PRELIMINARY

MEDRAD®

# Veris™ 8600
# Vital Signs Monitor

## Operation Manual

Veris™
MR MONITORING SYSTEM

**3010796 Revision 0**
**Date 10/04**

CE 0123

# *Veris™ 8600*
# *Operation Manual*



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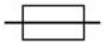
# Symbols

| | Symbol | Definition |
|---|---|---|
| **Regulatory Symbols** | CE 0123 | European Community Mark |
| | | ETL Mark |
| | | FCC (US Federal Communications Commission) Mark |
| **Safety Symbols** | | ATTENTION! Refer to Operation Manual for Information |
| | | Shock Hazard |
| | | Type CF Equipment, defib proof |
| | IPX0 | Indicates no protection against ingress of water (remote display) |
| | IPX1 | Identifies the degree of protection against fluid as drip-proof (main monitor) |
| | IPX2 | Identifies the degree of protection against fluid as drip-proof (power supply) |
| | | Equipotential Terminal |
| | | Protective Earth |
| | | Indicates the MR magnet and power |
| | | Indicates distance between MR magnet and monitor |
| | | Indicates the presence of a battery |
| | | Recycle batteries following hospital protocols and local environmental regulations. |
| | | Do not incinerate! Keep away from fire or other sources of extreme heat. |

| | Symbol | Definition |
|---|---|---|
| |  | Dispose of batteries properly in accordance with hospital and local regulations. |
| |  | Risk of electrical shock! Do not remove cover. Refer servicing to qualified personnel. |
| **System Symbols** |  | Fuse |
| |  | Alternating Current (AC) |
| |  | Direct Current (DC) |
| |  | Wireless Device |
| **Port Symbols** |  | Signal Input |
| |  | Signal Output |
| | IOIOI | Digital Output |
| |  | Air Intake |
| |  | Scavenging Port |
| |  | Communication Port |
| |  | Video Out |

**Miscellaneous Symbols**

| Symbol | Definition |
|---|---|
|  | Technical Support Phone Number |
|  | Manufacturing Contact |
| SN | Serial Number |
| REF | Part Reference Number |
| Place this side against the skin<br>Este lado hacia la piel<br>Ce côtē en contact avec peau | Place this side against the skin (Blood Pressure Cuff) |
|  | Placement of the cuff over the brachial artery. |
|  | Single use device only. Do not reuse. |

# Safety

**Definitions**

Definitions for Warning, Caution, and Note symbols:

| | |
|---|---|
| ⚠**WARNING**⚠ | Designates a possible dangerous situation. Non-observance may lead to death or the most severe injuries. |
| ⚠**CAUTION**⚠ | Designates a possible dangerous situation. Non-observance may lead to minor injuries or damage to the product. |

**NOTE:** Indicates that important information follows, a tip that can help you recover from an error, or point you to related details in the manual.

**Warnings**

⚠**WARNING**⚠

- Read this manual entirely before using the monitor.
- Inspect For Damage! User should inspect the system for signs of damage. Do not use the system if failure is evident or suspected.
- Possible burn hazard! Do not coil cables inside the MR scanner.
- Possible explosion hazard! Do not use the monitor in the presence of flammable anesthetics. The equipment is not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or Nitrous Oxide.
- Possible explosion hazard! Do not use the monitor in the presence of gas mixtures which may be flammable.
- Cables, tubing, and lead wires may present a risk of entanglement or strangulation! Verify safe and proper positioning of these items at all times.
- Unapproved modifications to the monitor may cause unexpected results and present a hazard to the patient.

- Risk of electrical shock! Do not remove cover. Refer servicing to qualified personnel.
- All cords must have hospital grade plugs and be plugged into hospital grade outlets. (The electrical installation of the relevant room must comply with NFPA 70: National Electric Code or NFPA 99: Standard for Health Care Facilities. Outside the United States, the relevant room must comply with all electrical installation regulations mandated by the local and regional bodies of government).
- Do not bring tools containing ferrous material into the magnet room. Risk of serious injury and/or damage to equipment can occur.

**⚠WARNING⚠**

- Do not route gating cables near or within the scanning volume.
- Apply brakes to prevent movement.
- Do not re-use accessories labeled as single use. Risk of patient contamination may occur.
- Improper disposal of batteries may result in explosion, leakage, or personal injury. Do not open batteries. Do not dispose of batteries in a fire. Follow all local regulations concerning the disposal of spent Lead-acid and Lithium-Ion batteries or contact MEDRAD for assistance.
- Connect only MEDRAD approved three-lead or five-lead ECG cables from the patient to the ECG module. Do not connect any other signal source to the ECG module.
- There is no defibrillator synchronization output on the ***Veris*** monitor. Make no connections between the ***Veris*** and a defibrillator.
- Leakage currents may increase if other equipment is interconnected to the patient. The increased leakage currents may present a hazard to the patient.
- PACEMAKER PATIENTS: This device does not include pacemaker spike rejection capability. Heart rate readouts derived from the ECG patient connections are likely to display erroneous high or erratic rates when a pacemaker is in use. Keep pacemaker patients under close surveillance. For pacemaker patients it may be advisable to select the $SpO_2$ function as the primary heart rate source.
- High Frequency (HF) surgical equipment may affect ECG operation. The system is not designed to operate in the presence of ESU interference. The patient may be burned. Patient burns can also result from defective HF surgical equipment neutral electrode connection.
- The heart rate calculated by the monitor may be affected by cardiac arrhythmia.
- Do not take the remote display or the ECG module battery charger into the MR scanner room. These contain ferromagnetic material and can be strongly attracted to the magnet causing a safety hazard.
- Do not use with an open MRI. Use of the monitor in an open MRI may result in erratic or unavailable monitoring.
- Do not stand or sit on monitor accessories tray. Possible injury can result from falling.

**⚠WARNING⚠**

- Do not lift the monitoring system by the tray. Possible injury can result from heavy weight.
- U.S. Federal law restricts this device to sale by or on the order of a physician.

**Cautions**

**⚠CAUTION⚠**

- Use only accessories designated for use with this monitor. Use of accessories not designated for use with the ***Veris*** monitor can cause inaccurate measurements and/or a safety hazard for the patient.
- Equipment accuracy may be affected at extreme temperatures.
- Do not store equipment at extreme temperature. Temperatures exceeding specified storage temperatures could damage the system.
- Avoid routing the DC cable through the magnet room door. Possible damage can occur to the DC cable and/or the scanner room door.
- Do not press on the keys with sharp or hard objects. This could damage the keys. Use only your fingertips to press on the keys.
- Changes or modifications not expressly approved by MEDRAD, Inc., may void the user's authority to operate the equipment and may also void the warranty.
- Do not use the monitor in the path of a Linear Accelerator or Positron Emission Tomography (PET) scanner beam. This could result in inaccurate physiologic parameters or waveforms.
- Transporting the monitor in a mobile scanner trailer can lead to damage from shock, vibration, or extreme temperatures.
- Do not allow the conductive parts of the patient electrodes to contact other conductive parts, including ground (earth).
- Do not tip the monitor. Possible injury can result from falling.
- Do not stand on power supply enclosure. Injury from tripping or falling can occur.
- Do not stand on the base. Possible injury can result from falling.
- Do not pinch cables between the table and the bore. This can damage the cables.
- Do not roll the monitor over or step on cables. This can damage the cables.

