monitoring patients.

Non-invasive Blood Pressure (NIBP)

The non-invasive blood pressure (NIBP) parameter provides systolic, diastolic, and mean arterial blood pressure values, and heart rate. The measured values for non-invasive blood pressure (SYS, DIA, and MAP) are displayed in the NIBP parameter box. NIBP measurements can be made in automatic, manual, or STAT modes.

Invasive Pressure

Two independent channels of invasive blood pressure (IBP1 and IBP2) monitoring are available to measure systolic, diastolic, and mean values for each invasive pressure. The measured values for invasive blood pressure (SYS, DIA, and MEAN) are displayed in parameter boxes that are labeled according to the invasive pressure site, such as ART1 or PA2. If the selected site is ART, then heart rate (HR) can be displayed in the ECG parameter box. If ART and ICP are both selected as invasive pressure sites, then CPP can be displayed in the parameter box. See *Choose the Heart Rate Source* in Chapter 8: ECG for detailed information regarding the source of the heart/pulse rate displayed in the ECG parameter box. Waveforms for each invasive blood pressure site can also be displayed.

Temperature

Two independent channels of temperature (T1 and T2) monitoring are available. Each channel is compatible with Smiths Medical PM, Inc. YSI 400-series disposable temperature sensors, or equivalent. The measured value for each temperature channel (T1 and T2) is displayed in the TEMP parameter box.

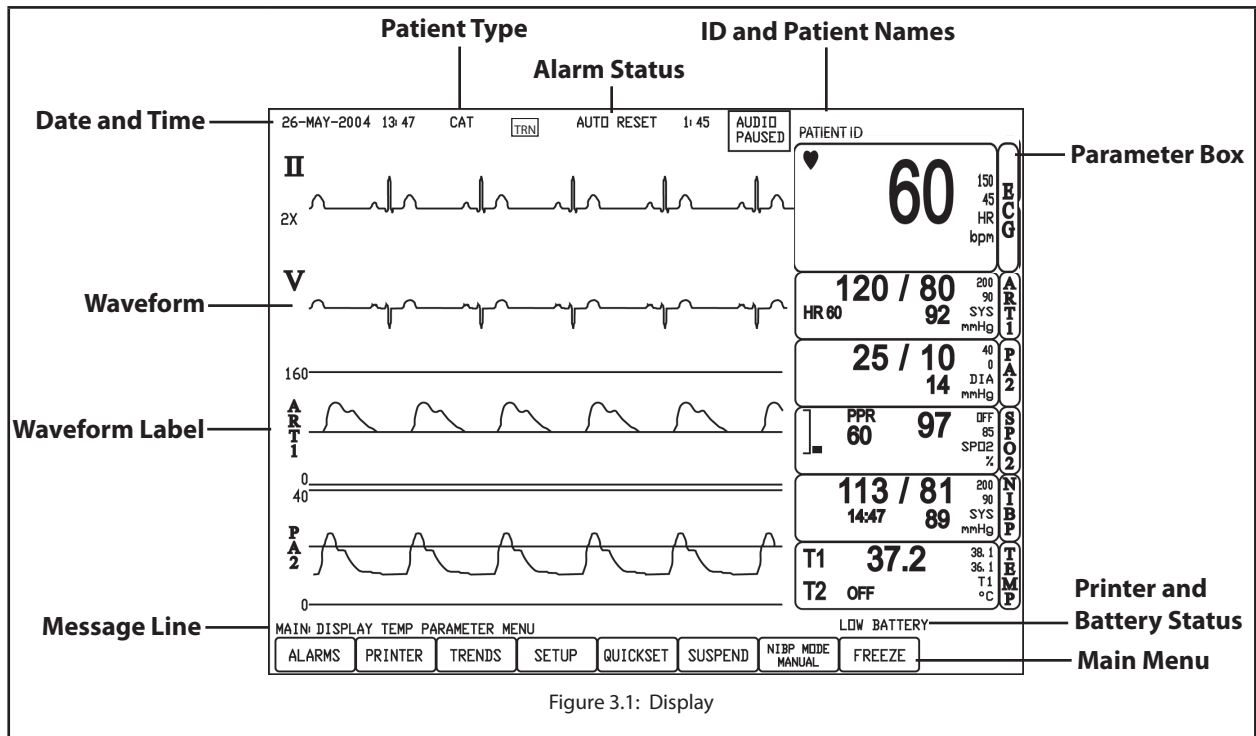
Capnography

The capnography parameter provides the continuous, non-invasive monitoring of sidestream end-tidal carbon dioxide (ETCO₂), inspired carbon dioxide (INCO₂), and respiration rate (RR). The measured values for capnography (ETCO₂, INCO₂, and RR) are displayed in the CO₂ parameter box and a CO₂ waveform can be continuously displayed. Nitrous oxide compensation is selectable. When the N₂O compensation is enabled, the module adjusts the CO₂ reading by an algorithm that assumes the concentration of N₂O is 40% and compensates accordingly.

Chapter 3: Controls and Features

Indicators and Displays with Embedded Submenus

The monitor has a large, high-resolution, high-contrast, color LCD display. It provides a continuous, real-time display of up to four waveforms. It also shows measured values, chronological data, measurement trends, and alarm limits.



DISPLAYS	DESCRIPTION
Patient Type	You must select the patient type (HORSE, DOG, or CAT) before monitoring a patient. When you change the patient type: - The alarm limits will be reset to their default settings.(if not in STATIC LIMITS mode) - NIBP inflation pressure settings will be reset for a cat, dog, or horse patient. For example, the default <i>cat</i> NIBP inflation pressure setting is 200 mmHg; the default <i>dog</i> NIBP inflation pressure setting is 150 mmHg; the default <i>horse</i> NIBP inflation pressure setting is 100 mmHg. - The NIBP mode will be reset to MANUAL. - All auto print features will be turned off. - The Print All Report will be reset to the default setting. - The scales for the IBP waveforms will be reset to the default settings. - If the alarm limits for oximetry were adjusted to below 85%, they will be reset to 85%.

DISPLAYS	DESCRIPTION
Alarm Status	If the monitor detects that one or more of a patient's parameter values are violated, ALARM will be displayed. If the patient's parameter values are within the specified limits, the chosen alarm reset mode, either AUTO RESET or MANUAL RESET, will be displayed. See <i>Select the Alarm Reset Operation</i> in <i>Chapter 17: Service Menu</i> for details regarding auto or manual reset.
Bed and Patient Names	You can choose which patient information to display: just the bed, the bed and the patient's name, or the bed and the patient ID. While specific patient identification information is expected to change, the bed or room to which the monitor is assigned may remain the same.
Printer and Battery Status	The printer and battery status line provides a brief description of the condition of the installed internal rechargeable battery and the optional built-in printer.
Main Menu	The main menu provides a means of changing monitor settings, such as alarm limits and parameter colors, and performing monitoring functions, such as NIBP calibration verification and monitor suspension. There are several points of entry into the monitor's menu system including the main menu, parameter menus, and waveform menus.
Waveform	Up to four waveforms can be displayed simultaneously: • Waveform 1 is dedicated to the primary ECG lead, although you can specify which lead is to be the primary. • Waveform 2 can be assigned to another ECG lead (in five-lead mode only), a cascade (continuation) of the primary ECG lead waveform, or a waveform from any other enabled parameter. • Waveform 3 defaults to the invasive blood pressure (IBP1) waveform, labeled ART1, and is displayed when the IBP1 cable is connected to the monitor. Waveform 3 can be changed to display a cascade (continuation) of the primary ECG lead waveform after waveforms 1 and 2, or it can be a waveform from any other enabled parameter. • Waveform 4 defaults to the invasive blood pressure (IBP2) waveform, labeled PA2, and is displayed when the IBP2 cable is connected to the monitor. Waveform 4 can be changed to display a cascade (continuation) of the primary ECG lead waveform after waveforms 1, 2, and 3, or it can be a waveform from any other enabled parameter. • CO₂ and SpO₂ waveforms will be displayed in the first available waveform (2, 3, or 4) when the respective cables are connected, or when the parameter is turned on using the SETUP menu and PARAMETER OPTIONS submenu.
Waveform Label	The waveform label provides access to a menu for each waveform where you can adjust various settings related to the waveform. For some parameters, such as ECG, the waveform label displays information about the primary lead and the size of the ECG tracing.
Message Line	The message line provides a brief description of the highlighted field or menu selection. It can be turned on or off.
Date and Time	The monitor's real-time clock and calendar keep track of the time and date, even when the monitor is turned off or is not connected to AC power. The time and date stamp is used for the NIBP tabular trends, the displayed and printed trends, and all other printouts. The time display format is based on the 24-hour clock. For example, 5:00 a.m. is displayed as 5:00 and 5:00 p.m. is displayed as 17:00.

Parameter Box

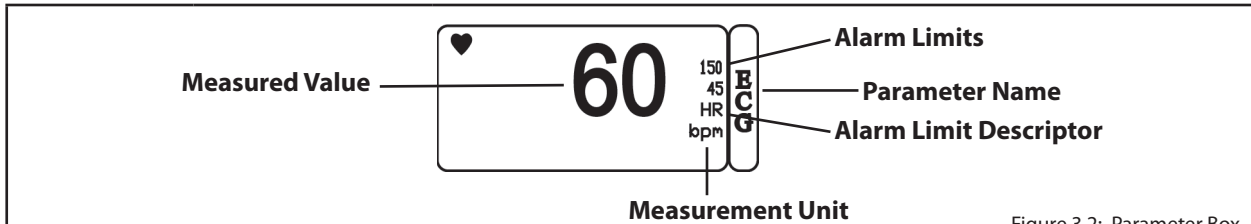


Figure 3.2: Parameter Box

Parameter Box	When you turn on a parameter, a box appears on the display containing the parameter or measurement name, the numeric values for the selected measurement, the high and low alarm limits, a descriptor for the alarm limits displayed, and the measurement unit. In figure 2-2, the parameter is ECG, the numeric measured value is the heart rate (HR), the alarm limits shown are for the heart rate (HR), and the measurement unit is beats per minute (bpm).	
Parameter Name	The name of the monitored parameter is displayed. Invasive blood pressure parameters (IBP1 and IBP2) are more precisely labeled according to the invasive pressure site, such as ART 1 or PA2. The parameter name box provides access to a menu for the parameter where you can adjust various settings related to the parameter.	
Numeric Measured Values	The number value for the selected measurement (such as HR, RESP, or TEMP) is displayed. The value may be derived or calculated. Dashes (- -) in place of a numeric measured value indicate that the measurement is invalid or unavailable.	
High and Low Alarm Limits	The high and low alarm limits for the numeric measured values are displayed. If you do not set alarm limits for a new patient, the default high and low limits will be used.	
Alarm Limit Descriptor	The alarm limit descriptor indicates which high and low limits are displayed. For the parameters where more than one measurement can be monitored such as blood pressure (systolic, diastolic, and mean) only one set of high and low limits can be displayed. You can specify which set of limits is displayed. Alarms are issued if any one of the limits is violated, whether or not it appears on the display.	
Measurement Unit	Units of measurement can be changed for temperature and pressure. Temperature measurement units may be displayed as degrees Celsius or Fahrenheit (°C or °F). Pressure measurement units may be displayed as millimeters of mercury (mmHg), kilopascals (kPa), and for capnography, percent volume (%).	

Keys

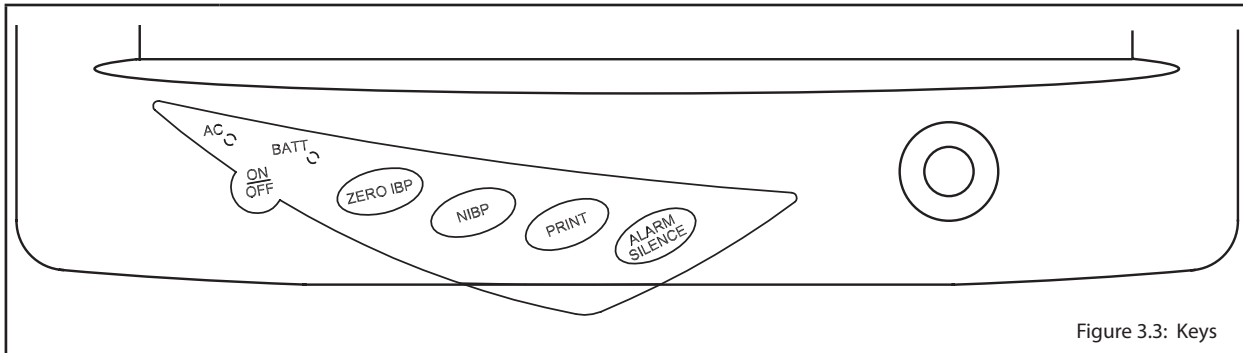


Figure 3.3: Keys

DESCRIPTION		INSTRUCTION	
ON/OFF		Press this key to turn on the monitor. To turn off the monitor, press the key and a message will be displayed indicating that if you continue to power down, some configuration data will be lost; press the key again to turn off the monitor.	
ZERO IBP		Press this key to initiate a zeroing or calibration of the invasive pressure values for each invasive pressure cable connected to the monitor.	
NIBP		Press this key to activate an immediate non-invasive blood pressure (NIBP) measurement. To cancel an NIBP measurement in progress, press the key again.	
PRINT		Press this key to begin printing a PRINT ALL REPORT, which is a snapshot of selected waveforms. You can choose the waveforms to print on the SETUP menu. To stop any print job, press the key again. To print a continuous, real-time strip chart of the primary ECG, press and hold this key for 3 seconds.	
ALARM SILENCE		Press the key momentarily to silence alarms for 2 minutes. To reactivate the audible alarm tones within the two minutes, press the key again. Press the key for 3 seconds to silence alarms indefinitely. AUDIO PAUSED will be displayed. A new alarm will cancel silence. Press the key for 6 seconds to turn alarm sounds off permanently. AUDIO OFF will be displayed.*	
Rotary Knob		The rotary knob is a dial control with a push selection switch. It is located on the front of the monitor, in the lower right corner. Turn the rotary knob to navigate the cursor around the display. Push the knob to select highlighted options.	
INDICATOR		DESCRIPTION	
AC		The green AC Power LED will light to indicate that the monitor is connected to an AC power source.	
BATT		The green Battery Charge LED will light to indicate that the optional internal rechargeable battery is fully charged and AC power is connected. The LED will flash to indicate that the battery is charging.	

***NOTE! Qualified personnel may change the allowed alarm audio silence mode. See *Select the Alarm Audio Silence Operation* in *Chapter 17: Service Menu* for details regarding alarm silence.**

Side Panel

The left side panel of your monitor contains all of the patient connector receptacles and the AC power receptacle.

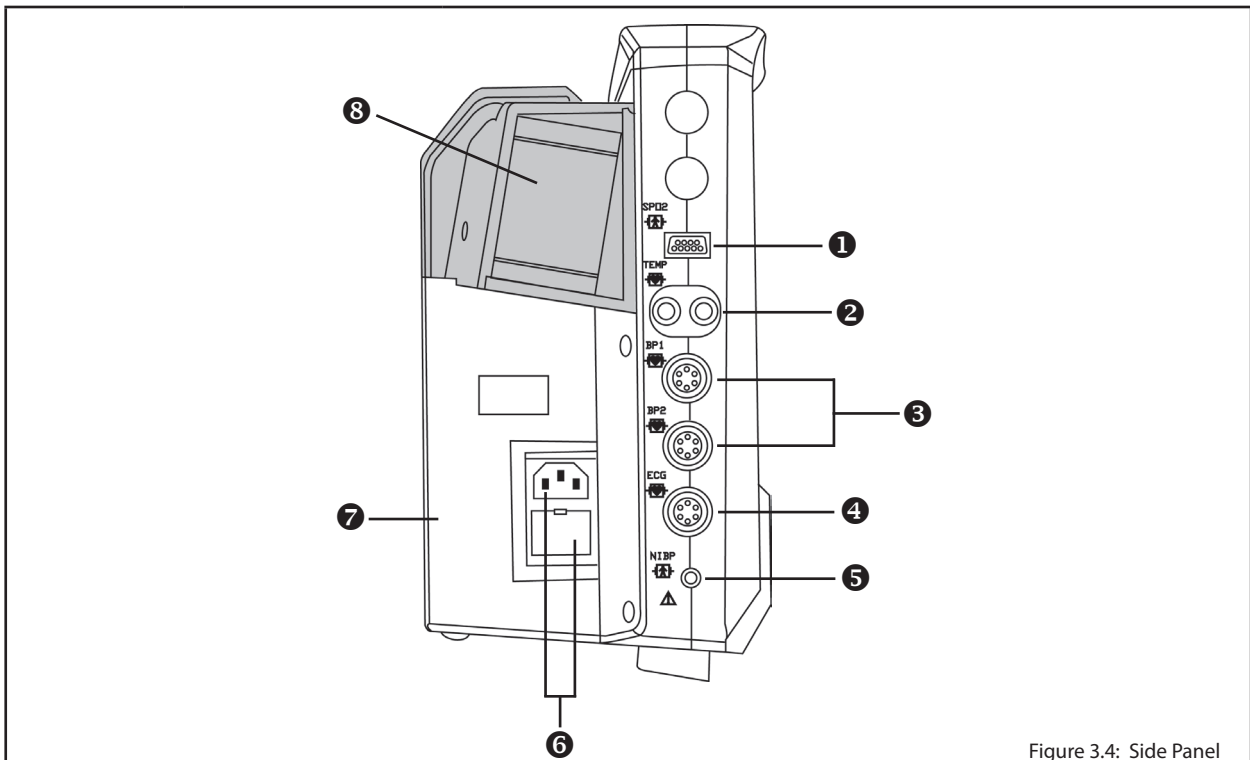


Figure 3.4: Side Panel

CONNECTOR	DESCRIPTION	INSTRUCTION
①	Oximetry Connector (SpO ₂)	The SPO ₂ parameter box will appear on the display when the patient connector is attached to the monitor. Measured values for oxygen saturation (%SpO ₂) in the blood and peripheral pulse rate (PPR) will be displayed when the sensor is attached to the patient.
②	Dual Temperature Connectors (T2 left and T1 right)	If the temperature and invasive blood pressure parameters are installed on your monitor, the TEMP parameter box will appear on the display when the patient connector is attached to the monitor. A measured value for temperature (TEMP) will be displayed when the sensor is attached to the patient and the T1 MONITOR or T2 MONITOR menu option is turned on. See <i>Parameter Options</i> in <i>Chapter 4: Setting Up the Monitor</i> for instructions for turning on T1/T2 MONITOR.
③	Dual Invasive Blood Pressure Connector (IBP1 top and IBP2 bottom)	If the temperature and invasive blood pressure parameters are installed on your monitor, the ART1 or PA2 parameter box will appear on the display when the patient connector is attached to the monitor. ART1 and PA2 are the default measurement sites for IBP1 and IBP2, respectively. See <i>Change the Site Label</i> in <i>Chapter 11: Invasive Blood Pressure</i> for details on changing the measurement sites. Measured values for invasive blood pressure (systolic, diastolic, and mean) will be displayed when the sensor is attached to the patient.
See ④ on next page		
⑤	Non-Invasive Blood Pressure Connector (NIBP)	The NIBP parameter box will always appear on the display. Measured values for non-invasive blood pressure (systolic, diastolic, and mean) will be displayed when the most recent NIBP measurement is complete.

CONNECTOR	DESCRIPTION	INSTRUCTION
④	ECG Connector	The ECG parameter box will always appear on the display. A measured value for the ECG heart rate (HR) will be displayed when the ECG leads are attached to the patient and the ECG MONITOR menu option is turned on. If five-lead processing is installed on your monitor, you must also set the ECG LEADS PROCESSING menu option to five-lead processing. See <i>Parameter Options</i> in <i>Chapter 4: Setting Up the Monitor</i> for instructions for turning on ECG MONITOR and setting ECG LEADS PROCESSING. CAUTION! A three-lead ECG cable must be used if 3-Lead processing is selected. A five-lead ECG cable must be used if 5-Lead processing is selected. Using the incorrect cable for the selected mode might lead to a floating reference or additional noise on the ECG signal.
⑥	AC Power Connector and Fuse Holder	Plug the AC power cord into the AC power receptacle at the back of the monitor. When the other end is plugged into a grounded, three-wire hospital-grade outlet, the AC Power LED (X) will light. The monitor automatically switches between 110V and 220V AC line voltage sources. An installed internal rechargeable battery ensures consistent monitor operation during a line interruption. WARNING! Do not plug the monitor into an outlet controlled by a wall switch. The monitor's fuse holder is below the AC power receptacle. The fuses (5x20 mm fast-acting 1.6A/250V) are installed in the fuse holder.
⑦	Voltage Rating	The monitor's AC rating is shown. If the AC rating does not match the nominal voltage at your installation site, do not use the monitor. Contact your authorized repair center for help. CAUTION! If the integrity of the protective earth conductor is in doubt, operate the monitor using its internal power source (if the installed internal rechargeable battery is installed).
⑧	Capnography Connector (CO ₂)	If the capnography parameter is installed, the module, with an installed connector, is attached to the back of the monitor. The CO₂ parameter box will appear on the display when CO₂ MONITOR menu option is turned on. See <i>Parameter Options</i> in <i>Chapter 4: Setting Up the Monitor</i> for instructions for turning on CO₂ MONITOR. Measured values for end tidal carbon dioxide (ETCO₂) and inspired carbon dioxide (INCO₂) and RESP will be displayed when the sensor is attached to the patient.

Back Panel

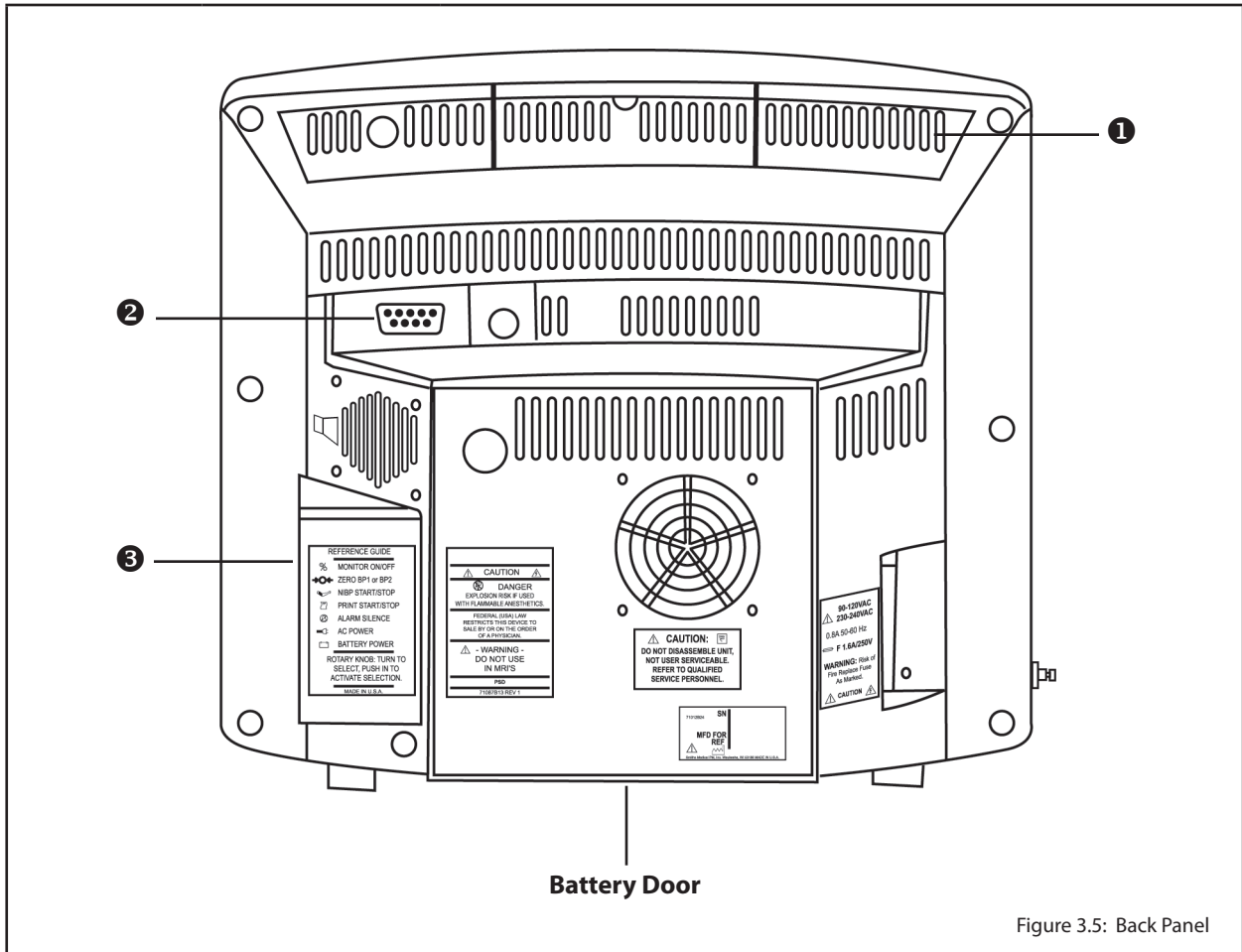


Figure 3.5: Back Panel

CONNECTOR	DESCRIPTION	INSTRUCTION
①	Air Vents	The monitor has air vents at the top of the back panel and on the bottom of the monitor.
②	Serial Output	The monitor provides an electrically isolated RS-232C compatible serial output channel with the nine-pin connector. The optional Data Logger module attaches here. See <i>Optional Data Logger</i> section in <i>Chapter 14</i> for connecting instructions.
③	Printer	This optional feature is a two-inch, graphic/alphanumeric, thermal array printer. It provides waveform snapshots, waveform strips, and tabular parameter data. Annotation lines are printed every 200 mm (8 inches). The printer has three paper speeds (four if capnography is installed), a dedicated print key, and an easy-to-use, drop-in paper replacement compartment.

Internal Battery

The installed internal rechargeable battery is intended primarily for backup and switch-over use. Charge the battery after the monitor has operated using battery power or after the monitor has been shipped or stored. To charge the battery, connect the AC power cord to the monitor and to the AC power source. There are no set up requirements for using a charged battery; the monitor operates exactly the same way under AC or battery power.

To replace the installed rechargeable battery:

1. Disconnect AC power and verify that the monitor is off.
2. Remove the battery door from the bottom of the monitor.
3. Disconnect the battery from the battery cable and remove it from the battery compartment.
4. Connect a new battery to the battery cable.
5. Insert the battery and cables into the battery compartment.
6. Reattach the battery door to the bottom of the monitor.
7. Connect the AC power cord to the monitor and to the AC power source and allow the battery to charge fully.
8. Dispose of the battery properly. See the CAUTION below.

CAUTION! The internal rechargeable battery is user-replaceable. It may contain a Lithium Ion (Li-ion), Nickel Metal Hydride (NiMH), or Sealed Lead Acid (SLA) battery. Disposal of such batteries should be conducted in accordance to local and federal guidelines.

 Refer servicing to qualified personnel.

NOTE! Typical battery life is 2 to 5 years depending on usage.

NOTE! When the monitor is connected to AC power, the internal battery charges whether the monitor is on or off. The Battery Charge LED flashes while the battery is charging; it is steady when the battery is fully charged. Allow the battery to fully recharge before using the monitor under battery power.

NOTE! When approximately 10 minutes of battery use remains, the LOW BATTERY message is displayed and a medium priority alarm is sounded every 20 seconds.

NOTE! Battery charge time will be increased at elevated temperatures (temperatures above 30 degrees Celsius).

NOTE! A fully charged NiMH battery will last 2 to 3.5 hours, depending on monitor usage. Frequent printer use will reduce the battery run time. Use the printer sparingly for increased battery run time.

Chapter 4: Setting up the Monitor

Unpack the Monitor and Check the Shipment

Before you begin setting up, carefully remove the Advisor® Vital Signs Monitor and its accessories from the shipping carton. Save the packing materials in case the monitor must be shipped or stored. Compare the packing list with the supplies and equipment you received to make sure the shipment is complete.

Quick Setup Instructions

Follow these setup steps every time you begin monitoring a patient. See *Detailed Setup Instructions* in this chapter for a thorough explanation of each step.

1. Choose the installation site.
2. Check the monitor's AC rating.
3. Connect the AC power cord.
4. Press the ON/OFF key  to turn on the monitor.
5. Select the patient type.
6. Add a new patient.
7. Use the SETUP menu to define some general configuration information and parameter options.
8. If necessary, set the time and date on the display.

Detailed Setup Instructions

1. Set up the monitor in a room with a temperature of 0-40° C (32-104° F) and a relative humidity of 15-95%, non-condensing.
 - a. If the monitor was in an area having a temperature higher or lower than this, wait a few minutes before setting up and using the monitor.
2. Check the monitor's AC rating. Check the monitor's AC rating plate to ensure the nominal voltage at your installation site matches the monitor's rating.
 - a. If the AC rating is not correct, do not use the monitor. Contact your authorized repair center for help.

CAUTION! If the integrity of the protective earth conductor is in doubt, operate the monitor using its internal power source (if the installed internal rechargeable battery is installed).

3. Plug the AC power cord into the power connector on the back of the monitor.
4. Plug the other end of the AC power cord into a grounded, three-wire hospital-grade outlet.
5. Verify that the front panel AC Power LED  is lit.

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

6. Press the ON/OFF key  to turn on the monitor.
 - a. The display will light up, the monitor will begin a brief system check, and then automatically enter the monitoring mode.

NOTE! The monitor performs a number of system checks during its start-up time. If the monitor detects an error with its internal circuitry, a message is displayed and the monitor will not enter the monitoring mode.

Select the Patient Type

The patient type indicator is located on the upper portion of the display. The default patient type is DOG.

When you change the patient type:

- The alarm limits will be reset to their default settings (unless STATIC LIMITS mode is on).
- NIBP inflation pressure settings will be reset for a cat, dog, or horse. For example, the default cat NIBP inflation pressure setting is 200 mmHg; the default dog NIBP inflation pressure setting is 150 mmHg; the default horse NIBP inflation pressure setting is 100 mmHg.
- The NIBP mode will be reset to MANUAL.
- All auto print features will be turned off.
- The Print All Report will be reset to the default setting.
- The scales for the IBP waveforms will be reset to the default settings.
- If the alarm limits for oximetry were adjusted to below 85%, they will be reset to 85%.

When monitoring a cat or small animal, set the monitor to the cat type. When monitoring dogs or medium-size animals, set the monitor to the dog type. When monitoring horses or large animals, set the monitor to the horse type.

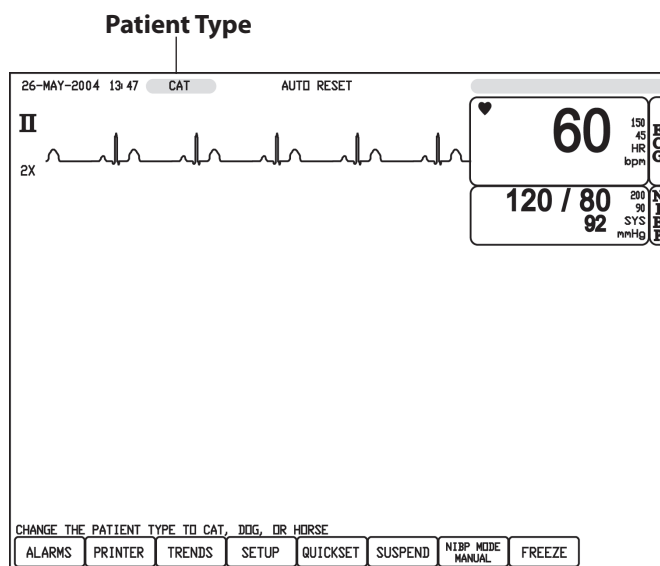


Figure 4.1: Patient Type

Change the Patient Type

1. Turn the rotary knob on the monitor to move the cursor. Highlight HORSE, DOG, or CAT, whichever is displayed. Push the knob to access the patient type submenu in the lower left corner of the display.
2. Highlight PATIENT TYPE and push the knob to select.
3. Turn the rotary knob to choose the desired type (HORSE, DOG, or CAT) and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

Add a New Patient

The patient identity indicator is located in the upper right corner of the display. You can choose which patient information to display: just the bed, the bed and the patient's name, or the bed and the patient ID. While specific patient identification information is expected to change, the bed or room to which the monitor is assigned may remain the same.

NOTE! When a new patient is added to the monitor, all previous patient information is removed from the monitor's memory, and all parameter options are reset to the unit defaults. The bed name is not removed.

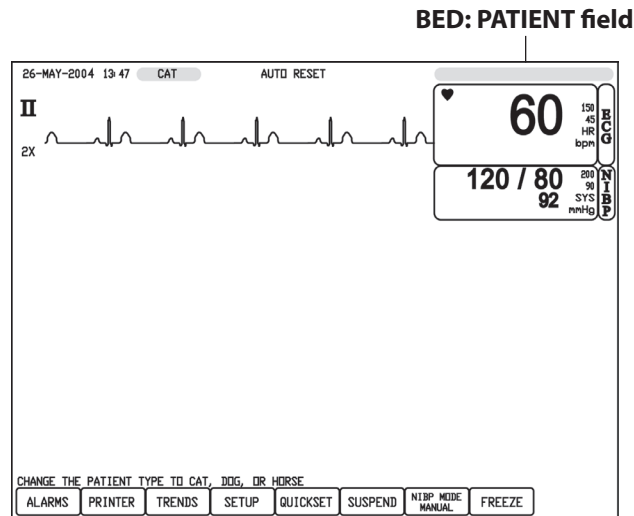


Figure 4.2: Add a Patient

Choose Which Patient Information to Display

1. Turn the rotary knob on the monitor to move the cursor. Highlight the BED: PATIENT field in the upper right corner of the display. The field may be blank. Push the knob to access the patient identification submenu in the lower left corner of the display.
2. Highlight DISPLAY and push the knob to select.
3. Turn the rotary knob to choose the desired patient information to display (BED ONLY, BED: PATIENT ID, BED: PATIENT NAME) and push the knob to select. You can add the bed name on the SETUP MENU. See *Bed Name* in this chapter for details regarding changing the bed name.

Add a New Patient

1. Turn the rotary knob on the monitor to move the cursor. Highlight the BED: PATIENT field in the upper right corner of the display. The field may be blank. Push the knob to access the patient identification submenu in the lower left corner of the display.
2. Highlight ENTER NEW PATIENT and push the knob to select.
3. Turn the rotary knob to choose YES and push the knob to select.
4. If you do not want to add the patient's name and ID, turn the rotary knob to highlight MAIN MENU and push the knob to select.

Add a Patient's Name

1. Turn the rotary knob on the monitor to move the cursor. Highlight the BED: PATIENT field in the upper right corner of the display. The field may be blank. Push the knob to access the patient identification submenu in the lower left corner of the display.
2. Highlight PATIENT NAME and push the knob to select.
3. Turn the rotary knob to access the patient name box and push the knob to select the first character field.
4. Turn the rotary knob to highlight the desired character and push the knob to select.
5. Push the knob to select the next character field.
6. Turn the rotary knob to highlight the desired character and push the knob to select. Repeat steps 4 and 5 until each character in the patient's name is selected. A patient name may be up to 14 characters long.
7. Highlight ENTER and push the knob to select.

Add a Patient's ID

1. On the patient identification submenu, turn the rotary knob to highlight PATIENT ID and push the knob to select.
2. Turn the rotary knob to access the patient ID box and push the knob to select the first character field.
3. Turn the rotary knob to highlight the desired character and push the knob to select.
4. Push the knob to select the next character field.
5. Turn the rotary knob to highlight the desired character and push the knob to select. Repeat steps 4 and 5 until each character in the patient's ID is selected. A patient ID may be up to 14 characters long.
6. Highlight ENTER and push the knob to select.

Setup Menu

On the SETUP menu, you will find display settings that can be selected according to your preferences. You can turn on or off the message line, change the bed name, and select new colors for the waveforms and parameter boxes. You will also find the PARAMETER OPTIONS submenu, which provides setup options associated with specific monitoring parameters.

Message Line

The message line provides a brief description of the highlighted field or menu selection. When the message line feature is turned on, messages will be displayed directly above the menu at the bottom of the display. The default setting for the message line is ON.

Turn On or Off the Message Line

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
2. Highlight MESSAGE LINE and push the knob to select.
3. Turn the rotary knob to choose whether or not you want the message line to be displayed. Push the knob to select YES or NO.
4. Highlight MAIN MENU and push the knob to select.

Print All Report

If your Advisor® Vital Signs Monitor includes the optional printer, you can print a snapshot of the waveforms displayed for the monitored parameters. Use the Print All Report menu option to choose which waveforms will print when you press the Print key() on the monitor.

Choose the Waveforms to Print

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
2. Highlight PRINT ALL REPORT and push the knob to access the print all report submenu.
3. Highlight WAVEFORM 2, WAVEFORM 3, or WAVEFORM 4 and push the knob to select. You cannot change WAVEFORM 1; it must remain set to Primary ECG.
4. Highlight the desired source of the printed waveform (OFF, I, II, III, CO2, SPO2, IBP1, OR IBP2) and push the knob to select.
5. Highlight MAIN or PREVIOUS and push the knob to select.

Parameter Options

The PARAMETER OPTIONS submenu provides setup options associated with specific monitoring parameters. You can choose 3-lead or 5-lead ECG processing. You can turn on or off some of the installed parameters such as ECG, capnography (CO₂), and temperature (T1 and T2). And, you can change the measurement unit that describes the parameter.

Choose 3-lead or 5-lead ECG processing (the default setting is 3-LEAD)

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
2. Highlight PARAMETER OPTIONS and push the knob to access the parameter options submenu.
3. Highlight ECG LEADS PROCESSING and push the knob to select.
4. Highlight 3-LEAD or 5-LEAD and push the knob to select.

CAUTION! A three-lead ECG cable must be used if 3-Lead processing is selected. A five-lead ECG cable must be used if 5-Lead processing is selected. Using the incorrect cable for the selected mode might lead to a floating reference or additional noise on the ECG signal.

5. Highlight MAIN or PREVIOUS and push the knob to select.

Turn On or Off Installed Parameters

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
2. Highlight PARAMETER OPTIONS and push the knob to access the parameter options submenu.
3. Highlight ECG MONITOR, CO2 MONITOR, T1 MONITOR, or T2 MONITOR and push the knob to select.
 - If ECG is turned off and AUTO is selected as the heart rate source, the heart/pulse rate (HR) digits will continue to be displayed and monitored for alarms as long as there is another active rate source (oximetry or arterial pressure). The default setting is ON.
 - CO2 MONITOR can be turned on only if the capnography parameter is installed. The default setting is OFF.
 - T1 MONITOR and T2 MONITOR can be turned on only if the temperature parameter is installed on your monitor and a temperature sensor is connected. The default setting for T1 and T2 is ON.
4. Highlight ON or OFF and push the knob to select.
5. Highlight MAIN or PREVIOUS and push the knob to select.

Change the Units of Measurement

Units of measurement can be changed for temperature, pressures, and optional capnography. The selected units of measurement will remain in the monitor's memory until changed, even if the monitor is turned off.

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
2. Highlight PARAMETER OPTIONS and push the knob to access the parameter options submenu.
3. Highlight UNITS OF MEASURE and push the knob to access the units of measure submenu.
4. Highlight UNITS, PRESSURE, or CO₂ and push the knob to select.
5. Turn the rotary knob to highlight the desired unit and push to select.
 - a. If the temperature parameter is installed on your monitor, UNITS can be changed to degrees Celsius or Fahrenheit (°C or °F). The default setting is °C.
 - b. PRESSURE can be changed to millimeters of mercury (mmHg) or kilopascals (kPa). The default setting is mmHg.
 - $\text{kPa} = \text{mmHg} \times 0.133$
 - $\text{mmHg} = \text{kPa} / 0.133$
 - CO₂ can be changed to millimeters of mercury (mmHg), kilopascals (kPa), or percent volume (%). The default setting is mmHg. The units apply to both end-tidal ET_{CO₂} and inspired IN_{CO₂}. CO₂ can be changed only if the capnography parameter is installed on your monitor.
6. Highlight MAIN or PREVIOUS and push the knob to select.

Bed Name

While specific patient identification information is expected to change, the bed or room to which the monitor is assigned may remain the same. The BED NAME menu option makes it possible to associate a room or bed with the monitor without respect to any particular patient.

To change the bed name:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
2. Highlight BED NAME and push the knob to select.
3. Turn the rotary knob to access the bed name box and push the knob to select the first character field.
4. Turn the rotary knob to highlight the desired character and push the knob to select.
5. Push the knob to select the next character field.
6. Turn the rotary knob to highlight the desired character and push the knob to select. Repeat steps 5 and 6 until each character in the bed name is selected. The bed name can include up to 14 characters.
7. Highlight ENTER and push the knob to select.

Parameter Colors

You can change the color of the text in each displayed parameter box and its corresponding waveform. Available colors are green, blue, cyan, magenta, white, orange, pink, lime (light green), purple, sky (light blue), and brown.