**⚠CAUTION⚠**

- Do not bend fiber optic cables too tightly. Follow cable manufacturers specifications for bend allowance.
- If a probe falls on the floor or into liquid, clean the probe following proper cleaning methods. If the probe is not properly cleaned, inaccurate physiologic parameters or waveforms may result.
- Do not place more than 40 pounds (18 kg) on the tray.

Leakage Current

The monitor complies with leakage current limits required by medical safety standards for patient-connected devices. The ***Veris*** monitor conforms to EN 60601-1 standards. A hazard caused by the summation of leakage currents is possible, when several pieces of equipment are interconnected.

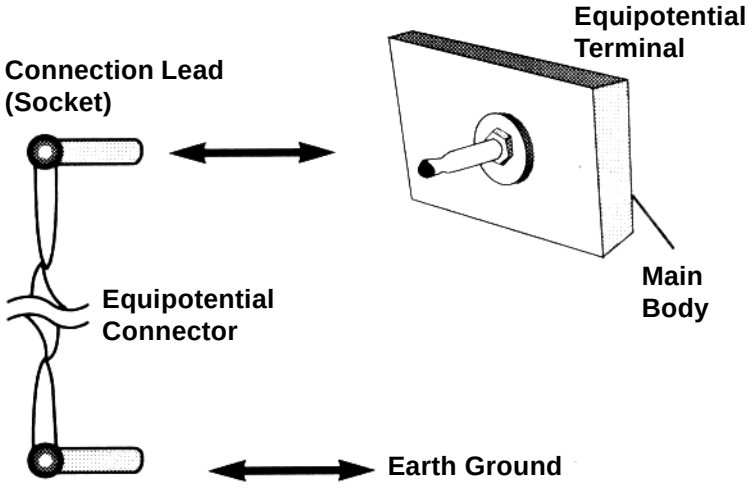
Voltage Fluctuations

When operated in the line voltage range specified in this manual any minor fluctuations will have a negligible effect. Very low line voltage will cause the monitor to revert to battery power. Very high line voltage may cause damage to the charger circuits. The monitor is designed with circuitry that will turn the unit off before spurious readings can be caused by a low battery condition.

Equipotential Ground

Health care providers and patients are subject to dangerous, uncontrollable compensating currents for electrical equipment. These currents are due to the potential differences between connected equipment and touchable conducting parts as found in medical rooms.

The safety solution to the problem is accomplished with consistent equipotential bonding. Medical equipment is fitted with connecting leads made up with angled sockets to the equipotential bonding network in medical rooms.



Software Error Related Hazard Mediation

MEDRAD, Inc., has quality control practices and procedures in place to review potential hazards as they relate to software. The monitor utilizes a four-digit year for all date, time, and leap year calculations.

Potential Interference

This device has been tested to 60601-1-2 specified levels for emissions of and immunity to electrical interference. External disturbances which exceed these levels, such as motor driven tools, may cause operational issues with this device. Other devices which are sensitive to a lower level of emissions than those allowed by IEC 60601-1-2 2nd Edition may experience operational issues when used in proximity to this device.

**MAGNETIC FIELDS**

Always position the ***Veris*** Base, Base Plus, and Cardiac monitors at or outside the 2000 Gauss line. Always position the ***Veris*** Anesthesia monitor at or outside of the 500 Gauss line. This monitor is designed specifically for MR compatibility and is 1.5 and 3T compatible. It will not cause interference with MRI image quality, nor will its performance be affected by the magnet field.

The "T" wave may become excessively large or inverted with the patient in the magnetic field. This effect is due to hemodynamic flow induced voltage and may interfere with QRS detection. Try other leads and/or electrode placements for best results.

**CONDUCTED TRANSIENTS**

The monitor conforms with IEC 1000-4-4, and IEC 1000-4-5 for conducted transients, and will operate with negligible adverse effects.

**X-RAY, CT, ULTRASOUND, AND/OR NUCLEAR MEDICINE**

The monitor will operate with negligible adverse effects in these environments. However, the monitor should not be placed directly in the radiated beam, which could damage the internal electronics of the monitor.

**OTHER INTERFERENCE**

There is a negligible adverse effect to the monitor from infrared energy and defibrillation.

Use of Anesthetics

Do not use this device in conjunction with flammable anesthetics such as cyclopropane and ether. The monitor can sample from pure oxygen environments, but the monitor itself should never be placed inside an oxygen rich environment, such as an oxygen tent or gas containment apparatus. Proper anesthetic gas waste recovery should be used.

Biocompatibility

All patient-contact or user-contact materials in this monitor and it's accessories have passed ISO 10993-5, -10, & -11 biocompatibility tests or have been in use in clinical environments in large numbers over an extended period of time predating these standards.

Probes Fall in Fluids

Whenever probes fall and land in fluids, clean the probes according to the cleaning instructions in “Cleaning and Disinfecting” on page A-1.

FCC and Industry Canada Compliance

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including intereference that may cause undesired operation.

**⚠WARNING⚠**

- Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

The term “IC” before the certification/registration number only signifies that the Industry Canada technical specifications were met.

**IC: 5338A-CSI8600**

Audible Pulse Tone

The amplitude of the audible pulse tone remains constant regardless of changes in patient parameter measurements.

Disposal Accessory Disposal

Discard disposable medical waste according to your institution's policies and procedures to prevent biological contamination. See “Disposal” on page A-7.

Latex Content

This MEDRAD product (patient monitors and approved accessories) are free from latex in any location that may result in patient contact.

# Introduction

**Description**

The ***Veris***™ 8600 patient monitor is designed for use in the MRI environment. It interprets and displays physiologic data as waveforms and numeric information which, depending on the configuration of the system, may include ECG, NIBP, $SpO_2$, $CO_2$, respiration, temperature, $O_2$, anesthetic gases, and IBP. User defined alarm limits and alerts may be set for each parameter. Monitored parameter data is stored as tabular trend information and may be printed or downloaded.

**Intended Use**

The system is intended to monitor physiological parameters of patients within any health care environment, specifically in the MR environment. The user, responsible to interpret the monitored data made available, will be a professional health care provider. Physiological data, gas monitoring, system alarms, and patient analysis will be available to the care provider from the monitor.

The monitor shall be MR compatible based on the FDA guidelines for equipment to be used in MR.

There are two distinct needs for patient monitors in MR:

- Vital signs monitoring, to monitor medically unstable patients or patients under conscious sedation, as required by the JCAHO.
- And, provide image gating, to gate image acquisition to a physiological parameter, such as the cardiac cycle.

There is the additional requirement for the accurate function of the equipment in the MR environment. The monitor used in the scan room shall not be affected by the radio frequency pulse or gradient fields and shall not produce any RF interference on the image.