Red, black, and yellow are reserved system colors and cannot be assigned.

Invasive blood pressure (IBP) colors are set by site name, such as arterial (ART) and central venous pressure (CVP), not by connector number.

Only one color can be set for the temperature parameter (TEMP). Both temperature channels (T1 and T2) will be displayed in the same color.

The selected parameter colors can be changed any time but will remain in monitor's memory until they are changed again, even if the monitor is turned off.

The PARAMETER COLORS menu includes a RESTORE FACTORY COLORS option. The factory default colors for parameter boxes and corresponding waveforms are shown below.

PARAMETER	DEFAULT COLOR
ECG	Green
Capnography (CO ₂)	Sky (light blue)
NIBP	White
Oximetry (SPO ₂)	Orange
Temperature (TEMP)	Blue
Invasive Pressures	
ART (arterial)	Purple
PA (pulmonary artery)	Magenta
LV (left ventricle)	Orange
RV (right ventricle)	Orange
CVP (central venous pressure)	Orange
ICP (intracranial pressure)	Orange
LA (left atrium)	Orange
RA (right atrium)	Orange
P (generic pressure)	Orange

Change the Parameter Colors

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
2. Highlight PARAMETER COLORS and push the knob to select.
3. Highlight the desired parameter and push the knob to select.
4. Highlight the desired color and push the knob to select.

5. For invasive blood pressure colors:
 - a. Turn the rotary knob to highlight INVASIVE PRESSURES and push the knob to access the invasive pressures submenu.
 - b. Highlight the desired site name and push the knob to select.
 - c. Highlight the desired color and push the knob to select.
 - d. Highlight PREVIOUS and push the knob to select.
6. To restore the factory default colors, turn the rotary knob to highlight RESTORE FACTORY COLORS and push the knob to select.
7. Highlight MAIN or PREVIOUS and push the knob to select.

Software Revisions

Use this menu option to identify the version of software installed on your Advisor® Vital Signs Monitor. This information may be useful to service personnel.

View the Software Revisions Box

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
2. Highlight SOFTWARE REVISIONS and push the knob to select.
3. Highlight PRINT WINDOW and push the knob to select.
4. Highlight MAIN or PREVIOUS and push the knob to select.

Service Menu

Access to the service menu is by authorized password only. Refer to *Chapter 17: Service Menu* for use of this option.

Time and Date

If necessary, set the time and date on the display. The time and date indicator is located in the upper left corner of the display. The monitor's real-time clock and calendar keep track of the time and date, even when the monitor is turned off or is not connected to AC power. The time and date stamp is used for the NIBP tabular trends, the displayed and printed trends, and all other printouts. The time display format is based on the 24-hour clock. For example, 5:00 a.m. is displayed as 5:00 and 5:00 p.m. is displayed as 17:00.

Change the Time and Date

1. Turn the rotary knob on the monitor to move the cursor. Highlight the time and date as they are displayed. Push the knob to access the time and date menu in the lower left corner of the display.
2. Highlight the item to be changed (YEAR, MONTH, DATE, HOUR, or MINUTE) and push the knob to select.
3. Turn the rotary knob to choose the desired value and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

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Chapter 5: Monitoring the Patient

Follow the steps in *Chapter 4: Setting Up the Monitor*; the remainder of this chapter assumes that the monitor is properly installed and set up.

General Monitoring Instructions

Regardless of the parameters or measured values you want to monitor, follow these steps when you are ready to attach a patient. Each step is further explained in this chapter.

1. Attach the patient and sensors.
2. Choose the waveforms to be displayed.
3. Adjust the settings in the parameter boxes.
4. Set the high and low alarm limits.
5. Use these features as needed:
 - Silence an alarm
 - Use QUICKSET alarms
 - NIBP mode
 - Suspend mode
 - Freeze mode
 - Trends
 - Printing

Attach the Patient

Attach the patient to the desired sensors and connect the sensor cables to the monitor.

Some parameters will automatically turn on when the sensor cable is connected to the monitor and the related parameter box will appear on the display. Others require you to turn on the parameter box using the SETUP menu and the PARAMETER OPTIONS submenu. Refer to the chapters dedicated to each parameter for details regarding sensors and specific parameter box functions.

Adjust the Waveforms Settings

Choose the waveforms to be displayed in positions 2-4 and adjust the settings for each waveform.

Turn the rotary knob on the monitor to move the cursor. Highlight the waveform label and push the knob to access the waveform menu in the lower left corner of the display. The settings available for the selected waveform will be displayed.

- Waveform 1 is dedicated to the primary ECG lead, although you can specify which lead is to be the primary.
- Waveform 2 defaults to the CO₂ waveform. It can be assigned to another ECG lead (in five-lead mode only), a cascade (continuation) of the primary ECG lead waveform, or a waveform from any other enabled parameter.

- Waveform 3 defaults to the invasive blood pressure (IBP1) waveform, labeled ART1, and is displayed when the IBP1 cable is connected to the monitor. Waveform 3 can be changed to display a cascade (continuation) of the primary ECG lead waveform after waveforms 1 and 2, or it can be a waveform from any other enabled parameter.
- Waveform 4 defaults to the SpO₂ waveform. It can be changed to display a cascade (continuation) of the primary ECG lead waveform after waveforms 1, 2, and 3, or it can be a waveform from any other enabled parameter.

Refer to the chapters dedicated to each parameter for more details regarding waveform settings.

Adjust the Parameter Box Settings

- Turn the rotary knob on the monitor to move the cursor. Highlight the parameter box name and push the knob to access the parameter menu in the lower left corner of the display. The settings available for the selected parameter will be displayed.
- Every parameter allows you to turn on or off its alarm detection capability in the parameter menu. For example, if SPO₂ ALARMS is on, an alarm will be issued when the high or low alarm limit is violated. If you turn SPO₂ ALARMS off and the high or low alarm limit is violated, an alarm will not be issued. See *Silence Alarms* in *Chapter 6: Alarms* for information regarding silencing alarms that are in progress, and *Select the Alarm Audio Silence Operation* in *Chapter 17: Service Menu* for information about silencing alarms indefinitely.
- For the parameters where more than one measurement can be monitored such as blood pressure (systolic, diastolic, and mean) and temperature (T1 and T2), only one set of high and low limits can be displayed. You can specify in the parameter menu which set of limits is displayed.

Refer to the chapters dedicated to each parameter for details regarding other pertinent settings.

Set the Alarm Limits

Set the high and low alarm limits for each parameter.

- When a numeric measured value matches or exceeds the high or low limit set for that parameter, an alarm is issued. For example, if the low alarm limit for SpO₂ is 85 and the patient's measured value for SpO₂ is 85 or less, an alarm will be issued.
- The Advisor[®] Vital Signs Monitor provides clinically appropriate default high and low alarm limits for each numeric measured value. You can choose different high and low limits, depending on the monitoring requirements of each patient. For a list of default alarm limits, see Appendix B: Alarm Limit Default Values.

WARNING! Verify that alarm limits are clinically appropriate for your patient and adjust according to institutional policy.

NOTE! Alarm limit settings for invasive blood pressure (IBP1 and IBP2) are associated with the site label. The settings for IBP1 ART1 site are not the same as the settings for the IBP1 PA1 site. Verify alarm settings when assigning a new site label to either IBP1 or IBP2 connector.

NOTE! Alarms may be tested while the monitor is in use by setting alarm limits such that the measured value is outside the limits. Return the alarm limits to their clinically appropriate settings after testing.

To set the high and low alarm limits:

1. Be sure that the sensor for each parameter is connected to the monitor, and where applicable, that the parameter or measured value (ECG, RESP, CO₂, T1 and T2) is turned on using the SETUP menu and the PARAMETER OPTIONS submenu.
2. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight ALARMS and push the knob to select.
3. Highlight CHANGE CURRENT ALARM LIMITS and push the knob to access the alarm limit box.
4. Highlight the name of each measured value and push the knob to select.
5. Highlight the high alarm limit (HI) and push the knob to select.
6. Turn the rotary knob to choose the desired value and push the knob to select. If you do not want a high alarm value, choose OFF. For example, the measured value for SpO₂ will not exceed 100 percent; select OFF and no alarm will be issued for a high SpO₂ value.
7. Turn the rotary knob to highlight the low alarm limit (LO) and push the knob to select.
8. Turn the rotary knob to choose the desired value and push the knob to select. If you do not want a low alarm value, choose OFF.
9. Turn the rotary knob to move the cursor back to the name of the measured value and push to select.
10. Highlight MENU in the alarm limit box and push the knob to select.
11. Highlight MAIN MENU and push the knob to select.

Use these Features as Needed

Responding to an Alarm

1. When a numeric measured value matches or exceeds the high or low limit set for that parameter, an alarm is issued. An audible alarm tone will sound, ALARM will appear in the alarm status line, and the violating measured value and violated alarm limit will flash in the parameter box.
2. The alarming action will cease when the measured value is once again within the alarm limits. Your monitor will either be set to automatically stop alarming as soon as the measured value returns to within the alarm limits, or it will require you to manually acknowledge the alarm by pressing the alarm silence key (Ⓢ). See *Select the Alarm Reset Operation in Chapter 17: Service Menu* for instructions for choosing AUTO RESET or MANUAL RESET.

NOTE! Only qualified personnel may set the automatic or manual alarm silence, or enable indefinite alarm silence. See Chapter 17: Service Menu for details regarding alarm reset and silence.

3. For MANUAL RESET alarms, if the measured value returns to within the alarm limits before you press the alarm silence key, a flashing up (↑) or down (↓) arrow will be displayed next to the measured value to indicate the violation and the auditory alarm will continue until you press the alarm silence key.
4. If the alarm limit is still violated after two minutes, the audible alarm tone will sound again. If, within the two minutes of alarm silence, another measured value matches or exceeds its alarm limits, the alarming action will resume, including the audible alarm tone.
5. If it is appropriate for your patient, you can turn off the alarm detection capability for a single parameter so that when the measured value matches or exceeds the alarm limits, the monitor will not issue an alarm.

Disabling Alarms

To turn off the alarm detection capability for a single parameter:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the parameter box name and push the knob to access the parameter menu in the lower left corner of the display.
2. Highlight [MEASURED VALUE] ALARMS and push the knob to select. For example, in the SPO₂ parameter menu, select SPO₂ ALARMS.
 - If the parameter has more than one measured value:
 - a. Highlight ALARMS and push the knob to access the alarms submenu.
 - b. Highlight the desired measured value (SYS ALARMS, DIA ALARMS, MAP/MEAN ALARMS, INCO₂ ALARMS, and ETCO₂ ALARMS) and push the knob to select.
3. Turn the rotary knob to choose OFF and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

NOTE! When you change the patient type or power down, this setting will default to ON.

Alternatively, you can preclude additional alarms by adjusting the current high and low alarm limits, by using the QUICKSET feature, or by setting the limits to OFF in the alarm limits box. In some cases, the indefinite alarm silence feature may be enabled. This will prevent the audible alarm tones from sounding at all. If this feature is enabled on your monitor, press and hold the ALARM SILENCE key (Ⓢ) for six seconds to indefinitely silence alarms. AUDIO PAUSED will be displayed on the upper right side of the display. If a new alarm occurs during audible silence, the audible alarm will be reactivated.

NOTE! Only qualified personnel may enable indefinite alarm silence. See *Select the Alarm Audio Silence Operation* in Chapter 17: Service Menu for details regarding alarm silence.

Refer to the chapters dedicated to each parameter for details regarding the high, medium, and low alarming conditions.

QUICKSET Alarm Limits

You can quickly adjust the high and low alarm limits using the QUICKSET feature. You may choose to reset all the alarm limits, or just the alarm limits for a measured value that has matched or exceeded a high or low limit and generated an alarm.

When you select QUICKSET ALL LIMITS, the monitor will use the patient's current measured values, add the QUICKSET high (QS HI) number for each measured value, and reset all the high alarm limits to reflect each total. Likewise, the monitor will subtract the QUICKSET low (QS LO) numbers from the patient's current measured values and reset all the low alarm limits. See the following example:

PATIENT'S CURRENT MEASURED VALUES	QUICKSET NUMBERS	QUICKSET FUNCTIONS	HIGH AND LOW ALARM LIMITS AS RESET USING THE QUICKSET FEATURE
Heart rate: 65 beats per minute (bpm)	QS HI: +25 QS LO: -25	$65 + 25 = 90$ $65 - 25 = 40$	High: 90 bpm Low: 40 bpm
Invasive Blood Pressure (IBP1 = ART1) Systolic: 118 mmHg Diastolic: 80 mmHg Mean Arterial Pressure: 92 mmHg	QS HI/Systolic: +20 QS LO/Systolic: -15 QS HI/Diastolic: +10 QS LO/Diastolic: -10 QS HI/Mean Arterial Pressure: +10 QS LO/Mean Arterial Pressure: -10	$118 + 20 = 138$ $118 - 15 = 103$ $80 + 10 = 90$ $80 - 10 = 70$ $92 + 10 = 102$ $92 - 10 = 82$	High/Systolic: 138 mmHg Low/Systolic: 103 mmHg High/Diastolic: 90 mmHg Low/Diastolic: 70 mmHg High/Mean: 102 mmHg Low/Mean: 82 mmHg
Oximetry: 98% SpO ₂	QS HI: NO CHG* QS LO: -5	NO CHG* $98 - 5 = 93$	High: No change is made. Low: 93%

The newly reset alarm limits will be displayed in the parameter boxes.

When an alarm occurs and you select QUICKSET VIOLATED ONLY, the monitor will either add the QUICKSET high (QS HI) number, or subtract the QUICKSET low (QS LO) number for the current measured value that exceeded the existing alarm limit, and then reset the high or low alarm limit to reflect the total. See the following example:

MEASURED VALUE	CURRENT HIGH AND LOW ALARM LIMITS	PATIENT'S CURRENT MEASURED VALUES	QUICKSET NUMBERS	HIGH AND LOW ALARM LIMITS AS RESET USING THE QUICKSET FEATURE
Heart Rate	High: 150 beats per minute (bpm) Low: 40 bpm	Heart rate: 65 bpm	QS HI: +25 QS LO: -25	No violation, no change.
Invasive Blood Pressure (IBP1 = ART1)	High/Systolic: 200 mmHg Low/Systolic: 90 mmHg High/Diastolic: 105 mmHg Low/Diastolic: 40 mmHg High/Mean: 110 mmHg Low/Mean: 50 mmHg	Invasive Blood Pressure (IBP1 = ART1) Systolic: 118 mmHg Diastolic: 80 mmHg Mean Arterial Pressure: 92 mmHg	QS HI/Systolic: +20 QS LO/Systolic: -15 QS HI/Diastolic: +10 QS LO/Diastolic: -10 QS HI/Mean Arterial Pressure: +10 QS LO/Mean Arterial Pressure: -10	No violation, no change.
SpO ₂	High: OFF Low: 85%	84%	QS HI: NO CHG* QS LO: -5	High: No change is made. Low: 79%

The newly reset alarm limit will be displayed in the parameter box.

- If a current measured value is not available, no changes will be made with QUICKSET.
- If a high or low alarm limit is set to OFF, no changes will be made with QUICKSET.
- If a QUICKSET high number (QS HI) or QUICKSET low number (QS LO) is set to NO CHG (no change), the alarm limit will not be reset with QUICKSET.

The Advisor® Vital Signs Monitor provides a clinically appropriate range of selectable high and low alarm limits for each measured value. Typically, the final choice at the upper end of each range of high alarm limits is OFF, and the final choice at the lower end of each range of low alarm limits is OFF. Regardless of the QUICKSET high and low numbers, a high or low alarm limit will never be reset to OFF when you select QUICKSET. The alarm limit will be reset to the final value at the end of the range of high or low alarm limits. See the following example:

SELECTABLE HIGH AND LOW ALARM LIMIT RANGES	QUICKSET NUMBERS	PATIENT'S CURRENT MEASURED VALUES	HIGH AND LOW ALARM LIMITS AS RESET USING THE QUICKSET FEATURE
Heart Rate High: 20 – 350 bpm/OFF Low: OFF/20 – 350 bpm	QS HI: +25 QS LO: -25	Heart rate: 44 beats per minute (bpm)	High: 77 Low: 20 Since the minimum value for a low alarm limit is 20, 27 bpm is not an option ($44 - 25 < 20$). QUICKSET will not reset the low alarm limit to less than 20, or OFF.

To set the QUICKSET high and low numbers:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight ALARMS and push the knob to select.
2. Highlight CHANGE CURRENT ALARM LIMITS and push the knob to access the alarm limit box.
3. Turn the rotary knob to highlight the name of the current measured value and push the knob to select.
4. Highlight the QS HI or QS LO and push the knob to select.
5. Turn the rotary knob to choose the desired number and push the knob to select. If you do not want a high or low alarm limit to change when you use the QUICKSET feature, select NO CHG (no change).
6. Turn the rotary knob to move the cursor back to the name of the measured value and push to select.

NOTE! Be sure that the QUICKSET alarm limits you select are clinically appropriate for your patient.

7. Highlight MENU in the alarm limit box and push the knob to select.
8. Highlight MAIN MENU and push the knob to select.

Resetting Alarm Limits using the QUICKSET Feature

To reset all high and low alarm limits for the current measured values using the QUICKSET feature:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight QUICKSET and push the knob to select.
2. Highlight QUICKSET ALL LIMITS and push the knob to select. The alarm limit box will appear, displaying the reset high and low alarm limits.
3. If the new limits are correct and clinically appropriate for your patient, highlight MAIN MENU and push the knob to select.
4. If the new limits are not correct and clinically appropriate for your patient:
 - a. Turn the rotary knob to highlight the name of the incorrect measured value and push the knob to select.
 - b. Highlight the incorrect high (HI) or low (LO) limit and push the knob to select.
 - c. Turn the rotary knob to choose the desired value and push the knob to select.
 - d. Turn the rotary knob to move the cursor back to the name of the measured value and push to select.
 - e. When the high and low alarm limits are correct and clinically appropriate for your patient, highlight MENU in the alarm limit box and push the knob to select.
 - f. Highlight MAIN MENU and push the knob to select.

To use the QUICKSET feature to reset an alarm limit for a measured value that matched or exceeded the existing alarm limit:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight QUICKSET and push the knob to select.
2. Highlight QUICKSET VIOLATED ONLY and push the knob to select. If an alarm limit was reset, the alarm limit box will appear, displaying the reset high or low alarm limit. If no change was made, the main menu will reappear on the display. This may be the case if no alarm limits were violated, if the new QUICKSET values are the same as the old ones, or if NO CHG (no change) was selected for the QUICKSET limit.
3. If the new limit is correct and clinically appropriate for your patient, highlight MAIN MENU and push the knob to select.
4. If the new limit is not correct and clinically appropriate for your patient:
 - a. Turn the rotary knob to highlight the name of the incorrect measured value and push the knob to select.
 - b. Highlight the incorrect high (HI) or low (LO) limit and push the knob to select.
 - c. Turn the rotary knob to choose the desired value and push the knob to select.
 - d. Turn the rotary knob to move the cursor back to the name of the measured value and push to select.
 - e. When the high and low alarm limits are correct and clinically appropriate for your patient, highlight MENU in the alarm limit box and push the knob to select.
 - f. Highlight MAIN MENU and push the knob to select.

NIBP Mode

Non-invasive blood pressure (NIBP) measurements can be made in automatic, manual, or STAT modes. In the automatic mode, the monitor will measure the patient's NIBP periodically, according to the interval you select. In the manual mode, the monitor will measure the patient's NIBP only when you press the NIBP key (). In the STAT mode, the monitor will measure the patient's NIBP continuously for five minutes. The default setting for NIBP mode is MANUAL. See *Chapter 10: Non-invasive Blood Pressure* for more details regarding the NIBP mode.

To change the NIBP mode:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight NIBP MODE and push the knob to select.
2. Turn the rotary knob to choose a mode (AUTO, MANUAL, or STAT), and push the knob to select.

Suspend Mode

Use this feature to temporarily stop or suspend monitoring. While the monitor is in suspend mode, no parameters are being monitored, no data are stored for trends, and no alarm will be issued. When you resume monitoring, all the previous settings such as alarm limits and waveform settings will be retained. However, if you are monitoring invasive blood pressure, you will have to recalibrate, or re-zero, the invasive pressure transducers. See *Set the Transducer to Zero* in *Chapter 11: Invasive Blood Pressure* for details regarding calibrating invasive pressure transducers.

To suspend monitoring:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SUSPEND and push the knob to select. A box will appear indicating that the monitor is in suspend mode.

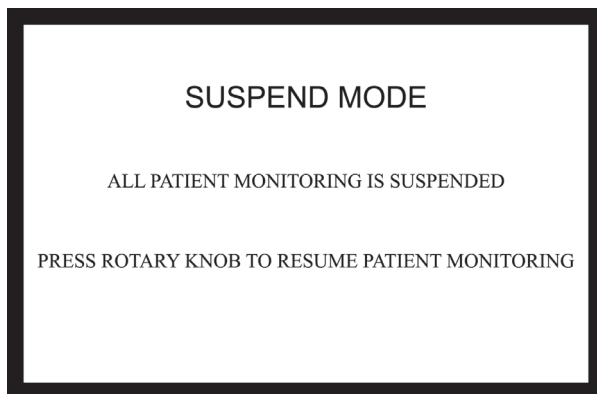


Figure 5.1: Suspend Mode

2. To resume Monitoring, push the rotary knob.

Freeze Mode

Use this feature to temporarily hold or freeze all current waveforms, even those that are not displayed. You can then print a snapshot of any parameter's waveform (if the optional printer is installed on your monitor). Monitoring does not stop; you can still view the current measured values in the parameter boxes. You can also use the PRINT STRIP feature to continue viewing a real-time waveform for any parameter.

When you freeze the waveforms, you may not adjust any waveform settings. The waveform menus on the left side of the screen are not accessible and the waveform submenus on the parameter menus are not available.

In addition, attempting to perform any functions that require the waveform area will cause the freeze mode to be cancelled. For example, if you freeze the waveforms and then select ALARMS from the main menu, the alarm limits box will be displayed in the waveform area and the waveforms will no longer be in freeze mode.

To freeze the waveforms:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight FREEZE and push the knob to select. The waveforms will stop, or freeze.
2. To start the waveforms again, turn the rotary knob to highlight UNFREEZE and push the knob to select.

Trends

The Advisor® Vital Signs Monitor stores tabular trend data every 30 seconds for up to 26 hours for the following parameters:

- a. ECG
 - Heart rate (HR)
- b. Capnography
 - CO₂ Respiration (RR)
 - End-tidal carbon dioxide (ETCO₂)
 - Inspired carbon dioxide (INCO₂)
- c. Invasive blood pressure (IBP1 and IBP2)
 - All pressure sites (systolic, diastolic, mean)
- d. Oximetry
 - Oxygen saturation (SpO₂)
 - Peripheral pulse rate (PPR), when SPO₂ is the selected heart rate source
- e. Non-invasive blood pressure (NIBP) (systolic, diastolic, mean)
- f. Temperature (T1 and T2)

Viewing Stored Trend Data

NOTE! This is not for data stored on the flash memory card for the optional Data Logger. See *Optional Data Logger* section in Chapter 14 for information about storing and retrieving trend data using the flash memory card with Data Logger.

To view all of the stored trend data for the entire monitored period, up to 26 hours:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight TRENDS and push the knob to select.
2. Highlight TABULAR VITAL SIGNS and push the knob to access the vital signs box.
3. Turn the rotary knob to highlight SCROLL ↑ ↓ or SCROLL ← → and push the knob to select.
4. Turn the rotary knob and the trend data will scroll up and down or left and right in the vital signs box.
5. To return to the menu, push the knob again.

To view the stored tabular trend data in selected time increments:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight TRENDS and push the knob to select.
2. Highlight TABULAR VITAL SIGNS and push the knob to access the vital signs box.
3. Turn the rotary knob to highlight INTERVAL and push the knob to select.
4. Turn the rotary knob to choose the amount of time (30 seconds, 1, 5, 10, 15, or 30 minutes, and one hour) between displayed measured values. Push the knob to select.

Erasing Stored Trend Data

To erase the stored trend data from the monitor's memory:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight TRENDS and push the knob to select.
2. Highlight TABULAR VITAL SIGNS and push the knob to access the vital signs box.
3. Turn the rotary knob to highlight CLEAR ALL TRENDS and push the knob to select.
4. Turn the rotary knob to choose YES.

NOTE! Selecting YES will permanently erase all the stored trend data.

5. Push the knob to select.

Printing Trend Data

To print all the stored trend data (if an optional printer is installed on your monitor):

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight TRENDS and push the knob to select.
2. Highlight TABULAR VITAL SIGNS and push the knob to access the vital signs box.
3. Turn the rotary knob to highlight PRINT ALL TRENDS and push the knob to select.
4. Turn the rotary knob to choose YES and push the knob to select. To stop printing, press the print key () on the monitor.

To print a segment of the stored trend data (if an optional printer is installed on your monitor):

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight TRENDS and push the knob to select.
2. Highlight TABULAR VITAL SIGNS and push the knob to access the vital signs box.
3. Turn the rotary knob to highlight PRINT REPORT and push the knob to access the printing submenu.
4. Choose the time segment of stored trend data that you want to print. Note that the trend report begins at the later or more recent hour and minute and prints backward in time so that the printed segment ends at the earlier hour and minute.

For example, if you want to print the segment of trend data that was stored between 10:06 and 11:06, choose a start hour of 11:06 and a length of one hour.

- a. Turn the rotary knob to highlight START HOUR and push the knob to select.
- b. Turn the rotary knob to choose the latest or most recent hour in the segment of stored trend data that you want to print (11 in the previous example) and push the knob to select. Choose the hour as it is displayed in the vital signs box, based on the 24-hour clock.
- c. Turn the rotary knob to highlight START MINUTE and push the knob to select.
- d. Turn the rotary knob to choose the latest minute of stored trend data to be printed (06 in the previous example) and push the knob to select. Choose the minutes as they are displayed in the vital signs box.
5. Highlight INTERVAL and push the knob to select.
6. Turn the rotary knob to choose the amount of time (30 seconds, or 1, 5, 10, 15, or 30 minutes) between printed measured values and push the knob to select.
7. Highlight desired interval of time and push the knob to select.
8. Turn the rotary knob to choose the length of the segment to print (1-24 hours) and push the knob to select.
9. Highlight PRINT and push the knob to select.
10. Turn the rotary knob to choose YES and push the knob to select. To stop printing, press the Print key () on the monitor.
11. Highlight MAIN or PREVIOUS and push the knob to select.

Non-Invasive Blood Pressure (NIBP) Readings

The monitor stores up to 150 non-invasive blood pressure (NIBP) readings.

To display the non-invasive blood pressure (NIBP) history:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight TRENDS and push the knob to select.
2. Highlight NIPB HISTORY and push the knob to access the NIBP history box.
3. Highlight the available menu options and push the knob to select.

To view all of the stored NIBP readings for the entire monitored period, up to 26 hours:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight TRENDS and push the knob to select.
2. Highlight NIPB HISTORY and push the knob to access the NIBP history box.
3. Turn the rotary knob to highlight SCROLL ↑ ↓ and push the knob to select.
4. Turn the rotary knob and the trend data will scroll up and down in the NIBP history box.
5. To return to the menu, push the knob again.

Erasing NIBP History

To erase the stored NIBP history from the monitor's memory:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight TRENDS and push the knob to select.
2. Highlight NIPB HISTORY and push the knob to access the NIBP history box.
3. Turn the rotary knob to highlight CLEAR ALL NIBP HISTORY and push the knob to select.
4. Turn the rotary knob to choose YES.

NOTE! Selecting YES will permanently erase all the stored NIBP history.

5. Push the knob to select.

Printing NIBP Readings

To print all the stored NIBP readings (if an optional printer is installed on your monitor):

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight TRENDS and push the knob to select.
2. Highlight NIBP HISTORY and push the knob to access the NIBP history box.
3. Turn the rotary knob to highlight PRINT ALL NIBP HISTORY and push the knob to select.
4. Turn the rotary knob to choose YES and push the knob to select. To stop printing, press the print key () on the monitor.

To print only the NIBP readings displayed in the NIBP history box (if an optional printer is installed on your monitor):

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight TRENDS and push the knob to select.
2. Highlight NIBP HISTORY and push the knob to access the NIBP history box.
3. Turn the rotary knob to highlight PRINT WINDOW and push the knob to access the printing submenu.
4. Turn the rotary knob to choose YES and push the knob to select. To stop printing, press the print key (F) on the monitor.
5. Turn the rotary knob to highlight MAIN or PREVIOUS and push the knob to select.

Printer

If an optional printer is installed on your Advisor® Vital Signs Monitor, you will find print options in the waveform menus, the parameter menus, and the trends menu. You can also print by pressing the PRINT key () on the monitor. In addition to these printing options, there is a printer menu accessible on the main menu. Using the options on the printer menu, you can set your monitor to automatically print whenever an alarm limit is violated or as soon as an NIBP reading is taken. You can set your monitor to print patient data on a regular basis. The printer menu is also the place where you choose the speed or resolution (millimeters per second) at which all waveforms will print and the length of all printed snapshots (200 or 300 millimeters).

See *Chapter 7: Printing* for more details regarding the printer menu.

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Chapter 6: Alarms

Follow the steps in *Chapter 4: Setting Up the Monitor*; the remainder of this chapter assumes that the monitor is properly installed and set up.

Parameter Alarms and System Alarms

A parameter alarm occurs when there is a malfunction with any of the sensors or connections, or when a numeric measured value matches or exceeds the high or low limit set for that parameter. A system alarm will be issued when the battery is low or when an error is detected during automatic printing.

During an alarm, an audible alarm tone will sound and ALARM will appear in the alarm status line at the top of the display. For parameter alarms, a message may be displayed in the relevant parameter box, and the violating measured value and violated alarm limit will flash. For system or status alarms, a message will be displayed in the printer and battery status line.

Critical Failure Alarm (CFA)

The Critical Failure Alarm (CFA) is a high-pitched, continuous alarm tone used to alert you when the monitor is not performing in its intended capacity.

The critical failure alarm will sound when:

- an unorganized power shut down occurs, for example:
 - if AC power is lost while the monitor is on (and an installed rechargeable battery is not connected)
 - if the optional rechargeable battery is drained while the monitor is on (and AC power is not connected)
- the main processor is performing in an erratic, unintended manner

The critical failure alarm will be silenced when:

- you press ALARM SILENCE key (Ⓢ) or
- you connect the AC power cord to the monitor and turn the monitor on or
- the CFA alkaline battery is drained

This alarm should be tested annually:

1. On the service menu, highlight TEST CFA ALARM and push the knob to select. See *Chapter 17: Service Menu* for instructions for accessing the service menu.
2. Highlight YES and push the knob to select.
3. Verify that the alarm sounds.
4. To silence the critical failure alarm (CFA), press the ALARM SILENCE key (Ⓢ) or highlight NO under TEST CFA ALARM and push the knob to select.

If the alarm does not sound, contact your authorized repair center for help.

High, Medium, and Low Priority Alarms

Alarms are categorized as high priority, medium priority, or low priority.

High Priority Alarms

A high priority alarm sound consists of two bursts of five single tones over a four-second interval. The sequence is repeated every ten seconds. High priority alarms supersede all other alarms. ALARM will appear, red and flashing, in the alarm status line; the violating measured value will flash in red; and the alarm message in the parameter box will be displayed in red.

PARAMETER	HIGH PRIORITY ALARM
ECG	High heart rate
	Low heart rate
	Asystole
Capnography	None
Invasive blood pressure	High arterial pulse rate (if ART is the rate source)
	Low arterial pulse rate (if ART is the rate source)
Oximetry	Low %SpO ₂
	High pulse rate (if SpO ₂ is the rate source)
	Low pulse rate (if SpO ₂ is the rate source)
	Lost pulse
Non-invasive blood pressure (NIBP)	None
Temperature	None

Medium Priority Alarms

A medium priority alarm sound consists of a single burst of three single tones that repeats every 20 seconds. ALARM will appear, yellow and flashing, in the alarm status line; the violating measured value will flash in yellow; and the alarm message in the parameter box will be displayed in yellow. If a high priority alarm is occurring at the same time as a medium priority alarm begins, ALARM will continue to appear in red.

PARAMETER	MEDIUM PRIORITY ALARM
ECG	Leads fail
	Com error
Capnography	Occlusion
	Trap full (advanced pneumatics only)
	High end-tidal CO ₂
	Low end-tidal CO ₂
	High inspired CO ₂
	High respiration rate
	Low respiration rate
Invasive blood pressure	Com error
	IBP out of range
	High systolic
	Low systolic
	High diastolic
	Low diastolic
	High mean
Oximetry	Low mean
	Com error
	Oximeter error
	Check sensor
	Searching too long
Non-invasive blood pressure (NIBP)	High %SpO ₂
	High systolic
	Low systolic
	High diastolic
	Low diastolic
	High MAP
Temperature	Low MAP
	Com Error
	High temperature
System alarm	Low temperature
	Low battery
	Battery charging error

Low Priority Alarms

A low priority alarm sound consists of a single burst of two single tones that repeat every 20 seconds. ALARM will appear, yellow and steady, in the alarm status line and the alarm message in the parameter box will be displayed.

PARAMETER	LOW PRIORITY ALARM
ECG	RA, LA, LL, or V fail
	Lead I fail or Lead II fail
	Low signal
Capnography	Com error
	Sensor error
Invasive blood pressure	Zero out of range
	Zero unstable
Non-invasive blood pressure (NIBP)	Com error
	NIBP error
	NIBP timeout
	NIBP cuff leak
	NIBP artifact
	NIBP weak signal
	Cuff over-pressure
	NIBP cal error
	Valve error
System alarm	Auto print error
	Auto print no paper

Controlling Alarms

You can control many factors in the way the Advisor® Vital Signs Monitor issues an alarm. You can turn off the alarm detection capability for a single parameter. You can change the high and low alarm limits. You can quickly reset the alarm limits relative to the patient's current measured values. You can control the volume of the audible alarm. And you can silence an alarm for two minutes, or on some monitors, indefinitely.

Turn off alarm detection

If it is appropriate for your patient, you can turn off the alarm detection capability for a single parameter so that when the measured value matches or exceeds the alarm limits, the monitor will not issue an alarm. See *Responding to an Alarm* in *Chapter 5: Monitoring the Patient* for instructions for turning off the alarm detection capability for a single parameter.

Change alarm limits

The monitor provides clinically appropriate default high and low alarm limits for each numeric measured value. You can change the high and low alarm limits, depending on the monitoring requirements of each patient. You can even set a high or low alarm limit to OFF, so that no alarm will be issued. For a list of default alarm limits, see *Appendix B: Alarm Limit Default Values*. See *Set the Alarm Limits* in *Chapter 5: Monitoring the Patient* for instructions for changing high and low alarm limits.

You can quickly adjust the high and low alarm limits using the QUICKSET feature. You may choose to reset all the alarm limits, or just the alarm limits for a measured value that has exceeded, or violated, a high or low limit and generated an alarm. See *QUICKSET Alarm Limits* in *Chapter 5: Monitoring the Patient* for instructions for using the QUICKSET feature.

Adjust alarm volume

You can adjust the volume of the audible alarm to one of ten levels. When an alarm occurs (and alarm silence is not enabled), the alarm tones will sound at the chosen volume. The default alarm volume setting is the third level, or 30%. You cannot set the alarm volume to OFF.

To change the alarm volume:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight ALARMS and push the knob to select.
2. Highlight ALARM VOLUME and push the knob to select.
3. Turn the rotary knob to increase or decrease the volume to the desired level and push the knob to select. A momentary beep tone will sound at each new level of volume.
4. Highlight MAIN MENU and push the knob to select.

Stop alarms automatically or manually

Your monitor will either be set to automatically stop an alarm as soon as the measured value returns to within the alarm limits, or it will be set so you must acknowledge the alarm manually. See *Select the Alarm Reset Operation* in *Chapter 17: Service Menu* for instructions for choosing AUTO RESET or MANUAL RESET.

If your monitor is set to AUTO RESET, all alarm indicators for a parameter will cease as soon as the measured value is once again within the alarm limits.

If your monitor is set to MANUAL RESET, you must acknowledge an alarm condition by pressing the alarm silence key (Ⓢ). If the measured value returns to within the alarm limits before you press the alarm silence key, a flashing up ↑ or down ↓ arrow will be displayed next to the measured value to indicate the violation and the auditory alarm will continue until you press the alarm silence key.

Silence alarms

If your monitor is set to allow TEMPORARY OR INDEFINITE audio alarm silence, then pressing the ALARM SILENCE key while audible alarms are enabled will do one of the following:

- Press ALARM SILENCE momentarily to silence alarms for two minutes. AUDIO PAUSED will appear at the top of the display with a two-minute timer. Audible alarms will be re-enabled if any new alarm occurs, if the two-minute timer times out, or if the ALARM SILENCE key is pressed again.
- Press and hold the Alarm Silence key for about three (3) seconds to silence alarms indefinitely. AUDIO PAUSED will be displayed with no timer. Audible alarms will be re-enabled if any new alarm occurs, or if the ALARM SILENCE key is pressed again.
- Press and hold ALARM SILENCE for six (6) or more seconds to silence alarms permanently. AUDIO OFF will be displayed. Audible alarms will NOT be re-enabled if any new alarm occurs. Press the ALARM SILENCE key again to re-enable audible alarms.

If audio alarm silence for your monitor is set to allow TEMPORARY ONLY, then pressing the ALARM SILENCE key will silence alarms for two minutes. AUDIO PAUSED will be displayed with a two-minute timer (2:00). Audible alarms will be re-enabled if any new alarm occurs, if the two-minute timer times out, or if the ALARM SILENCE key is pressed again.

If audio alarm silence for your monitor is set to allow INDEFINITE ONLY, then pressing and holding ALARM SILENCE key will silence alarms for an unspecified amount of time. AUDIO PAUSED will be displayed with no timer. The audible alarms will be re-enabled if any new alarm occurs, or if the ALARM SILENCE key is pressed again.

NOTE! Only qualified personnel may change the allowed alarm audio silence mode. See *Select Alarm Audio Silence Operation* in *Chapter 17: Service Menu* for details regarding alarm silence.

Refer to the chapters dedicated to each parameter for details regarding the high, medium, and low alarming conditions.

Chapter 7: Printing

The optional built-in printer produces waveform snapshots, waveform strip charts, and tabular trend data. Annotation lines are printed every 200-300 millimeters (8-12 inches) providing numeric measured values with the waveform. The printer has three paper speeds (four if capnography is installed on your monitor) and an easy-to-use drop-in paper replacement compartment. There is a dedicated printer key PRINT () on the front of the monitor for starting and stopping the print function.

If an optional printer is installed on your monitor, you will find print options in the waveform menus, the parameter menus, and the trends menu. In addition to these printing options, there is a printer menu accessible on the main menu. Using the options on the printer menu, you can set your monitor to automatically print whenever an alarm limit is violated or as soon as an NIBP reading is taken. You can set your monitor to print patient data at regular intervals. The printer menu is also the place where you choose the speed or resolution (millimeters per second) at which all waveforms will print and the length of all printed snapshots (200 or 300 millimeters).

General Print Settings

There are some print settings that apply to every print job, such as the speed or resolution of printed waveforms and the length of all snapshots. These options are found in the printer menu.

To set the print speed:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight PRINTER and push the knob to access the printer menu.
2. Highlight PRINT SPEED and push the knob to select.
3. Highlight the desired print speed (12.5, 25, or 50 mm/sec) and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

To set the print speed for carbon dioxide (CO₂):

1. Turn the rotary knob on the monitor to move the cursor. Select the CO₂ Parameter box on right side of screen and push the knob to access the CO₂ menu.
2. Highlight CO₂ WAVEFORM and push the knob to select.
3. Highlight PRINT SPEED and push the knob to select.
4. Highlight the desired print speed and push the knob to select. Highlight MAIN MENU and push the knob to select.

To set the print length of a snapshot:

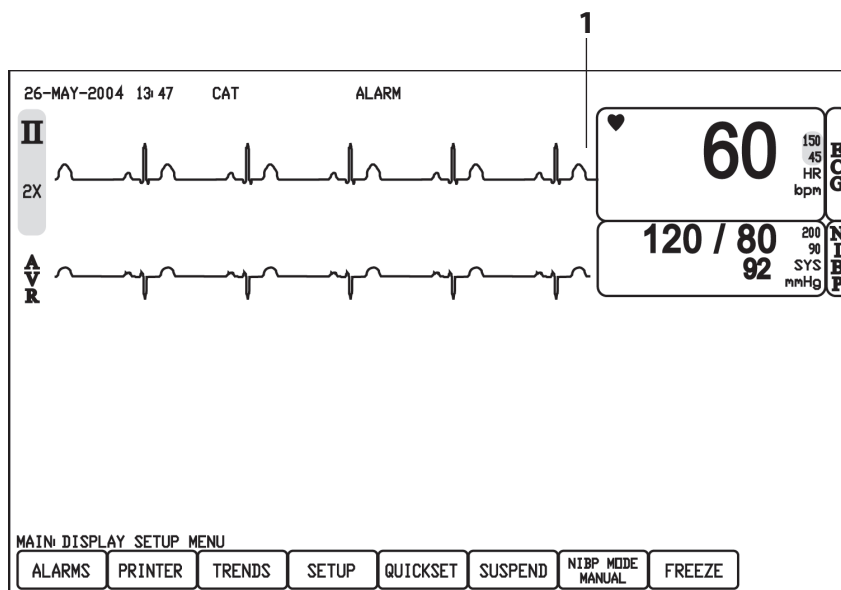
1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight PRINTER and push the knob to access the printer menu.
2. Highlight SNAPSHOT and push the knob to select.
3. Highlight the desired print length (200 or 300 mm) and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

Printing Waveforms

You can print a waveform for any parameter that has a measured value that can be traced as a waveform. Waveforms can be printed as snapshots or as continuous, real-time strips. A snapshot is a 200 or 300 millimeter (mm) segment of the waveform captured at the moment you select the print command. You can print a snapshot of a single parameter's waveform or a report that includes a number of selected waveform snapshots. You can print a continuous real-time strip of a single waveform.

On a printed strip, annotation lines are repeated every 200-300 millimeters (8-12 inches). The annotation line contains time and date information, paper speed, printout delay, and other parameter data. The printout delay ensures that the event that triggered the snapshot is captured on the printout. In the annotation line in Figure 7.2, the delay is four seconds (delay = 4). This means that the waveform data on the printout began four seconds earlier than the waveform on the display reached the right edge.

Figure 7.1: Printout Delay



- 1) **The printout delay ensures that the waveform printed on the snapshot starts before the waveform reaches the right edge of the display.**

To print a snapshot of a single parameter's waveform:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the desired waveform label on the left side of the display. Or, highlight the related parameter box name on the right side of the display. Push the knob to access either the waveform menu or the parameter menu in the lower left corner of the display.
2. Highlight PRINT SNAPSHOT and push the knob to select. To stop printing, press the PRINT () key on the monitor.

To print a report of selected waveform snapshots:

1. Be sure you have chosen which waveforms will be included in the report.

To choose the waveforms:

- a. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
 - b. Turn the rotary knob to highlight PRINT ALL REPORT and push the knob to access the print all report submenu.
 - c. Turn the rotary knob to highlight WAVEFORM 2, WAVEFORM 3, or WAVEFORM 4 and push the knob to select. You cannot change WAVEFORM 1; it must remain set to Primary ECG.
 - d. Turn the rotary knob to highlight the desired source of the printed waveform (OFF, I, III, CO2, SPO2, IBP1, OR IBP2). The available sources will vary, depending on the parameters installed on your monitor. Push the knob to select.
 - e. Turn the rotary knob to highlight MAIN or PREVIOUS and push the knob to select.
2. Press the PRINT key () on the monitor. To stop printing, press the key again.

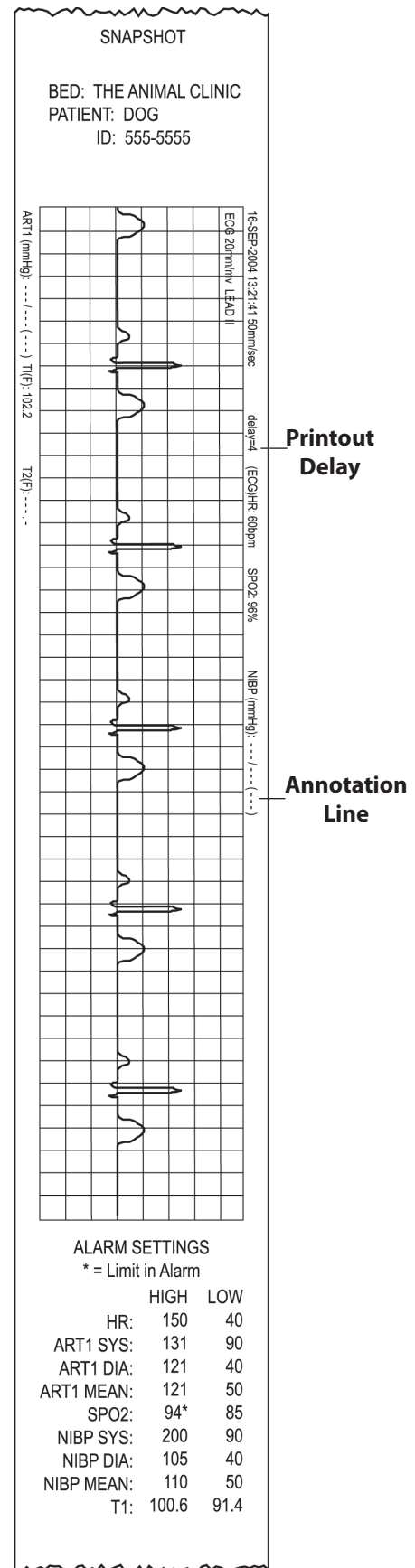


Figure 7.2: Print Snapshot

To print a continuous strip of a single waveform:

- 1. Turn the rotary knob on the monitor to move the cursor. Highlight the desired waveform label on the left side of the display. Or, highlight the related parameter box name on the right side of the display. Push the knob to access either the waveform menu or the parameter menu in the lower left corner of the display.
- 2. Highlight PRINT STRIP and push the knob to select. To stop printing, press the PRINT key (⏏) on the monitor. To print a continuous, real-time strip chart of the primary ECG, press and hold the PRINT key (⏏) for 3 seconds.

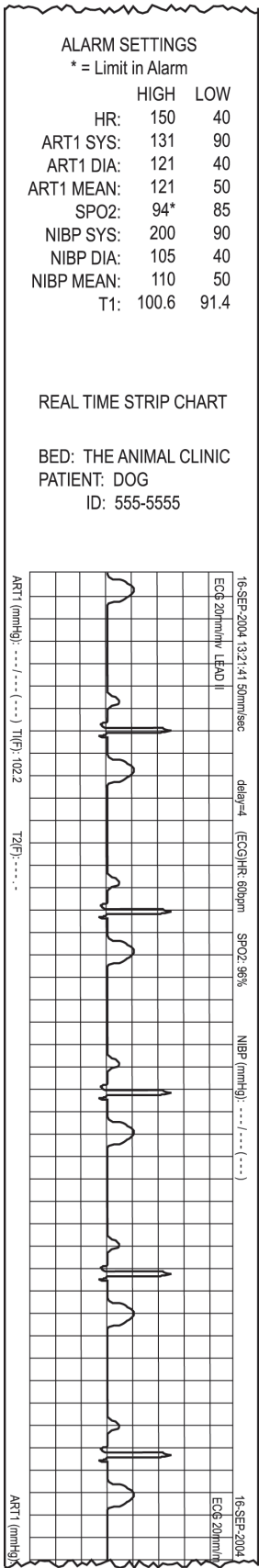


Figure 7.3: Print Strip

Printing Tabular Trend Data (Trends)

The monitor stores tabular trend data every 30 seconds for up to 26 hours. You can print all of the trend data or just a segment of the stored numeric measured values.

To print all the stored tabular trend data:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight TRENDS and push the knob to select.
2. Highlight TABULAR VITAL SIGNS and push the knob to access the vital signs menu.
3. Highlight PRINT ALL TRENDS and push the knob to select.
4. Turn the rotary knob to choose YES and push the knob to select. To stop printing, press the PRINT key () on the monitor.

To print a segment of the stored tabular trend data:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight TRENDS and push the knob to select.
 2. Highlight TABULAR VITAL SIGNS and push the knob to access the vital signs menu.
 3. Highlight PRINT REPORT and push the knob to access the printing submenu.
 4. Choose the time segment of stored trend data that you want to print. Note that the trend report begins at the later or more recent hour and minute and prints backward in time so that the printed segment ends at the earlier hour and minute.
 - For example, if you want to print the segment of trend data that was stored between 10:06 and 11:06, choose a start hour of 11:06 and a length of one hour.
- a. Turn the rotary knob to highlight START HOUR and push the knob to select.
 - b. Turn the rotary knob to choose the latest or most recent hour in the segment of stored trend data that you want to print (11 in the previous example) and push the knob to select. Choose the hour as it is displayed in the vital signs box, based on the 24-hour clock
 - c. Turn the rotary knob to highlight START MINUTE and push the knob to select.
 - d. Turn the rotary knob to choose the latest minute of stored trend data to be printed (06 in the previous example) and push the knob to select. Choose the minutes as they are displayed in the vital signs box.

LONG TREND TABLE									
Date: 09/15/2004									
Time: 11:07:15									
Bed: The Animal Clinic									
Patient: Dog									
ID: 555-5555									
Interval: 1 min									
Sample Time	HR bpm	RSP	AR1 mmHg SYS/DIA/Mean	CV2 mmHg SYS/DIA/Mean	NIBP mmHg SYS/DIA/Mean	SPO2 %	PPR bpm	TMPI C	TMPI C
11:06	80	30	120/ 80 96	12	110/ 83 95	98	79	36.9	33.9
11:05	80	29	120/ 80 96	12		98	79	36.9	33.9
11:04	80	29	120/ 80 96	12		98	79	36.9	33.9
11:03	80	29	120/ 80 96	12		98	79	36.9	33.9
11:02	80	30	120/ 80 96	12		98	79	36.9	33.9
11:01	80	29	120/ 80 96	12		98	79	36.9	33.9
11:00	80	30	120/ 80 96	12		98	79	36.9	33.9
10:59	80	29	120/ 80 96	12		98	79	36.9	33.9
10:58	80	29	120/ 80 96	12	122/ 78 99	98	79	36.9	33.9
10:57	80	30	120/ 80 96	12		98	79	36.9	33.9

Figure 7.4: Print Tabular Trend Data

5. Highlight INTERVAL and push the knob to select.
6. Turn the rotary knob to choose the amount of time (30 seconds, or 1, 5, 10, 15, or 30 minutes) between printed measured values and push the knob to select.
7. Highlight LENGTH and push the knob to select.
8. Turn the rotary knob to choose the length of the segment to print (1-24 hours) and push the knob to select.
9. Highlight PRINT and push the knob to select.
10. Turn the rotary knob to choose YES and push the knob to select. To stop printing, press the PRINT key (🖨️) on the monitor.
11. Highlight MAIN or PREVIOUS and push the knob to select.

The monitor stores up to 150 non-invasive blood pressure (NIBP) readings.

To print all the stored NIBP readings:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight TRENDS and push the knob to select.
2. Highlight NIBP HISTORY and push the knob to access the NIBP history box.
3. Highlight PRINT ALL NIBP HISTORY and push the knob to select.
4. Turn the rotary knob to choose YES and push the knob to select. To stop printing, press the PRINT key (🖨️) on the monitor.

To print a selected range of NIBP readings:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight TRENDS and push the knob to select.
2. Highlight NIBP HISTORY and push the knob to access the NIBP history box.
3. Turn the rotary knob to highlight SCROLL ⬆️ ⬆️ and push the knob to select.
4. Turn the rotary knob and the trend data will scroll up and down in the NIBP history box. When the desired range of NIBP readings is displayed in the NIBP history box, push the rotary knob to return to the NIBP history menu.
5. Highlight PRINT WINDOW and push the knob to access the printing submenu.
6. Turn the rotary knob to choose YES and push the knob to select. To stop printing, press the PRINT key (🖨️) on the monitor.
7. Highlight MAIN or PREVIOUS and push the knob to select.

NIBP LOG HISTORY					
Date: 09/18/2004					
Time: 10:45:05					
Bed: THE ANIMAL CLINIC					
Patient: DOG					
ID: 555-5555					
Sample	Time	SPO2	HR	SYS/DIA	MAP
	10:44:34	98	83	124/	92 104
	10:43:17	98	84	111/	80 93
	10:41:01	98	87	124/	80 101
	10:39:07	98	81	124/	83 102

Figure 7.5: Print NIBP History

Automatic Printing

You can set the Advisor® Vital Signs Monitor to print automatically, either at preset intervals or when an alarm occurs. The monitor can automatically print a snapshot of a parameter's waveform whenever an alarm limit is violated. If a measured value such as temperature cannot be traced in a waveform, the ECG waveform will be printed instead. The monitor can automatically print a non-invasive blood pressure history as soon as an NIBP reading is taken. You can also set your monitor to print patient data at regular intervals.

If the printer is in use printing a snapshot and the monitor initiates an automatic print job, the snapshot will complete and then the automatic print job will begin. If the printer is printing a continuous real-time strip and the monitor initiates an automatic print job, the continuous strip will be interrupted, the automatic print job will print, and then the strip will start again. If the printer is printing tabular trend data or NIBP history and the monitor initiates an automatic print job, the trend data or NIBP history printout will be paused, the automatic print job will print, and then the trend data or NIBP history printout will resume. If the printer is printing an automatic snapshot of an alarming parameter, and the monitor initiates another automatic print job, the first snapshot will complete and then the second will begin. If several alarms occur in close succession, only the first snapshot and the snapshot of the last alarm to occur will print; the monitor cannot store in memory more than the current print job, and the most recent.

To set the monitor to automatically print a snapshot of a parameter in alarm:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight PRINTER and push the knob to select.
2. Highlight AUTO PRINT ALARMS and push the knob to select.
3. Turn the rotary knob to choose ON and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

To set the monitor to automatically print NIBP history as soon as a reading is taken:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight Printer and push the knob to select.
2. Highlight AUTO PRINT NIBP HISTORY and push the knob to select.
3. Turn the rotary knob to choose ON and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

To set the monitor to automatically print all numeric measured values at a preset interval:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight PRINTER and push the knob to select.
2. Highlight DATA LOG INTERVAL and push the knob to select.
3. Turn the rotary knob to choose the number of minutes (1, 2, 5, 10, 15, or 30) that should elapse between print jobs and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

Replacing the Printer Paper

A colored strip appears on the printer paper when the paper roll is almost empty. Only use exact replacement printer paper. See *Chapter 16: Optional Supplies and Accessories* for ordering information. Using any other printer paper may produce undesirable results or may damage the printer.

To replace the printer paper:

1. Open the printer door on the right side of the printer.
2. Gently pull the door down until it is completely open.
3. Grip the empty paper roll and gently but firmly pull it toward you. The empty roll should easily come out.

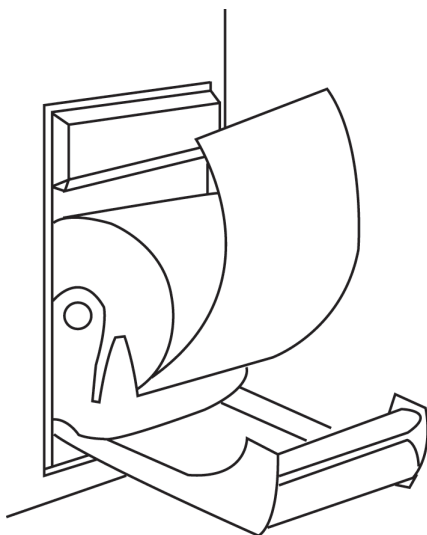


Figure 7.7: Inset New Paper

4. Insert a new paper roll into the paper carrier. The paper should come out from the bottom of the roll. The new roll should snap into place.

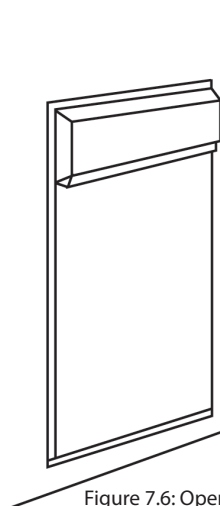


Figure 7.6: Open Printer Door

5. Unroll about 10 centimeters (four inches) of paper, then push the paper carrier door up until it locks into the printer housing.

The printer is now ready to print.

NOTE! If no print appears on the paper after changing, the printer paper may be installed in the wrong direction. The printer will only print on one side of the printer paper. Make sure the printer paper is coming out from the bottom of the roll

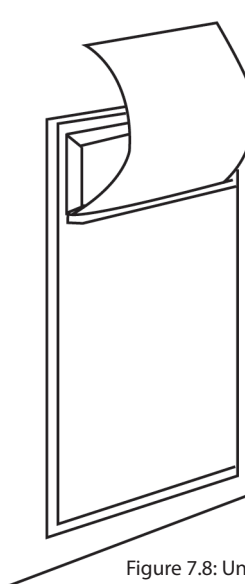


Figure 7.8: Unroll Paper and Close Printer Door

Chapter 8: ECG

ECG Measurement Capability

The Advisor® Vital Signs Monitor provides continuous three-lead and five-lead ECG processing with standard lead selections and filtering from electrocautery discharge. The heart rate measured value (HR) and primary lead messages are displayed in the ECG parameter box, and a waveform for the primary ECG lead is continuously displayed.

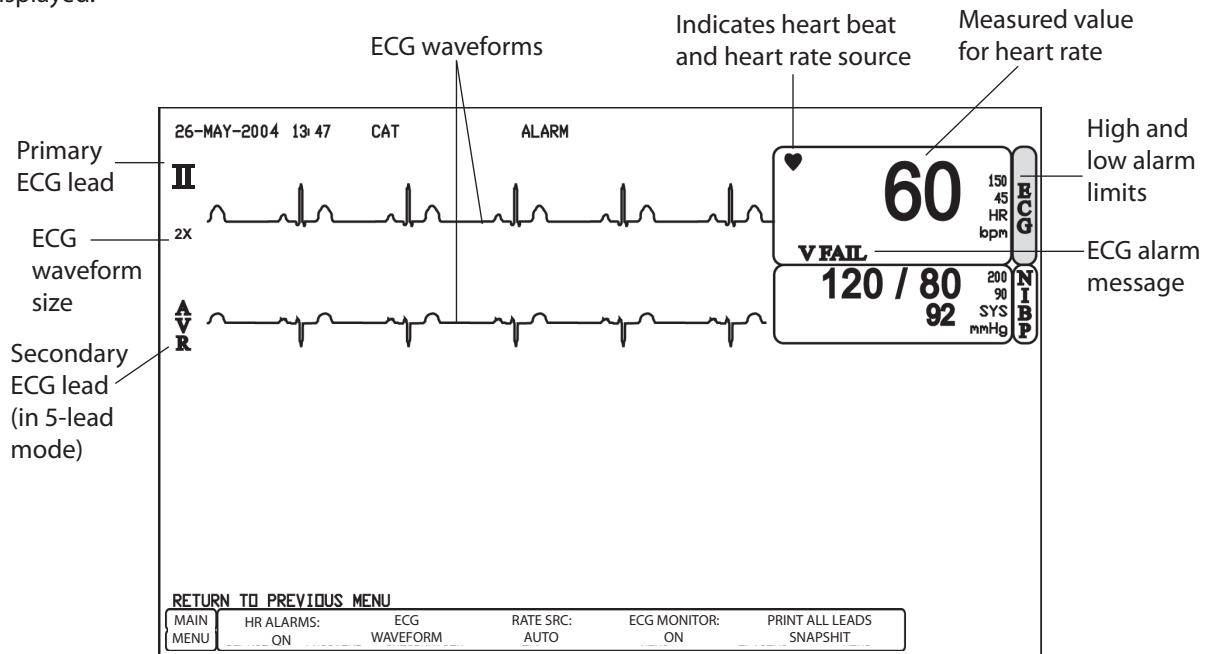


Figure 8.1: ECG Display

ECG Warnings, Cautions, and Notes

WARNING! Connect only three-lead or five-lead ECG lead wires from the patient to the ECG patient cable. Do not connect any other signal source to the ECG patient cable.

WARNING! This monitor does not identify or interpret arrhythmia events. The indication of heart rate may be adversely affected by the presence of cardiac arrhythmias.

CAUTION! A three-lead ECG cable must be used if 3-Lead processing is selected. A five-lead ECG cable must be used if 5-Lead processing is selected. Using the incorrect cable for the selected mode might lead to a floating reference or additional noise on the ECG signal.

NOTE! Follow institutional standards when applying ECG electrodes. Silver/Silver Chloride disposable electrodes are strongly recommended to avoid polarization effects that result in large input offset potentials. Use of "squeeze bulb" type electrodes is not recommended.

NOTE! Use only standard AAMI three-lead or five-lead ECG cables.

NOTE! Line isolation monitor transients may resemble actual cardiac waveforms and thus inhibit heart rate alarms.

Theory of Operation

Electrical currents influenced by the cardiac impulse flow through the body tissue around the heart. Three or five electrodes, placed on the skin on opposite sides of the heart, transmit the electrical potentials to circuitry in the monitor.

The monitor's ECG circuitry amplifies, filters, and digitizes (converts analog signals to digital signals) the received electrical potentials. The digitized signals are used to display the ECG waveform and calculate the ECG heart rate.

Using the ECG Parameter

This chapter includes information specific to the ECG parameter. Refer to chapters 4-7 for general step-by-step monitoring instructions. The remainder of this chapter assumes that the monitor is properly installed and set up.

Attaching the Patient

NOTE! Follow institutional standards when applying ECG electrodes.

NOTE! The ECG cable uses a standard AAMI three-lead or five-lead ECG connector. Use only standard AAMI three-lead or five-lead ECG wires.

NOTE! The monitor is protected against damage from defibrillator, diathermy, and electrocautery discharge.

NOTE! Ensure the ECG LEADS PROCESSING setting in the SETUP menu under PARAMETER OPTIONS is correct for the type of ECG cable being used.

1. Choose 3-lead or 5-lead ECG processing:
 - a. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
 - b. Highlight PARAMETER OPTIONS and push the knob to access the parameter options submenu.
 - c. Highlight ECG LEADS PROCESSING and push the knob to select.
 - d. Highlight 3-lead or 5-lead and push the knob to select.

CAUTION! A three-lead ECG cable must be used if 3-Lead processing is selected. A five-lead ECG cable must be used if 5-Lead processing is selected. Using the incorrect cable for the selected mode might lead to a floating reference or additional noise on the ECG signal.

- e. Highlight MAIN or PREVIOUS and push the knob to select.
2. Make sure that the alligator clips and banana plugs on the ECG leads are thoroughly cleaned and dry before attaching to the patient. If the alligator clip and the banana plugs are dirty, ECG signal quality may be compromised.
3. Connect the ECG cable to the monitor. Align the key on the monitor's ECG receptacle with the notch in the ECG connector and push the connector firmly into the receptacle.

NOTE! To remove the ECG cable, grip the connector and pull back firmly. DO NOT pull on the ECG cable to remove the ECG connector from the monitor.

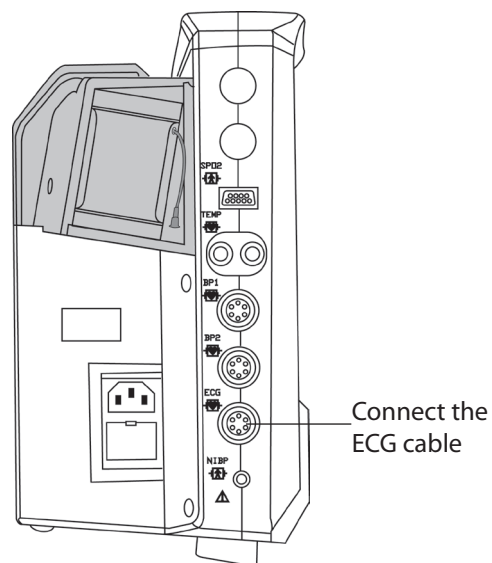
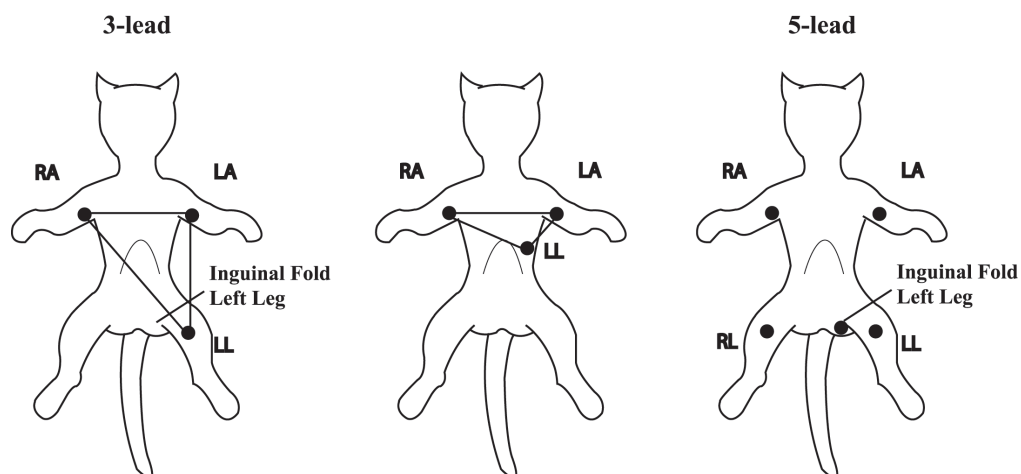


Figure 8.2: Connect the ECG Cable

4. To attach the ECG leads to the patient, position three or five alligator clips in the standard configuration.

WARNING! Electrodes of dissimilar metals should not be used.

Figure 8.3: Position the ECG Leads



5. Be sure that the leads are in the correct ECG cable position. The ECG leads and patient cable connector are color-coded according to the AAMI standard for ECG leads.

CAUTION! Ensure conductive parts, including electrodes of the patient cable, do not come into contact with any conductive surfaces or earth parts.

ECG 3-LEAD ELECTRODE IDENTIFICATION		
Electrode Label	Location	Color
RA	Right Arm	White
LA	Left Arm	Black
LL	Left Leg	Red

ECG 5-LEAD ELECTRODE IDENTIFICATION		
Electrode Label	Location	Color
RA	Right Arm	White
RL	Right Leg	Green
LA	Left Arm	Black
LL	Left Leg	Red
V	4th Intercostal Space (left)	Brown

The monitor will automatically detect when the ECG cable is connected. Heart rate (HR) will be displayed in the ECG parameter box and the primary ECG waveform will appear as Waveform 1.

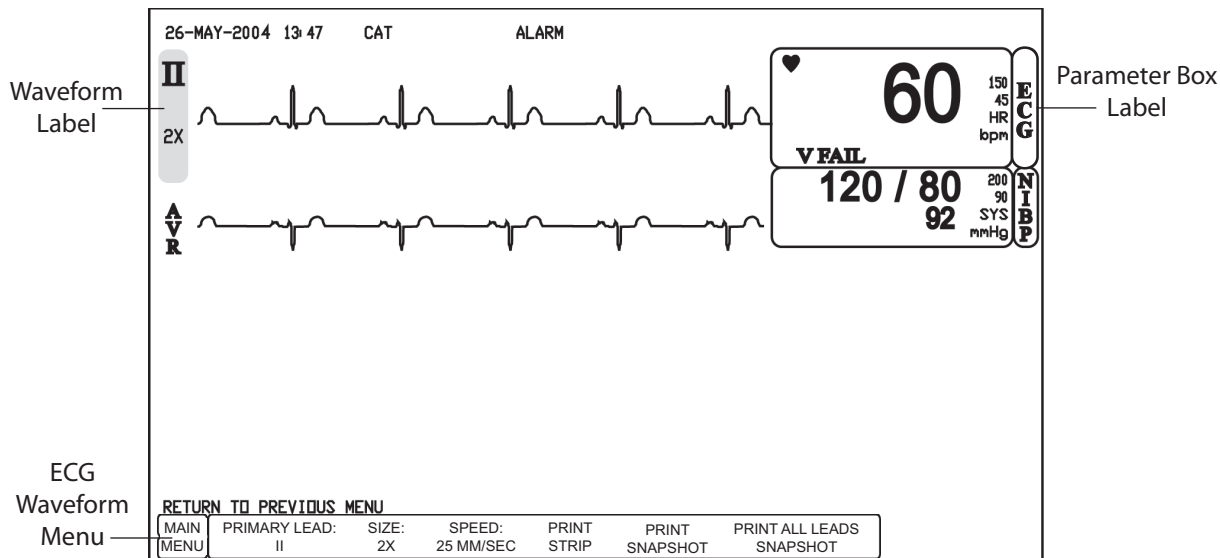
Choosing the Waveform Settings

Use the ECG waveform menu options to choose the primary ECG lead and adjust the settings for the size and speed of the ECG waveform.

Access the Waveform Menu

The ECG waveform menu is accessible from any ECG waveform label or from the ECG parameter box name.

Figure 8.4: ECG Display



To access the ECG waveform menu from the waveform label:

1. Turn the rotary knob on the monitor to move the cursor.
2. Highlight the waveform label for Waveform 1 and push the knob to select. The ECG waveform menu will appear in the lower left corner of the display.

To access the ECG waveform menu from the ECG parameter box:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the ECG parameter name and push the knob to select. The ECG parameter menu will appear in the lower left corner of the display.
2. Turn the rotary knob to highlight ECG WAVEFORM and push the knob to select. The ECG waveform settings submenu will appear.

Change the Primary ECG Lead

Waveform 1 is dedicated to the primary ECG lead. For both three-lead and five-lead processing, lead II is the default primary lead. You can designate any other lead to be the primary using the ECG waveform menu. The selected primary lead will be displayed in the waveform label.

To change the primary lead:

1. On the ECG waveform menu, highlight PRIMARY LEAD and push the knob to access the ECG leads IDs submenu.
2. Highlight the desired primary ECG lead and push the knob to select. See the following tables for the primary lead configuration.

ECG 3-LEAD CONFIGURATION		
I	Lead I Configuration	RA - LA
II	Lead II Configuration	RA - LL
III	Lead III Configuration	LA - LL

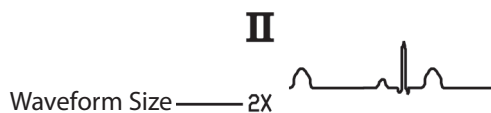
ECG 5-LEAD CONFIGURATION		
I	Lead I Configuration	RA - LA
II	Lead II Configuration	RA - LL
III	Lead III Configuration	LA - LL
V	Lead V Configuration	LA - V
AVF	Augmented Lead AVF	
AVL	Augmented Lead AVL	
AVR	Augmented Lead AVR	

3. Highlight MAIN or PREVIOUS and push the knob to select.

Choose the Waveform Size

You can choose the size of the ECG waveforms on the display. The selected size (0.5X, 1X, 2X, or 4X) will appear in the waveform label. The default size is times one (1X).

Figure 8.5: ECG Waveform Size



To change the size of the ECG waveform:

1. On the ECG waveform menu, highlight SIZE and push the knob to select.
2. Highlight the desired size of the waveform (0.5X, 1X, 2X, or 4X) and push the knob to select.

SIZE	SCALE
0.5X	+/- 5 mV
1X	+/- 2.5 mV
2X	+/- 1.25 mV
4X	+/- .0625 mV

3. Highlight MAIN MENU and push the knob to select.

Choose the Waveform Speed

You can choose the speed at which the ECG waveform is updated.

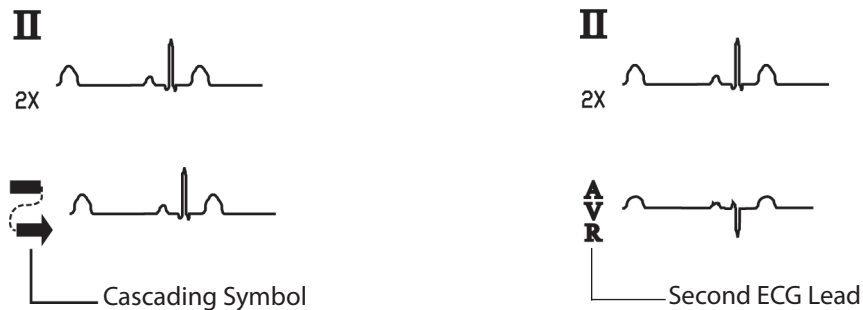
To change the speed of the ECG waveform:

1. On the ECG waveform menu, highlight SPEED and push the knob to select.
2. Highlight the desired speed of the waveform (6.25, 12.5, 25, or 50 mm/second) and push the knob to select.
3. Highlight MAIN MENU and push the knob to select.

Use Waveforms 2-4 to Display ECG

Waveforms 2, 3, and 4 can be used to display ECG waveforms as well. For three-lead processing, you can cascade or continue the waveform of the primary ECG lead into each successive waveform area. For five-lead processing, you can designate a second lead to display as an ECG waveform or you can cascade the primary lead from Waveform 1. If you choose a second ECG waveform, the selected lead will be displayed in the waveform label. If you choose to cascade from Waveform 1, a cascading symbol will be displayed in the waveform label.

Figure 8.6: Display ECG



To cascade the ECG waveform from the previous waveform area:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the label for the desired waveform and push the knob to access the waveform menu.
2. Highlight WAVEFORM and push the knob to access the parameter waveforms submenu.
3. Highlight CASCADE and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

To choose a second lead to display as an ECG waveform (for five-lead processing only):

1. Highlight the label for the desired waveform and push the knob to access the waveform menu.
2. Highlight WAVEFORM and push the knob to access the parameter waveforms submenu.
3. Highlight the desired lead (I, II, III, V, AVF, AVL, or AVR) and push the knob to select. I, II (the default primary lead), III, and V (the default second lead) are simultaneously acquired and analyzed; the augmented leads, aVR, aVF, and aVL are calculated.
4. Highlight MAIN MENU and push the knob to select.

Adjusting the Settings in the Parameter Box

Turn Alarm Detection On or Off

You can turn on or off the alarm detection capability for the heart rate value. If HR ALARMS is on, an alarm will be issued when the high or low alarm limit is violated. If you turn HR ALARMS off and the high or low alarm limit is violated, an alarm will not be issued. When you turn off the monitor and turn it on again, HR ALARMS will be reset to ON; the default setting is ON. See *Choose the Heart Rate Source* in this chapter for information regarding the source of the measured value for heart rate.

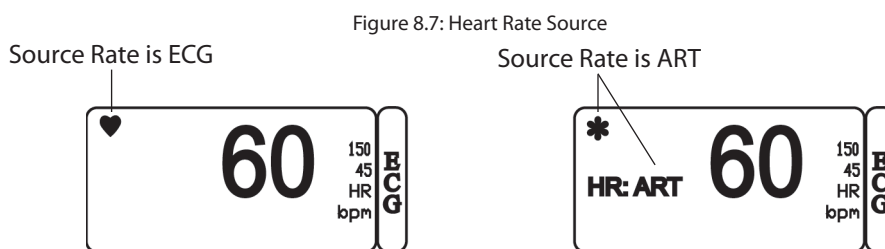
To turn on or off the heart rate alarm detection:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the ECG parameter box name and push the knob to access the ECG parameter menu.
2. Highlight HR ALARMS and push the knob to select.
3. Choose ON or OFF and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

Choose the Heart Rate Source

The Advisor® Vital Signs Monitor can measure the heart/pulse rate using three different parameters: ECG, oximetry (SPO₂), and arterial invasive blood pressure (ART). Regardless of the source, the measured value for heart rate can be continuously displayed in the ECG box. You can choose the source (AUTO, ECG, SPO₂, or ART) of the heart/pulse rate displayed. The default setting is AUTO.

If you choose ECG, a small heart (♥) will flash in the ECG parameter box at the detection of each QRS complex in the waveform. If you choose SPO₂ or ART as the source, an asterisk (*) and a label identifying the source will be displayed in the ECG parameter box at the detection of a pulse.



If you choose AUTO, the monitor will determine the best source depending on the quality of available data and the following source priority:

- a. If ECG MONITOR is turned on using the ECG parameter menu, the ECG cable is connected to the monitor, and the ECG reading is valid, then ECG will be the heart rate source.
- b. If ECG MONITOR is turned off or the signal is otherwise undetected, an oximetry cable (SPO₂) is connected to the monitor, and the SPO₂ reading is valid, then SPO₂ will be the heart rate source.
- c. If ECG MONITOR is turned off or the signal is otherwise undetected, SPO₂ is undetected, an invasive blood pressure (IBP1 or IBP2) cable is connected to the monitor, the site is set to ART1 or ART2, and the reading is valid, then ART will be the heart rate source.

To choose the source of the heart rate displayed in the ECG parameter box:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the ECG parameter box name and push the knob to access the ECG parameter menu.
2. Highlight RATE SRC and push the knob to select.
3. Choose the desired source of the measured value for heart rate (AUTO, ECG, SPO₂, or ART) and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

Adjust the Volume of the Heartbeat Beep Tone

You can set the monitor to issue a beep tone with each detected heartbeat. You can control the volume of the beep tone, or turn it off. If the SPO₂ reading is valid, the pitch of the beep tone will vary depending on changes in oxygen saturation. When SPO₂ increases, the pitch increases; when SPO₂ decreases, the pitch decreases.

To adjust the volume of the pulse beep:

1. Turn the rotary knob on monitor to move cursor. Highlight SETUP in main menu and push the knob to select. Move the cursor and highlight PARAMETER OPTIONS. Push the knob to select.
2. In the PARAMETER OPTIONS menu, highlight PULSE VOL and push the knob to select.
3. Turn the rotary knob to increase or decrease the volume to the desired level and push the knob to select. A momentary beep tone will sound at each new level of volume. The lowest volume option is OFF.
4. Highlight MAIN MENU and push the knob to select.

ECG and Heart Rate Alarms

An ECG alarm will be issued when an expected ECG signal is not detected, or when there is a malfunction with any of the ECG leads. A heart rate/pulse rate alarm will be issued when the numeric measured value for heart rate matches or exceeds the alarm limits set for heart rate. See *Set the Alarm Limits* in *Chapter 5: Monitoring the Patient* for instructions for setting high and low alarm limits.

During an alarm, an audible alarm tone will sound and ALARM will appear in the alarm status line at the top of the display. In the ECG parameter box, a message may be displayed describing the alarm condition and, when applicable, the violating measured value and violated alarm limit will flash.

ECG alarms are categorized as high priority, medium priority, or low priority.

ALARM CONDITION	INDICATION
HIGH HR	Audible high priority alarm; flashing red heart rate value in the ECG parameter box
LOW HR	Audible high priority alarm; flashing red heart rate value in the ECG parameter box
ASYSTOLE	Audible high priority alarm; flashing red message in the ECG parameter box
COM ERROR	Audible medium priority alarm; flashing yellow message in the ECG parameter box
LEADS FAIL	Audible medium priority alarm; flashing yellow message in the ECG parameter box
LA FAIL	Audible low priority alarm; message in the ECG parameter box
RA FAIL	Audible low priority alarm; message in the ECG parameter box
LL FAIL	Audible low priority alarm; message in the ECG parameter box
V FAIL	Audible low priority alarm; message in the ECG parameter box

ECG Alarm Messages

The messages are listed below in order of their display priority.

NOTE! If more than one ECG alarm condition occurs simultaneously and the alarm reset mode is set to MANUAL, the highest-priority message is displayed in the ECG parameter box. However, if an ASYSTOLE alarm is issued and then another, lower priority ECG alarm occurs, the ASYSTOLE message and the other alarm message will alternately be displayed in the parameter box.

ASYSTOLE

This message flashes in red in the ECG parameter box when all leads are connected to the patient, ECG MONITOR is on, and no QRS signal is detected within a six second period. This is a high priority alarm. If a QRS signal is again detected and RESET ALARMS is set to MANUAL on the service menu, the ASYSTOLE alarm will continue until you press the alarm silence key (Ⓢ). This message may cycle or alternate with other alarm messages.

NOTE! ASYSTOLE always triggers a high priority alarm, even if ECG is not the rate source.

COM ERROR

This message is displayed in the ECG parameter box when the monitor detects an unrecoverable error within the ECG circuitry. The message will appear in yellow unless a high priority alarm occurs. During a COM ERROR, no ECG waveforms or measured values for heart rate are available. This is a medium priority alarm.

LEADS FAIL

This message is displayed in the ECG parameter box when any lead fails during three-lead processing, when the RL lead fails, or when any two of the LA, RA, or LL leads fail during five-lead processing. The message will appear in yellow unless a high priority alarm occurs. This is a medium priority alarm.

To correct:

- Be sure that all the leads are properly positioned and connected.
- Turn off ECG MONITOR, and then turn it on again.
 - a. Turn the rotary knob on the monitor to move the cursor. Highlight the ECG parameter box name and push the knob to access the ECG parameter menu.
 - b. Highlight ECG MONITOR and push the knob to select.
 - c. Highlight OFF and push the knob to select.
 - d. Turn the rotary knob on the monitor to highlight ON and push the knob to select.
 - e. Turn the rotary knob to highlight MAIN MENU and push the knob to select.
- If the alarm condition persists, turn off the monitor, and then turn it on again.
 - a. Press the On/Off key (Ⓢ) on the front of the monitor. A message will be displayed indicating that if you continue to power down, some configuration data will be lost.
 - b. Press the key again to turn off the monitor.
 - c. Press the key once more to turn on the monitor.

If condition persists, please contact your authorized repair center for help.

RA FAIL

This message is displayed in the ECG parameter box when either the RA lead fails, or the RA and V leads fail during 5-lead processing. During an RA FAIL alarm, lead III is displayed in Waveform 1. All other ECG waveforms are erased. This is a low priority alarm.