The monitor (including accessories) shall be capable of monitoring a full range of patients from neonate to adult.

**Clinical Use**

This manual provides separate sections for measured parameters. These sections provide instructions for patient connections and monitoring. The caregiver is expected to be fully familiar with patient monitoring techniques and with the functions of this monitor before using it with a patient.

This system is designed to only monitor one patient at a time per monitoring system.

Before you Begin

Protect yourself and your patient. Read the precautions for each measured parameter that appears in each measured parameter section.

These instructions describe the use of the basic sampling devices and accessories that come with your monitor. An extended list of approved accessories can be found in “Accessories” in Appendix D of this manual.

The monitor should always be checked by the caregiver before use for actual patient monitoring. Perform the following procedure before using the monitor with each patient.

1. Make sure the monitor has been fully charged before use. Check that the AC (Mains) power cord is plugged in for long-term monitoring situations.
2. Check the menus and default settings to confirm that the monitor is setup correctly.
3. Examine the accessories for wear, damage or contamination. Replace or disinfect the accessories as required.
4. Turn the desired monitoring modules to *ON* in the *PARAMS* softkey window.
5. Select the correct mode of operation (*Adult*/*Pediatric*/*Neonate*) by entering the patient size in the *ADM/DIS* softkey window.

**⚠CAUTION⚠**

- All accessories connected to the patient monitor must comply with all applicable UL (Underwriters Laboratories) standards and IEC standards for such products.
- Substitution of recommended sensor and sampling accessories may cause inaccurate measurements and degrade patient safety, or may damage the monitor.

# 1 — Panel Features

This section provides an overview of the ***Veris*** 8600 monitor's control panels, switches, accessory connections, and communication sockets.

**Front Panel**

The front panels of the monitor and the optional remote display feature a color flat-screen display. Located below the screen is the primary control panel equipped with the power button, eight dedicated function keys and a menu knob. Menu selections are displayed on the screen and can be selected via the menu knob. The keypad is push-button style, composed of a touch-sensitive membrane.

The water trap receptacle is also located on the front of the main monitor (Anesthesia units only).

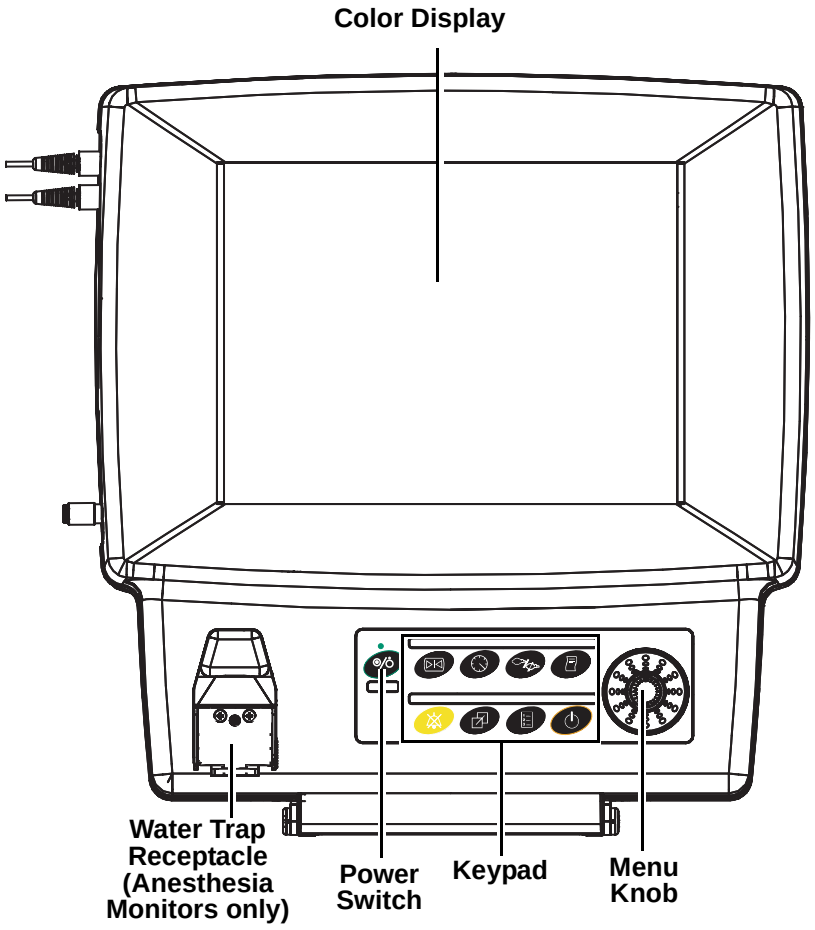



**Figure 1-1: *Veris* 8600 Front Controls**

A green LED indicator is located above the power (ON/OFF) key. The indicator is on if AC power is present.

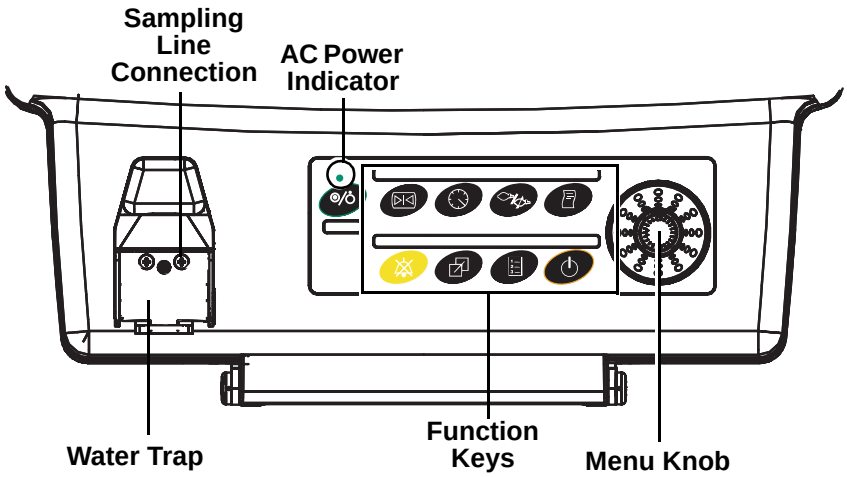



**Figure 1-2: Detail of Lower Front Panel**

Menu Knob

The menu knob can be turned left or right to make selections from any of the menus that appear on the front display. The selected menu option can then be activated by pressing in on the menu knob.

Color Display

The display provides real-time waveform and numerical data of the measured parameters. Additional menus and menu options which may be selected and activated by the menu knob are also displayed on this and the optional remote display screen.

Water Trap and Gas Sampling Connection

The water trap connection is a feature on Anesthesia and Anesthesia with Temperature models only. MEDRAD ***Veris*** monitors without gas analysis capability have a blank plate in this location. The water trap is easily accessed on the front of the monitor. The gas sampling line is connected to the water trap and it is used for $CO_2$, $O_2$, $N_2O$, and agent monitoring. The sample line fitting is a standard female Luer-lock connector when using the WaterChek™ $2^+$ water trap accessory.