LA FAIL

This message is displayed in the ECG parameter box when either the LA lead fails, or the LA and V leads fail during 5-lead processing. During an LA FAIL alarm, only lead II is displayed in Waveform 1. All other ECG waveforms are erased. This is a low priority alarm.

LL FAIL

This message is displayed in the ECG parameter box when either the LL lead fails, or the LL and V leads fail during 5-lead processing. During an LL FAIL alarm, lead I is displayed in Waveform 1. All other ECG waveforms are erased. This is a low priority alarm.

V FAIL

This message is displayed in the ECG parameter box when the V lead fails during 5-lead processing. If the V lead is the primary ECG lead during a V FAIL alarm, lead II will become the primary ECG lead and will be displayed in Waveform 1. All other leads remain available. This is a low priority alarm.

LEADS OVERLOAD

This message is displayed in the ECG parameter box when there is a high impedance in the ECG cable or on more than one of the ECG leads.

To correct:

- Be sure that all the leads are properly positioned and connected.
- Turn off ECG MONITOR, and then turn it on again.
 - a. Turn the rotary knob on the monitor to move the cursor. Highlight the ECG parameter box name and push the knob to access the ECG parameter menu.
 - b. Highlight ECG MONITOR and push the knob to select.
 - c. Highlight OFF and push the knob to select.
 - d. Turn the rotary knob on the monitor to highlight ON and push the knob to select.
 - e. Highlight MAIN MENU and push the knob to select.
- If the alarm condition persists, turn off the monitor, and then turn it on again.
 - a. Press the On/Off key ($\odot/\circ$) on the front of the monitor. A message will be displayed indicating that if you continue to power down, some configuration data will be lost.
 - b. Press the key again to turn off the monitor.
 - c. Press the key once more to turn on the monitor.

If condition persists, contact your authorized repair center for help.

LEAD I OVERLOAD

This message is displayed in the ECG parameter box when there is a high impedance on lead I.

LEAD II OVERLOAD

This message is displayed in the ECG parameter box when there is a high impedance on lead II.

LEAD III OVERLOAD

This message is displayed in the ECG parameter box when there is a high impedance on lead III.

LEAD V OVERLOAD

This message is displayed in the ECG parameter box when there is a high impedance on lead V.

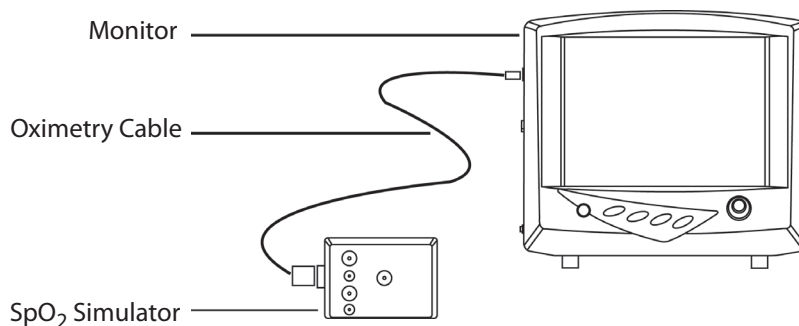
ECG DISABLED

This message is displayed in the ECG parameter box when ECG MONITOR is set to off using the ECG parameter menu.

Verifying ECG Calibration

Verify the calibration of the ECG parameter if doubt exists about the accuracy of measured values.

Figure 8.8: Verify ECG Calibration



You will need:

- Advisor® Vital Signs Monitor
- SurgiVet® 1606 SpO₂ /ECG Patient Simulator
- SurgiVet® 3311 Oximetry Cable
- 3 or 5 lead set (V3110 or V3406)

To verify that the ECG parameter is calibrated:

1. Disconnect all cables and sensors from the monitor.
2. Press the On/Off key (⏻) on the front of the monitor to turn it on.

3. Set RATE SOURCE to ECG.
 - a. Turn the rotary knob on the monitor to move the cursor. Highlight the ECG parameter box name and push the knob to access the ECG parameter menu.
 - b. Highlight RATE SRC and push the knob to select.
 - c. Choose ECG and push the knob to select.
 - d. Highlight MAIN MENU and push the knob to select.
4. Select 3-LEAD ECG processing:
 - a. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
 - b. Highlight PARAMETER OPTIONS and push the knob to access the parameter options submenu.
 - c. Highlight ECG LEADS PROCESSING and push the knob to select.
 - d. Highlight 3-lead and push the knob to select.
 - e. Highlight MAIN or PREVIOUS and push the knob to select.
5. Connect the SurgiVet® 3311 Oximetry Cable to the SurgiVet® 1606 SpO₂ /ECG Patient Simulator.
6. Connect the oximetry cable to the oximetry connector (SPO₂) on the side of the monitor.
 - a. The simulator will automatically turn on and the Pulse LED will flash to indicate that it is operating.
 - b. A measured value of 97-99 % SpO₂ should be displayed in the SPO₂ parameter box, and a measured value of 79-81 beats per minute (bpm) should be displayed in the SPO₂ parameter box.
 - c. If the Pulse LED does not light or if the measured values in the SPO₂ parameter box are incorrect, replace the 9V transistor battery in the simulator.
7. Connect the RA, LA, and LL leads to the simulator.
8. Connect the ECG cable to the monitor. A simulated ECG waveform should appear in Waveform 1.
9. Press and hold the SpO₂ OFF button on the simulator to momentarily disable the oximetry reading.
10. If the ECG parameter is functioning properly an ECG waveform will be displayed and a measured value for heart rate of 79-81 beats per minute (bpm) will appear in the ECG parameter box.
 - You can remove any one of the ECG leads from the simulator to verify that the LEADS FAIL alarm is reliable.

- You can change the primary ECG lead (to I, II, or III) to verify that each waveform is accurately displayed.
 - a. On the ECG waveform menu, turn the rotary knob to highlight PRIMARY LEAD and push the knob to access the ECG leads IDs submenu.
 - b. Highlight the desired primary ECG lead and push the knob to select. See the following tables for the primary lead configuration.

ECG 3-LEAD CONFIGURATION		
I	Lead I Configuration	RA - LA
II	Lead II Configuration	RA - LL
III	Lead III Configuration	LA - LL

- c. Highlight MAIN or PREVIOUS and push the knob to select.
- 11. Disconnect the simulator from the monitor. The simulator will automatically turn off.

ECG Technical Data

See the Appendix A for technical information about the ECG parameter.

Chapter 9: Oximetry

Using the Oximetry Parameter

This chapter includes information specific to the Oximetry parameter. Refer to chapters 4-7 for general step-by-step monitoring instructions. The remainder of this chapter assumes that the monitor is properly installed and set up.

Oximetry Measurement Capability

The oximetry parameter provides the continuous non-invasive monitoring of oxygen saturation (%SpO₂) in the blood and peripheral pulse rate (PPR). The measured values for oximetry (%SpO₂ and PPR) and a pulse strength bar graph are displayed in the SpO₂ parameter box. A plethysmogram, or oxygen saturation waveform can be continuously displayed. A variety of reusable sensors is available for monitoring patients.

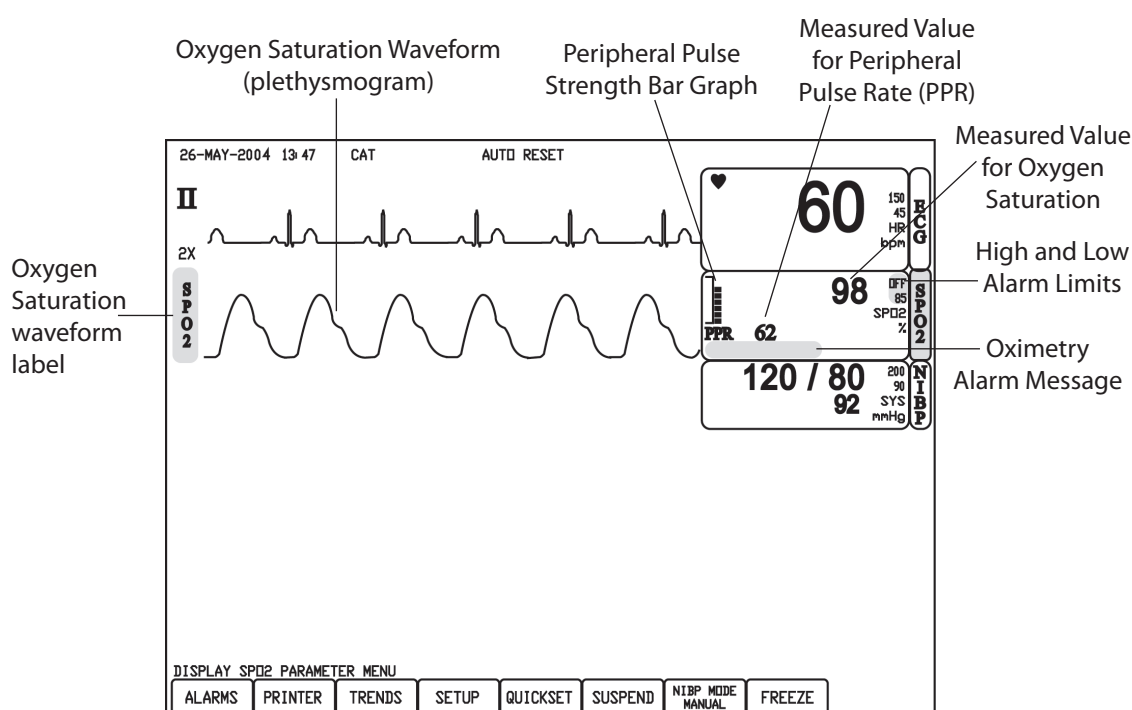


Figure 9.1: Oximetry Display

Oximetry Warnings, Cautions, and Notes

WARNING! Prolonged use or the patient's condition may require changing the sensor site periodically. Change the 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 patient's skin (lack of skin respiration, not heat, causes the blisters).

WARNING! Using a damaged sensor may cause inaccurate readings, possibly resulting in patient injury or death. 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 patient cable may cause inaccurate readings, possibly resulting in patient injury or death. Inspect the patient cable. If the patient cable appears damaged, do not use it. Contact your authorized repair center for help.

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

WARNING! Do not autoclave, ethylene oxide sterilize, or immerse the sensors in liquid. Evidence that liquid has been allowed to enter the monitor voids the warranty.

WARNING! Use only SpO₂ sensors supplied with, or specifically intended for use with, this device.

WARNING! SpO₂ measurements may be adversely affected in the presence of high ambient light. Shield the sensor area (with a surgical towel, for example) if necessary.

WARNING! Dyes introduced into the bloodstream, such as methylene blue, indocyanine green, indigo carmine, patent blue (PBV), and fluorescein may adversely affect the accuracy of the SpO₂ 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 SpO₂ and pulse rate readings.

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

NOTE! Obstructions or dirt on the sensor's red light or detector may cause a sensor failure. Make sure there are no obstructions and the sensor is clean.

NOTE! If the oximeter parameter is being monitored, the pitch of the pulse beep is determined by the SpO₂ value. The higher the SpO₂ value, the higher the pulse beep pitch; the lower the SpO₂ value, the lower the pulse beep pitch.

NOTE! The low SpO₂ alarm limit minimum test value is 85. If you change the low SpO₂ alarm limit to a value less than 85 and then change the patient type, add a new patient, or power down/power up the monitor, a minimum value of 85 takes the place of the value you entered.

Pulse Oximetry Theory of Operation

The pulse oximeter determines %SpO₂ 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 *SpO₂ 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 9.2: Pulse Oximetry Theory of Operation



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 SpO₂) 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 SpO₂ 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 SpO₂ and pulse rate readings.

WARNING! Under certain clinical conditions, pulse oximeters may display dashes if unable to display SpO₂ 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.

Attaching the Patient

WARNING! Prolonged use or the patient's condition may require changing the sensor site periodically. Change the 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 patient's skin (lack of skin respiration, not heat, causes the blisters).

1. Choose a sensor to be used to monitor oximetry.

SURGIVET [®] SENSOR SELECTION CHART		
Patient	Site	Description
Small/Medium Animal	Tongue Ear, Toe webbing, Tongue, Thin Tissue Rectum/Tail Hock, Achilles tendon, Thicker Tissue	V1703: Universal 'Y' Sensor with Lingual clip V3078: Mini Clip V1700: Reflectance Sensor V1707: Universal 'C' Sensor
Large Animal	Tongue Rectum/Tail Hock, Achilles tendon, Thicker Tissue	V1703: Universal 'Y' Sensor with Lingual clip V1700: Reflectance Sensor V1707 Universal 'C' Sensor
Horse	Tongue	V1707 Universal 'C' Sensor

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

WARNING! Do not autoclave, ethylene oxide sterilize, or immerse the sensors in liquid. Evidence that liquid has been allowed to enter the monitor voids the warranty.

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

NOTE! Obstructions or dirt on the sensor's red light or detector may cause a sensor failure. Make sure there are not obstructions and the sensor is clean.

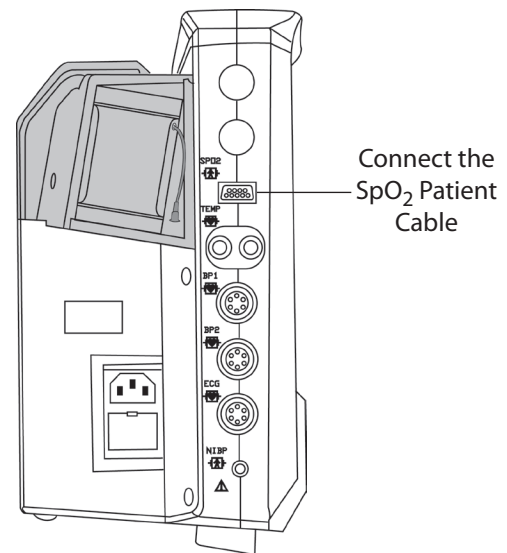
3. Check the sensor and the patient cable to make sure they do not appear damaged.

WARNING! Using a damaged sensor may cause inaccurate readings, possibly resulting in patient injury or death. 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 patient cable may cause inaccurate readings, possibly resulting in patient injury or death. Inspect the patient cable. If the patient cable appears damaged, do not use it. Contact your authorized repair center for help.

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

4. If necessary, connect the sensor to the patient cable.
5. Connect the patient cable to the monitor. Align the pins on the patient cable with the monitor's SpO₂ receptacle and push the connector firmly into the receptacle.
 - The monitor will automatically detect when the SpO₂ patient cable is connected and the oximetry parameter will be active.
6. Attach the sensor to the patient.
 - a. Make sure the red light in the sensor is illuminated.
 - b. Make sure the SPO2 SENSOR message is displayed
 - c. Select the appropriate sensor size; either for a small/medium animal, or for a large animal. See the *Application Guide* in this chapter for information regarding sensor application.

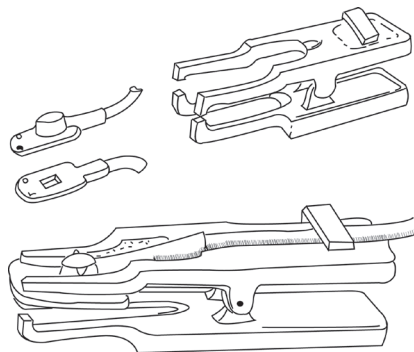
Figure 9.3: Connect the SpO₂ Cable

Application Guide

Universal 'Y' Sensor with Lingual Clip (V1703)

Position the lingual clip on the base of the tongue. Placement is dependent on the thickness of the tongue. Start at the tip and work your way toward the base. Always direct the light downward, toward 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.

Figure 9.4: Universal 'Y' Sensor



If necessary, the lingual clip may also be positioned on lips, cheeks, prepuce, vulva, and hocks. Moisten the hock area with isopropyl alcohol and/or water, and clip hair if needed. To get a better reading on smaller tongues, bring the sides of the tongue up and pass the light through both layers. Do not fold the tip of the tongue, as you will restrict blood flow to the tongue.

Mini Clip (V3078)

The Mini Clip is similar to the Universal 'Y' Sensor, but less than a quarter of the size of the lingual clip. The smaller clip is effective on 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.

Figure 9.5: Mini Clip Sensor

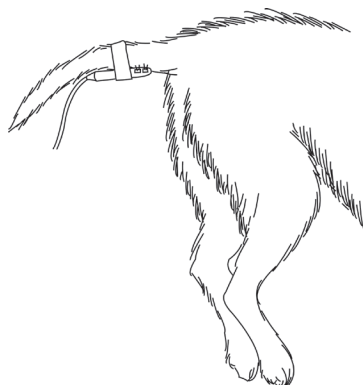


Small Reflectance Sensor (V1700)

Use the reflectance sensor if you are performing a dental procedure or any oral work that precludes the use of the lingual clip. Clean the reflectance sensor by wiping it with isopropyl alcohol or chlorhexidine.

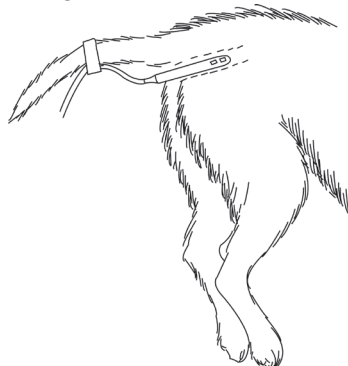
Place the reflectance sensor on the ventral base of the tail. The LED's should be positioned dorsally. You may need to clip a small patch of hair, only large enough for the LED's to lay on the skin. Be sure the skin is clean. Hold the sensor snugly against the tail and wrap with non-adhesive wrap.

Figure 9.6: Small Reflectance Sensor



When using the sensor in the rectum, a thin coat of lubricant can be used. Remove existing feces. Slightly rotate the sensor to ensure that the LED's are touching tissue and not fecal material. You do not need to anesthetize the animal when using the reflectance sensor.

Figure 9.7: Reflectance Sensor



This sensor may be used in the esophagus or cloaca of reptiles and large avians.

Universal “C” Sensor (V1707)

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 horses. 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 tissue must be at least as thick as the space between the two LED’s on the ‘C’ Sensor to get an SpO₂ reading.

Figure 9.8: Universal ‘C’ Sensor



Measured values for oximetry (%SpO₂ and PPR) will be displayed in the SpO₂ parameter box and an SpO₂ waveform, or plethysmogram, will appear on the display.

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 SpO₂ and pulse rate signal to the oximeter. This allows the oximeter’s performance to be checked.

NOTE! The 1606 Oximeter/ECG Patient Simulator does not calibrate the oximeter. The oximeter does not require calibration. The 1606 provides a known SpO₂ value and pulse rate to the oximeter that allows the oximeter’s performance to be checked.

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

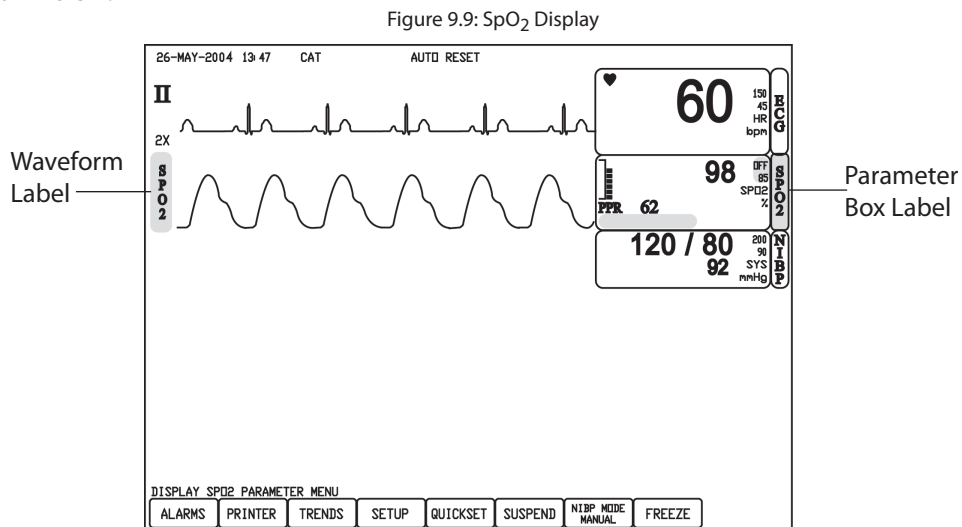
NOTE! ⚠ Follow the instructions included with the Oximeter Patient Simulator.

Choosing the Waveform Settings

Use the SpO₂ waveform menu options to adjust the speed of the SpO₂ waveform, or plethysmogram.

Access the Waveform Menu

The SpO₂ waveform menu is accessible from the SpO₂ waveform label. Since the speed of the plethysmogram is the only adjustable waveform setting, the SPEED menu option is included in the parameter menu when the SpO₂ waveform is ON.



To access the SpO₂ waveform menu from the waveform label:

- Turn the rotary knob on the monitor to move the cursor. Highlight the SpO₂ waveform label and push the knob to select. The SpO₂ waveform menu will appear in the lower left corner of the display.

Choose the Waveform Speed

You can choose the speed at which the SpO₂ waveform is displayed.

To change the speed of the SpO₂ waveform:

1. On the SpO₂ waveform menu, highlight SPEED and push the knob to select.
2. Highlight the desired size of the waveform (6.25, 12.5, 25, or 50 mm/second) and push the knob to select.
3. Highlight MAIN MENU and push the knob to select.

Adjusting the Settings in the Parameter Box

Turn Alarm Detection On or Off

You can turn on or off the alarm detection capability for the oxygen saturation value. If SpO₂ ALARMS is on, an alarm will be issued when the high or low alarm limit is violated. If you turn SpO₂ ALARMS off and the high or low alarm limit is violated, an alarm will not be issued. When you turn off the monitor and turn it on again, SpO₂ ALARMS will be reset to ON; the default setting is ON.

To turn on or off the oxygen saturation (SpO₂) alarm detection:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the SpO₂ parameter box name and push the knob to access the SPO₂ parameter menu.
2. Highlight SpO₂ ALARMS and push the knob to select.
3. Choose ON or OFF and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

Choose the Waveform Speed

If SpO₂ WAVEFORM is ON, you can choose the speed at which the plethysmogram is displayed.

To change the speed of the SpO₂ waveform:

1. On the SpO₂ parameter menu, highlight SPEED and push the knob to select.
2. Highlight the desired speed of the waveform (6.25, 12.5, 25, or 50 mm/second) and push the knob to select.
3. Highlight MAIN MENU and push the knob to select.

Turn the Peripheral Pulse Rate (PPR) Display On or Off

You can turn on or off the measured value for peripheral pulse rate displayed in the SpO₂ parameter box. The default setting is ON. Note that even if you turn PPR DISPLAY off, SpO₂ can still be the heart rate source displayed in the ECG parameter box. See *Choose the Heart Rate Source* in Chapter 8: ECG for more details.

To turn on or off the peripheral pulse rate (PPR) display:

1. On the SpO₂ parameter menu, highlight PPR DISPLAY and push the knob to select.
2. Highlight ON or OFF and push the knob to select.
3. Highlight MAIN MENU and push the knob to select.

Choose the Averaging Period for the Oximetry Parameter

NOTE! SpO₂ averaging to the number of pulse beats over which the SpO₂ value is averaged; pulse averaging is the number of seconds over which the pulse value is averaged.

The measured values for oximetry (%SpO₂ and PPR) can be determined by averaging the sensor readings over a selected number of beats or seconds. For example, if you choose SLOW, the measured value displayed for oxygen saturation (%SpO₂) will be the average of the oxygen saturation readings over sixteen pulse beats; the measured value displayed for peripheral pulse rate (PPR) will be the average of the number of pulse beats over sixteen seconds. See the table below for specific averaging periods using SurgiVet® sensors.

To choose the averaging period:

1. Highlight AVERAGING PERIOD and push the knob to select.
2. Choose the desired averaging period (FAST, NORMAL, or SLOW) and push the knob to select.

AVERAGING PERIOD DESCRIPTION	AVERAGING PERIOD FOR %SPO ₂ READINGS	AVERAGING PERIOD FOR PPR READINGS
SLOW	16 beats	16 seconds
NORMAL	8 beats	8 seconds
FAST	4 beats	8 seconds

3. Highlight MAIN MENU and push the knob to select.

NOTE: Increasing or decreasing the averaging setting has no effect on the data update rate.

Adjusting the Volume of the Heartbeat Beep Tone

You can set the monitor to issue a beep tone with each detected SpO₂ heartbeat. You can control the volume of the beep tone, or turn it off. If the monitor detects a valid SpO₂ reading, the pitch of the beep tone will vary depending on changes in oxygen saturation. See *Choose the Heart Rate Source* in Chapter 8: ECG for information regarding the source of the heart rate.

To adjust the volume of the pulse beep:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
2. Highlight PARAMETER OPTIONS and push the knob to select.
3. Highlight PULSE VOL and push the knob to select.
4. Turn the rotary knob to increase or decrease the volume to the desired level and push the knob to select. A momentary beep tone will sound at each new level of volume. The lowest volume option is OFF.
5. Highlight MAIN MENU and push the knob to select.

SPO₂ Alarms

An SpO₂ alarm will be issued when the numeric measured value for SpO₂ matches or exceeds the alarm limits set for %SpO₂ (or PPR if PPR is the selected heart rate source), when the monitor loses a pulse, or when there is a malfunction with the sensor. See *Set the Alarm Limits* in *Chapter 5: Monitoring the Patient* for instructions for setting high and low alarm limits.

NOTE! The low SpO₂ alarm limit minimum test value is 85%. If you change the low SpO₂ alarm limit to a value less than 85% and then change the patient type, add a new patient, or power down/power up the monitor, a value of 85% takes the place of the value you entered.

During an SpO₂ alarm, an audible alarm tone will sound and ALARM will appear in the alarm status line at the top of the display. In the SpO₂ parameter box, a message may be displayed describing the alarm condition and, when applicable, the violating measured value and violated alarm limit will flash.

SpO₂ alarms are categorized as high or medium priority.

ALARM CONDITION	INDICATION
LOW %SpO ₂	Audible high priority alarm; flashing red %SpO ₂ value in the SpO ₂ parameter box
HIGH PPR (if SpO ₂ is the heart rate source)	Audible high priority alarm; flashing red pulse rate value in the ECG parameter box
LOW PPR (if SpO ₂ is the heart rate source)	Audible high priority alarm; flashing red pulse rate value in the ECG parameter box
LOST PULSE	Audible high priority alarm; red message in the SpO ₂ parameter box
HIGH %SpO ₂	Audible medium priority alarm; flashing yellow %SpO ₂ value in the SpO ₂ parameter box
CHECK SENSOR	Audible medium priority alarm; flashing yellow message in the SpO ₂ parameter box
SEARCHING TOO LONG	Audible medium priority alarm; flashing yellow message in the SpO ₂ parameter box
OXIMETER ERROR	Audible medium priority alarm; flashing yellow message in the SpO ₂ parameter box
OXIMETER COM ERROR	Audible medium priority alarm; flashing yellow message in the SpO ₂ parameter box

Oximetry Alarm Messages

The following messages can be displayed in the SpO₂ parameter box:

ALARM MESSAGE	POSSIBLE CAUSE	CORRECTIVE ACTION
LOST PULSE	This message is displayed in the SpO ₂ parameter box when a valid PPR is obtained and then lost while the sensor is still attached to the patient. If the alarm reset mode is set to MANUAL, then this message may cycle or alternate with other alarm messages. This is a high priority alarm.	Check the patient's condition, and then be sure the sensor is properly positioned.
CHECK SENSOR	This message is displayed in the SpO ₂ parameter box when the monitor is unable to detect that the sensor is connected to the patient. This is a medium priority alarm.	Be sure the sensor is properly positioned on the patient. Be sure that the patient cable is connected to the monitor.
PULSE SEARCH	This message is displayed in the SpO ₂ parameter box when the oximeter circuitry is optimizing the LED drive levels in the sensor to properly detect the PPR and %SpO ₂ measured values.	Be sure the sensor is properly positioned on the patient.
SEARCHING TOO LONG	This message is displayed in the SpO ₂ parameter box when the monitor detects that an SpO ₂ sensor is attached to the patient, but cannot find a pulse after searching 15-20 seconds. This is a medium priority alarm.	Check the patient's condition, and then be sure the sensor is properly positioned.
SMALL SIGNAL	This message is displayed in the SpO ₂ parameter box when the pulse bar graph in the parameter box does not move higher than two bar segments.	Reposition the sensor on the patient.
OXIMETER ERROR	This message is displayed in the SpO ₂ parameter box when the oximetry processor detects an error in the oximeter's circuitry. All oximeter functions are disabled. This is a medium priority alarm.	Turn the monitor off and back on again. Contact your authorized repair center for help.
COM ERROR	This message is displayed in the SpO ₂ parameter box when the monitor's main processor cannot communicate with the oximeter. All oximeter functions are disabled. This is a medium priority alarm.	Turn the monitor off and back on again. Contact your authorized repair center for help.

Chapter 10: Non-invasive Blood Pressure

Using the NIBP Parameter

This chapter includes information specific to the non-invasive blood pressure (NIBP) parameter. Refer to chapters 4-7 for general step-by-step monitoring instructions. The remainder of this chapter assumes that the monitor is properly installed and set up.

Non-invasive Blood Pressure Measurement Capability

The non-invasive blood pressure (NIBP) parameter provides systolic, diastolic, and mean arterial blood pressure values. The measured values for non-invasive blood pressure (SYS, DIA, and MAP) are displayed in the NIBP parameter box. The time of the last successful reading will also be displayed. If 24 hours have passed since the last NIBP reading, the measured values will be removed. NIBP measurements can be made in automatic, manual, or STAT modes.

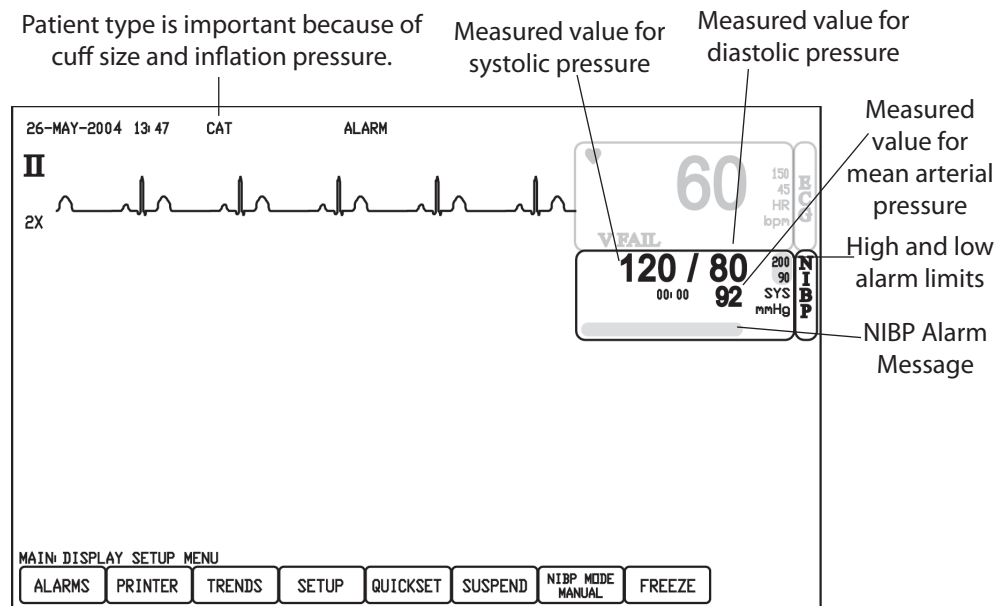


Figure 10.1: Non-Invasive Blood Pressure Display

Non-invasive Blood Pressure Warnings, Cautions, and Notes

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

WARNING! Verify cuff size is correct for the selected patient mode on the monitor.

WARNING! Repeated use of 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! 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! Blood pressure measurements may not be accurate for patients experiencing arrhythmias.

WARNING! Do not verify the Non-Invasive Blood Pressure calibration while the cuff is attached to a patient.

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 physician.

NOTE! There are no user-serviceable adjustments for the Non-Invasive Blood Pressure calibration verification. If the monitor appears to be out of calibration, contact your authorized repair center for help.

NOTE! Systolic and diastolic blood pressure measurements determined with this device are equivalent to those obtained by the 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.

NIBP Theory of Operation

The Advisor® Vital Signs Monitor uses oscillometric principles to calculate the systolic, diastolic and mean arterial pressure values from the blood pressure cuff. When the blood pressure cuff is inflated it creates an occlusion of the artery on the limb being used. The cuff is then deflated by a set amount of pressure in the cuff. When an oscillometric pulse is identified, another similar pulse must also be identified and measured before it steps down again. This method of measuring blood pressure ensures the measurement is a true measurement and not a change in the cuff due to motion. If the measurement is not reproduced a second time, it is not recorded and the pressure is stepped down. Once two identical oscillations are obtained the cuff deflates. In other words, it will only capture readings that are reproduced; if there are no similar oscillations at that pressure, the reading is discarded as artifact. This type of oscillometric technology is more motion tolerant and generally produces a higher success rate than other NIBP technologies.

Attaching the Patient

1. Choose a blood pressure cuff appropriate for the patient and the limb size by measuring the circumference of the limb. See the table below.

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

NOTE! The NIBP Cuff Kit is latex-free.

LIMB CIRCUMFERENCE	CUFF
3 – 9 cm	Extra small (SurgiVet® part number 31543B1)
5 – 15 cm	Small (SurgiVet® part number 31543B2)
9 – 25 cm	Medium (SurgiVet® part number 31543B3)
17 – 41 cm	Large (SurgiVet® part number 31543B4)

Cuff Warranty

Cuffs carry a six-month warranty, pending evaluation by Smiths Medical PM, Inc., Veterinary Division Technical Services. Cuffs that are contaminated, have liquid in them, have been misused/abused, or are older than six months will not be covered under the warranty.

2. Attach the cuff to the patient.

WARNING! Verify cuff size is correct for the selected patient mode on the monitor.

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.

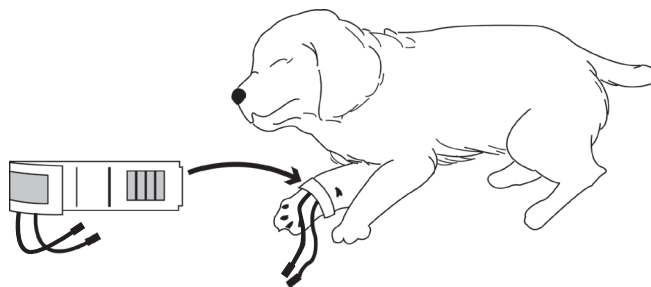
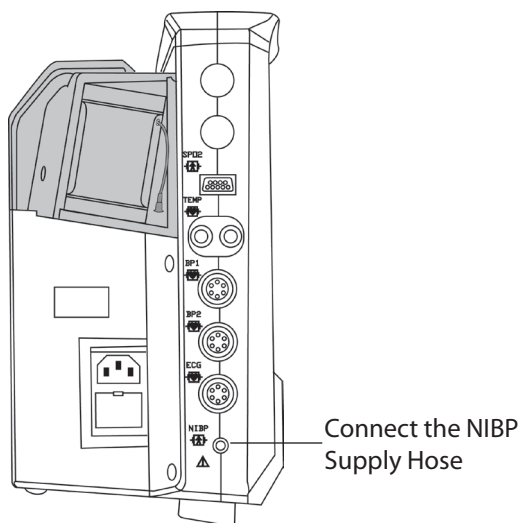


Figure 10.2: Attach the Cuff

- a. Squeeze all the air out of the cuff.
 - b. Place the cuff on a limb at the same level as the heart. The SurgiVet® logo should be facing up, away from the patient. The width of the cuff should be approximately 30-60% of the circumference of the limb. You do not need to align the cuff along an artery.
 - c. Wrap the cuff around the limb and secure the Hook & Loop closure.
3. Connect the NIBP supply hose to the monitor.

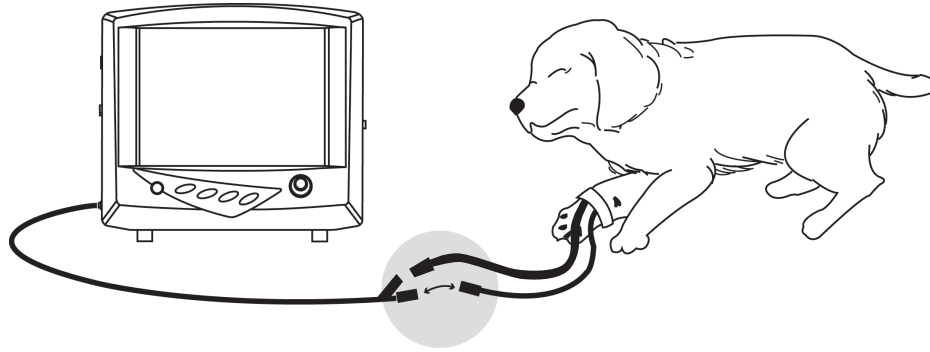
WARNING! Make sure that hoses are not kinked, compressed, or restricted.

Figure 10.3: Connect the NIBP Supply Hose



4. Connect the cuff to the supply hose.
- The NIBP parameter box is always displayed; measured values will appear as soon as a blood pressure measurement is taken.

Figure 10.4: Connect the Cuff the the Supply Hose



5. Be sure the patient type (CAT, DOG, or HORSE) is appropriate for the patient. See *Select the patient type* in *Chapter 4: Setting Up the Monitor* for instructions for setting the patient type.
6. If necessary, add the patient information to the monitor. See *Add a new patient* in *Chapter 4: Setting Up the Monitor* for instructions for adding a patient.

NOTE! When a new patient is added to the monitor, all previous patient information, including NIBP history, is removed from the monitor's memory, and all parameter options are reset to the unit defaults.

7. Choose the NIBP mode (AUTO, MANUAL, or STAT) that is appropriate for the patient.
 - Non-invasive blood pressure (NIBP) measurements can be made in automatic, manual, or STAT modes. In the automatic mode, the monitor will measure the patient's NIBP periodically, according to the interval you select using the parameter box menu. In the manual mode, the monitor will measure the patient's NIBP only when you press the NIBP key (). In the STAT mode, the monitor will measure the patient's NIBP continuously for five minutes. The default setting for NIBP mode is MANUAL.

To change the NIBP mode:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight NIBP MODE and push the knob to select.
2. Turn the rotary knob to choose a mode (AUTO, MANUAL, or STAT), and push the knob to select.
 - If you choose AUTO or STAT, the selected mode will be displayed in the parameter box.



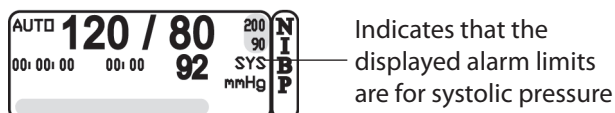
Figure 10.5: NIBP Mode

Adjusting the Settings in the Parameter Box

Turn Alarm Detection On or Off

You can turn on or off the alarm detection capability for each of the NIBP measured values (SYS, DIA, and MAP). You can also choose which alarm limits to display in the parameter box (SYS, DIA, or MAP). If SYS ALARMS is on, an alarm will be issued when the high or low alarm limit for systolic pressure is violated, regardless of which set of alarm limits is displayed. If you turn SYS ALARMS off and the high or low alarm limit is violated, an alarm will not be issued. When you turn off the monitor and turn it on again, [SYS, DIA, or MAP] ALARMS will be reset to ON; the default setting for each pressure value is ON.

Figure 10.6: NIBP Alarm Limits



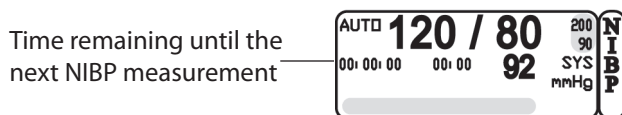
To turn on or off the alarm detection for each pressure value (SYS, DIA, and MAP):

1. Turn the rotary knob on the monitor to move the cursor. Highlight the NIBP parameter box name and push the knob to access the NIBP parameter menu.
2. Highlight ALARMS and push the knob to access the alarms submenu.
3. Highlight each pressure value (SYS, DIA, and MAP) and choose ON or OFF for each one. Push the knob to select.
 - To choose the pressure value alarm limits (SYS, DIA, and MAP) to be displayed in the NIBP parameter box:
 - a. Highlight DISPLAY and push the knob to select.
 - b. Choose SYS LIMITS, DIA LIMITS, OR MAP LIMITS and push the knob to select.
4. Highlight MAIN or PREVIOUS and push the knob to select.

Choose the Interval for Automatic NIBP Measurements

If you selected the automatic mode (AUTO) for NIBP measurements (instead of MANUAL or STAT), the monitor will measure the patient's NIBP periodically, according to the interval you select (1, 2, 3, 4, 5, 10, 15, 20, or 30 minutes, or 1, 2, 4, or 8 hours). The time remaining until the next measurement will be displayed in the parameter box. When the interval has elapsed, the time remaining (00:00:00) will flash for several seconds indicating that an NIBP measurement is going to begin.

Figure 10.7: NIBP Time



To choose the automatic NIBP measurement interval:

1. Be sure the NIBP MODE is set to AUTO.
2. On the NIBP parameter menu, highlight AUTO INTERVAL and push the knob to select.
3. Highlight the desired interval (1, 2, 3, 4, 5, 10, 15, 20, or 30 minutes, or 1, 2, 4, or 8 hours) and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

Choose the Inflation Pressure

You can change the cuff inflation pressure before any measurement. If you change the pressure, the monitor will use the new value for the next NIBP measurement. The default settings are 200 mmHg for the cat mode, 150 mmHg for the dog mode, and 100 mmHg for the horse mode.

After an NIBP measurement is taken and there is a valid systolic pressure reading displayed in the NIBP parameter box, the cuff inflation pressure will automatically inflate to the systolic pressure plus 35 mmHg for cat and dog patient types, and plus 20 for the horse type. For example, if the latest NIBP measurement for a cat shows a systolic pressure of 112 mmHg, then the next time a measurement is taken the cuff inflation pressure will be 147 mmHg (unless you change it).

To choose the cuff inflation pressure:

1. On the NIBP parameter menu, highlight INFL PRESS and push the knob to select.
2. Turn the rotary knob to choose the desired pressure (50-250 mmHg for cat and dog patients, 50-120 for horses) and push the knob to select.
3. Highlight MAIN MENU and push the knob to select.

Adjust the Volume of the NIBP Completion Beep Tone

The monitor will issue a beep tone when each NIBP measurement has been completed. You can control the volume of the beep tone.

To adjust the volume of the NIBP completion beep:

1. On the NIBP parameter menu, highlight COMPLETION VOLUME and push the knob to select.
2. Turn the rotary knob to increase or decrease the volume to the desired level and push the knob to select. A momentary beep tone will sound at each new level of volume.
3. Highlight MAIN MENU and push the knob to select.

Measuring Non-invasive Blood Pressure (NIBP)

Manual NIBP Mode

If you selected MANUAL as the NIBP MODE, press the NIBP key () on the monitor.

If the measurement is successful, you will see the systolic, diastolic, and mean arterial pressure values displayed in the NIBP parameter box and you will hear the completion beep. The time of the successful reading will also be displayed in the parameter box.

If the measurement is not successful, the previous pressure values will be displayed. If there is no previous data, you will see dashes (- - -) displayed in the place of the pressure values. The monitor will attempt to obtain a reading for up to 120 seconds for cat and dog patient types. For the horse patient type, the monitor will retry for 90 seconds. If the monitor is unable to take a measurement, you will hear a bell tone and see a message displayed in the parameter box. To acknowledge the NIBP error message, press the NIBP key () on the monitor while the message is displayed in the NIBP parameter box.

AUTO NIBP Mode

If you selected AUTO as the NIBP MODE, the first measurement will begin after the interval time has elapsed. The time remaining (00:00:00) will flash for several seconds indicating that an NIBP measurement is going to begin.

NOTE! If you suspend patient monitoring (by selecting SUSPEND from the main menu) while AUTO is the selected NIBP mode, the monitor will return to the default mode (MANUAL) when you resume monitoring.

If the measurement is successful, you will see the systolic, diastolic, and mean arterial pressure values displayed in the NIBP parameter box and you will hear the completion beep. The time of the successful reading will also be displayed in the parameter box. The automatic measurement interval will be reset, and another measurement will begin as soon as the interval time has elapsed.

If the measurement is not successful, the previous pressure values will be displayed. If there is no previous data, you will see dashes (- -) displayed in the place of the pressure values. The monitor will attempt to obtain a reading for up to 120 seconds for cat and dog patient types. For the horse patient type, the monitor will retry for 90 seconds. If the monitor is unable to take a measurement, you will hear a bell tone and see a message displayed in the parameter box. To acknowledge the NIBP error message, press the NIBP key () on the monitor while the message is displayed in the NIBP parameter box. The automatic measurement interval will be reset.

STAT NIBP Mode

If you selected STAT as the NIBP MODE, the first measurement will begin immediately and a five-minute timer is started. NIBP measurements are taken repeatedly until the five minutes have elapsed.

If the measurement is successful, you will see the systolic, diastolic, and mean arterial pressure values displayed in the NIBP parameter box and you will hear the completion beep. The time of the successful reading will also be displayed in the parameter box. When the five minutes have passed or if you press NIBP key () to cancel, the mode will automatically return to the previous setting (MANUAL or AUTO).

If the measurement is not successful, the previous pressure values will be displayed. If there is no previous data, you will see dashes (- -) displayed in the place of the pressure values. You will hear a bell tone and see a message displayed in the parameter box. To acknowledge the NIBP error message, press the NIBP key () on the monitor while the message is displayed in the NIBP parameter box. NIBP readings will not continue until the error message is acknowledged, but the five-minute timer will continue to run.

Canceling an NIBP Measurement

Regardless the selected mode (AUTO, MANUAL, or STAT), you can stop a measurement in progress by pressing the NIBP key () on the monitor.

If the monitor is in automatic (AUTO) mode, another measurement will start after the selected interval has elapsed.

If the monitor is in STAT mode and you press the NIBP key () to cancel the measurement, the mode will automatically return to the previous setting (MANUAL or AUTO).

Cleaning the NIBP Cuff

1. Place the Cuff Cap (SurgiVet® part number 31545B1) on the end of the cuff hose.

NOTE! Failure to place the cuff cap on the hose will allow water to enter the bladder. This will cause the cuff to malfunction and will damage the monitor.

2. Pre-clean the cuff by removing contaminate material, hair, and debris.
3. Wash the cuff in a regular load of laundry, or hand-wash.
4. Allow the cuff to air-dry.

CAUTION! Do not place the cuff in the dryer.

NIBP Alarms

An NIBP alarm will be issued when the numeric measured value for pressure matches or exceeds the alarm limits set for systolic, diastolic or mean arterial pressure or when there is a malfunction with the blood pressure cuff. See *Set the Alarm Limits* in *Chapter 5: Monitoring the Patient* for instructions for setting high and low alarm limits.

During an NIBP alarm, an audible alarm tone will sound and ALARM will appear in the alarm status line at the top of the display. In the NIBP parameter box, a message may be displayed describing the alarm condition and, when applicable, the violating measured value and violated alarm limit will flash.

NIBP alarms are categorized as medium or low priority.

ALARM CONDITION	INDICATION
HIGH SYSTOLIC PRESSURE	Audible medium priority alarm; flashing yellow systolic pressure value in the NIBP parameter box
LOW SYSTOLIC PRESSURE	Audible medium priority alarm; flashing yellow systolic pressure value in the NIBP parameter box
HIGH DIASTOLIC PRESSURE	Audible medium priority alarm; flashing yellow diastolic pressure value in the NIBP parameter box
LOW DIASTOLIC PRESSURE	Audible medium priority alarm; flashing yellow diastolic pressure value in the NIBP parameter box
HIGH MEAN ARTERIAL PRESSURE	Audible medium priority alarm; flashing yellow MAP value in the NIBP parameter box
LOW MEAN ARTERIAL PRESSURE	Audible medium priority alarm; flashing yellow MAP value in the NIBP parameter box
COM ERROR	Audible low priority alarm; message in the NIBP parameter box
NIBP ERROR	Audible low priority alarm; message in the NIBP parameter box
NIBP TIMEOUT	Audible low priority alarm; message in the NIBP parameter box
NIBP CUFF LEAK	Audible low priority alarm; message in the NIBP parameter box
NIBP ARTIFACT	Audible low priority alarm; message in the NIBP parameter box
NIBP WEAK SIGNAL	Audible low priority alarm; message in the NIBP parameter box
CUFF OVER-PRESSURE	Audible low priority alarm; message in the NIBP parameter box
NIBP CAL ERROR	Audible low priority alarm; message in the NIBP parameter box
VALVE ERROR	Audible low priority alarm; message in the NIBP parameter box

NIBP Alarm Messages

The following messages can be displayed in the NIBP parameter box:

ALARM MESSAGE	POSSIBLE CAUSE	CORRECTIVE ACTION
COM ERROR	This message is displayed in the NIBP parameter box when the monitor's main processor cannot communicate with the NIBP cuff. This is a low priority alarm.	Turn the monitor off and back on again. Contact your authorized repair center for help.
NIBP ERROR	This message is displayed in the NIBP parameter box when the monitor has detected an unrecoverable malfunction with the NIBP parameter. This is a low priority alarm.	Turn the monitor off and back on again. Contact your authorized repair center for help.
NIBP TIMEOUT	This message is displayed in the NIBP parameter box when the NIBP measurement cannot be completed within the allowed time. This is a low priority alarm.	Be sure the cuff is properly positioned on the patient. Be sure the patient remains still during NIBP measurement.
NIBP CUFF LEAK	This message is displayed in the NIBP parameter box when the monitor detects an air leak in the system causing pressure variations. This is a low priority alarm.	Be sure the hose and cuff connections are secure. Check the hose and cuff for leaks. Replace the cuff. Contact your authorized repair center for help.
NIBP ARTIFACT	This message is displayed in the NIBP parameter box when the NIBP measurement cannot be completed due to excessive signal artifact. This may be caused by patient movement, shaking and shivering during the measurement, or by disturbances in the cuff before the measurement is complete. This is a low priority alarm.	Be sure the patient remains still during NIBP measurement. Do not remove the cuff until the measurement is complete.
NIBP WEAK SIGNAL	This message is displayed in the NIBP parameter box when the NIBP measurement cannot be completed due to a low pulse signal from the patient. This is a low priority alarm.	Try the reading again. Reposition the cuff over the artery.
CUFF OVER-PRESSURE	This message is displayed in the NIBP parameter box when the monitor detects that the cuff pressure is greater than 300 mmHg in the cat and dog modes, or 150 mmHg in the horse mode. The cuff immediately deflates and the current NIBP measurement stops. This is a low priority alarm.	Check the patient's condition. Try the reading again. Contact your authorized repair center for help.

ALARM MESSAGE	POSSIBLE CAUSE	CORRECTIVE ACTION
NIBP CAL ERROR	This message is displayed in the NIBP parameter box when there is a malfunction during the NIBP calibration procedure. This is a low priority alarm.	Contact your authorized repair center for help.
VALVE ERROR	This message is displayed in the NIBP parameter box when the cuff does not deflate properly; there may be malfunction with the dump valve. This is a low priority alarm.	Contact your authorized repair center for help.
NIBP CALIBRATION	This message is displayed in the NIBP parameter box when NIBP calibration verification is in progress.	Contact your authorized repair center for help.

NOTE! There are no user-serviceable adjustments for the NIBP calibration. If the monitor appears to be out of calibration, contact your authorized repair center for help.

Chapter 11: Invasive Blood Pressure

Using the IBP Parameter

This chapter includes information specific to the invasive blood pressure (IBP) parameter. Refer to chapters 4-6 for general step-by-step monitoring instructions. The remainder of this chapter assumes that the monitor is properly installed and set up.

Invasive Blood Pressure Measurement Capability

Two independent channels of invasive blood pressure (IBP1 and IBP2) monitoring are available to measure systolic, diastolic, and mean values for invasive pressure. The measured values for invasive blood pressure (SYS, DIA, and MN) are displayed in parameter boxes that are labeled according to the invasive pressure site, such as ART1 or PA2. Waveforms for each invasive blood pressure site can also be displayed.

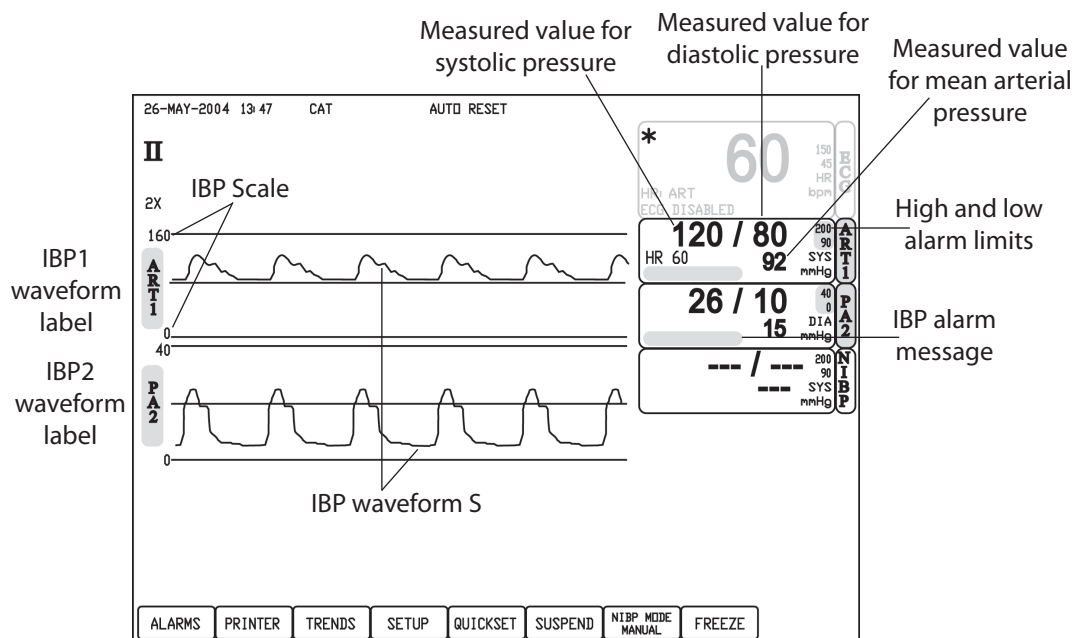


Figure 11.1: Invasive Blood Pressure Display

Invasive Blood Pressure Warnings, Cautions, and Notes

WARNING! Avoid conductive connection with any metal parts.

NOTE! The IBP ZERO NEEDED message is displayed when the monitor is turned on or when the transducer is connected to the monitor (even if the same transducer is disconnected then reconnected to the monitor).

NOTE! Use only invasive pressure transducers and interface cables specifically intended for use with this device and its side panel connectors.

NOTE! When IBP1 and IBP2 are overlaid, the scale settings for IBP1 and IBP2 are changed to the higher of the two scales.

NOTE! Dual channel simulators may affect verification of IP operation. Use only single channel simulators.

NOTE! All specified transducers were tested for immunity to radiated radio frequency electromagnetic fields at a level of 10V/m in accordance with IEC 60601-2-34:2000.

Theory of Operation

The Advisor® Vital Signs Monitor has been validated for use with other disposable transducers and interface cables.

- Becton-Dickinson DTX™ Plus DT-4812 (compatible with interface cable provided)
- Edwards Lifesciences TruWave
- Abbott Critical Care Systems Transpac® IV

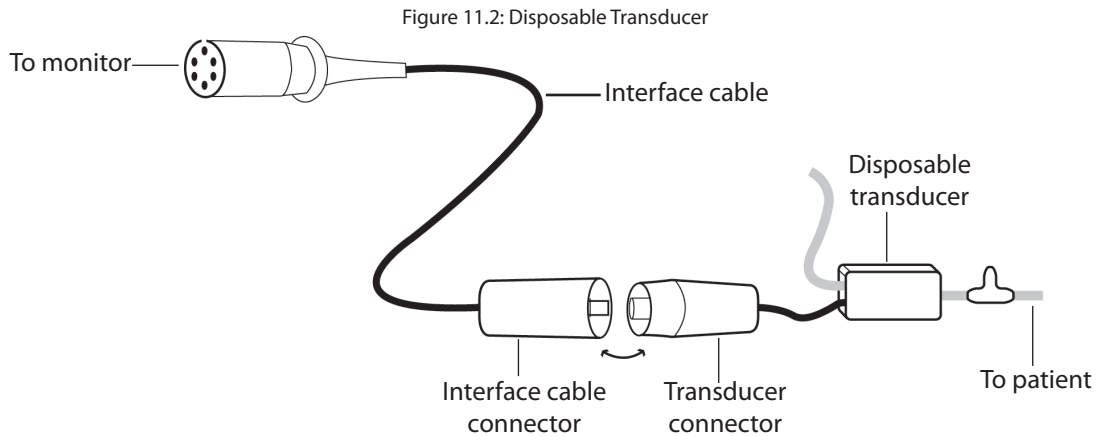
Transducers 2. and 3. are compatible for use with the Advisor® Vital Signs Monitor, but require the purchase of a compatible interface cable. Please contact Technical Service at 1-888-745-6562 for more information.

Attaching the Patient

1. Choose an invasive pressure transducer.

NOTE! All specified transducers were tested for immunity to radiated radio frequency electromagnetic fields at a level of 10V/m in accordance with IEC 60601-2-34:2000.

- a. If you are using a disposable transducer, choose an appropriate interface cable designed to mate with the IBP1 and IBP2 receptacles on the side of the monitor.

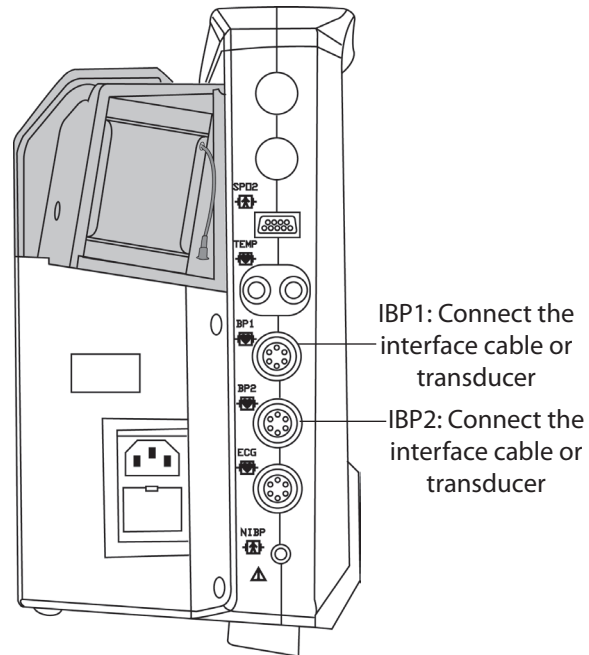


- b. If you are using a non-disposable transducer, choose one that is designed to mate with the IBP1 and IBP2 receptacles on the side of the monitor.
2. ⚠ Prepare the transducer according to the transducer manufacturer's instructions.
 3. If you are using a disposable transducer, connect the prepared transducer to the interface cable.
 4. Connect the interface cable or the non-disposable transducer to the monitor.

WARNING! Avoid conductive connection with any metal parts.

5. Choose the waveform and parameter box settings for the patient.
6. Insert a sterile catheter into the patient according to the standards of practice and care for your facility.
7.  Attach the transducer to the catheter according to the transducer manufacturer's instructions.
 - The monitor will automatically detect when the interface cable or non-disposable transducer is connected and the invasive blood pressure (IBP) parameter will be active.
 - Measured values for IBP will be displayed in the relevant parameter box, identified by the selected site label, and a waveform will appear on the display. The default site label for IBP1 is ART1; the default site label for IBP2 is PA2. See *Change the Site Label* in this chapter for instructions for changing the site label.

Figure 11.3: Connect the interface cable or transducer



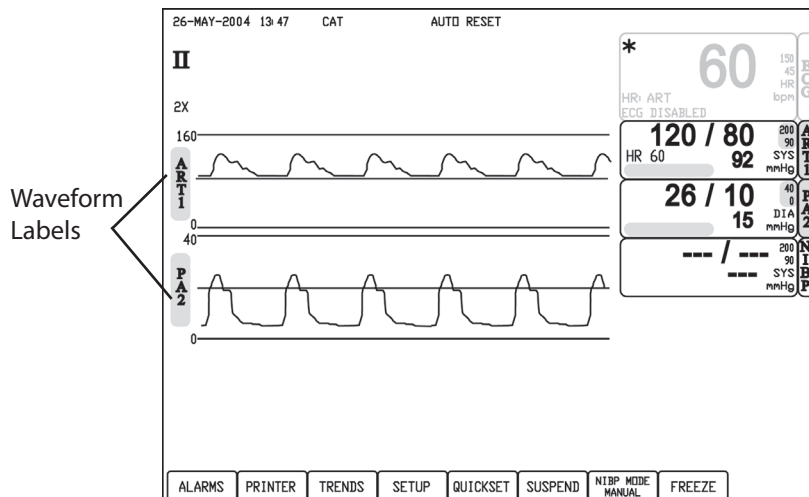
Choosing the Waveform Settings

Use the waveform menu options for invasive blood pressure to adjust the scale and speed of the waveforms, to calibrate, or set to zero, the transducer, and to change the IBP waveform from separated to overlaid.

Access the Waveform Menu

The IBP waveform menu is accessible from the waveform label, shown below as ART1 or PA2.

Figure 11.4: IBP Display



To access the waveform menu from the waveform label:

1. Turn the rotary knob on the monitor to move the cursor.
2. Highlight the waveform label and push the knob to select. The waveform menu will appear in the lower left corner of the display.

To access the waveform menu from the parameter box:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the parameter name (shown as the IBP site such as ART1 or PA2) and push the knob to select. The parameter menu will appear in the lower left corner of the display.
2. Turn the rotary knob to highlight [IBP SITE] WAVEFORM (such as ART1 or PA2) and push the knob to select. The waveform settings submenu will appear.

If the IBP waveform has been turned off:

1. On the IBP parameter submenu, highlight WAVEFORM OFF and push the knob to select.
2. Highlight the waveform area in which to display the selected waveform and push the knob to select. The waveform will be displayed.
3. Highlight [IBP SITE] WAVEFORM and push the knob to select. The pressure waveform settings submenu will appear.

Choose the Scale of the IBP Waveform

You can choose the scale at which the IBP waveform is displayed. See below for the available scales for invasive pressure.

AVAILABLE IBP SCALES
AUTO
0 - 20 mmHg
0 - 40 mmHg
0 - 60 mmHg
0 - 100 mmHg
0 - 160 mmHg
0 - 200 mmHg
0 - 300 mmHg

To change the scale of the IBP waveform:

1. On the waveform menu, highlight IBP SCALE and push the knob to select.
2. Highlight the desired scale and push the knob to select.
3. Highlight MAIN or PREVIOUS and push the knob to select.

Choose the Waveform Speed

You can choose the speed at which the IBP waveform is displayed. The default waveform speed is 25 mm/second.

To change the speed of the IBP waveform:

1. On the waveform menu, highlight SPEED and push the knob to select.
2. Highlight the desired speed of the waveform (6.25, 12.5, 25, or 50 mm/second) and push the knob to select.
3. Highlight MAIN MENU and push the knob to select.

Choose Separate Scales or Overlaid IBP Waveforms

You can choose to display the IBP waveforms on separate pressure scales or display two IBP waveforms overlaid on the same scale.

To choose separated or overlaid waveforms:

1. On the waveform menu, highlight IBP WAVEFORMS and push the knob to select.
2. Highlight SEPARATED or OVERLAID and push the knob to select.
3. If you choose to view two IBP waveforms overlaid on the same scale, select the two IBP sites to be displayed as waveforms.
 - a. Turn the rotary knob on the monitor to move the cursor. Highlight the waveform label and push the knob to access the waveform menu in the lower left corner of the display.
 - b. Highlight WAVEFORM and push the knob to access the waveform submenu.
 - c. Highlight the IBP site to be displayed as a waveform and push the knob to select.
 - d. Highlight PREVIOUS and push the knob to select.
4. The monitor will adjust the scale to reflect the maximum range occupied by the two selected waveforms. For example:
 - The waveform for ART1 (the selected site for IBP1) may be displayed with a maximum value at 120 mmHg and a minimum value at 80 mmHg.
 - The waveform for PA2 (the selected site for IBP2) may be displayed with a maximum value of 40 mmHg and a minimum value at 10 mmHg
 - Therefore, both IBP waveforms will be displayed on a 0 to 160 scale.

Set the Transducer to Zero

The invasive pressure transducers must be calibrated, or set to zero, to ensure accurate absolute pressure measurements. You can set the pressure to zero by pressing the Zero IBP key (), or using either the waveform menu or the parameter menu.

To calibrate the invasive pressure transducer using the waveform menu, see *Calibrating the IBP Transducers* later in this chapter.

Adjusting the Settings in the Parameter Box

Change the Site Label

You can change the IBP parameter box label to reflect the site or vessel that is to be monitored. The label will be displayed as the parameter box name and as the waveform label. There are nine possible site labels for each invasive pressure channel. See the table below for a description of each label, the measured values displayed for each label, and the default waveform scale for both cat, dog, and horse patient types.

LABEL	MEASURED VALUES	DEFAULT IBP WAVEFORM SCALE	
		limits are for systolic pressure	
		Cat/dog	Horse
ART (arterial)	systolic, diastolic, mean, heart rate*	0 - 160 mmHg	0 - 100 mmHg
PA (pulmonary artery)	systolic, diastolic, mean	0 - 40 mmHg	0 - 40 mmHg
LV (left ventricle)	systolic, diastolic, mean	0 - 160 mmHg	0 - 100 mmHg
RV (right ventricle)	systolic, diastolic, mean	0 - 40 mmHg	0 - 40 mmHg
P (generic pressure)	systolic, diastolic, mean	0 - 160 mmHg	0 - 100 mmHg
CVP (central venous pressure)	mean	0 - 20 mmHg	0 - 20 mmHg
ICP (intra-cranial pressure)	mean	0 - 20 mmHg	0 - 20 mmHg
RA (right atrium)	mean	0 - 20 mmHg	0 - 20 mmHg
LA (left atrium)	mean	0 - 20 mmHg	0 - 20 mmHg
* Display of the heart rate from the invasive pressure parameter depends on the status of the monitor's other heart rate detection systems.			

To change the site label:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the IBP parameter box name (ART1 and PA2 are the default names) and push the knob to access the IBP parameter menu.
2. Highlight SITE LABEL and push the knob to access the site label submenu.
3. Highlight the desired label (ART, PA, LV, RV, P, CVP, ICP, RA, or LA) and push the knob to select.
4. Highlight MAIN or PREVIOUS and push the knob to select.
5. Set the pressure to zero. See *Calibrating the IBP Transducers* later in this chapter.

Turn Alarm Detection On or Off

You can turn on or off the alarm detection capability for each of the IBP measured values (SYS, DIA, and MN). You can also choose which alarm limits to display in the parameter box (SYS, DIA, or MN). If SYS ALARMS is on, an alarm will be issued when the high or low alarm limit for systolic pressure is violated, regardless of which set of alarm limits is displayed. If you turn SYS ALARMS off and the high or low alarm limit is violated, an alarm will not be issued. When you turn off the monitor and turn it on again, [SYS, DIA, or MN] ALARMS will be reset to ON; the default setting for each pressure value is ON.

Figure 11.5: IBP Parameter Box



To turn on or off the alarm detection for each pressure value (SYS, DIA, and MN):

1. Turn the rotary knob on the monitor to move the cursor. Highlight the IBP parameter box name and push the knob to access the IBP parameter menu.
2. Highlight ALARMS and push the knob to access the alarms submenu.
3. Highlight each pressure value (SYS, DIA, and MN) and choose ON or OFF for each one. Push the knob to select.
 - To choose the pressure value alarm limits (SYS, DIA, and MN) to be displayed in the IBP parameter box:
 - a. Highlight DISPLAY and push the knob to select.
 - b. Choose SYS LIMITS, DIA LIMITS, OR MN LIMITS and push the knob to select.
4. Highlight MAIN or PREVIOUS and push the knob to select.

Turn the Arterial Heart Rate Display On or Off

If you selected ART as the site label (or left it as the default label), you can display the patient's arterial heart rate in the IBP parameter box.

To turn on or off the arterial heart rate display:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the IBP parameter box name (ART1 or ART2) and push the knob to access the IBP parameter menu.
2. Highlight HR DISPLAY and push the knob to select.
3. Highlight ON or OFF and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

Set the Transducer to Zero

The invasive pressure transducers must be calibrated, or set to zero, to ensure accurate absolute pressure measurements. You can set the pressure to zero using either the waveform menu or the parameter menu.

To calibrate the invasive pressure transducer using the parameter menu, see *Calibrating the IBP Transducers* later in this chapter.

IBP Alarms

An IBP alarm will be issued when the numeric measured value for invasive blood pressure matches or exceeds the alarm limits set for systolic, diastolic or mean pressure or when there is a malfunction with the transducer. See *Set the Alarm Limits* in *Chapter 5: Monitoring the Patient* for instructions for setting high and low alarm limits.

During an IBP alarm, an audible alarm tone will sound and ALARM will appear in the alarm status line at the top of the display. In the relevant IBP parameter box, a message may be displayed describing the alarm condition and, when applicable, the violating measured value and violated alarm limit will flash.

IBP alarms are categorized as high, medium, or low priority.

ALARM CONDITION	INDICATION
HIGH SYSTOLIC PRESSURE	Audible medium priority alarm; flashing yellow systolic pressure value in the IBP parameter box
LOW SYSTOLIC PRESSURE	Audible medium priority alarm; flashing yellow systolic pressure value in the IBP parameter box
HIGH DIASTOLIC PRESSURE	Audible medium priority alarm; flashing yellow diastolic pressure value in the IBP parameter box
LOW DIASTOLIC PRESSURE	Audible medium priority alarm; flashing yellow diastolic pressure value in the IBP parameter box
HIGH MEAN PRESSURE	Audible medium priority alarm; flashing yellow mean value in the IBP parameter box
LOW MEAN PRESSURE	Audible medium priority alarm; flashing yellow mean value in the IBP parameter box
HIGH ART PULSE RATE (if ART is the heart rate source)	Audible high priority alarm; flashing red heart rate value in the ECG parameter box
LOW ART PULSE RATE (if ART is the heart rate source)	Audible high priority alarm; flashing red heart rate value in the ECG parameter box
IBP OUT OF RANGE	Audible medium priority alarm; message in the IBP parameter box
COM ERROR	Audible medium priority alarm; message in the IBP parameter box
ZERO UNSTABLE	Audible low priority alarm; message in the IBP parameter box
ZERO OUT OF RANGE	Audible low priority alarm; message in the IBP parameter box

IBP Alarm Messages

The following messages can be displayed in the IBP parameter box:

ALARM MESSAGE	POSSIBLE CAUSE	CORRECTIVE ACTION
COM ERROR	This message is displayed in the IBP parameter box when the monitor's main processor cannot communicate with the invasive pressure circuitry. Invasive pressure functions for the affected channel are disabled. This is a medium priority alarm.	Disconnect the interface cable or the non-disposable transducer from the monitor. Turn the monitor off and back on again. Contact your authorized repair center for help.
IBP ZERO NEEDED	This message is displayed in the IBP parameter box when the transducer must be calibrated or set to zero.	Set the transducer to zero pressure. To calibrate the invasive pressure transducer using the parameter menu: - On the parameter menu, highlight ZERO PRESSURE and push the knob to select. - Highlight MAIN MENU and push the knob to select.
IBP OUT OF RANGE	This message is displayed in the IBP parameter box when the pressure transducer's measurement is outside the monitor's measurement range. Pressure readings in the range of -50 to 300 mmHg are valid.	Set the transducer to zero pressure. Replace the transducer. Contact your authorized repair center for help.
ZERO OUT OF RANGE	This message is displayed in the IBP parameter box when the monitor cannot calibrate or set to zero the transducer because it is out of the specified range.	Be sure the interface cable or non-disposable transducer connections are secure. Open the transducer to air before selecting ZERO PRESSURE then set the transducer to zero pressure. Replace the interface cable. Replace the transducer. Contact your authorized repair center for help.
ZERO UNSTABLE	This message is displayed in the IBP parameter box when the monitor cannot calibrate or set to zero the transducer because the pressure at the transducer was not stable during the zeroing process.	Be sure the interface cable or non-disposable transducer connections are secure. Replace the interface cable. Replace the transducer. Set the transducer to zero pressure. Contact your authorized repair center for help.

Calibrating the IBP Transducers

The invasive pressure transducers must be calibrated, or set to zero, to ensure accurate absolute pressure measurements. You can set the pressure to zero using either the IBP ZERO ALL ($\rightarrow \bigcirc \leftarrow$) key, the waveform menu or the parameter menu.

NOTE! The IBP ZERO NEEDED message is displayed when the monitor is turned on or when the transducer is connected to the monitor (even if the same transducer is disconnected and reconnected to the monitor).

1. Flush the transducer(s) and corresponding lines with an IV solution.
2. Open the transducer(s) to air, or ambient pressure.
3.  Prepare the transducer(s) for zeroing as described in the transducer manufacturer's instructions.
4. To zero both IBP transducers, press the IBP ZERO ALL key ($\rightarrow \bigcirc \leftarrow$) on the front of the monitor.
5. To zero a single IBP transducer using the parameter menu or the waveform menu:
 - a. Turn the rotary knob on the monitor to move the cursor. Highlight the IBP parameter box name or the waveform name and push the knob to select.
 - b. Highlight ZERO PRESSURE and push the knob to select.
 - c. Highlight MAIN MENU and push the knob to select.
6. Close the transducer(s) to air, or ambient pressure.

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Chapter 12: Temperature

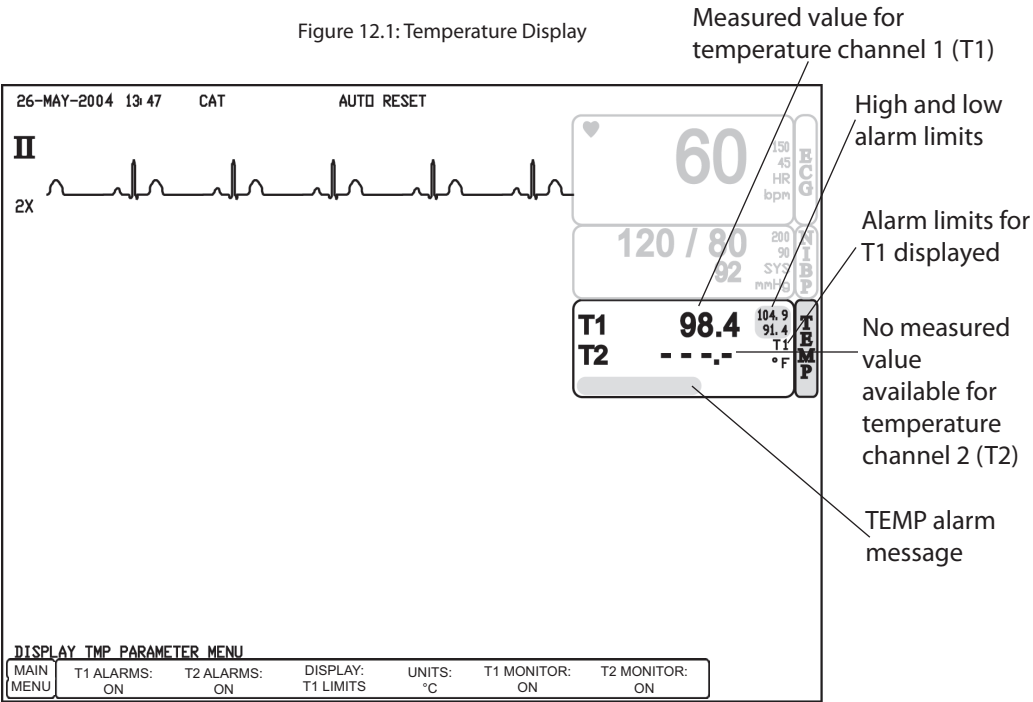
Using the Temperature Parameter

This chapter includes information specific to the temperature parameter. Refer to chapters 4-7 for general step-by-step monitoring instructions. The remainder of this chapter assumes that the monitor is properly installed and set up.

Temperature Measurement Capability

Two independent channels of temperature (T1 and T2) monitoring are available. Each channel is compatible with Smiths Medical PM, Inc. YSI 400-series disposable temperature sensors, or equivalent. The measured value for each temperature channel (T1 and T2) is displayed in the TEMP parameter box. If the temperature channel is turned on and no measured value is available, dashes (- - -) will be displayed in the parameter box. If the temperature channel is turned off, the word OFF will be displayed next to the channel label (T1 or T2) in the parameter box.

Figure 12.1: Temperature Display



Temperature Warnings, Cautions, and Notes

NOTE! Use only temperature sensors and interface cables specifically intended for use with this device.

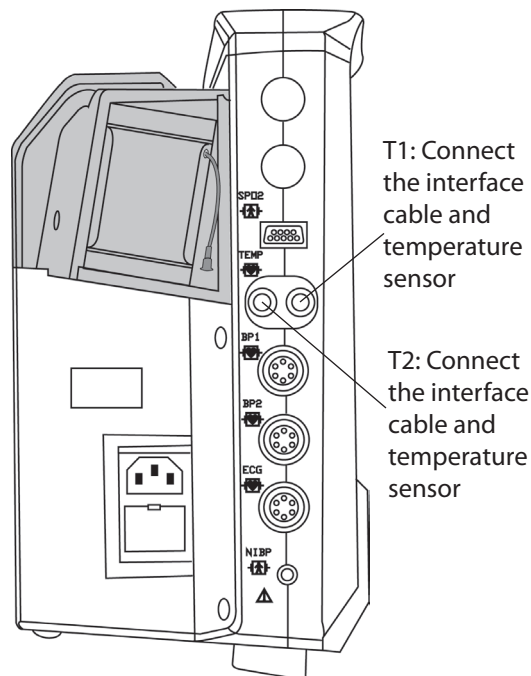
Attaching the Patient

1. Choose a temperature sensor. Each temperature channel is compatible with Smiths Medical PM, Inc. YSI 400-series disposable temperature sensors, or equivalent.
2. Apply the temperature sensor to the patient according to the standards of practice and care for your facility, and according to the temperature sensor manufacturer's instructions. ⚠
3. If applicable, connect the temperature sensor to the interface cable.
4. Connect the interface cable and the temperature sensor to the T1 or T2 receptacle on the side of the monitor.

The monitor will automatically detect when the interface cable and temperature sensor are connected.

The temperature parameter will be active and measured values for temperature will be displayed in the TEMP parameter box.

Figure 12.2: Connect the interface cable or temperature sensor



Adjusting the Settings in the Parameter Box

Turn Alarm Detection On or Off

You can turn on or off the alarm detection capability for each temperature channel. If T1 ALARMS or T2 ALARMS is on, an alarm will be issued when the high or low alarm limit for either channel is violated. If you turn T1 ALARMS or T2 ALARMS off and the high or low alarm limit for either channel is violated, an alarm will not be issued. When you turn off the monitor and turn it on again, T1 or T2 ALARMS will be reset to ON; the default setting for each is ON.

To turn on or off the temperature alarm detection:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the TEMP parameter box name and push the knob to access the TEMP parameter menu.
2. Highlight T1 ALARMS or T2 ALARMS and push the knob to select.
3. Choose ON or OFF and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

Choose the Units of Measurement

You can choose to display the temperature in degrees Celsius (°C), or degrees Fahrenheit (°F). The units of measurement can also be changed using the parameter options menu. See *Change the Units of Measurement* in Chapter 4: Setting Up the Monitor for details.

To change the unit of measurement for temperature using the TEMP parameter box:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the TEMP parameter box name and push the knob to access the TEMP parameter menu.
2. Highlight UNITS and push the knob to select.
3. Highlight MAIN MENU and push the knob to select.

Turn a Temperature Channel On or Off

You can turn on or off the measured value for temperature displayed in the TEMP parameter box. The default setting is ON.

To turn on or off a temperature channel:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the TEMP parameter box name and push the knob to access the TEMP parameter menu.
2. Highlight T1 MONITOR or T2 MONITOR and push the knob to select.
3. Highlight ON or OFF and push the knob to select.
4. Highlight MAIN MENU and push the knob to select.

TEMP Alarms

A temperature alarm will be issued when the numeric measured value for temperature matches or exceeds the alarm limits set for T1 or T2 or when there is a malfunction with the temperature sensor. See *Set the Alarm Limits* in *Chapter 5: Monitoring the Patient* for instructions for setting high and low alarm limits.

During a temperature alarm, an audible alarm tone will sound and ALARM will appear in the alarm status line at the top of the display. In the TEMP parameter box, a message may be displayed describing the alarm condition and, when applicable, the violating measured value and violated alarm limit will flash.

Temperature alarms are categorized as medium priority.

ALARM CONDITION	INDICATION
HIGH TEMP	Audible medium priority alarm; yellow temperature value in the TEMP parameter box
LOW TEMP	Audible medium priority alarm; yellow temperature value in the TEMP parameter box
COM ERROR	Audible medium priority alarm; message in the TEMP parameter box

Temperature Alarm Messages

The following message can be displayed in the TEMP parameter box:

ALARM MESSAGE	POSSIBLE CAUSE	CORRECTIVE ACTION
COM ERROR	This message is displayed in the TEMP parameter box when the monitor's main processor cannot communicate with the temperature circuitry. All temperature functions are disabled. This is a medium priority alarm.	Contact your authorized repair center for help.