**Left Side Panel (Main Monitor)**

The left side of the main monitor has up to nine connections for patient monitoring. The electrocardiogram (ECG), pulse oximetry ($SpO_2$), and the non-invasive blood pressure (NIBP) connections are standard on all ***Veris*** 8600 models.

All potential ***Veris*** main monitor connections are described in the picture below.

The optional remote display has no patient connections.

More information about accessory connections can be found in the patient monitoring sections of this manual.

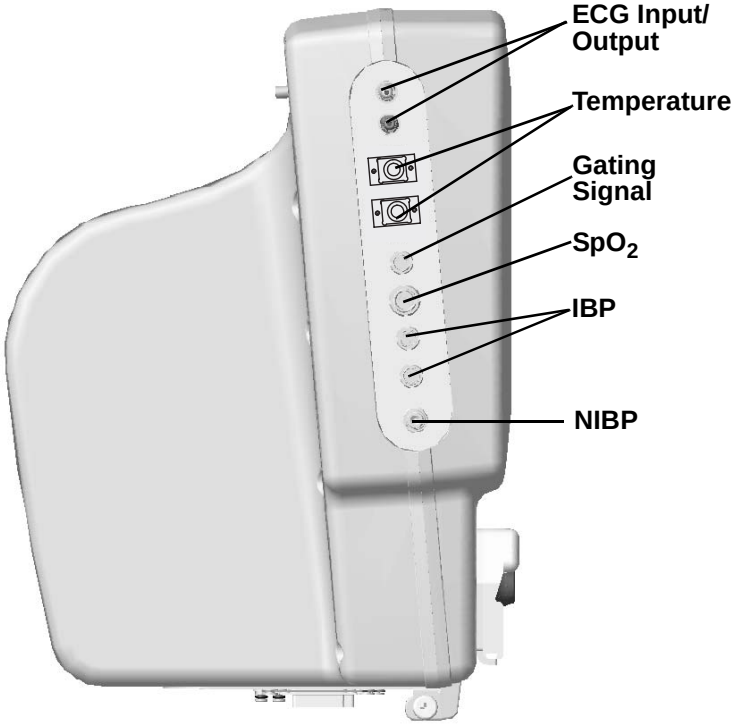



**Figure 1-3: *Veris* 8600 Left Side**

**Communication Port (Main Monitor)**

There are two fiber optic ports at the bottom of the monitor. One is an input port and the other an output port. These ports, on both the main monitor and the remote display, are for fiber optic communication between the main monitor and the remote display. See the Installation Instructions for installing the fiber optic communications.

See “Figure 1-8:: Remote Display Fiber Optic Connections” on page 1-7 for the location of the fiber optic ports on the remote display.

**NOTE**: These connections have protective covers that need to be removed before use.

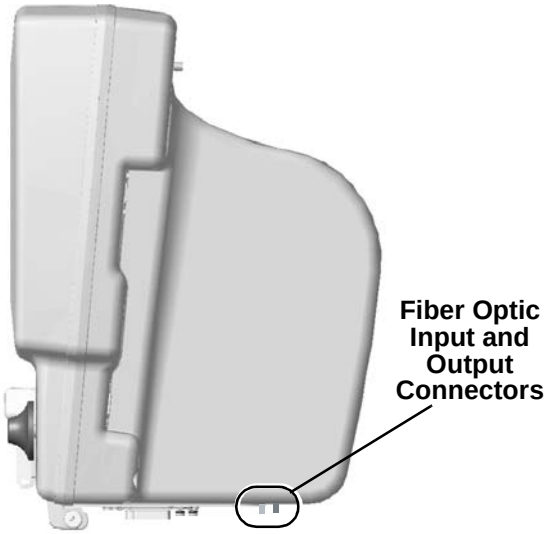
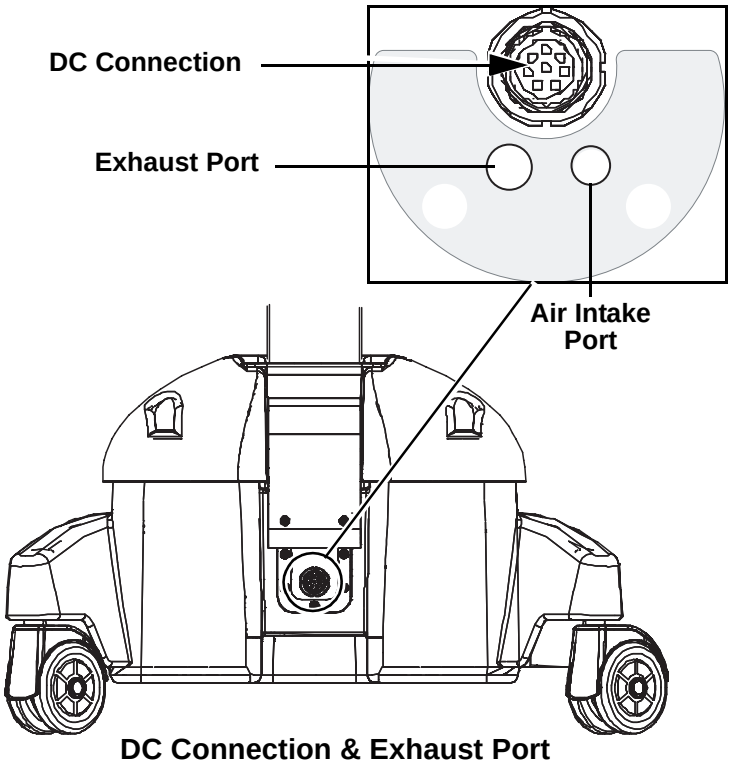



**Figure 1-4: Main Monitor Fiber Optic Connections**

**Main Monitor Base Connections**




**DC Connection & Exhaust Port**

**Figure 1-5: Main Monitor Base Connections**

Chassis Ground — The ***Veris*** monitor has an internal chassis ground.

DC Connection — A DC power cable connection is located at the center of the base of the patient monitor. Attach the cable from the power supply in this socket.

**⚠CAUTION⚠**

- Ensure that the cable from the power source to the monitor base is placed in an area free from traffic to prevent tripping and/or damage to the cable.

Exhaust Port — The exhaust port is located on the base of the Anesthesia monitor assembly by the DC connection. The scavenging kit fits this nozzle. Use the scavenging kit and a waste gas recovery system when anesthetic agents are present in gas samples.

Air Intake Port — An ambient air intake port (located next to the exhaust port on the base of the Anesthesia monitor assembly) is used for making zero gas concentration calibrations. Do not block or attach anything to the air intake port.

Remote Display

The remote display displays the patient data in another location. Changes to the display can be made from the remote display and be effected on the patient monitor.