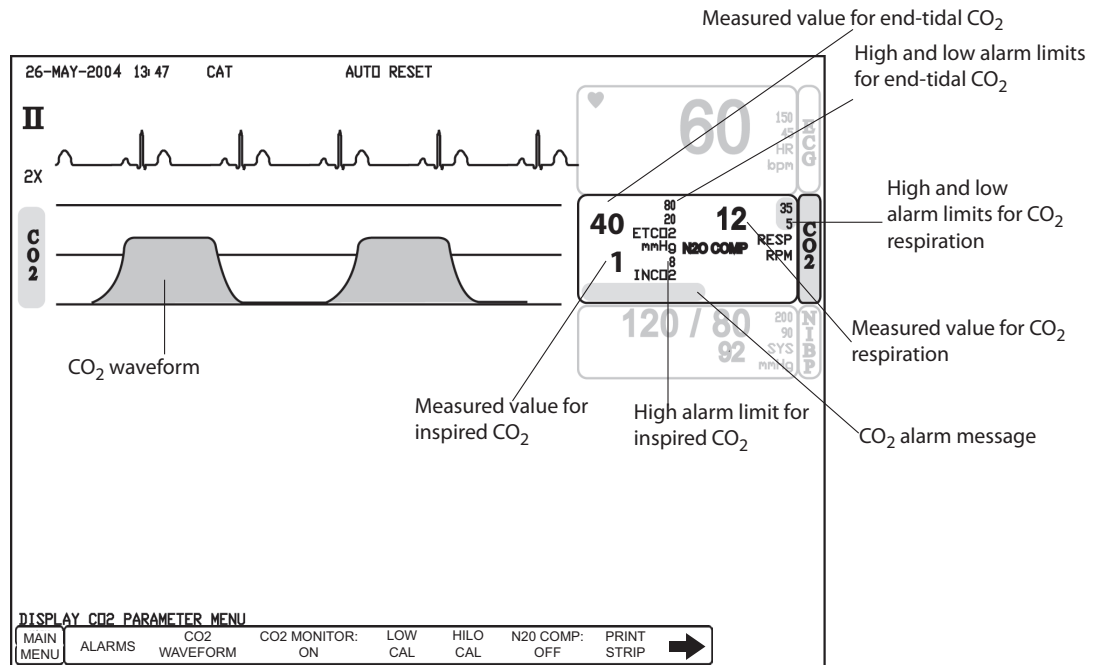
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Chapter 13: Capnography

Using the Capnography Parameter

This chapter includes information specific to the capnography parameter. Refer to chapters 4-7 for general step-by-step monitoring instructions. The remainder of this chapter assumes that the monitor is properly installed and set up.

Figure 13.3: Capnography Display



Capnography Warnings, Cautions, and Notes

WARNING! The capnograph contains no compensation for barometric pressure; therefore, readings in mmHg and kPa are correct only under the pressure at which the capnograph is calibrated. Manual compensation can be made by performing a low calibration (low cal).

CAUTION! Pump motors in the capnograph may adversely affect other medical equipment such as ECG tracings.

CAUTION! Use of the monitor during continuous nebulized medication delivery will result in damage to the monitor which is not covered by the factory warranty. Disconnect the ET CO_2 sample line from the patient circuit or power off during medication delivery.

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

NOTE! During the auto zero calibration (autocal) sampling, the CO_2 waveform and digits will disappear for 1-5 seconds. After this, breath detection restarts. This should happen only during extreme temperature changes, and not during normal patient monitoring or changes of ambient pressure.

NOTE! The auto zero calibration (autocal) is similar to a low calibration (low cal), excluding ambient pressure so as not to stop the pump.

NOTE! Capnograph patient attachments and sample lines are disposable, single-patient use items. Use a new patient attachment and sample line for each new patient.

NOTE! Discard and replace the patient attachment if it becomes occluded. If an air leak is noted, check all patient connections. If the air leak persists, discard and replace the patient attachment.

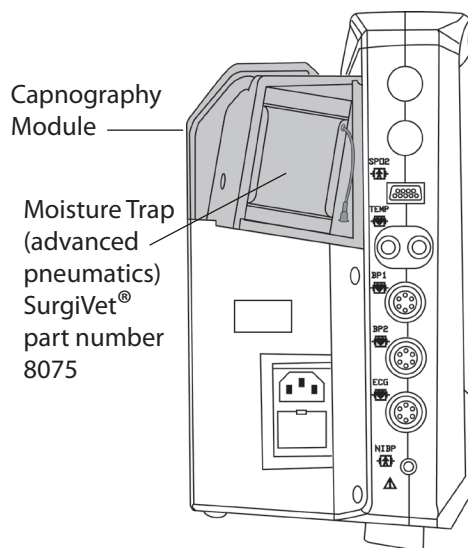
Capnography Measurement Capability

The capnography parameter provides the continuous, non-invasive monitoring of sidestream end-tidal carbon dioxide (ETCO₂), inspired carbon dioxide (INCO₂), and respiration rate (RR). The measured values for capnography (ETCO₂, INCO₂, and RR) are displayed in the CO₂ parameter box and a CO₂ waveform can be continuously displayed. Nitrous oxide compensation is selectable. When the N₂O compensation is enabled, the module adjusts the CO₂ reading by an algorithm that assumes the concentration of N₂O is 40% and compensates accordingly.

Theory of Operation

If the capnography parameter is installed, the module, with an installed connector, is attached to the back of the monitor. The capnography module is configured with a moisture trap, referred to as advanced pneumatics.

Figure 13.1: Capnography Module (left side view of monitor)



The capnography module has an installed CO₂ absorber, an exhaust port, and a rear filter. You can connect a non-recirculating scavenging system to the exhaust port (SurgiVet® part number V1175).

CAUTION! When connecting a non-recirculating scavenging system, use only an exhaust line approved by Smiths Medical PM, Inc. Failure to comply may result in damage to the monitor.

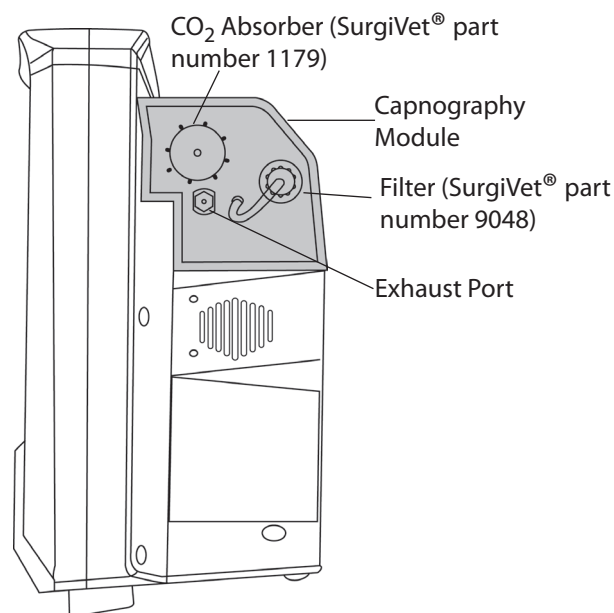
Measuring CO₂

The module draws a sample of gas through the sample chamber. A light source shines infrared (IR) light through an optical bandpass filter and then through the sample chamber. An IR detector responds to the amount of IR light that passes through the sample chamber. Because CO₂ absorbs IR light at a specific wavelength, the amount of light passing through the sample chamber varies according to the concentration of CO₂ in the sample chamber. When there is a high concentration of CO₂ in the sample chamber, the detector senses a smaller amount of the CO₂ absorption wavelength light than when there is a low concentration of CO₂.

The module computes the partial pressure of CO₂ STPD (standard temperature, pressure, dry) based on measured levels of IR light intensity.

The ETCO₂ measurement shows an average of four breaths.

Figure 13.2: Capnography Module (right side view of monitor)



Measuring Respiration Rate (RR)

The module uses the continuous CO₂ waveform to detect each breath cycle. It uses an adaptive algorithm to recognize each breath in the waveform, even in the presence of an elevated baseline (rebreathing) and higher frequencies in the CO₂ waveform (cardiogenic oscillations).

The respiration rate (RR) is computed from the total number of seconds for the last four breaths according to this formula:

$$\text{Respirations per minute} = \frac{60 \text{ seconds} \times \text{breaths}}{\text{Number of seconds for 4 breaths}}$$

N₂O Compensation

The interfering effect of nitrous oxide (N₂O) results in inaccurate CO₂ readings; however, the capnography module has the means to compensate.

When the N₂O compensation is enabled, the module adjusts the CO₂ reading by an algorithm that assumes the concentration of N₂O is 40% and compensates accordingly. If N₂O compensation is enabled and the concentration of N₂O is not 40%, the displayed value is adjusted by the following equation to get the actual CO₂ concentration.

$$\text{Actual CO}_2 = \frac{\text{CO}_2 \text{ reading} \times 1.0625}{1 + \left(\frac{0.0625 \times \text{N}_2\text{O}\%}{40\%} \right)}$$

When the N₂O compensation is disabled, the module adjusts the CO₂ reading by an algorithm that assumes the concentration of N₂O is 0%. If N₂O compensation is disabled and the concentration of N₂O is not 0%, the displayed value is adjusted by the following equation to get the actual CO₂ concentration.

$$\text{Actual CO}_2 = \frac{\text{CO}_2 \text{ reading}}{1 + \left(\frac{0.0625 \times \text{N}_2\text{O}\%}{40\%} \right)}$$

See *Turning N₂O Compensation On or Off* in this chapter for instructions on enabling or disabling this feature.

Attaching the Patient

NOTE! Capnography patient attachments and sample lines are disposable, single-patient use items. Use a new patient attachment and sample line for each new patient.

NOTE! Discard and replace the patient attachment if it becomes occluded. If an air leak is noted, check all patient connections. If the air leak persists, discard and replace the patient attachment.

To attach the patient

1. Choose a capnography attachment, such as a cannula or an adapter, that is appropriate for the patient type.

PATIENT TYPE	DESCRIPTION
Awake animal	Nasal cannula
Intubated/anesthetized animal	Airway adapter or F-circuit Elbow adapter

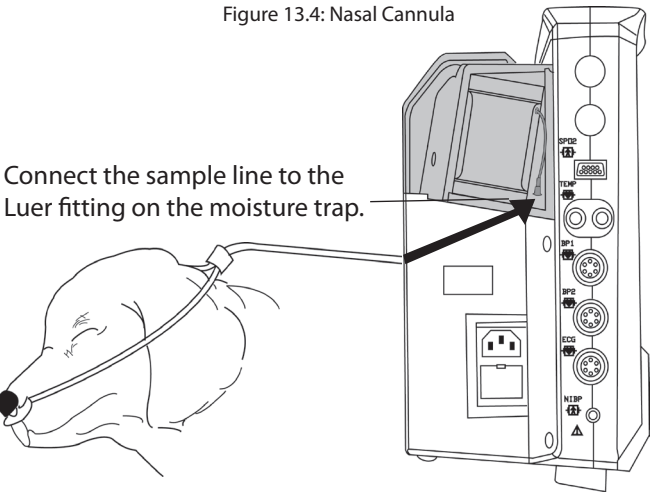
2. Attach the cannula or adapter to the patient and to the monitor.

Using a Nasal Cannula

If you are using a nasal cannula:

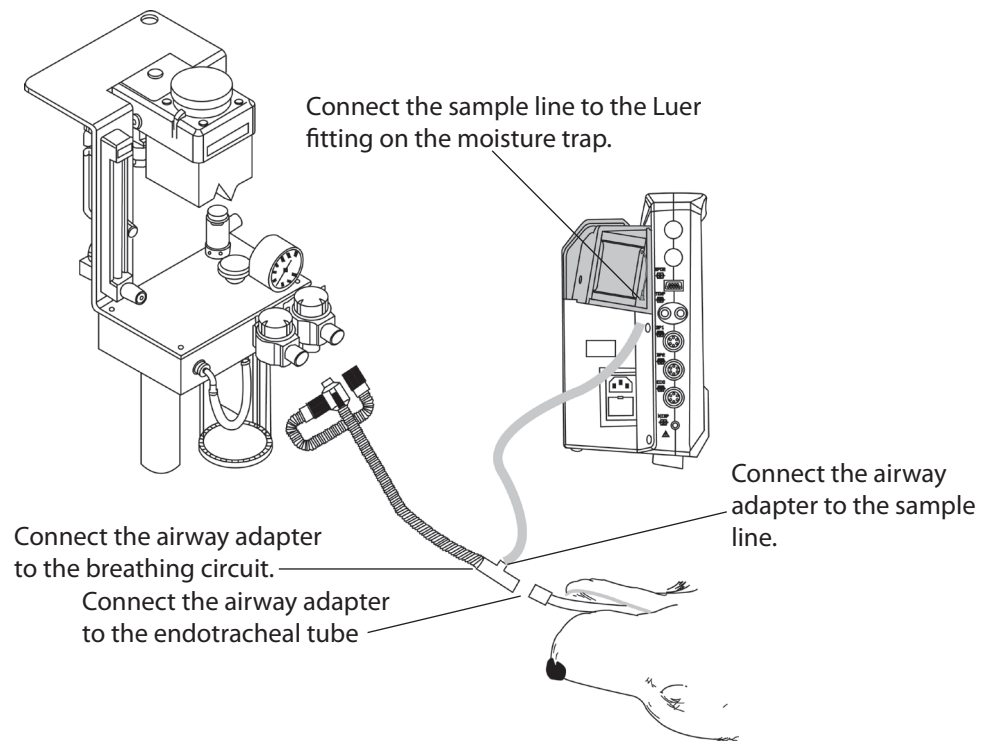
1. Be sure the moisture trap (SurgiVet® part number 8075) is attached to the left side of the capnography module on the monitor.
2. Connect the nasal cannula sample line (SurgiVet® part number 1186) to the Luer fitting on the moisture trap and twist to tighten.
3. Place the cannula over the patient's head and tighten the strap to fit the patient.

Figure 13.4: Nasal Cannula



Using an Airway Adapter

Figure 13.5: Airway Adapter

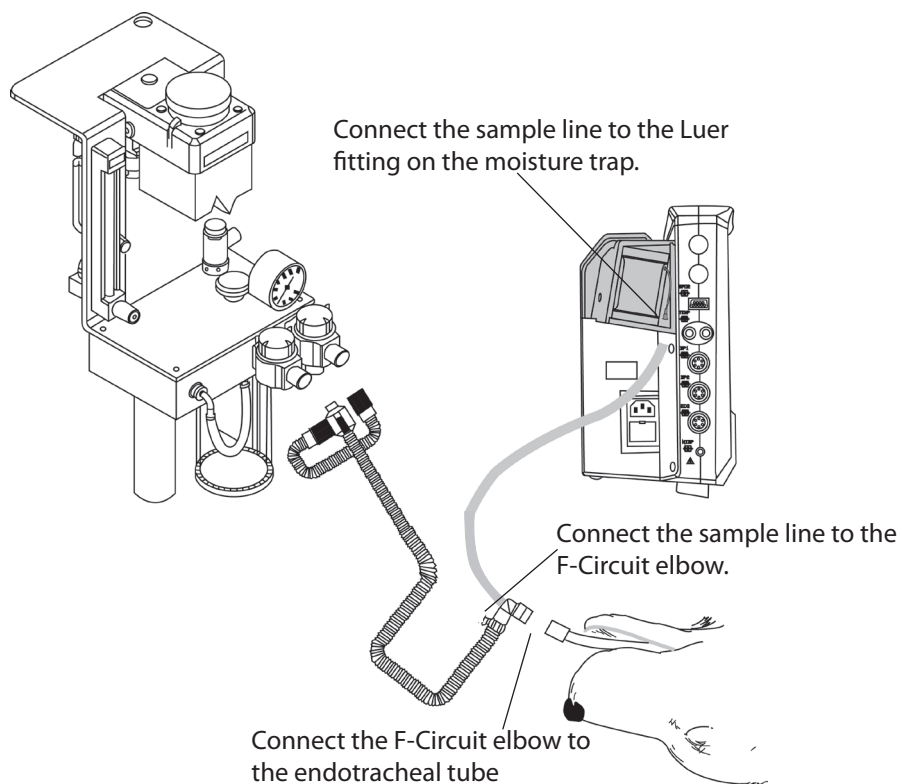


If you are using an airway adapter:

1. Be sure the moisture trap (SurgiVet® part number 8075) is attached to the left side of the capnography module on the monitor.
2. Connect the sample line (SurgiVet® part number 8044 or 8211) to the Luer fitting on the moisture trap and twist to tighten.
3. Connect the airway adapter to the sample line and twist to tighten.
4. Connect the large end of the airway adapter to the breathing circuit.
5. Connect the small end of the airway adapter to the endotracheal tube.

Using an F-Circuit Elbow

Figure 13.6: F-Circuit Elbow



If you are using an F-circuit Elbow:

1. Be sure the moisture trap (SurgiVet® part number 8075) is attached to the left side of the capnography module on the monitor.
2. Connect the sample line (SurgiVet® part number 8044 or 8211) to the Luer fitting on the moisture trap and twist to tighten.
3. Connect the sample line to the F-circuit elbow and twist to tighten.
4. Connect the F-circuit elbow to the endotracheal tube.

Turning on the Capnography (CO₂)

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
2. Highlight PARAMETER OPTIONS and push the knob to access the parameter options submenu.
3. Highlight CO₂ MONITOR and push the knob to select.
4. Highlight ON and push the knob to select. The CO₂ parameter box will appear on the display and the CO₂ waveform will begin.
5. Turn the rotary knob to highlight MAIN or PREVIOUS and push the knob to select.

NOTE! The default setting for capnography is on if the capnography parameter is installed on your monitor.

NOTE! CO₂ MONITOR can be turned on only if the capnography parameter is installed on your monitor.

Checking for leaks

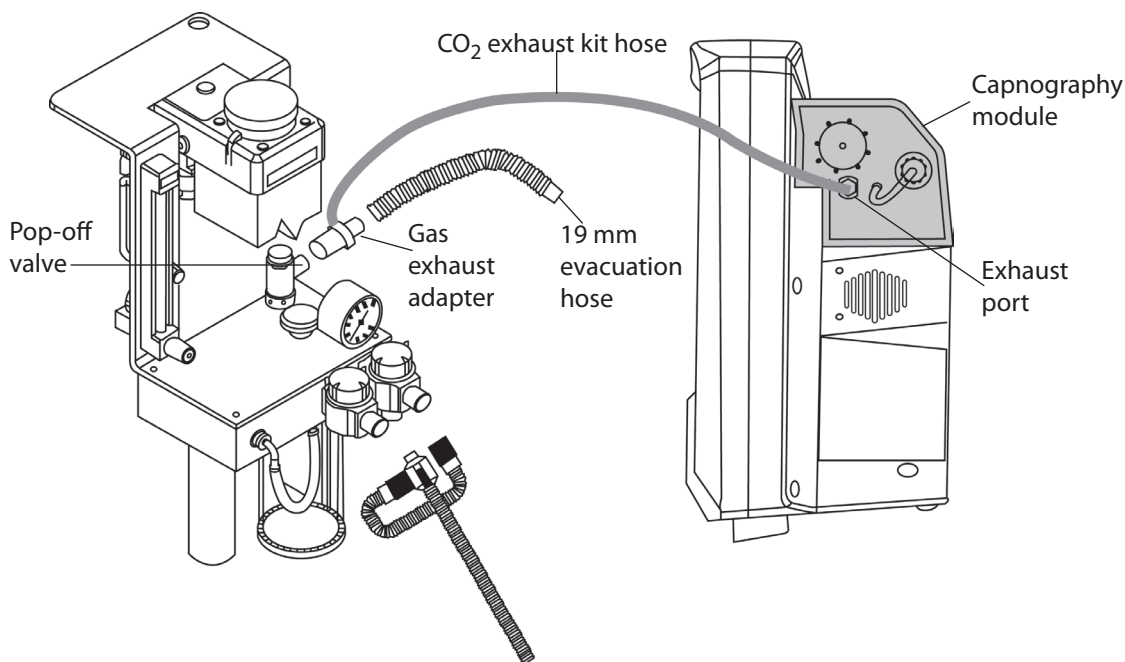
To check for leaks:

1. Pinch the sample line tubing near the moisture filter or moisture trap.
2. Look in the alarm message area in the CO₂ parameter box. If OCCLUSION is displayed, the capnography module is functioning properly. If not, see *Chapter 15: Operator's Maintenance and Troubleshooting*.

Check the capnography module for leaks. Intentionally block or occlude the sample line tubing; if there is an internal leak in the module, it will not recognize the occlusion. If the module is functioning properly, an alarm will occur and OCCLUSION will be displayed in the parameter box. If the OCCLUSION message does not appear, see *Chapter 15: Operator's Maintenance and Troubleshooting*.

Scavenging the Exhaust of the Capnography Module

Figure 13.7: CO₂ Exhaust Kit



CAUTION! Failure to connect the CO₂ exhaust kit (part number V1175) to the capnography module will result in waste anesthetic gas contamination of the work environment.

To connect the CO₂ exhaust kit (part number V1175):

1. Connect one end of the CO₂ exhaust kit hose to the exhaust port on the monitor.
2. Connect the other end of the of the CO₂ exhaust kit hose to the gas exhaust adapter.
3. Connect the larger end of the gas exhaust adapter to the pop-off valve on the anesthesia machine.
4. Connect one end of the 19 mm evacuation hose to the exhaust port adapter.
5. Connect the other end of the 19 mm evacuation hose to your scavenging system.

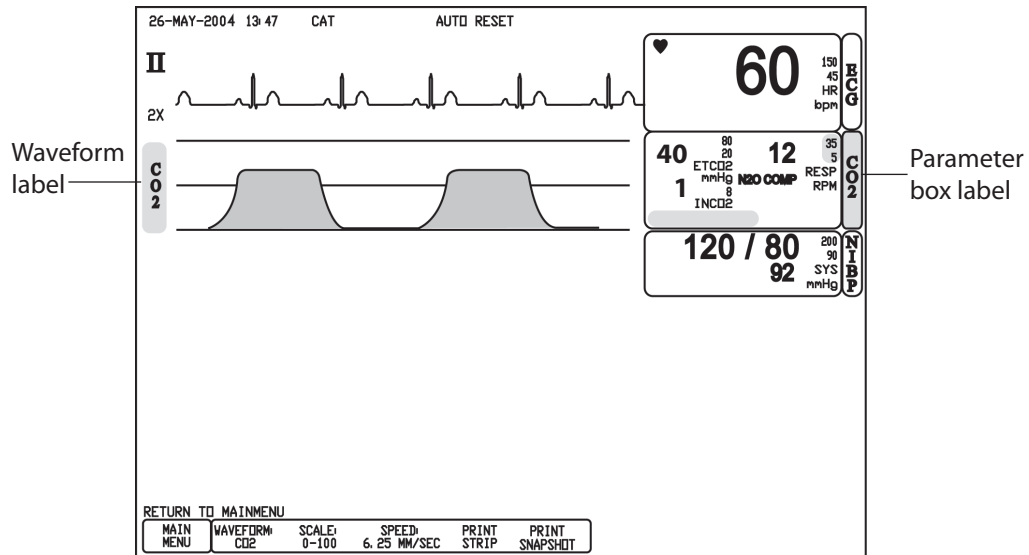
Choosing the Waveform Settings

Use the waveform menu options for capnography to adjust the scale and speed of the CO₂ waveform.

Access the Waveform Menu

The CO₂ waveform menu is accessible from the waveform label and from the CO₂ parameter box.

Figure 13.8: CO₂ Display



To access the waveform menu from the CO₂ waveform label:

1. Turn the rotary knob on the monitor to move the cursor.
2. Highlight the waveform label and push the knob to select. The waveform menu will appear in the lower left corner of the display.

To access the waveform menu from the parameter box:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the parameter name (CO₂) and push the knob to select. The parameter menu will appear in the lower left corner of the display.
2. Turn the rotary knob to highlight CO₂ WAVEFORM and push the knob to select. The waveform settings submenu will appear.

If the CO₂ waveform has been turned off:

1. On the CO₂ parameter submenu, highlight WAVEFORM OFF and push the knob to select.
2. Highlight the waveform area in which to display the CO₂ waveform and push the knob to select. The waveform will be displayed.
3. Highlight CO₂ WAVEFORM and push the knob to select. The respiration waveform settings submenu will appear.

Choose the Scale of the Waveform

You can choose the scale at which the CO₂ waveform is displayed. See below for the available scales for CO₂.

AVAILABLE CO ₂ SCALES		
mmHg	kPa	%
0 – 50 mmHg	0 – 6 kPa	0 – 5 %
0 – 75 mmHg	0 – 10 kPa	0 – 7.5 %
0 – 100 mmHg	0 – 14 kPa	0 – 10 %

To change the scale of the CO₂ waveform:

1. On the waveform menu, highlight SCALE and push the knob to select.
2. Highlight the desired scale and push the knob to select.

Changing the Units of Measurement

You can change the unit of measurement available for CO₂ to millimeters of mercury (mmHg), kiloPascals (kPa), or percent volume (%). The units apply to both end-tidal ETCO₂ and inspired INCO₂.

To change the units of measurement:

1. Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
2. Highlight PARAMETER OPTIONS and push the knob to access the parameter options submenu.
3. Highlight UNITS OF MEASURE and push the knob to access the units of measure submenu.
4. Highlight CO₂ UNITS and push the knob to select.
5. Highlight the desired unit and push to select.
6. Highlight MAIN or PREVIOUS and push the knob to select.

Choose the Waveform Speed

You can choose the speed at which the CO₂ waveform is displayed. The default waveform speed is 25 mm/second.

To change the speed of the CO₂ waveform:

1. On the waveform menu, highlight SPEED and push the knob to select.
2. Highlight the desired speed of the waveform (6.25, 12.5, or 25 mm/second) and push the knob to select.
3. Highlight MAIN MENU and push the knob to select.

Adjusting the Settings in the Parameter Box

Turn Alarm Detection On or Off

You can turn on or off the alarm detection capability for each measured value (ETCO₂, INCO₂, RR). For example, if ETCO₂ ALARMS is on, an alarm will be issued when the high or low alarm limit for end-tidal CO₂ is violated. If you turn ETCO₂ ALARMS off and the high or low alarm limit is violated, an alarm will not be issued. When you turn off the monitor and turn it on again, [ETCO₂, INCO₂, or RR] ALARMS will be reset to ON; the default setting for each measured value is ON.

To turn on or off the alarm detection for each measured value:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the CO₂ parameter box name and push the knob to access the CO₂ parameter menu.
2. Highlight ALARMS and push the knob to select.
3. Highlight ETCO₂ ALARMS, INCO₂ ALARMS or CO₂ RESP ALARMS and push the knob to select.
4. Choose ON or OFF and push the knob to select.
5. Highlight MAIN MENU and push the knob to select.

Turn the Capnography Parameter Off

You can turn off the capnography parameter. The parameter box and waveform will disappear from the display. You must turn on the capnography parameter using the setup menu. See *Parameter Options* in *Chapter 4: Setting Up the Monitor*.

NOTE! The default setting for capnography is on if the capnography parameter is installed on your monitor.

NOTE! CO₂ MONITOR can be turned on only if the capnography parameter is installed on your monitor.

To turn the capnography parameter off:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the CO₂ parameter box name and push the knob to access the CO₂ parameter menu.
2. Highlight CO₂ MONITOR and push the knob to select.
3. Highlight OFF and push the knob to select. The CO₂ parameter box and waveform will disappear from the display.
4. Turn the rotary knob to highlight MAIN or PREVIOUS and push the knob to select.

Turn N₂O Compensation On or Off

When N₂O compensation is turned on, the module adjusts the CO₂ reading by an algorithm that assumes the nitrous concentration is 40% and compensates accordingly. When the N₂O compensation is turned off, the module adjusts the CO₂ reading by an algorithm that assumes the concentration of N₂O is 0%. See *N₂O Compensation* in this chapter for more information.

To turn on or off N₂O compensation:

1. Turn the rotary knob on the monitor to move the cursor. Highlight the CO₂ parameter box name and push the knob to access the CO₂ parameter menu.
2. Highlight N₂O COMP and push the knob to select.
3. Highlight ON or OFF and push the knob to select. When N₂O compensation is turned on, N₂O COMP will be displayed in the CO₂ parameter box.
4. Highlight MAIN MENU and push the knob to select.

Capnography Alarms

A capnography alarm will be issued when one of the numeric measured values for capnography (ETCO₂, INCO₂, RR) matches or exceeds the alarm limits or when there is a malfunction with the capnography module. See *Set the Alarm Limits* in *Chapter 5: Monitoring the Patient* for instructions for setting high and low alarm limits.

During a capnography alarm, an audible alarm tone will sound and ALARM will appear in the alarm status line at the top of the display. In the CO₂ parameter box, a message may be displayed describing the alarm condition and, when applicable, the violating measured value and violated alarm limit will flash.

Capnography alarms are categorized as medium or low priority.

ALARM CONDITION	INDICATION
HIGH RESP RATE	Audible medium priority alarm; flashing CO ₂ respiration value in the CO ₂ parameter box
LOW RESP RATE	Audible medium priority alarm; flashing CO ₂ respiration value in the CO ₂ parameter box
HIGH ETCO ₂	Audible medium priority alarm; flashing end-tidal CO ₂ value in the CO ₂ parameter box
LOW ETCO ₂	Audible medium priority alarm; flashing end-tidal CO ₂ value in the CO ₂ parameter box
HIGH INCO ₂	Audible medium priority alarm; flashing inspired CO ₂ value in the CO ₂ parameter box
OCCLUSION	Audible medium priority alarm; message displayed in the CO ₂ parameter box
TRAP FULL	Audible medium priority alarm; message displayed in the CO ₂ parameter box
SENSOR ERROR	Audible low priority alarm; message displayed in the CO ₂ parameter box
COM ERROR	Audible low priority alarm; message displayed in the CO ₂ parameter box

Capnography Alarm Messages

The following messages can be displayed in the CO₂ parameter box:

ALARM MESSAGE	POSSIBLE CAUSE	CORRECTIVE ACTION
LOW CAL ERROR	This message is displayed in the CO ₂ parameter box when the capnography module's main processor detects an error during a low calibration. The monitor will revert to the last successful low calibration data and resume operation.	Replace the CO ₂ absorber (SurgiVet® part number 1179) on the capnography module. Contact your authorized repair center for help.
HI CAL ERROR	This message is displayed in the CO ₂ parameter box when the capnography module's main processor detects an error during a high calibration. The monitor will revert to the last successful high calibration data and resume operation.	Turn on the calibration gas sooner. Use a new canister of gas. Contact your authorized repair center for help.
SENSOR ERROR	This message is displayed in the CO ₂ parameter box when there is a malfunction with capnography module. This is a low priority alarm.	Contact your authorized repair center for help.
OCCLUSION	This message is displayed in the CO ₂ parameter box when the sample line tubing is blocked, or occluded. This is a medium priority alarm.	Disconnect the sample line tubing from the moisture trap assembly on the left side of the capnography module. If the OCCLUSION message disappears, replace the moisture trap with a new one. Disconnect the filter (SurgiVet® part number 9048) on the right side of the capnography module. If the OCCLUSION message disappears, replace the filter with a new one. Contact your authorized repair center for help.
COM ERROR	This message is displayed in the CO ₂ parameter box when the monitor's main processor cannot communicate with the capnography module. All capnography functions are disabled. This is a low priority alarm.	Turn the capnography parameter off and then on again. Turn the monitor off and back on again. Contact your authorized repair center for help.
TRAP FULL	This message is displayed in the CO ₂ parameter box when the moisture trap on the left side of the capnography module is full. This is a medium priority alarm.	Disconnect the sample line tubing from the moisture trap assembly on the left side of the capnography module and replace the moisture trap with a new one.

NOTE! The moisture trap can run over 50 hours in a heated wire circuit at 100% humidity without occluding.

CO₂ Messages (Information Only)

CO ₂ MESSAGE	POSSIBLE CAUSE
LO CAL IN PROGRESS	This message is displayed in the CO2 parameter box when the capnography module is performing a low calibration.
HI CAL IN PROGRESS	This message is displayed in the CO2 parameter box when the capnography module is performing a high calibration.
CAL DONE	This message is displayed in the CO2 parameter box when the calibration procedure is complete.
TURN GAS ON	This message is displayed in the CO2 parameter box during a high calibration when the monitor is waiting for you to turn on the calibration gas canister.
GAS IS ON	This message is displayed in the CO2 parameter box during a high calibration when the monitor detects that the calibration gas is turned on.
TURN GAS OFF	This message is displayed in the CO2 parameter box when it is time for you to shut off the calibration gas.
CAL CANCELLED	This message is displayed in the CO2 parameter box when you select the QUIT CAL option from the CO2 parameter menu. QUIT CAL is only available on the menu when a calibration is in progress. The module cancels the calibration.

Calibrating the Capnography Module

The capnography module must be calibrated, or set to zero, to ensure that the end-tidal CO₂ (ETCO₂) and inspired CO₂ (INCO₂) measurements are accurate. Calibrate the capnography module about once a month.

NOTE! Use only the calibration gas canister and flow regulator supplied with or specifically intended for use with this device. See *Chapter 16: Optional Supplies and Accessories* for information about ordering calibration gas.

The capnography module has two user-controlled calibration procedures: low calibration (LOW CAL) and high/low calibration (HILO CAL). The LOW CAL procedure resets the baseline measurement for CO₂ to zero. You can perform a low calibration while the patient is attached because a three-way valve closes the patient inlet and opens to room air. A HILO CAL procedure should be performed after the capnography parameter has been on for at least 15 minutes. The HILO CAL requires the delivery of a gas mixture from a canister.

The capnography module includes two automatic calibration procedures: auto calibration (LOW CAL), and auto zero calibration (AUTO ZERO). The monitor initiates an auto LOW CAL when no new atmospheric pressure reading has been available for 24 hours. The monitor initiates an AUTO ZERO when the module detects a large temperature change.

To perform a LOW CAL:

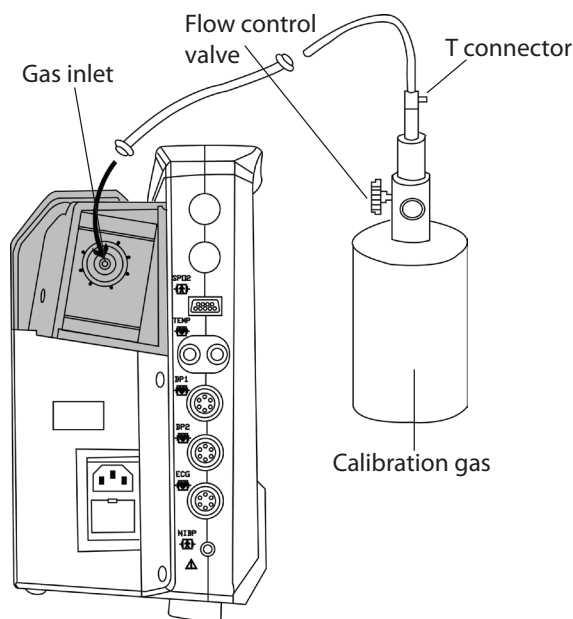
1. Turn the rotary knob on the monitor to move the cursor. Highlight the CO₂ parameter box name and push the knob to select.
2. Highlight LOW CAL and push the knob to select.
3. Turn the rotary knob to highlight YES and push the knob to select. LO CAL IN PROGRESS will be displayed in the CO₂ parameter box.
4. When the calibration procedure is finished, CAL DONE will be displayed in the CO₂ parameter box.

To perform a HILO CAL:

NOTE! A HILO CAL procedure should be performed only after the capnography parameter has been on for at least 15 minutes.

NOTE! Remove the device from the patient before performing a high/low calibration procedure.

Figure 13.9: HILO CAL



1. If the patient is attached to the capnography module, disconnect the sample line tubing from the monitor by unscrewing the filter Luer from the module on the left side of the monitor.
2. Connect one end of the "T" assembly to the regulator on the gas canister. Connect the second end of the "T" assembly to the Luer fitting on the moisture trap. Leave the third end of the "T" assembly open to room air.
3. Turn the rotary knob on the monitor to move the cursor. Highlight the CO₂ parameter box name and push the knob to select.
4. Highlight HILO CAL and push the knob to select.
5. Turn the rotary knob to highlight YES and push the knob to select. The monitor will first do a low calibration. After a short time, the message "TURN GAS ON" will be displayed in the CO₂ parameter box.
6. Quickly open the flow control valve on the calibration gas canister. The valve must be fully opened in less than 30 seconds.
7. When TURN GAS OFF is displayed in the CO₂ parameter box, close the flow control valve of the calibration gas canister.
8. When the calibration procedure is finished, CAL DONE will be displayed in the CO₂ parameter box.
9. Change the units of measurement for CO₂ to percent concentration (%) as follows:
 - Turn the rotary knob on the monitor to move the cursor. On the main menu at the bottom of the display, highlight SETUP and push the knob to select.
 - Highlight PARAMETER OPTIONS and push the knob to access the parameter options submenu.
 - Highlight CO₂ UNITS and push the knob to select.
 - Highlight the desired unit and push to select.
 - Highlight MAIN or PREVIOUS and push the knob to select.
10. Verify the accuracy of the calibration by opening and closing the flow control valve on the calibration gas canister at a rate of approximately 15Hz (on for two seconds, off for two seconds). Repeat this for 4-8 on/off cycles.
11. Verify that the ETCO₂ reading in the CO₂ parameter box indicates 10.0% CO₂ ± 0.4 (9.6-10.4%).
12. Disconnect the calibration gas fixture.
13. If the calibration procedure is unsuccessful, a message will be displayed in the CO₂ parameter box. The capnography parameter will revert to the last successful calibration data and resume operation.

Figure 14.1: Serial Output Connector



1. To acquire data using the REAL-TIME NUMERIC (CSV) serial output protocol:
 - a. Turn the rotary knob on the monitor to move the cursor. Highlight SETUP and push the knob to access the setup menu.
 - b. Highlight SERVICE MENU and push the knob to select.
 - c. Turn the rotary knob to access the password box and push the knob to select the first character field.
 - d. Turn the rotary knob to highlight the desired character and push the knob to select. The factory-installed password is ADVISOR.
 - e. Push the knob to select the next character field.
 - f. Turn the rotary knob to highlight the desired character and push the knob to select. Repeat steps d and e until each character in the password is selected.
 - g. Highlight ENTER and push the knob to select.
2. On the service menu, highlight MONITOR DEFAULTS and push the knob to select.
3. Highlight SERIAL OUTPUT MODE and push the knob to select.
4. Turn the rotary knob to highlight REAL-TIME NUMERIC (CSV) and push the knob to select.
5. Connect a serial cable (DB-9) to the back of the monitor and to a serial (COM) port on your PC.
6. On your PC, open Hyperterminal or some similar serial communications program.

7. Configure the program for:

- Bits per second (baud): 115,200
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: None

8. Select the *Transfer* (Hyperterminal) menu option along the top edge of the terminal window and select *Capture Text*.

9. Select the location where you wish to save the file and the file name (for example C:\AdvisorData.txt).

10. Click *Start*.

11. When the data capture is complete, select the *Transfer* (Hyperterminal) menu option along the top edge of the terminal window and select *Stop*. The file will be saved to the location previously selected (C:\AdvisorData.txt).

12. This file can be opened using Microsoft Excel by following these steps:

- a. Select *File > Open*.
- b. Change the *Files of type* selection to *Text files (*.prn; *.txt; *.csv)*.
- c. Open the previously saved file (C:\AdvisorData.txt).
- d. Select *Delimited* and click *Next*.
- e. Check the *Comma* box and uncheck all other selected boxes. Click *Finish*.
- f. Each column in the following table represents a measured value from the monitor and has the following format:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	380	60	95	6	60	119	80	92	60	25	10	14	-32764	-32767
2	380	60	95	6	60	119	80	92	60	25	10	14	-32764	-32767
3	380	60	95	6	60	119	80	92	60	25	10	14	-32764	-32767
4	380	60	95	6	60	119	80	92	60	25	10	14	-32764	-32767

	O	P	Q	R	S	T	U	V	W	X	Y
1	-32767	-32767	-32767	-32767	-32767	-32767	-32767	-32767	-32767	745	0
2	-32767	-32767	-32767	-32767	-32767	-32767	-32767	-32767	-32767	745	0
3	-32767	-32767	-32767	-32767	-32767	-32767	-32767	-32767	-32767	745	0
4	-32767	-32767	-32767	-32767	-32767	-32767	-32767	-32767	-32767	745	0

g. When you open the file using Microsoft Excel, you can add new column headings such as those in the following table:

A	B	C	D	E	F	G	H	
Flags	ECG HR (bpm)	SpO ₂ (%)	Ox Strength	Ox Pulse (bpm)	IBP1 SYS (mmHg)	IBP1 DIA (mmHg)	IBP1 MN (mmHg)	
I	J	K	L	M	N	O	P	
IBP1 HR (bpm)	IBP2 SYS (mmHg)	IBP2 DIA (mmHg)	IBP2 MN (mmHg)	IBP2 HR (bpm)	Temp 1 (°C)	Temp 1 (°F)	Temp 2 (°C)	
Q	R	S	T	U	V	W	X	Y
Temp 2 (°F)	NIBP SYS (mmHg)	NIBP DIA (mmHg)	NIBP MAP (mmHg)	NIBP HR (bpm)	ETCO ₂ (mmHg)	INCO ₂ (mmHg)	Ambient Pressure (mmHg)	CO ₂ RESP (rpm)

NOTE! The values -32767, -32766, -32765, and -32764 are invalid numbers and appear as dashes on the monitor, or are not displayed.