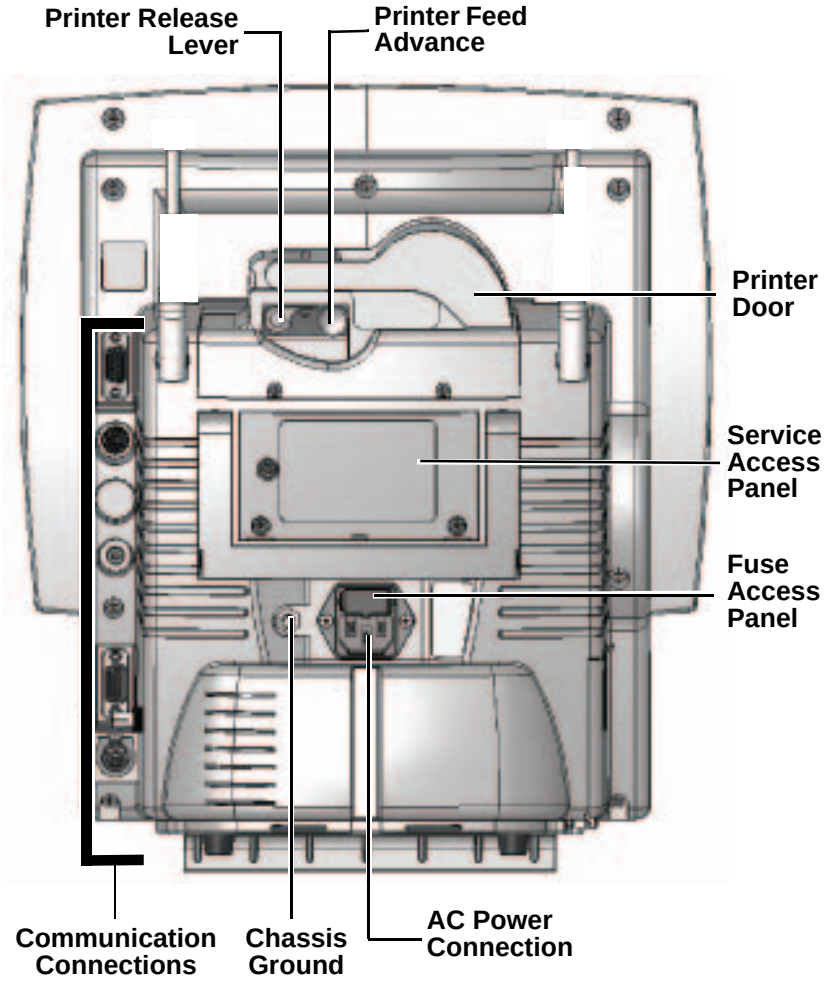



**Figure 1-6: Remote Display Rear View**

**COMMUNICATION PORTS (REMOTE DISPLAY)**

There are three communications sockets available along the back edge of the remote display. These connections provide links to external printers, computers, and other medical devices. See “Printing and Data Ports” in Section 12 for more information about serial printing and communications

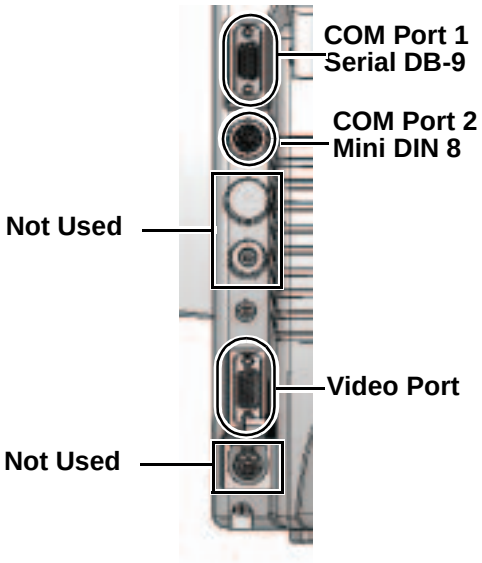



**Figure 1-7: Communication Ports (Remote Display)**

There are also two fiber optic ports on the right side of the remote display. These ports, on both the main monitor and the remote display, are for fiber optic communication between the main monitor and the remote display. See the Installation Instructions for installing the fiber optic communications.

**NOTE**: These connections have protective covers that need to be removed before use.

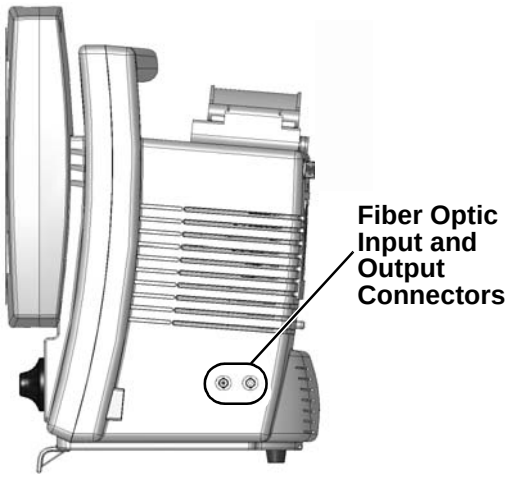



**Figure 1-8: Remote Display Fiber Optic Connections**

**Printer**

This printer door provides quick access to the internal printer paper spool. The printer lever releases the printer rollers for removing jammed paper. The knob can be turned to feed paper. See “Printing and Data Ports” in Section 12 for additional printer information.

Printers are only available on ***Veris*** 8600 remote displays.

**Accessory Tray**

The monitor has an integral accessories tray where the user can store and hang accessories.

**⚠WARNING⚠**

- Do not stand or sit on monitor accessories tray. Possible injury can result from falling.
- Do not lift the monitoring system by the tray. Possible injury can result from heavy weight.

**⚠CAUTION⚠**

- Do not place more than 40 pounds (18 kg) on the tray.

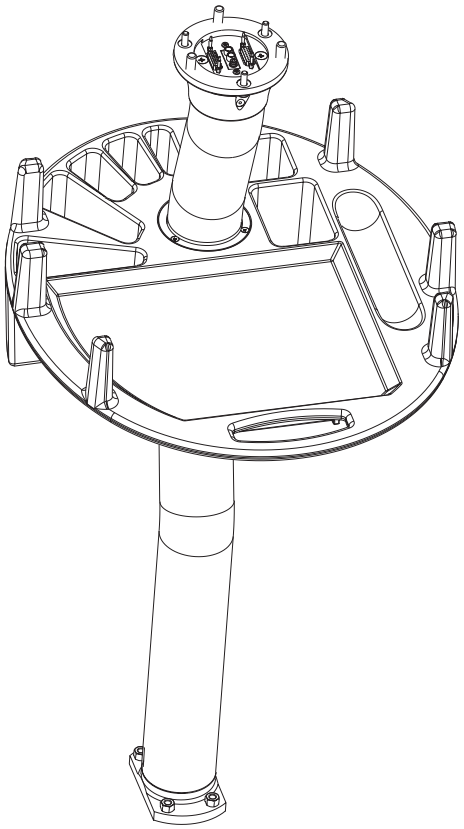


**Figure 1-9: Accessory Tray**

### *Veris* 8600 Configurations

There are six factory-set configurations and one optional remote display available. See below for configuration options.

| Number | Description | Features |
|---|---|---|
| 3011991 | Base MR Monitor | Standard 3-lead ECG, $SpO_2$, and NIBP |
| 3011992 | BasePlus MR Monitor | Base plus Remote Display |
| 3011993 | Cardiology configuration | Base plus 5-lead ECG, ECG Gating, $SpO_2$ Gating, IBP.<br>The Remote Display is optional. |
| 3011994 | Cardiology with Temperature | Cardiology plus Temperature.<br>The Remote Display is optional. |
| 3011995 | Anesthesia configuration | Base plus 5-lead ECG, ECG Gating, $SpO_2$ Gating, IBP, $O_2$, $CO_2$, $N_2O$, agents.<br>The Remote Display is optional. |
| 3011996 | Anesthesia with Temperature | Anesthesia plus Temperature.<br>The Remote Display is optional. |
| 3010482 | Remote Display | Remote display with printer and fiber optic communications. |

The instructions in this manual cover the operation of each of the option packages listed above. For those models that do not include a particular monitoring module (i.e. Agents), the system functions as if that module is turned off.

# 2 — Monitor Setup

This section provides an overview of the setup procedures for the ***Veris*** 8600 monitor. Also see the appropriate chapters on patient parameter monitoring for parameter setup information.

The monitor should be set up by the health care provider before using it on patients:

- Load paper (if remote display is present). See paper loading instructions in “Changing Printer Paper” on page 12-7.
- Charge all batteries (ECG module battery, main monitor batteries.)

Preparations such as charging the batteries should be performed if the monitor is new.

## Battery Power

The monitor base contains two lead-acid gel batteries that when fully charged provide a minimum of ten hours of operational use.

### Charging the Battery

The ***Veris*** monitor is battery powered. The monitor internally recharges the battery when it is connected to the power supply. The monitor can operate in continuous use for a minimum of 10 hours on a fully charged battery. Charge the battery from the power supply over night for approximately 12 hours.

**⚠WARNING⚠**

- If the electrical integrity of the earth ground is in doubt, the power cord should be disconnected and the machine should be operated from its internal electrical power source.
- Explosion hazard. Keep lighted cigarettes, sparks, and flames away from the battery.
- Avoid contact with battery acid! The batteries contains sulfuric acid electrolyte which can cause severe burns and eye damage, as well as illness from sulfur oxide fumes. Use necessary precautions when servicing batteries.
- Do not short circuit the battery terminals. The resulting high-current discharge can cause burns.
- Do not operate the monitor with discharged or defective batteries. Monitor failure could occur during AC power loss which can compromise patient safety.
- Do not use the monitor if the batteries are missing.

The ***Veris*** monitor can function on AC or battery power. MEDRAD recommends that batteries be fully charged at all times. If the batteries are insufficiently charged, battery life is degraded and shortened. If defective batteries are suspected, contact MEDRAD Service or your local representative.

Battery Indicators

The battery icons are located on the lower portion of the main screen as described in “Screen Display and Interface” on page 2-5. The battery icons change color to indicate the status of the batteries and appear when using DC (battery) or AC (Mains) power.

When AC is connected to the monitor (green light above ON/OFF key is lit), the battery icon colors are:

- Amber: Battery is charging.
- Green: Battery is fully charged.

When AC is not connected to the monitor (green light above ON/OFF key is not lit), the battery icon colors are:

- Green: Battery life is greater than 1 hour.
- Yellow: Battery is weak. (less than 1 hour and more than 15 minutes of charge remains). A *LOW BAT* message also appears.
- Black: Battery is nearly drained. (less than 15 minutes of charge remain). The *LOW BAT* message remains.

While using battery power there is a short delay between a change in battery status and the updated display of the battery icons.

If the monitor is currently operating under AC power, the monitor may take up to two minutes to display a change in battery status.

The monitor also displays the battery status for the ECG module in the heart rate (*HR*) parameter box. The battery icon colors are:

- Green: Battery life is greater than seven (7) hours.
- Yellow: Battery life is less than seven (7) hours. Charge the module battery soon
- Black: This can indicate the ECG module is not connected to the monitor. Verify the module is connected to the monitor.
  If the module is connected to the monitor, the battery is drained. ECG module will not operate. Charge the module battery immediately.

**System Start and Auto-calibration**

To power up the main monitor, press the ON/OFF key located on the front, left side of the control panel. If your system has a remote display, power is applied via the same key on that component.

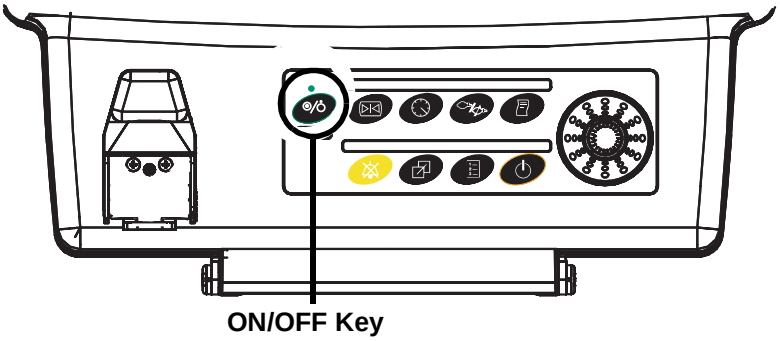



**Figure 2-1: ON/OFF Key**

Immediately upon power up, the monitor displays the ***Veris*** splash screen. The software version appears on the screen. For systems with a remote display, a paper feed automatically activates.

- The informational message *NO ADMIT* is reserved for future use.
- Audible alarms are suspended for each parameter until the first valid measurement has been taken for each parameter. Visual alerts are always active.
- If a patient had been previously admitted by the monitor, a notice message *RESUME MONITORING* appears in a yellow box. Press the knob to continue monitoring with the current patient. Select *NO* to change the patient.

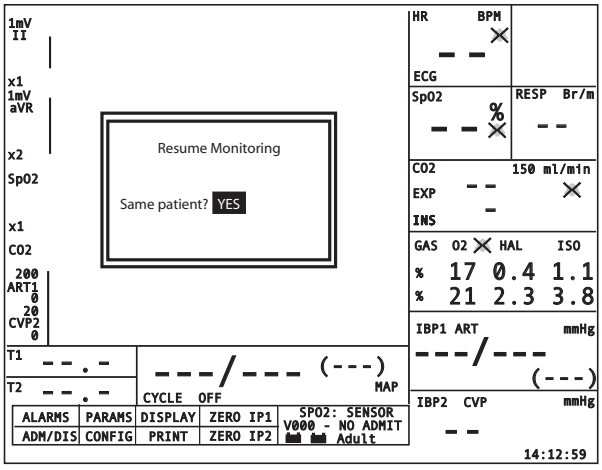



**Figure 2-2: "Resume Monitoring" Dialogue Box**

The monitor is comprised of a number of modules which measure physiologic parameters. Some modules such as the oximeter are ready for use within seconds of power up. Others such as the gas bench take a few minutes to equilibrate.