NOTE! The flags column is a bit-mapped field that has the following format:

FLAG BITS		
12-31	Unused	
11	IBP2 Zero Needed	
10	IBP1 Zero Needed	
7-9	Heart Rate Source	1 = ECG 2 = Oximetry 3 = IBP
6	I Fail	
5	II Fail	
4	III Fail	
3	V Fail	
2	a VR Fail	
1	a VL Fail	
0	a VF Fail	

To convert the flag number to a binary number, use the DEC2BIN() function in Excel. The rightmost digit is bit zero and the digits increase as you move to the left.

Trend Retrieval Output

To acquire data using the TREND RETRIEVAL serial output protocol:

1. Access the service menu:
 - a. Turn the rotary knob on the monitor to move the cursor. Highlight SETUP and push the knob to access the setup menu.
 - b. Highlight SERVICE MENU and push the knob to select.
 - c. Turn the rotary knob to access the password box and push the knob to select the first character field.
 - d. Turn the rotary knob to highlight the desired character and push the knob to select. The factory-installed password is ADVISOR.
 - e. Push the knob to select the next character field.
 - f. Turn the rotary knob to highlight the desired character and push the knob to select. Repeat steps d and e until each character in the password is selected.
 - g. Highlight ENTER and push the knob to select.
2. On the service menu, highlight MONITOR DEFAULTS and push the knob to select.
3. Highlight SERIAL OUTPUT MODE and push the knob to select.
4. Turn the rotary knob to highlight TREND RETRIEVAL and push the knob to select.
5. Connect a serial cable (DB-9) to the back of the monitor and to a serial (COM) port on your PC.
6. On your PC, open Hyperterminal or some similar serial communications program.
7. Configure the program for:
 - Bits per second (band): 115,200
 - Data bits: 8
 - Parity: None
 - Stop bits: 1
 - Flow control: None
8. Select the *Transfer* (Hyperterminal) menu option along the top edge of the terminal window and select *Capture Text*.
9. Select the location where you wish to save the file and the file name (for example C:\AdvisorData.txt).
10. Click *Start*.
11. When the data capture is complete, select the *Transfer* menu option along the top edge of the terminal window. Select *Transfer* and *Stop*. The file will be save to the location previously selected (C:\AdvisorData.txt).

12. This file can be opened using Microsoft Excel by following these steps:

- a. Select *File > Open*.
- b. Change the *Files of type* selection to *Text files (*.prn; *.txt; *.csv)*.
- c. Open the previously saved file (C:\AdvisorData.txt).
- d. Select *Delimited* and click *Next*.
- e. Check the *Comma* box and uncheck all other selected boxes. Click *Finish*.

13. Each column in the following table represents a measured value from the monitor and has the following format:

	A	B	C	D	E	F	G	H	I
1	DATE	TIME	RATE	RESP	SPO ₂	PPR	ART1-S	ART1-D	ART1-MN
2	19-Oct	14:56.0	60	0	---	---	15.7	10.7	12.3
3	19-Oct	14:55.5	60	0	---	---	15.7	10.7	12.3
4	19-Oct	14:55.0	60	0	---	---	15.7	10.7	12.3

	J	K	L	M	N	O	P	Q
1	ICP2-MN	T1	T2	NIBP-S	NIBP-D	NIBP-M	ETCO ₂	INCO ₂
2	1.6	37	37				--.-	--.-
3	1.6	37	37				--.-	--.-
4	1.6	37	37				--.-	--.-

Analog Output

Description

Four analog output channels are available, corresponding to waveform traces 1-4 on the display. The analog channels provide continuous output of the monitor's waveforms. The monitor's analog outputs operate at all times. When a trace is not connected, the output is -5V.

Analog Output

The monitor may be connected to the Life Sensing Instrument Company, Inc. HTS 820 Central Station for remote monitoring of patient status.

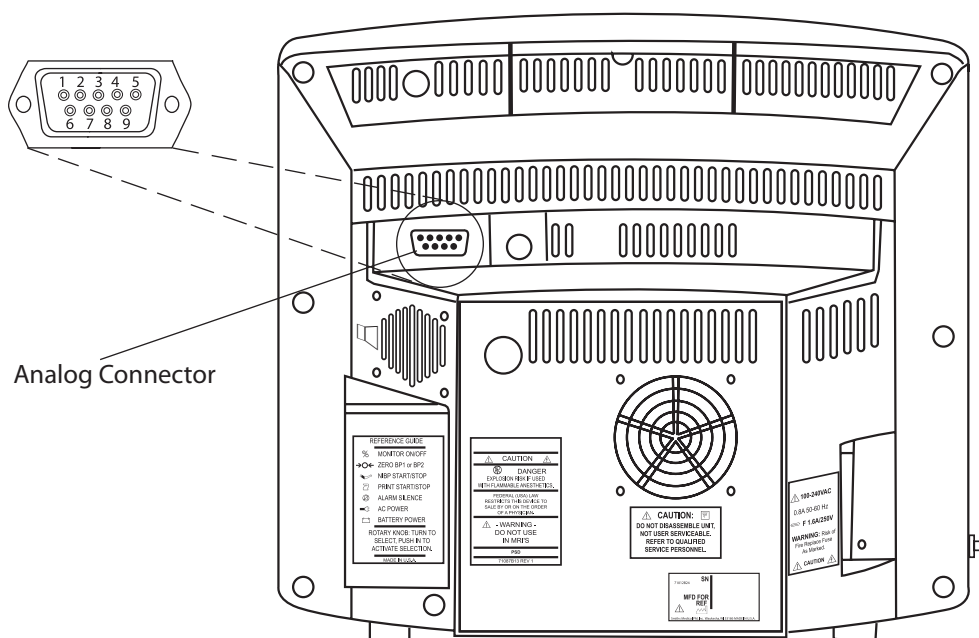


Figure 14.2: Analog Connector

WARNING! Do not connect the serial data cable (DB9) to the SpO₂ patient cable input. This may compromise the patient electrical isolation, which can result in injury or death.

WARNING! Do not connect the SpO₂ patient cable to the serial output connector. The oximetry function will not operate.

WARNING! The analog data output function has been tested to 30.48 m (100 ft). Do not exceed this cable length. Patient data may be corrupted or lost.

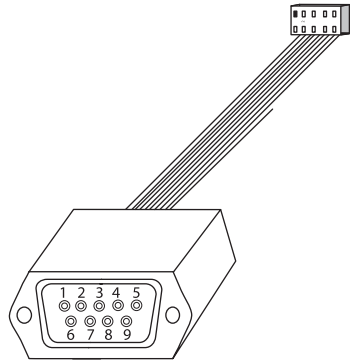


Figure 14.3: Serial/Analog Output Connector (DB9)

PIN NO.	SIGNAL
1	Analog Channel 1
2	Serial Transmit (Tx)
3	Serial Receive (Rx)
4	Analog Channel 2
5	Digital Ground
6	+5 Volts
7	Analog Channel 4
8	Analog Ground
9	Analog Channel 3

Central Station Connection

The monitor is intended to connect to the HTS 820 Central Station from the Life Sensing Instrument Company, Inc. Refer to the central station's operations manual for configuration instructions. The serial/analog output connector of this monitor is used to connect to the central station. The monitor can be hardwired to the central station, or it can communicate using an RF link. In the central station's bedside monitor menu, select "advisor II tcp" for the bedside monitor when using a hardwired connection. Select "BWI.tcp" when using RF communications.

WARNING! When the monitor is connected to the central station, alarm limits must be set at both the central station and the bedside.

WARNING! Each patient parameter being monitored should be tested to ensure proper setup after connecting the monitor to the central station. Do not connect patients nor rely on remotely displayed patient data until all testing has been performed and the system has been shown to be functioning properly.

Optional Data Logger

Intended Use

The Smiths Medical PM, Inc. Veterinary Data Logger, [\[REF\] WWV9220SYS](#), (hereafter called Data Logger) is designed to capture real-time trend data from the SurgiVet® Advisor® multi-parameter vital signs monitor to an SD-type Flash (memory) Card. It also offers the options to capture primary lead ECG waveforms and/or Advisor® Screen Captures. The SurgiVet® Advisor® controls all the functions of the Data Logger.

NOTE!  For more information about the Data Logger, see the Veterinary Data Logger operation manual ([\[REF\] V1920](#)).

Data Logger Features

Data Logger can perform the following functions:

- Record trend data at regular intervals.
- Capture (record) a 30 second primary ECG waveform image. This records the primary (topmost) ECG only.
- Capture a screen image, that is, a bitmap snapshot of the entire Advisor® screen.
- The Data Logger and Flash Card offer an improvement over current methods of transferring patient data from vital signs monitors to a personal computer.
- The Data Logger accumulates trend data from the SurgiVet® Advisor® Vital Signs Monitor onto a removable Flash Card. The data then can be uploaded by the clinician to a personal computer.
- The Flash Card helps improve clinical efficiency by making the transfer of trend data and screen snapshots portable, eliminating reliance on a cable. This is especially important in an environment where cable proliferation is a problem.
- The Data Logger eliminates the need to purchase a separate computer for the procedure area. It also eliminates the inconvenience of wheeling a vital signs monitor from procedure area to personal computer.

System Requirements

- Smiths Medical PM, Inc. Veterinary Data Logger module connected to the serial port on a SurgiVet® Advisor®.
- Advisor® software version VAVRD 1.11 or higher.
- SD (Secure Digital) type flash card; recommended size: 512 MB or 1 Gigabyte.
- Flash Card Reader with SD Flash Card capability.
- Computer with CD-ROM drive to access the Data Logger installation disc and Excel® templates and a USB port to interface with Flash Card Reader.
- PC running Microsoft® Excel® 2002, 2003 or 2007. (See Excel® installation notes from Microsoft® for PC system requirements.)

NOTE: Smiths Medical PM, Inc.'s Data Logger system has been tested using Windows XP with Excel® 2002, 2003 and 2007.

Getting Started

CAUTION! Please be sure that the Advisor[®] is powered off when connecting the Data Logger to the Advisor[®].

1. With the Advisor[®] powered off, connect the Data Logger to the serial port on the back of the Advisor[®]. Fasten the Data Logger with the screws provided. To prevent stripping the screws or damage to the Advisor[®], do not use a power screwdriver.

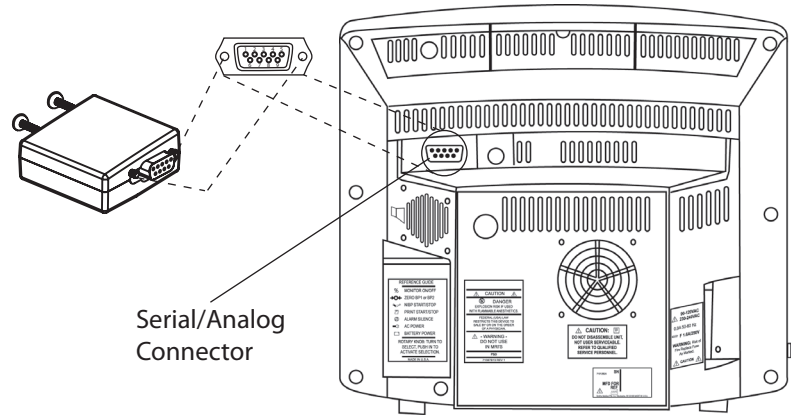


Figure 1: Data Logger Connection

2. Press the $\frac{\circ}{\circ}$ key on the Advisor[®] to turn the monitor on. Under setup, select the service menu.
3. Enter the password. Select **ENTER** to enter and exit the password menu. If the password is correct, the Service Menu will be displayed.

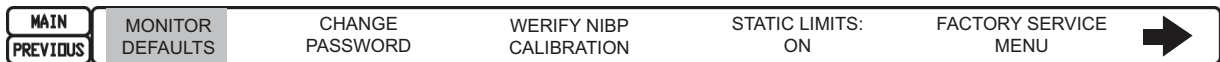


Figure 4: Service Menu

4. Select **MONITOR DEFAULTS** in the Service Menu.
5. Scroll to the **SERIAL OUTPUT MODE** menu item, then select **FLASH CARD DATA LOGGER** to enable Data Logger functions.

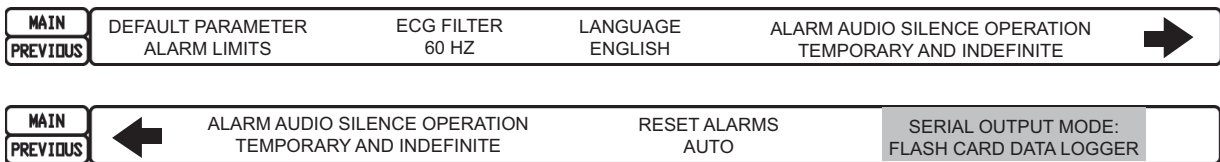


Figure 5: Monitor Defaults Menu

Data Logger Functions and Indicators

Data Logger can perform the following functions:

- Record trend data at regular intervals.
- Capture (record) a 30 second primary ECG waveform image. This records the primary (topmost) ECG only.
- Capture a screen image, that is, a bitmap snapshot of the entire Advisor® screen.

A green icon appears at the top of the Advisor® screen next to the patient type during a Data Logger recording session. Different icons indicate different types of recording. (See icons and explanations below.)

- TRN -  indicates that Trend Data Logger mode is activated. This means that trend data for each parameter will be recorded at pre-selected intervals. The green RECORD dot  is present when trend data files are being recorded to the Flash Card.
- ECG- A primary lead ECG waveform is being recorded (ECG Capture) when the green record dot is present or flickering . The capture starts when the PRINT key  is pressed, and stops by itself in approximately 30 seconds.
- IMG - A bitmap screen image is being recorded (image capture) when the green record dot is present or flickering . The capture starts when the PRINT key  is pressed, and stops by itself in approximately 1 minute.

When a Data Logger error occurs, a yellow icon  appears at the top of the Advisor® screen next to the patient type. See *Error Messages* and *Clearing the Error Indicator* sections later in this chapter for more information about the error indicator.

Recording Real-Time Trends

To begin recording Real-Time Trends:

1. If a Flash Card is not present, insert a Flash Card (formatted to the FAT type file system) into the VDL.

NOTE: Flash Cards come preformatted, so formatting is not always necessary before use. See *Formatting a Flash Card* in the *Troubleshooting* section of the Data Logger operation manual if there are card formatting error messages.

2. In the Advisor® menu options, select the trend record interval by selecting **TRENDS | TABULAR VITAL SIGNS | INTERVAL:** and choosing the desired interval. Default is 30 seconds.
3. Optionally, to set a Procedure number, select **TRENDS | PROCEDURE** and choose a number from 1 to 99.

NOTE: This number will be automatically incremented each time a procedure is stopped. The recorded data is tagged with this number and a time/date stamp. If a patient name is entered, data folders will be labeled with date, time and name.

NOTE: For instructions on how to enter the patient name, see *Chapter 4: Setting Up the Monitor* in this manual.

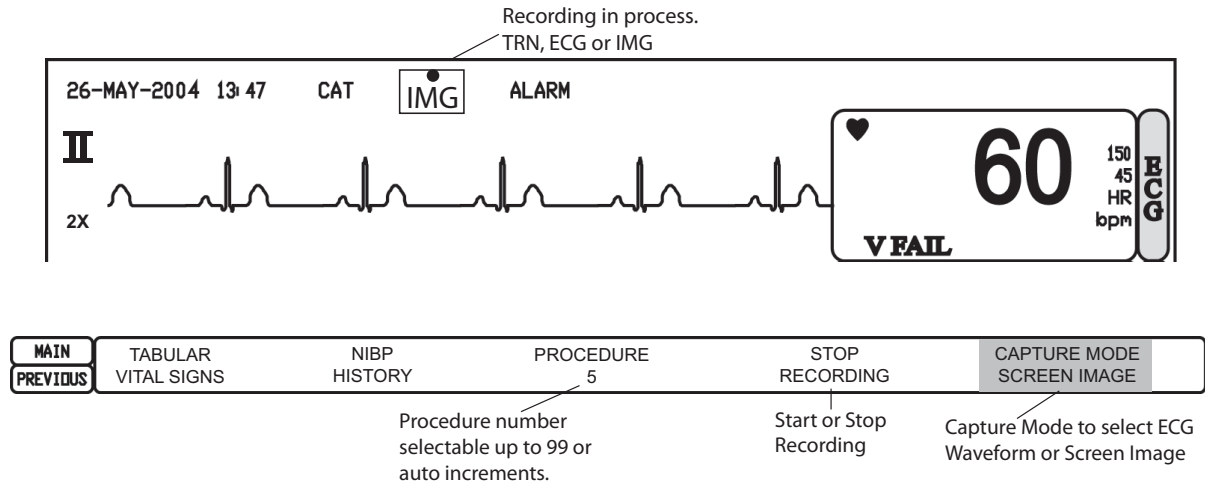
4. Select **TRENDS | START RECORDING** to begin recording trends at the selected interval. A small green icon or will appear at the top of the screen.

NOTE: The veterinary data logger requires up to 30 seconds for configuration when a procedure is initiated, as indicated by a solid green dot in the TRN block. During this time the print key will not cause waveforms or images to be stored to the device. Once the initial green dot is turned off, the image and waveform storage is enabled.

5. To end the recorded session, select **TRENDS | STOP RECORDING**.

WARNING! Do not remove the SD Flash Card while recording! Removing the card during recording can damage the card or cause corrupt files.

WARNING! Do not turn the monitor off or enter suspend mode before stopping the recording, as this can cause corrupt files. The monitor will try to close the files if the monitor is turned off or suspend mode is activated while recording.



Capture Mode

Capture mode allows the operator to use the PRINT key to capture (record) data snapshots to the Flash Card.

There are 3 capture menu options to record real-time trends:

- OFF – Nothing will be recorded to the Flash Card when the PRINT key is pressed during a recorded session.
- ECG TRACE – A 30 second primary lead ECG Trace will be captured to the Flash Card when the PRINT key is pressed during a recorded session
- SCREEN IMAGE – A bitmap file will be created on the Flash Card when the PRINT key is pressed during a recorded session.

The following are present only when the optional printer is installed.

- ECG TRACE WITH PRINTING – A 30 second primary lead ECG Trace will be captured to the Flash Card and an PRINT ALL printout on the Advisor® printer will occur when the PRINT key is pressed during a recorded session.
- SCREEN IMAGE WITH PRINTING – A bitmap file will be created on the Flash Card and an PRINT ALL printout on the Advisor® printer will occur when the PRINT key is pressed during a recorded session.

NOTE! To avoid a paper print-out when the print key is pressed select the appropriate option in the TREND/CAPTURE MODE menu.

NOTE: Flash Cards come preformatted, so formatting is not always necessary before use. Only format the SD Flash Card if it has be corrupted. See *Formatting a Flash Card* in Chapter 5 of the Data Logger operation manual if there are card formatting error messages.

Capturing an ECG Trace

To capture an ECG trace:

1. Select a capture mode. To select a capture mode, select the **TRENDS | CAPTURE MODE** option and select **ECG TRACE**. This selection will capture an ECG trace onto the SD Flash Card when the  PRINT key is pressed during recording.  will change to .

NOTE: This selection does not affect the normal PRINT key operation.

NOTE: Trend information will be written to the card during ECG capture.

2. To stop recording, press the print key  or wait until the 30 second capture is complete.  will revert back to .

Capturing an ECG Trace with Printing

With this option enabled, pressing the PRINT key will start a PRINT ALL printout as well as capture an ECG trace to the Flash Card.

To capture an ECG trace:

1. Select a capture mode. To select a capture mode, select the **TRENDS | CAPTURE MODE** option and select **ECG TRACE**. This selection will capture an ECG trace onto the SD Flash Card when the  PRINT key is pressed during recording.  will change to .

NOTE: This selection does not affect the normal PRINT key operation.

NOTE: Trend information will be written to the card during ECG capture.

2. To stop recording, press the print key  or wait until the 30 second capture is complete.  will revert back to .

Capturing a Screen Image

To capture a screen image:

1. Select a capture mode. To select a capture mode, select the **TRENDS | CAPTURE MODE** option and select **SCREEN IMAGE**. This selection will capture a screen image onto the Flash Card when the  PRINT key is pressed during recording.  will change to  and will revert back to  after approximately 1 minute.

NOTE: Pressing the PRINT key again while recording an image will end the Capture and will result in a corrupt bitmap file.

NOTE: Trend information will be written to the Flash Card during Screen Image capture.

Capturing a Screen Image with Printing

With this option enabled, pressing the PRINT key will start a PRINT ALL printout as well as capture a screen image to the Flash Card.

To capture a screen image:

1. Select a capture mode. To select a capture mode, select the **TRENDS | CAPTURE MODE** option and select **SCREEN IMAGE**. This selection will capture a screen image onto the Flash Card when the  PRINT key is pressed during recording.  will change to  and will revert back to  after approximately 1 minute.

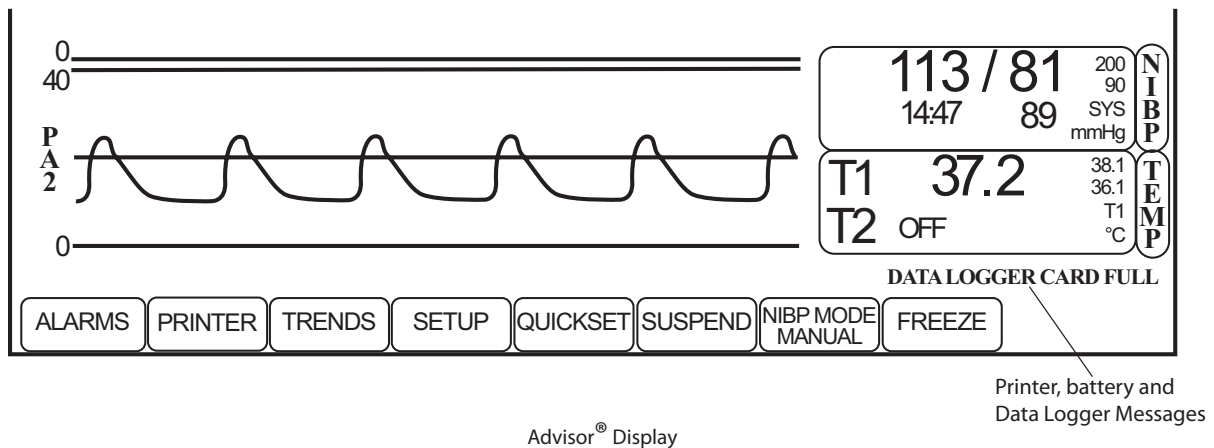
NOTE: Pressing the PRINT key again while recording an image will end the Capture and will result in a corrupt bitmap file.

NOTE: Trend information will be written to the Flash Card during Screen Image capture.

Error messages

If a Data Logger error occurs, a yellow error indicator  appears at the top of the Advisor[®] screen next to the patient type. This error indicator can be cleared as described in the next section, *Clearing the Error Indicator*.

An error message will also appear in the lower right corner of the Advisor[®] display. This error message will be displayed for approximately 10 seconds. See *Troubleshooting* in Chapter 5 of the Data Logger operation manual for possible corrective actions.



ERROR MESSAGE	POSSIBLE CAUSE
DATA LOGGER ERROR	Recording initiated with no data logger attached to the Advisor [®] monitor. Data Logger not securely connected to the Advisor [®] monitor.
DATA LOGGER CARD NOT PRESENT	No card inserted in the device. Card not completely inserted or improperly inserted.
DATA LOGGER CARD LOCKED	Slide switch on the card is in the locked position.
DATA LOGGER CARD FULL	No available memory remains on the memory card.
DATA LOGGER CARD FORMAT ERROR	The card has not been formatted or has been formatted to an incompatible format.

Clearing the Error Indicator

1. When a Data Logger error occurs, the **START RECORDING / STOP RECORDING** menu option will change to **CLEAR DATA LOGGER ERROR**.
2. Select **CLEAR DATA LOGGER ERROR** to erase the error indicator  from the top of the display. This will then allow recordings to be initiated again.

Extracting Data

The Data Logger Excel[®] Template is designed to extract captured real-time trend data and optionally captured primary lead ECG waveform and Advisor[®] screen image from a Flash Card. The spreadsheet is also designed to graphically represent each available parameter and primary ECG waveform captured and to be able to print the numerical trend data, graphical trend data, and the primary ECG Waveform.

NOTE!  See the Veterinary Data logger Operation manual ( V1920) for more information on extracting data from the flash memory card.

Chapter 15: Operator's Maintenance and Troubleshooting

Smiths Medical PM, Inc., Veterinary Division SurgiVet® products have been designed to operate continuously for long periods without maintenance.

However, in order to ensure a continued high level of performance and safety of operation, you must observe the routine maintenance information in this section.

Perform on-site routine maintenance daily; a summarized schedule and full details are contained in this section.

The Advisor® Vital Signs Monitor Service Manual (Smiths Medical PM, Inc. part number V1887R) also contains the circuit diagrams, parts lists, and descriptions required for carrying out repairs and disposing of batteries. The Service Manual is available on request from Smiths Medical PM, Inc., Veterinary Division or your local agent.

MAINTENANCE ITEM	RECOMMENDED ACTION	MAINTENANCE INTERVAL
Installed battery	Charge the battery by connecting AC power to the monitor	When LOW BATTERY is displayed in the printer and battery status line on the monitor After continuous use under battery power
Monitor surfaces	Clean and/or disinfect	As required (See page 15-2 for instructions)
ECG cables	Clean and/or disinfect Inspect for signs of damage or deterioration; replace as required	Daily
ECG electrodes	Clean and/or disinfect	When attaching a new patient
BP cables	Clean and/or disinfect Inspect for signs of damage or deterioration; replace as required	Daily
Invasive pressure transducers	⚠ See manufacturer's instructions	n/a
SpO ₂ sensor	Clean and/or disinfect	When attaching a new patient (see page 9-4 for information)
Temperature sensor	⚠ See manufacturer's instructions	n/a
Capnograph patient attachment	Disposable; discard after single-patient use	When attaching a new patient or when the patient attachment becomes occluded or has an air leak
NIBP cuff and hose	Clean and/or disinfect Inspect for signs of damage or deterioration; replace as required	When attaching a new patient (See page 10-8 for instructions) Daily
Capnography module	Perform a high/low calibration (HILO CAL)	Once per month
Moisture trap on the capnography module	Replace as required	When the moisture trap is full

MAINTENANCE ITEM	RECOMMENDED ACTION	MAINTENANCE INTERVAL
Pneumatic system on the capnography module	Check for leaks	After replacing the moisture trap At least once every 2 weeks
Calibration gas canister	Replace as required	When the gas pressure reading is 20 psi or less, as shown on the flow control valve's pressure gauge

CAUTION! Follow local governing ordinances and recycling instructions regarding disposal and recycling of device components.

Cleaning the Monitor's Surfaces

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

CAUTION! Do not allow water or any other liquid to be spilled onto the monitor. Unplug the AC power cord from the monitor before cleaning or disinfecting.

CAUTION! Where the equipment has accidentally gotten wet, it should be wiped dry externally and allowed to dry thoroughly before use.

NOTE! Use only a soft cotton cloth, or a cloth specifically designed for cleaning CRT displays, to clean the monitor's screen. Do not clean the screen with tissues, paper towels, or any other paper-based wipe. Paper-based wipes can scratch the screen.

NOTE! Do not clean the screen with isopropyl alcohol or glutaraldehyde. These liquids can scratch the screen. Use only water or a mild soap solution to clean the screen.

Clean the surfaces of the monitor with a soft cloth moistened in water or a mild soap solution. If disinfecting is necessary, wipe the surfaces of the monitor (but not the screen) with isopropyl alcohol or glutaraldehyde. Then wipe the surfaces with a soft, water-moistened cloth.

Long-term Storage

If the monitor will be stored for a long period of time, pack the monitor and its accessories in the original packing materials and shipping carton. The long-term storage facility should meet these requirements:

- Indoor
- From –40 to 75 °C (–40 to 167 °F)
- Relative humidity from 10-95% (non-condensing)
- No periodic inspection required

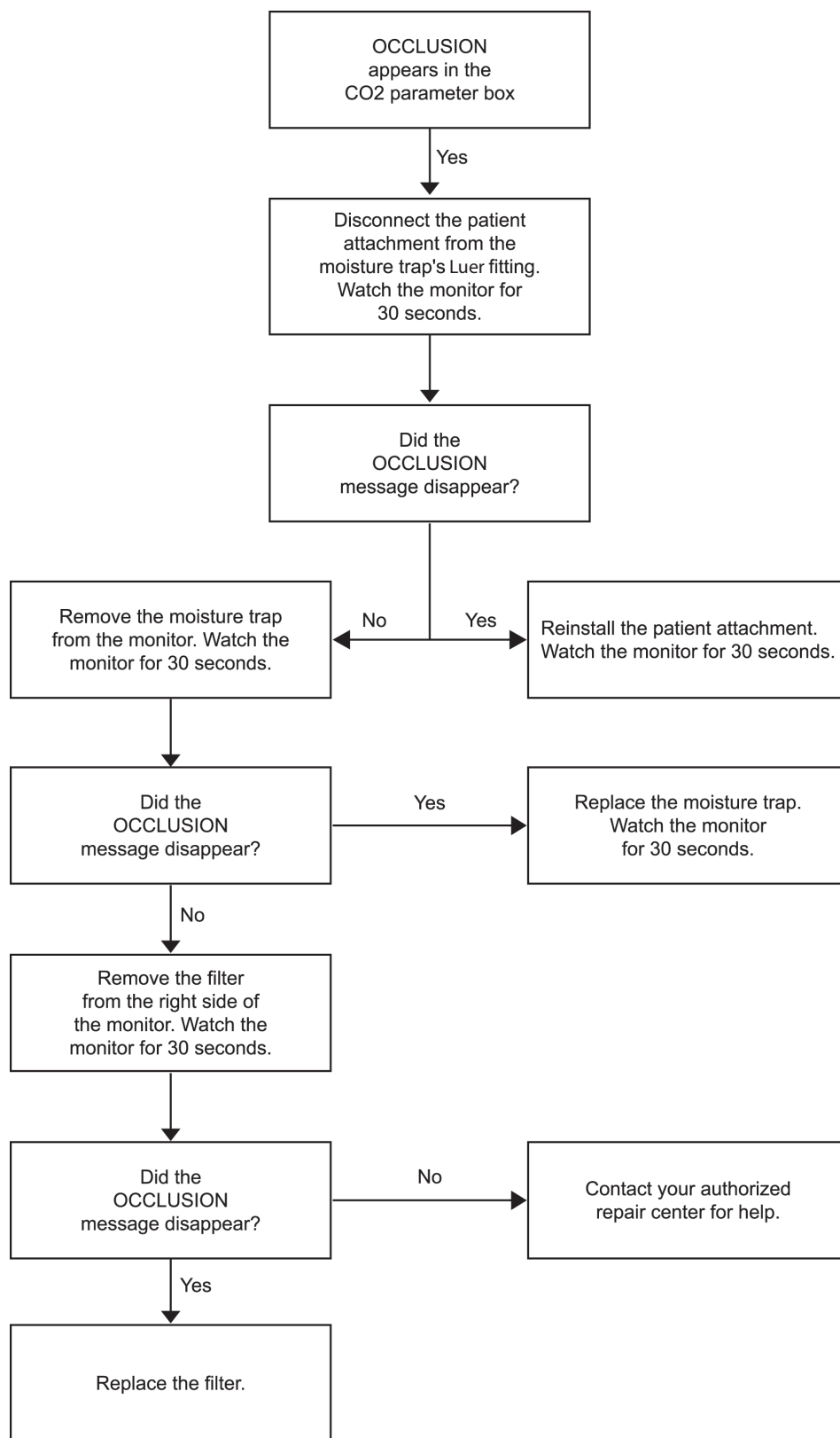
Operator's Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
The AC power LED on the front of the monitor is not lit.	The AC power cord is not connected to the monitor, the AC line, or both. The AC power cord is connected to a wall outlet that is controlled by a wall switch. The AC line fuse has blown (fuse type: 5 x 20 mm fast-acting 1.6 A/250 V).	Connect the AC power cord to the monitor and to the AC line. Only connect the AC power cord to an outlet that is not controlled by a wall switch. Contact your authorized repair center.
The monitor operates on AC power, but not on battery power.	The battery is disconnected. The battery is drained. The battery is defective.	Connect the battery. Charge the battery. Contact your authorized repair center.
BATTERY CHARGING ERROR is displayed in the system message area.	The battery is excessively drained or is defective.	Disconnect the AC power cord and then reconnect it. If the error message persists, the battery is defective. Contact your authorized repair center.
Battery run time is excessively short on a fully charged battery.	The battery is spent.	Contact your authorized repair center.
The display on the monitor does not light.	The display backlight is defective.	Contact the Smiths Medical PM, Inc., Veterinary Division service department.
CHECK SENSOR is displayed in the SPO ₂ parameter box.	The SpO₂ sensor is improperly positioned on the patient. You are using the improper SpO₂ sensor for the application. Either the SpO₂ sensor or the patient cable is defective.	Reposition the sensor on the patient. Change the sensor or contact the Smiths Medical PM, Inc., Veterinary Division service department. Change the sensor or contact the Smiths Medical PM, Inc., Veterinary Division service department.
The peripheral pulse rate in the SPO ₂ parameter box is erratic, intermittent, or incorrect.	The SpO₂ sensor is improperly positioned on the patient. The patient is experiencing poor perfusion. The patient is moving too much. There is too much ambient light around the SpO₂ sensor.	Reposition the sensor on the patient. Reposition the sensor on the patient. Make sure that the patient remains still. Shield the SpO₂ sensor with a towel.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
There is no peripheral pulse registering on the bargraph in the SPO ₂ parameter box.	The SpO ₂ sensor is not connected to the monitor or to the patient.	Connect the sensor to the extension cable and connect the extension cable to the monitor.
	The SpO ₂ sensor is improperly positioned on the patient.	Reposition the sensor on the patient.
	The patient is experiencing poor perfusion.	Reposition the sensor on the patient.
	Either the SpO ₂ sensor or the extension cable is defective.	Change the sensor or contact the Smiths Medical PM, Inc. service department.
The ECG leads and electrodes are connected, but no ECG waveform or messages are displayed.	The ECG parameter is turned off.	Turn on ECG MONITOR using the ECG parameter menu.
LEADS FAIL is displayed in the ECG parameter box.	One or more of the ECG leads is not connected to the electrode or the ECG patient cable.	Connect the ECG lead to the electrode and the extension cable.
	One of the ECG leads is broken, creating high impedance.	Replace the ECG lead.
	The electrode's impedance is too high.	Reapply the electrodes.
The CO ₂ readings are inaccurate.	The capnography module is out of calibration.	Perform a high/low calibration (HILO CAL).
	The atmospheric pressure changed dramatically while the monitor was in use.	Perform a low calibration (LOW CAL).
	The sample line is punctured or not connected properly, or there is a poor patient connection.	Check the patient connection; replace the sample line.
	N ₂ O Compensation is on when it is not required; or is off when it is required.	Turn off/on N ₂ O Compensation.

Troubleshooting Occlusion of the CO₂ sample line

Most occlusions or blockages of the CO₂ sample line are automatically cleared within a minute. If occlusion cycles occur frequently or the OCCLUSION message appears often, use the following flowchart to find and correct the problem.



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Chapter 16: Optional Supplies and Accessories

CAT. NUMBER	DESCRIPTION	QUANTITY
1100	Adapter, Airway, Straight, with Filter, 12.7 ID x 15 OD (mm)	10 per pkg
1140	CO ₂ Sample Line, Extension, 4.6 m (15 feet)	10 per pkg
1151	Adapter, Airway, without Filter, 12.7 ID x 15 OD (mm)	10 per pkg
V1175	CO ₂ Monitor Exhaust Kit	each
1179	External Absorber CO ₂	2 per pkg
V1186	Sample Line CO ₂ , Single, Nasal	6 per pkg
1606	Simulator, Oximeter/ECG	each
V1886R	Manual, Operation (9200)	each
1887R	Manual, Service (9200)	each
3005	Cord, Power 110 V, Advisor	each
3005A	Cord, Power 220 V, Advisor	each
V1703	Sensor, Oximetry, Universal 'Y' with Clip, Small/Medium	each
V1707	Sensor, Oximetry, Universal 'C' with Clip, Small	each
V3078	Sensor, Oximetry, Mini Clip	each
V3110	Cable, ECG, Shielded, Safety Type, 3-lead 40"	each
V3310L	Cable, ECG, Shielded, Safety Type, 3-lead 80"	each
3311	Patient Cable, Oximetry, 1.5 m (5 feet)	each
3339	PC Adapter Cable (null modem)	each
3362	PC Interface Cable	each
3387	Advisor Roll Stand	each
3406	Cable, ECG Shielded, Safety Type, 5-lead	each
V3413	Temperature Cable	each
V3417	Temperature Probe	each
WWV3418	Probe, Temperature, Reusable	each
5093	Calibration Gas, EtCO ₂ (10% CO ₂ , bal N ₂)	each
6111	Paper, Printer	4 per pkg
V6401	Invasive Pressure Cable	each
V6402	Invasive Pressure Transducer	each
8044	CO ₂ Sample Line, 2.4 m (8 feet)	10 per pkg
8061	Regulator, Calibration Gas Flow, with Gauge	each
8075	Moisture Trap, with Female Adapter (Advanced Pneumatics)	each
8211	CO ₂ Sample Line, 1.2 m (4 feet)	10 per pkg
8217	Kit: Calibration (5093, 8061, 8223, 8211)	each
8223	Calibration Adapter	each
9048	External 3.5 Micron Filter, 13 mm	2 per pkg
31543B1	NIBP Purple Cuff, Extra Small, 3-6 cm	each
31543B2	NIBP Purple Cuff, Small, 4-8 cm	each
31543B3	NIBP Purple Cuff, Medium, 6-11 cm	each
31543B4	NIBP Purple Cuff, Large, 17-41 cm	each
31545B1	Purple Cuff Cleaning Cap	each
31544B1	6-foot Purple Cuff Supply Hose	each

Ordering Information

For ordering information, contact your local distributor or the Smiths Medical PM, Inc. Veterinary Clinical Support department at the address or phone number below:

Smiths Medical PM, Inc.	Phone: (262) 513-8500
N7W22025 Johnson Drive	Toll-free: (888) 745-6562
Waukesha, WI 53186-1856, USA	Fax: (262) 542-0718
Website: www.surgivet.com	

Chapter 17: Service Menu

The service menu is password protected and contains the following options:

MAIN PREVIOUS	MONITOR DEFAULTS	CHANGE PASSWORD	VERIFY NIBP CALIBRATION	STATIC LIMITS OFF	SERIAL UPDATE: NO	➔
MAIN PREVIOUS	➔	PURCHASED OPTIONS	CO2 SERVICE MENU	DEMO MODE: NO	TEST CFA ALARM: NO	ECG ATTENDED MODE ALLOWED YES

To access the service menu:

1. Turn the rotary knob on the monitor to move the cursor. Highlight SETUP and push the knob to access the setup menu.
2. Highlight SERVICE MENU and push the knob to select.
3. Turn the rotary knob to access the password box and push the knob to select the first character field.
4. Turn the rotary knob to highlight the desired character and push the knob to select. The factory-installed password is ADVISOR.
5. Push the knob to select the next character field.
6. Turn the rotary knob to highlight the desired character and push the knob to select. Repeat steps 4 and 5 until each character in the password is selected.
7. Highlight ENTER and push the knob to select.

If you correctly selected the password, the service menu will appear on the lower left corner of the display.

If you did not select the correct password, *****Invalid Password; please re-enter***** will be displayed in the message line. Try to access the service menu again.

Setting Default Values for the Monitor

Default values are settings you can choose that will apply to your monitor each time you turn it on. You can set up your monitor to operate using the default values you choose for alarm limits, ECG filter, language, and alarm silence operation.

Set Default Alarm Limits

The Advisor® Vital Signs Monitor provides clinically appropriate factory default high and low alarm limits for each numeric measured value, relative to each patient type. You can change the default alarm limits for your facility so that each time you turn on the monitor or change the patient type, your default values will be applied to each patient type. See *Using the Static Limits Feature* in this section for details about how turning on or off the static limits feature affects default alarm limits. For a list of factory default alarm limits, see *Appendix B: Alarm Limit Default Values*.