### Sensor and Probe Messages

Depending on the accessories attached to the monitor upon start up, various messages concerning detached sensors and probes appear. These are only visual alarms until valid measurements are taken by the accessories, after which a low level alarm sounds when the sensors and probes are disconnected.

**NOTE:** *LEADS OFF* messages can be set by the user to be *Low*, *Medium*, or *High* level alarms.

If sensor and probe messages from unused modules become a distraction, these messages may be eliminated by turning the respective module off. The *OFF* settings are located in the *PARAMS* windows described in “PARAMS Softkey (Physiological Parameters)” on page 2-21.

Units with invasive blood pressure capability indicate that either there is no transducer attached (*NO XDUCER*) or that the transducer has not been calibrated by the user (*NOT ZEROED*). In either case it is not necessary to attach or zero the transducers in order to use the other features of the monitor.

### Gas Calibration

The agent gas detector may require a short warm up period and auto-calibration sequence similar to an internal capnometer. The message *AGT:WARMING* appears in the information message area. The informational message *AGT:MANUAL* or *AGT:AUTOMATIC* also appears indicating that the monitor is in either manual or automatic primary agent identification mode. *AGT: AUTO CAL* indicates that the agent calibration is in progress.

Respiration waveforms, capnogram, and numerical breath rate are available in one minute from applying power to the monitor. The monitor reaches full accuracy for agent concentrations in less than 20 minutes.

If the ***Veris*** system fails to auto-calibrate upon power up, the message *AGT:BAD CAL* appears. If the system continues to fail auto-calibration, contact MEDRAD Service or your local representative.

The oxygen monitoring module also requires auto-calibration, which is performed at the same time as the agent bench calibration. If the $O_2$ module fails to calibrate, the message *O2:SENSOR* appears.

Upon successfully completing auto-calibration the monitor displays values for monitored gases.

**Screen Display and Interface**

The display is divided into dedicated areas for data and interface functions. The left side of the screen is reserved for waveform (up to six) or graphic display. The uppermost waveform slot is factory set for ECG. The remaining five waveform slots can be configured by the user. The alarm silence icon (2 minutes or permanent) is shown in the upper right corner of the first waveform.

The far right column is dedicated to reporting numerical data, except for NIBP and temperature which appear below the waveforms. The color of each parameter is user selectable. Therefore, any given waveform and its corresponding numeric data appear in the same color.

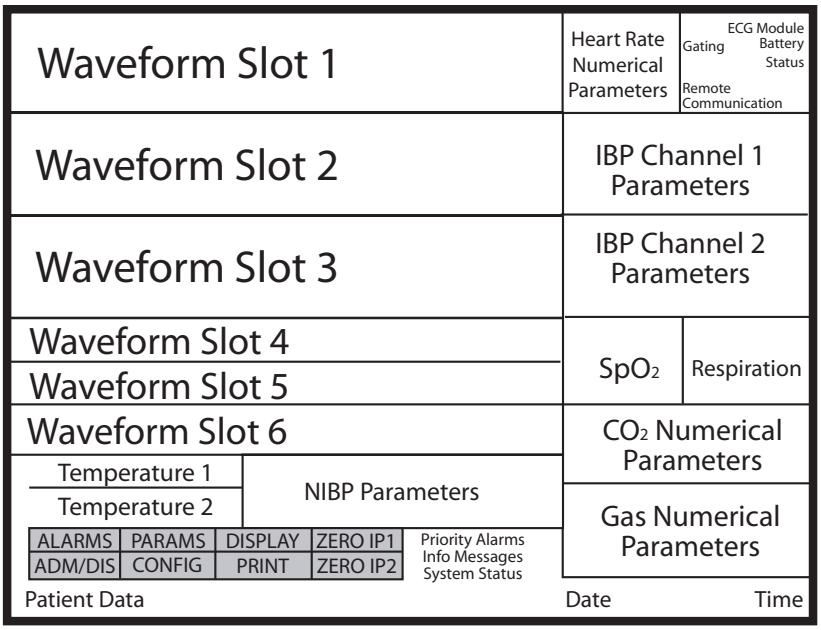



**Figure 2-3: Screen Diagram**

Main menu shown in grey above. The arrangement of the numerical parameter boxes varies depending upon the waveforms selected to be viewed and the waveform slot selected for the waveform. The parameter box displays to the right of its corresponding waveform if displayed in a waveform slot. The screen display is the same on the patient monitor and the remote display. Changes to the display can be made at the patient monitor or at the remote display.

The bottom portion of the display has space dedicated to the following message types and functions.

- The main screen menu of selectable softkeys.
- Two message lines for alarms and alerts.
- A system status line for battery status and patient size mode.
- The patient information bar, date stamp, and clock.

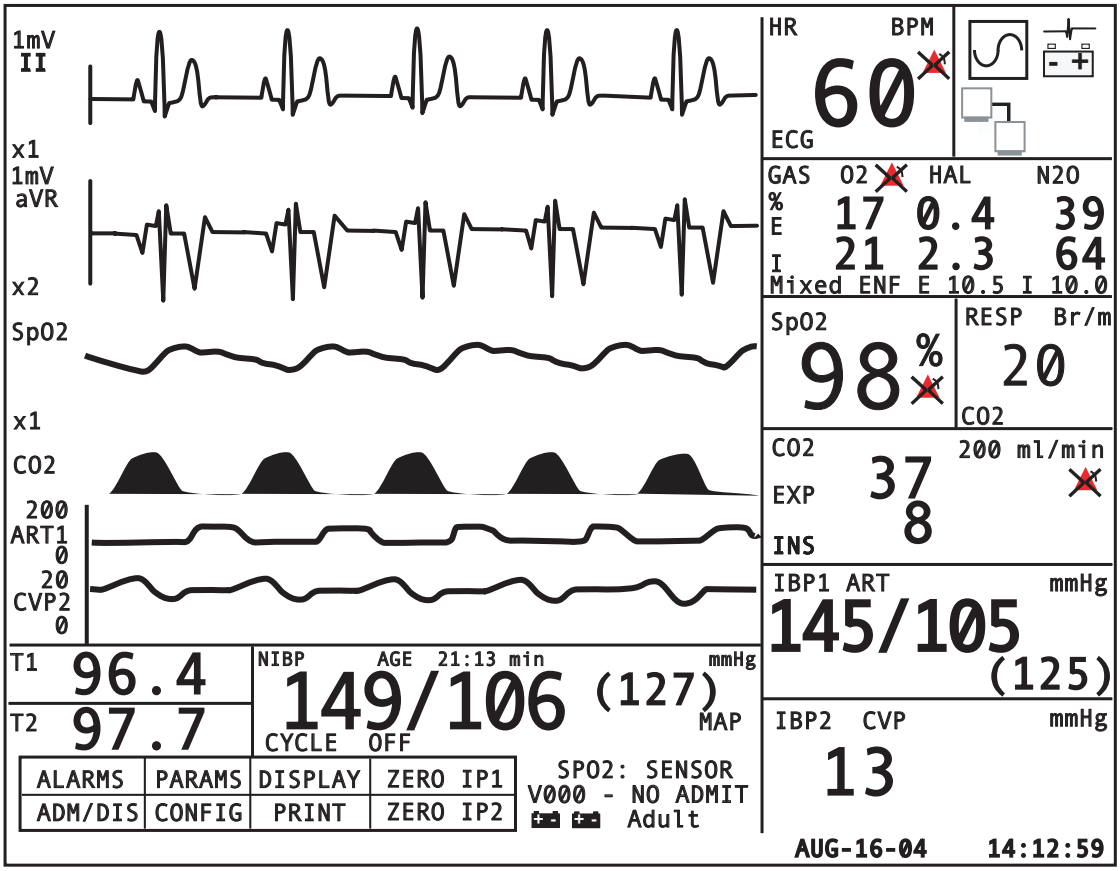
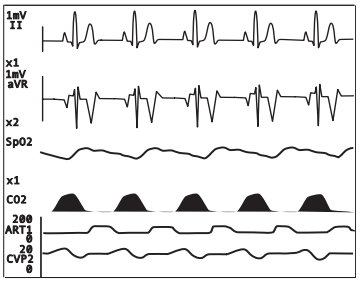