To set default alarm limits for each parameter:

1. Select the desired patient type (CAT, DOG, or HORSE). The patient type indicator is located on the upper portion of the display.
 - To change the patient type:
 - a. Turn the rotary knob on the monitor to move the cursor. Highlight HORSE, DOG, or CAT, whichever is displayed. Push the knob to access the patient type submenu in the lower left corner of the display.
 - b. Highlight PATIENT TYPE and push the knob to select.
 - c. Turn the rotary knob to choose the desired type (HORSE, DOG, or CAT) and push the knob to select.
2. On the service menu, highlight MONITOR DEFAULTS and push the knob to access the submenu for default parameter alarm limits.
3. Highlight DEFAULT PARAMETER ALARM LIMITS and push the knob to access the default alarm limit box.
4. Highlight CHANGE UNIT DEFAULT ALARM LIMITS and push the knob to select.
5. Turn the rotary knob to highlight the name of each measured value and push the knob to select.
6. Highlight the high alarm limit (HI) and push the knob to select.
7. Turn the rotary knob to choose the desired value and push the knob to select. If you do not want to set a default high alarm value, choose off.
8. Highlight the low alarm limit (LO) and push the knob to select.
9. Turn the rotary knob to choose the desired value and push the knob to select. If you do not want to set a default low alarm value, choose off.
10. Repeat steps four through seven to set the default high and low quickset alarm limits. See *QUICKSET Alarm Limits* in *Chapter 5: Monitoring the Patient* for details regarding the quickset feature.
11. Turn the rotary knob to move the cursor back to the name of the measured value and push to select.
12. Highlight MENU in the default alarm limit box and push the knob to return to the submenu.

To restore the factory default alarm limits for each parameter:

See *Using the Static Limits Feature* in this section for details about how turning on or off the static limits feature affects default alarm limits.

1. Select the desired patient type (CAT, DOG, or HORSE). The patient type indicator is located on the upper portion of the display.
 - To change the patient type:
 - a. Turn the rotary knob on the monitor to move the cursor. Highlight HORSE, DOG, or CAT, whichever is displayed. Push the knob to access the patient type submenu in the lower left corner of the display.
 - b. Highlight PATIENT TYPE and push the knob to select.
 - c. Turn the rotary knob to choose the desired type (HORSE, DOG, or CAT) and push the knob to select.
2. On the service menu, highlight MONITOR DEFAULTS and push the knob to access the submenu for default parameter alarm limits.
3. Highlight DEFAULT PARAMETER ALARM LIMITS and push the knob to select.
4. Highlight RESTORE FACTORY LIMITS AS UNIT DEFAULTS and push the knob to select.
5. Highlight YES and push the knob to select.
6. Highlight MAIN or PREVIOUS and push the knob to select.

Set the ECG Filter Level

You can change the ECG filter level (50 Hz or 60 Hz) depending on the AC line frequency at your facility, so that each time you turn on the monitor or change the patient type, the ECG filter level will be appropriate for your location.

To change the ECG filter level:

1. On the service menu, highlight MONITOR DEFAULTS and push the knob to access the submenu for default parameter alarm limits.
2. Highlight ECG FILTER and push the knob to select.
3. Turn the rotary knob on the monitor to choose the ECG filter level (50 Hz or 60 Hz) appropriate for your facility and push the knob to select.
4. Highlight MAIN or PREVIOUS and push the knob to select.

Select the Alarm Audio Silence Operation

You can choose how the alarm silence key (Ⓢ) will function.

If you select TEMPORARY ONLY:

- When you press the alarm silence key (Ⓢ), an audible alarm will be temporarily silenced for two minutes. AUDIO PAUSED will be displayed on the upper right side of the display. The audible alarm will be re-enabled if any new alarm condition occurs, or in two minutes if no new alarm condition occurs.

If you select INDEFINITE ONLY:

- When you press the alarm silence key (Ⓢ) for three seconds, audible alarms will be indefinitely silenced. AUDIO PAUSED will be displayed on the upper right side of the display. If any new alarm condition occurs while audible alarms are indefinitely silenced, the audible alarm will be re-enabled.

If you select TEMPORARY AND INDEFINITE:

- When you press and hold the alarm silence key (Ⓢ) for six seconds, audible alarms will be permanently silenced. AUDIO OFF will be displayed on the upper right side of the display. The audible alarm will not be re-enabled if a new alarm condition occurs.

NOTE! This option is only available if Dual Alarm Silence Allowed is enabled in the factory service menu.

To select the alarm audio silence operation:

1. On the service menu, highlight MONITOR DEFAULTS and push the knob to access the submenu for default parameter alarm limits.
2. Highlight ALARM AUDIO SILENCE OPERATION and push the knob to select.
3. Turn the rotary knob on the monitor to choose the desired setting (TEMPORARY ONLY, INDEFINITE ONLY, or TEMPORARY AND INDEFINITE) and push the knob to select.
4. Highlight MAIN or PREVIOUS and push the knob to select.

Select the Alarm Reset Operation

You can set the monitor to automatically silence an audible alarm tone as soon as the measured value returns to within the alarm limits (AUTO), or you can set it so that an audible alarm can be manually silenced (MANUAL) by pressing the alarm silence key (Ⓢ).

To select the alarm reset operation:

1. On the service menu, highlight MONITOR DEFAULTS and push the knob to access the submenu for default parameter alarm limits.
2. Highlight RESET ALARMS and push the knob to select.
3. Turn the rotary knob on the monitor to choose the desired setting (AUTO or MANUAL) and push the knob to select.
4. Highlight MAIN or PREVIOUS and push the knob to select.

Select the Serial Output Mode

The monitor includes an RS-232C compatible serial output channel. Measured values can be output to another device using one of three modes: the Smiths Medical PM, Inc. protocol, as real-time numeric data, or as trend data. You can select the mode that is appropriate for your facility.

To select the serial output mode:

1. On the service menu, highlight MONITOR DEFAULTS and push the knob to access the submenu for default parameter alarm limits.
2. Highlight SERIAL OUTPUT MODE and push the knob to select.
3. Turn the rotary knob on the monitor to choose the desired setting (SMITHS PROTOCOL, REAL-TIME NUMERIC (CSV) or TREND RETRIEVAL) and push the knob to select.
4. Highlight MAIN or PREVIOUS and push the knob to select.

Changing the Service Menu Password

The service menu is password protected. You can access the service menu only by using a password. Authorized personnel may change the password.

To change the password:

1. On the service menu, highlight CHANGE PASSWORD and push the knob to select.
2. Turn the rotary knob to access the password box and push the knob to select the first character field.
3. Turn the rotary knob to highlight the desired character and push the knob to select. Each character will be displayed as an asterisk as soon as it has been selected.
4. Push the knob to select the next character field.
5. Turn the rotary knob to highlight the desired character and push the knob to select. Repeat steps 4 and 5 until each character in the new password is selected. A maximum of ten characters can be used for a password.
6. Highlight ENTER and push the knob to select.
7. REENTER NEW PASSWORD FOR CONFIRMATION will be displayed above the menu in the message line. Use the rotary knob to reselect each character in your new password.
8. Highlight CONFIRM and push the knob to select.
9. Highlight MAIN or PREVIOUS and push the knob to select.

Verifying NIBP Calibration

Contact your authorized repair center for help.

Using the Static Limits Feature

The static limits feature provides a means for controlling how and where the Advisor® Vital Signs Monitor stores alarm limit changes. You can change active high and low limits using the alarm limit box or the default alarm limit box, or you can restore the limits to the factory default values.

Active high and low alarm limits are the alarm limits used for the current patient type, as shown in the parameter boxes on the display. You can change the current alarm limits in the alarm limits box. To access it, select **ALARMS** from the main menu, then **CHANGE CURRENT ALARM LIMITS**.

Default high and low alarm limits are the alarm limits set at your facility for each patient type. You can set these alarm limits in the default alarm limit box. To access it, select **SETUP, SERVICE MENU, MONITOR DEFAULTS, DEFAULT PARAMETER ALARM LIMITS**, and then **CHANGE UNIT DEFAULT ALARM LIMITS**.

Factory default high and low alarm limits for each patient type are installed in your monitor. You cannot change the factory default alarm limits. You can, however, change the active and/or default alarm limits back to the clinically appropriate factory default limits. To restore the factory limits default values, select **SETUP, SERVICE MENU, MONITOR DEFAULTS, DEFAULT PARAMETER ALARM LIMITS**, and then **RESTORE FACTORY LIMITS AS UNIT DEFAULTS**.

When the static limits feature is off and you change high and low alarm limits in the alarm limits box, these limits will only be applied until you change the patient type or turn the monitor off and then on again. At that time, the monitor will use the default alarm limits.

When the static limits feature is on and you change high and low alarm limits in the alarm limits box, or the default alarm limits box, or you restore the factory default alarm limits, these limits will be applied immediately. If you change the patient type or turn off the monitor and then turn it on again, the changes in the alarm limits will be retained in the alarm limit box and the default alarm limit box.

Note that when the static limits feature is on or off, only the parameters that are enabled, or turned on, will be displayed in the alarm limits box. All of the parameters and their alarm limits are displayed in the default alarm limit box.

The default setting for the static limits feature is **ON**.

To turn the static limits feature on or off:

1. On the service menu, highlight **STATIC LIMITS** and push the knob to select.
2. Highlight **YES** or **NO** to cancel and push the knob to select.
3. Highlight **MAIN** or **PREVIOUS** and push the knob to select.

Using the Factory Service Menu

This menu is intended for service personnel. Contact your authorized repair center for help.

Using the Serial Update Feature

It may become necessary to update your Advisor[®] monitor by downloading a file available from Smiths Medical PM, Inc.

You will need:

- Monitor
- a personal computer (PC)
- a DB-9 PC cable (#3366)

To initiate a serial update of the monitor:

1. Connect one end of the DB9 cable to the PC and the other end to the serial port on the monitor.
2. Press the ON/OFF key on the monitor to turn it on.
3. On the service menu, highlight MONITOR DEFAULTS and push the knob to select. See *To access the service menu* at the beginning of this chapter for instructions for entering the service menu.
4. Highlight SERIAL OUTPUT MODE and push the knob to select.
5. Highlight NONE and push the knob to select.
6. On the service menu, highlight SERIAL UPDATE and push the knob to select.
7. Highlight YES and push the knob to select. WAITING FOR XMODEM TRANSFER will appear on the display.
8. Insert the disk containing the update file received from Smiths Medical PM, Inc. into your PC. The file is named VAVRDXXX.ROM, where XXX is the new version number. If the file was received via email, save it to a disk.
9. On the PC, open the flash utility (flash.exe). There is no installation required for this program; it is self-contained.
10. Select the Serial Download tab.
11. Select the desired Comm Port (typically COM1).
12. Select Send ROM to Advisor.
13. On the file window, select the .ROM file (VAVRDXXX.ROM). A message will be displayed, asking, "Are you sure you want to program Advisor with c:\temp\ADVRDXXX.ROM?" Click Yes.
 - The serial update process may take up to ten minutes. Do not touch the monitor or power down during this time.

You can monitor the update process:

- A progress bar will be displayed on the PC.
- On the monitor, RECEIVING XMODEM DATA will be displayed, and a number will be shown, increasing to indicate progress.
- If a red hand appears on the PC, an error occurred during the update process. Re-check all connections and start over.
- When the serial update is complete, File Transfer Complete will be displayed on the PC. Click OK.

On the monitor, FLASH ERASE IN PROGRESS and then FLASH UPDATE IN PROGRESS will be displayed. The monitor display will turn blue and the new software will be loaded. On the boot screen, verify that the version and checksum on the MAIN (VAVRD) line match the version and checksum provided by Smiths Medical PM, Inc. If they do not match, contact your authorized repair center.

Using the Purchased Options Feature

The purchased options feature allows you to install options that you have purchased for your monitor.

To enable a purchased parameter or option:

1. On the service menu, highlight PURCHASED OPTIONS and push the knob to select.
2. The options or parameters purchased for your monitor will be displayed.
3. To enable or disable a purchased option, turn the rotary knob to highlight the desired parameter or option, such as 5-LEAD ECG, and push the knob to select.
4. Highlight MAIN or PREVIOUS and push the knob to select.

Using the Demo Mode

WARNING! While the demo mode is active, no patient data is collected or analyzed. Never attach a patient to the monitor while it is in demo mode.

The Advisor® includes a demonstration mode to be used for training and sales activities. Installed parameters, including non-invasive blood pressure, are simulated when the demo mode is turned on. All of the functions of the monitor will be simulated in the demo mode, including alarms, trends, auto print, and NIBP history.

To turn on the demo mode:

1. On the service menu, highlight DEMO MODE and push the knob to select.
2. Turn the rotary knob to highlight YES and push the knob to select.
 - DEMO will be displayed, red and flashing, in the message area in the lower right corner of the display.

To turn off the demo mode:

1. On the service menu, highlight DEMO MODE and push the knob to select.
2. Turn the rotary knob to highlight NO and push the knob to select.
 - The monitor will return to normal operating conditions and will collect patient data. When the demo mode is turned off, the demo options menu is not available from the setup menu.

Auto-Detectable Parameters

You can turn on or off the auto-detectable parameters such as oximetry (SPO₂), invasive blood pressures (IBP1 and IBP2), and temperature (T1 and T2) using the demo options menu, available on the SETUP menu.

To turn on or off auto-detectable parameters:

1. Turn the rotary knob on the monitor to move the cursor. Highlight SETUP and push the knob to access the setup menu.
2. Highlight DEMO OPTIONS and push the knob to select.
3. Turn the rotary knob to highlight the desired parameter and push the knob to select.
4. Turn the rotary knob to highlight YES or NO and push the knob to select.
5. Highlight MAIN or PREVIOUS and push the knob to select.

Using the CO₂ Service Menu

This menu is intended for service personnel. Contact your authorized repair center for help.

Chapter 18: Specifications

Display

10.4-inch diagonal high-resolution active color LCD

Resolution: 640 X 480 pixels

Indicators

LEDs: AC Power ( green) with power plug icon

Battery Charge ( green) with battery icon

If optional Data Logger installed:

Display Icons:  Recording Trends
 Recording Primary ECG Waveform
 Recording Screen Image Snapshot

Alarm Volume

45dBA to 85 dBA at 1 meter distance (adjustable)

Keys/User Controls

- On/Off Key ()
- Zero IBP Key ()
- NIBP Key ()
- Print Key ()
- Alarm Silence Key ()
- Rotary Knob

ECG

Heart Rate Range:	20-350 bpm
Heart Rate Accuracy:	± 2 bpm or $\pm 2\%$ (whichever is greater)
QRS Detection Range:	0.5 to 5 mV
Pace Pulse Detection:	± 2 mV to ± 700 mV amplitude
Detection Duration:	0.1 – 2.0 ms
Alarm Ranges Heart Rate:	High: 20-350 bpm and OFF Low: 20-350 bpm and OFF
Heart Rate Averaging:	Fixed 8 second averaging
Lead Selection:	I, II, or III (3-lead cable) I, II, III, V, aVR, aVL, or aVF (5-lead)
Display Gain Settings:	X 0.5, X1, X2, X4
Input Range:	-5.0 mV to +5.0 mV
Frequency Response:	0.05 Hz to 40 Hz
Input Impedance:	>5 Mohms differential, as required and tested per ANSI/AAMI EC-13.
CMRR:	100 dB @ 60 Hz
Defibrillation Protection:	Yes
I-Leakage:	< 10 μ A
Patient Isolation:	> 4000 VAC
Display Waveform:	120 Hz; 6.25, 12.5, 25, or 50 mm/sec
Update Rate Digits:	1 Hz

Capnograph

Measurement:	Non-Dispersive IR absorption
Calibration:	Manual 2 point
Measurement Range:	0-10% CO ₂ STPD (standard temperature pressure dry)
Display Range:	0-100 mmHg; 0-14 kPa; 0-10% CO ₂
Display Update Rate:	1 Hz for CO ₂ values; 120 Hz for waveform
Accuracy:	±2 mmHg or 4% of reading (whichever is greater) (0-10% CO ₂)
Stability:	≤ 0.3% (vol) CO ₂ /24 hours
Rise Time:	400 milliseconds (average)
Delay Time:	1.8 seconds (average)
System Response Time:	2.1 seconds (average)
Time from power on to accurate readings:	3 minutes (average)
N ₂ O Compensation:	Selectable 40% (default = OFF)
Averaging:	4 breath
Flow Rate:	150 ml/min ± 20 ml
ETCO ₂ Alarm Range:	
High:	0-100 mmHg (1 mmHg steps), and OFF 0-14 kPa (0.1 kPa steps), and OFF 0-10.0% CO ₂ (0.1% steps), and OFF
Low:	0-100 mmHg (1 mmHg steps), and OFF 0-14 kPa (0.1 kPa steps), and OFF 0-10.0% CO ₂ (0.1% steps), and OFF
INCO ₂ Alarm Range:	0-100 mmHg (1 mmHg steps), and OFF 0-14 kPa (0.1 kPa steps) 0-10.0% CO ₂ (0.1% steps)
Atmospheric Pressure:	525 mmHg (altitude: 10,000 feet) to 760 mmHg (altitude: sea level)

Respiration Rate (CO₂)

Range:	0-150 breaths per minute (rpm)
Accuracy:	± 1 rpm
Averaging:	4 breath average
Display Update Rate:	1 Hz
RESP Alarm Range:	
High:	3-120 rpm (1 rpm steps), and OFF
Low:	3-120 rpm (1 rpm steps), and OFF

Oximeter

SpO ₂ Range:	0-100% Functional Saturation
SpO ₂ Accuracy ¹ :	± 2% @ 70-100%
	<70% unspecified
Pulse Rate Range:	20-350 bpm
Pulse Rate Accuracy:	± 2 bpm or ± 2% (whichever is greater)
Display Response:	Update rate is 1 second for displayed values and 120 Hz for the waveform. The SpO ₂ waveform display is not proportional to the pulse volume (maximum age of SpO ₂ data is 20 seconds).
Calibration:	Factory calibrated over range 50% to 100% SpO ₂ using human blood samples to functional saturation. Test methods are available upon request. No in-service calibration is required.
SpO ₂ Alarm Ranges:	
High:	50-100% and OFF
Low:	50-100% and OFF
SpO ₂ Averaging:	User-selectable SLOW (16 beat), NORMAL (8 beat), or FAST (4 beat)
Sensors:	Red: 660 nm, 2 mW (typical)
	Infrared: 905 nm, 2-2.4 mW (typical)

¹ Because pulse oximeter equipment measurements are statistically distributed, only about two-thirds of pulse oximeter measurements can be expected to fall within the A_{RMS} of the value measured by the CO-oximeter. The V9200 multi-parameter monitor has been validated in human desaturation studies on 10 adult volunteers that did not have health problems and were non-smokers. The study was conducted at oxygen concentrations evenly distributed over an SaO₂ range of 70-100%.

NIBP

Blood Pressure Measuring

Method of Measurement: Oscillometric with step-down deflation

Range: Systolic: 40 to 265 mmHg

Mean Arterial: 27 to 222 mmHg

Diastolic: 20 to 200 mmHg

Pulse: 25 to 300 bpm

NIBP Accuracy: SunTech Medical has developed the blood pressure algorithm specifically for vet patient populations collecting and analyzing data from a large animal population. This algorithm is based upon SunTech's previously proven human algorithm which exceeds the limits prescribed by ANSI/AAMI SP10: 1992 & 2002 and is being used by many recognized companies worldwide.

Inflation Pressure Settings

Adjustment Range: 60 to 280 mmHg – Cat
120 to 280 mmHg – Dog/Horse

Measurement Time: 30 to 50 seconds typical, 120 seconds maximum

Default Inflation Pressure: 200 mmHg – Cat
150 mmHg – Dog
120 mmHg – Horse

Calibration: Factory calibrated

AUTO Interval Times: 1, 2, 3, 4, 5, 10, 15, 20, or 30 minutes
1, 2, 4, or 8 hours

Alarm Range: 20-260 (in 1 mmHg steps), and OFF

Pulse Rate Accuracy:* 25- 250 bpm, $\pm 2\%$ or ± 3 bpm (whichever is greater)
251-300 bpm, $\pm 5\%$

***NOTE: NIBP Pulse Rate accuracy outside of this range is unspecified.**

Altitude Range: 3048m (10,000 ft)

Invasive Pressure

Channels:	Two
Measuring Range:	-50 to 300 mmHg (after zeroing)
Zero Adjust Range:	± 500 mmHg
Accuracy:	± 1 mmHg or ± 1% (whichever is greater) (exclusive of transducer error)
Waveform Display Ranges:	0-300 mmHg 0-60 mmHg 0-200 mmHg 0-40 mmHg 0-160 mmHg 0-20 mmHg automatic scaling
Alarm Limits:	High and low alarm limits for the displayed channel are checked against that channel's displayed numeric values.
High:	-50 to 300 mmHg (in 1 mmHg steps)
Low:	-50 to 300 mmHg (in 1 mmHg steps)
Labels:	SYS, DIA, MEAN Mean only ART1, ART2 CVP1, CVP2 PA1, PA2 ICP1, ICP2 RV1, RV2 RA1, RA2 LV1, LV2 LA1, LA2 P1 (generic pressure label) P2 (generic pressure label)
Required Accessories:	Transducers with a resistance of 300 to 2000 Ω and an equivalent pressure sensitivity of 5 $\mu\text{V/V/mmHg}$ ± 10%
Pulse Rate (ART only):	
Range:	20-350 bpm
Accuracy:	± 2 bpm or ± 2% (whichever is greater)
Averaging:	8 seconds

Temperature

Channels:	Two
Range:	0-50°C (32-122°F)
Accuracy:	± 0.1°C (± 0.2°F) plus the temperature sensor tolerance
Resolution:	0.1°C (0.1°F)
Alarm Limits:	
High Alarm Range:	20.0-50.0°C (68.0-122.0°F) and OFF in 0.1° increments
Low Alarm Range:	20.0-50.0°C (68.0-122.0°F) and OFF in 0.1° increments
Sensor Compatibility:	YSI 400-series reusable temperature sensors YSI 4400-series disposable temperature sensors The monitor automatically detects sensor type
Transducer Detection:	Automatic for listed transducers
Display Resolution:	0.1°C (± 0.1°F)

Auxiliary Inputs/Outputs

Serial (RS-232) Dataline:	Measured parameter data is sent in a comma delimited string terminated with a carriage return. (1Hz)
Serial Out Rating:	± 10 V, 20 mA

Strip Printer

Paper Speeds:	12.5 mm/sec, 25 mm/sec, or 50 mm/sec for waveforms (CO ₂ can print at 6.25 mm/sec, 12.5 mm/sec, or 25 mm/sec).
Waveforms:	Prints one or two waveforms on a single chart. Annotation lines print with waveforms.
Annotation Lines:	Annotation lines print with waveforms showing the date, time, paper speed, delay, parameter values, and scale. Printed once every 200-300 mm (8-12 inches).
Snapshot:	Prints an annotated snapshot of each waveform group, 200-300 mm (8 or 12 inches) long. Optionally prints a list of alarm limit settings and a parameter trend table after the waveform groups.
Continuous:	Prints a continuous strip chart of the selected waveform, with annotation lines printed once every 200-300 mm (8-12 inches).
Print on Alarms:	Optionally prints a snapshot when a chosen alarm is triggered.
Print Trend Table:	All, Report Range
Trend Table Sample Intervals:	1, 2, 5, 10, 15, 30, or 60 minutes
Print NIBP History:	All, Window, or Every 10 measurements

Power Requirements

AC Input:	100 to 240 V, 0.8 A, 50/60 Hz
Battery (9208):	Approximate operating time: 60-120 minutes Approximate recharge time: 5 hours

Dimensions

Width:	18.0 cm (7 inches)
Length:	34.0 cm (13.25 inches)
Height:	30.5 cm (12.0 inches)
Weight:	4.1-5 kg (9-11 lbs.)

Environmental

Temperature:	0 to 40°C (32 to 104 °C) Operating -40 to 75°C (-40 to 167 °F) Storage
Humidity:	15 to 95% (non-condensing) Operating 10 to 95% (non-condensing) Storage

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

Design Standards

Safety:	EN60601-1 EN60601-1-1 UL2601 CSA Standard C22.2 No. 601.1
EMC:	EN60601-1-2:2001 FDA Reviewer’s Guidance for Resp Devices, Nov. 93
DEVICE:	AAMI EC13, IEC 60601-2-27 ECG AAMI SP10, IEC 60601-2-30 NIBP IEC 60601-2-34 IP EN865 SpO ₂ EN475 Alarms EN864 CO ₂ IEC 60601-2-49 Multifunction Patient Monitoring Equipment

Equipment Classification

Type of Protection:	Class 1 & Internally Powered
Degree of Protection: (Against Electric Shock)	Type CF defib protected
Mode of Operation:	Continuous
Degree of Protection:	IPX1, drip proof (against ingress of liquids)
Degree of Mobility:	Portable
Safety Requirements:	EN60601-1: 2002

Appendix A: ECG Technical Reference

Tall T-Wave Rejection Capability

With a standard 1 mV p-p QRS having a T-wave amplitude of 0 to 1.2 mV (0 to 120% of R-wave height), the displayed heart rate remains correct.

Heart Rate Averaging Method and Display Update Rate

The rate digit display is updated every second. Rate averaging is accomplished using a “box car” method as follows:

- Let n = the averaging interval 8 seconds. Each second, the oldest $1/n$ data points are discarded and replaced with the latest $1/n$ points. Then, all the points are summed and divided by n . The resulting average is the value displayed.

Response Time of Heart Rate Meter to Change in Heart Rate

From 80 to 120 bpm, response ranges from 6.0 to 6.0 seconds, average 6.0 seconds. From 40 to 80 bpm, the response range is 8 to 11 seconds, average 9.6 seconds.

Display Aspect Ratio

The 2X option meets the aspect ratio requirements of EC13 (0.4 ± 0.08 s/mV).

$$\frac{8.55 \text{ mm/mV}}{25.0 \text{ mm/s}} = 0.342 \text{ s/mV}$$

Audible Alarms

Alarm sounds and amplitudes conform to the EC-13 specifications.

Visual Alarms

Visual alarms consist of a flashing parameter value in the parameter box, which is in alarm and an alarm message at the top of the display. The word ‘ALARM’ flashes in red at the top of the display at a 2 Hz rate. The word ‘ALARM,’ as it appears on the display, is 15.3 mm long X 3 mm high. Alarm messages that are displayed in the ECG parameter box are 3 mm high. Visual alarms cannot be disabled. All alarm conditions are checked once each second and the display is updated to indicate the alarm status.

Line Isolation Transients

See the warnings, cautions, and notes in *Chapter 8: ECG* for proper operating conditions and lead placement.

Electrode Polarization

See the warnings, cautions, and notes in *Chapter 8: ECG* for proper operating conditions and lead placement.

Auxiliary Outputs

RS-232 serial outputs are provided. Electrical protection to 1.5 KV is provided on all I/O. The Advisor® Vital Signs Monitor is considered a DTE device.

Audible Alarm Silencing

Audible alarms may be silenced in three ways. To manually re-enable the alarms, press the alarm silence key (ⓧ) on the front of the monitor.

An audible alarm may be temporarily silenced for two minutes. To temporarily silence an alarm, press the alarm silence key (ⓧ). AUDIO PAUSED will be displayed on the upper right side of the display. The audible alarm will be re-enabled if any new alarm condition occurs, or in two minutes if no new alarm condition occurs. To manually re-enable the audible alarm, press the alarm silence key (ⓧ) again.

Audible alarms may be indefinitely silenced. Press and hold the alarm silence key (ⓧ) for about three seconds, until AUDIO PAUSED is displayed on the upper right side of the display. If any new alarm condition occurs while audible alarms are indefinitely silenced, the audible alarm will be re-enabled.

Audible alarms may be permanently silenced. Press and hold the alarm silence key (ⓧ) for about six seconds, until AUDIO OFF is displayed on the upper right side of the display. The audible alarm will not be re-enabled if a new alarm condition occurs. This condition is possible only if dual alarm silence is allowed and INDEFINITE is enabled.

Appendix B: Alarm Limit Defaults

Heart Rate

	ECG LIMIT DEFAULTS		
	Cat	Dog	Horse
HEART RATE HIGH LIMIT	200	160	50
HEART RATE LOW LIMIT	90	70	30
QUICKSET HIGH VALUE	+25	+25	+25
QUICKSET LOW VALUE	No Change	No Change	No Change

Oximetry

	SPO ₂ LIMIT DEFAULTS		
	Cat	Dog	Horse
SPO ₂ HIGH LIMIT	OFF	OFF	OFF
SPO ₂ LOW LIMIT	90%	90%	90%
QUICKSET HIGH VALUE	No change	No change	No change
QUICKSET LOW VALUE	No change	No change	No change

Non-invasive Blood Pressure (NIBP)

	NIBP LIMIT DEFAULTS			
		Cat	Dog	Horse
SYSTOLIC LIMITS	High	200 mmHg (26.7 kPa)	180 mmHg (24.0 kPa)	130 mmHg (17.3 kPa)
	Low	90 mmHg (12.0 kPa)	70 mmHg (9.3 kPa)	80 mmHg (10.7 kPa)
	QUICKSET high value	+20 mmHg (+2.7 kPa)	+20 mmHg (+2.7 kPa)	+10 mmHg (+1.3 kPa)
	QUICKSET low value	No change	No change	No change
DIASTOLIC LIMITS	High	105 mmHg (14.0 kPa)	90 mmHg (12.0 kPa)	90 mmHg (12.0 kPa)
	Low	40 mmHg (5.3 kPa)	35 mmHg (4.7 kPa)	60 mmHg (8.0 kPa)
	QUICKSET high value	+10 mmHg (+1.3 kPa)	+10 mmHg (+1.3 kPa)	+5 mmHg (+0.7 kPa)
	QUICKSET low value	No change	No change	No change
MEAN ARTERIAL PRESSURE LIMITS	High	110 mmHg (14.7 kPa)	125 mmHg (16.7 kPa)	70 mmHg (9.3 kPa)
	Low	60 mmHg (8.0 kPa)	60 mmHg (8.0 kPa)	20 mmHg (2.7 kPa)
	QUICKSET high value	+10 mmHg (+1.3 kPa)	+10 mmHg (+1.3 kPa)	+5 mmHg (+0.7 kPa)
	QUICKSET low value	No change	No change	No change

Invasive Blood Pressure

SITE LABEL	ALARM LIMIT	LIMIT DEFAULTS mmHg (kPa)			QUICKSET VALUES		
		Cat	Dog	Horse	Cat	Dog	Horse
ART	Systolic high	200 (26.7)	160 (21.3)	130 (17.3)	+20 (+2.7)	+20 (+2.7)	+10 (+1.3)
	Systolic low	90 (12.0)	70 (9.3)	80 (10.7)	No change	No change	No change
	Diastolic high	105 (14.0)	90 (12.0)	90 (12)	+10 (+1.3)	+10 (+1.3)	+5 (+0.7)
	Diastolic low	40 (5.3)	35 (4.7)	60 (8)	No	No	No
	Mean high	110 (14.7)	105 (14.0)	70 (9.3)	+10 (+1.3)	+10 (+1.3)	+5 (+0.7)
	Mean low	60 (8.0)	60 (8.0)	20 (2.7)	No change	No change	No change
PA RV	Systolic high	40 (5.3)	40 (5.3)	40 (5.3)	+15 (+2)	+15 (+2)	+15 (+2)
	Systolic low	0 (0.0)	0 (0.0)	0 (0.0)	No change	No change	No change
	Diastolic high	40 (5.3)	40 (5.3)	40 (5.3)	+15 (+2)	+15 (+2)	+15 (+2)
	Diastolic low	0 (0.0)	0 (0.0)	0 (0.0)	No change	No change	No change
	Mean high	40 (5.3)	40 (5.3)	40 (5.3)	+15 (+2)	+15 (+2)	+15 (+2)
	Mean low	0 (0.0)	0 (0.0)	0 (0.0)	No change	No change	No change
P LV	Systolic high	160 (21.3)	160 (21.3)	120 (16.0)	+20 (+2.7)	+20 (+2.7)	+20 (+2.7)
	Systolic low	0 (0.0)	0 (0.0)	0 (0.0)	No change	No change	No change
	Diastolic high	160 (21.3)	160 (21.3)	120 (16.0)	+20 (+2.7)	+20 (+2.7)	+20 (+2.7)
	Diastolic low	0 (0.0)	0 (0.0)	0 (0.0)	No change	No change	No change
	Mean high	160 (21.3)	160 (21.3)	120 (16.0)	+20 (+2.7)	+20 (+2.7)	+20 (+2.7)
	Mean low	0 (0.0)	0 (0.0)	0 (0.0)	No change	No change	No change
CVP LA RA	Mean high	20 (2.7)	20 (2.7)	20 (2.7)	No change	No change	No change
	Mean low	3 (0.4)	3 (0.4)	3 (0.4)	No change	No change	No change
	ICP						
ICP	Mean high	20 (2.7)	20 (2.7)	10 (1.3)	No change	No change	No change
	Mean low	3 (0.4)	3 (0.4)	0 (0.0)	No change	No change	No change

Temperature (T1/T2)

	TEMP LIMIT DEFAULTS		
	Cat	Dog	Horse
TEMP HIGH LIMIT	39.2 °C/102.6°F	39.2°C /102.6°F	38.6°C /101.5°F
TEMP LOW LIMIT	38.1°C /100.6°F	38.1°C /100.6°F	37.5°C /99.5°F
QUICKSET HIGH VALUE	+1°C /°F	+1°C /°F	+1°C /°F
QUICKSET LOW VALUE	-1°C /°F	-1°C /°F	-1°C /°F

Capnography (CO₂)

CO ₂ LIMIT DEFAULTS										
RESP RATE		Cat			Dog			Horse		
	RESP high limit	40 rpm			40 rpm			35 rpm		
	RESP low limit	8 rpm			8 rpm			5 rpm		
	QUICKSET high value	+20			+10			+10		
	QUICKSET low value	No change			No change			No change		
ETCO ₂		mmHg	kPa	% *	mmHg	kPa	% *	mmHg	kPa	% *
	ETCO ₂ high limit	60	8.0	8.1	60	8.0	8.1	60	8.0	8.1
	ETCO ₂ low limit	20	2.7	2.7	20	2.7	2.7	20	2.7	2.7
	QUICKSET high value	+10	+1.3	+1.3	+10	+1.3	+1.3	20	+1.4	+1.4
	QUICKSET low value	No change			No change			No change		
INCO ₂	INCO ₂ high limit	8	1.1	1.1	8	1.1	1.1	8	1.1	1.1
	QUICKSET high value	+2	+0.3	+0.3	+2	+0.3	+0.3	+2	+0.3	+0.3

* Percent (%) is variable, based on atmospheric pressure. See the equation below:

$$\% = \frac{\text{value for mmHg} \times 100}{\text{Atmospheric pressure in mmHg}}$$

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Appendix C: IEC 60601-1-2 Requirements, 2nd Edition, 2001

GUIDANCE AND MANUFACTURER'S DECLARATION – ELECTROMAGNETIC EMISSIONS		
The Advisor® Vital Signs Monitor is intended for use in the electromagnetic environment specified below. The customer or user of the Advisor® Vital Signs Monitor should assure that it is used in such an environment.		
EMISSIONS TEST	COMPLIANCE	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
RF emissions CISPR 11, 2003	Group 1	The Advisor® Vital Signs 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 Advisor® Vital Signs 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, 2001	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	
Radiated magnetic field FDA-RE 101-1993	Complies	

GUIDANCE AND MANUFACTURER'S DECLARATION – ELECTROMAGNETIC IMMUNITY			
The Advisor® Vital Signs Monitor is intended for use in the electromagnetic environment specified below. The customer or user of the Advisor® Vital Signs Monitor should assure that it is used in such an environment.			
IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
Electrostatic discharge (ESD) IEC 61000-4-2, 2001	± 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, 2001	± 0.5 kV - ± 2 kV for power supply lines ± 0.5 kV - ± 1 kV for input/output lines	± 0.5 kV - ± 2 kV on 220 VAC power line ± 0.5 kV - ± 1 kV on ECG, CO ₂ , BP1, BP2, SPO ₂ , NIBP, and TEMP	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5, 2001	± 1 kV differential mode ± 2 kV common mode	± 1 kV differential mode ± 2 kV common mode	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, 2004	<5 % UT (>95 % dip in UT) for 0.5 cycle 40 % UT (60 % dip in UT) for 5 cycles 70 % UT (30 % dip in UT) for 25 cycles <5 % UT (>95 % dip in UT) for 5 sec	<5 % UT (>95 % dip in UT) for 0.5 cycle 40 % UT (60 % dip in UT) for 5 cycles 70 % UT (30 % dip in UT) for 25 cycles <5 % UT (>95 % dip in UT) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the Advisor® Vital Signs Monitor requires continued operation during power mains interruption, it is recommended that the Advisor® Vital Signs Monitor be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) IEC 6100-4-8, 2001	10 A/m	10 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 a.c. mains voltage prior to application of the test level.			

GUIDANCE AND MANUFACTURER'S DECLARATION – ELECTROMAGNETIC IMMUNITY			
The Advisor® Vital Signs Monitor is intended for use in the electromagnetic environment specified below. The customer or user of the Advisor® Vital Signs Monitor should assure that it is used in such an environment.			
IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
Conducted RF IEC 61000-4-6, 2003	3 V, 80% AM modulation @ 2 Hz 0.15 MHz to 80 MHz	3 V	
Radiated RF IEC 61000-4-3, 2002	10 V/m, 80 % AM @ 2 Hz 80 MHz – 2500 MHz	10 V/m for all parameters (Edwards Lifesciences TruWave, and Abbott Critical Care Systems Transpac® IV invasive pressure transducers)	Portable and mobile RF communications equipment should be used no closer to any part of the Advisor® Vital Signs 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 animals.			
^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 Advisor® Vital Signs Monitor is used exceeds the applicable RF compliance level above, the Advisor® Vital Signs 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 Advisor® Vital Signs Monitor. ^b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 10 V/m.			

GUIDANCE AND MANUFACTURER'S DECLARATION – ELECTROMAGNETIC IMMUNITY

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

Rated maximum output power of transmitter (W)	Separation distances according to frequency of transmitter (m)		
	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 k 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 structures, objects, and animals.

Appendix D: Revision History

REVISION	DATE	COMMENT
Rev. 4	2009-03	• Changed Fax Number for Veterinary Clinical Support. • Added RX Only caution to list of general cautions in Chapter 1. • Replaced NIBP Accuracy information with new SunTech information.

REVISION	DATE	COMMENT
Rev. 3	2008-04	• Added CE mark and European Representative to Warranty section and back cover. • Added design frame, SurgiVet lozenge and Smiths Medical logo to front cover. Delete Smiths Medical logo from back cover. • Deleted any mention of "Veterinary Division." • Updated Loaner Device and Warranty Procedure sections of Warranty. • Added WEEE Recycling instructions. • Changed some cautions and notes to warnings. • Added AC power warnings. • Added caution about certain cleaning agents causing brittle plastic. • Added warning about the oximeter displaying dashes under certain clinical conditions. • Updated the Oximetry Theory of Operation. • Added Checking the Oximeter's Performance section. • Added 2 notes about SpO2 averaging to Choose the Averaging Period for the Oximetry Parameter section in Chapter 9. • Updated the NIBP Theory of Operation. • Added note about the moisture trap being able to run over 50 hours without occluding to Chapter 13. • Added information about the optional Data Logger to end of Chapter 14. • Added part WWV3418 to Optional Supplies and Accessories List. • Added Alarm Volume Spec. • Updated ECG Input Impedance. • Added Atmospheric Pressure spec to Capnograph specs. • Added Desat study information to SpO2 Accuracy spec. • Updated NIBP specs.

REVISION	DATE	COMMENT
Rev. 2	2006-09	• Updated Line Art. • Updated SurgiVet symbol on front cover. • Added trademark and patent information to Table of Contents. • Updated Warranty Section. • Updated symbol definitions in Chapter 1. • Added WEE, Rx Only, Graphical Recorder, and Use By symbols to symbol chart in Chapter 1. • Updated Attaching the Patient instructions in Chapter 8. • Updated instructions to Adjust the Volume of the Heartbeat Beep Tone in Chapter 8. • Added V3110 and V3406 to parts needed in Verifying ECG Calibration in Chapter 8. • Updated sensor chart in Chapter 9. • Changed rectal sensor to reflectance sensor everywhere. • Removed information about Nellcor® sensors from Chapter 9. • Deleted Verifying NIBP Calibration section from Chapter 10. • Updated Theory of Operation in Chapter 11. • Updated instructions on how to perform a HILO CAL. • Added Analog Output section to Chapter 14. • Added appropriate page numbers for instructions on maintenance to Chapter 15. • Deleted NIBP parameter and Calibration filter from Chapter 15. • Updated parts list in Chapter 16. • Deleted Verifying NIBP Calibration instructions from Chapter 16 and replaced with "Contact your authorized repair center for help." • Updated range values in Chapter 18. • Updated limits and values in Appendix B: Alarm Limit Defaults.



EC REP Authorized Representative (as defined by the Medical Device Directive):

Smiths Medical International, Ltd.
Colonial Way, Watford, Herts,
WD24 4LG, UK

Phone: (44) 1923 246434
Fax: (44) 1923 240273



Manufactured By
Smiths Medical PM, Inc.
N7W22025 Johnson Drive
Waukesha, WI 53186-1856 USA