**Figure 2-4: Sample Interface Screen**

Waveform Slots

The monitor has the capability to display up to six waveforms simultaneously.



The first trace is factory set to only display an ECG waveform. The user may select the lead type for this trace. All other displayed waveforms are user selectable.

Each waveform slot displays the parameter or source along the left edge of the screen. Amplitude bar and range are shown at the beginning of the slot if applicable to that type of waveform. The color of each waveform may be selected by the user. The waveform slots can be combined to form double high waveforms and waveforms can be cascaded to fill multiple slots. See “Double Height Slots” on page 2-28 and “Cascaded Slots” on page 2-29 for details.

**NOTE:** The $SpO_2$ waveform display is not necessarily directly proportional to pulse volume. The $SpO_2$ waveform display is not automatically gain adjusted.

**VISUAL ALARMS WITH WAVEFORMS**
The waveform slots are also used to display physiological alarms that will appear at the top center of each slot. For a high priority alarm the color of the message is red. For a medium priority alarm, the color of the message is yellow.

The bottom five slots may be covered by menus and messages. Since the top waveform slot is dedicated to ECG, the ECG waveform and the ECG high and medium priority messages are always visible if ECG is currently being monitored and the top slot is active.

See “Visible Alarms” on page 3-2 for a complete description of visual alarms.

**SILENCE ALERT STATUS**
The silence alert visual icon appears in the upper right area of the top waveform.

- The silence icon shows a bell with an "X" and an infinity symbol when the SILENCE hard key has been pressed and held for more than two seconds.


- The Alarm Suspend icon shows a bell with an “X” and the words *2 Min* when the SILENCE hard key has been momentarily pressed.

**ALARM INHIBIT**

The alarm inhibit icon appears in the parameter boxes when one or more of an individual parameter’s alarms are turned *OFF*.

**ECG WAVEFORM**
The lead number and scale setting are displayed in the top left corner of each slot set for ECG waveforms. The amplitude bar, shown in white, indicates the scale in millivolts (mV).

**SpO$_2$ WAVEFORM**
The waveform is auto ranging where the monitor attempts to keep the waveform centered in the slot at all times. No amplitude bar is shown.

**CO$_2$ WAVEFORM**
The CO$_2$ waveform, capnogram, is always displayed in percent regardless of the units selected for displaying the numerical data. The maximum range of the capnometer waveform is 12.5%.

**BREATH BY BREATH BAR GRAPH (B×B)**
The breath by breath bar graph is a method of representing the concentration of CO$_2$ at the end of each breath. The data is always displayed in percent with a maximum range of 12.5%.

**O$_2$ WAVEFORM**
The maximum range of the oxygen waveform is 100%. The units are always in percent.

**PRIMARY AGENT WAVEFORM**
The primary agent waveform is displayed in percentage only as is the display for primary agent numerical data. The waveform is auto-ranging within the slot. Secondary agents are not displayed as waveforms.

**NITROUS OXIDE ($N_2O$)**
The $N_2O$ waveform is derived from the agent detector of the ***Veris*** monitor.

**IBP WAVEFORMS**
The labels identifying the source of the IBP waveforms appear between the upper and lower range values at the beginning of the waveform.

The waveform has both manual and auto-ranging features. The selected range appears at the left side of the waveform. The scaling for IBP slots are locked at x1 and cannot be changed. Use the range settings to adjust the appearance of the waveform on the screen. See “Alarms and Messages” in Section 3 for details.

Selectable IBP sites are as follows:

- Arterial (ART)
- Pulmonary Artery (PA)
- Central Venous (CVP)
- Right Atrial (RA)
- Left Atrial (LA)
- Intracranial (ICP)
- Left Ventricle (LV)
- Right Ventricle (RV)

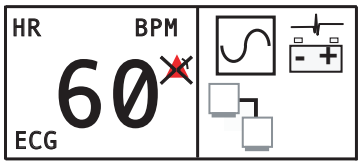
There are two IBP channels. The color of each channel can be selected independently.

If the amplitude of the waveform exceeds the selected range the waveform is clipped. An informational level alarm *OFF SCALE* appears in the Info Messages Box of the main screen display.

Numerical Parameter Boxes

The numerical parameter box area is directly to the right of the waveform area. The area is broken into seven numerical boxes. There are three additional numerical boxes below the waveforms. The numerical parameter boxes display the measured value of the vital sign being monitored, the unit of measure, and parameter-dependent information (such as the source for the heart rate or inspired/expired values for gases).

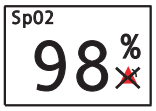
If a module is turned off in the *PARAMS* menu, the numerical parameters are replaced by the word *OFF* in each location. Smart parameters such as heart rate switch to another available module if possible. An alarm inhibit icon appears in the upper right corner or right center of a parameter box if an alarm limit is set to *OFF*. The alarm inhibit icon is red with a white “X” indicating that an alarm is turned *OFF*.




**ECG BOX**

The top parameter box, in the upper right hand corner, is dedicated to display the heart rate. The source of the heart rate (i.e. ECG, IBP, $SpO_2$, or NIBP) is shown in the lower left corner of this box. The color of the numeric display for heart rate matches the color of the waveform source data.

The right half of the ECG parameter box displays the gating output, the ECG module battery status, and an icon indicating that the monitor and remote display are communicating. The color of the gating icon matches the color of the waveform and numerical data of the source (i.e., ECG gating reflects the color of the ECG waveform and numerics).

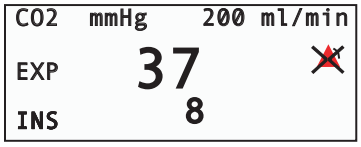



**$SpO_2$ BOX**

The $SpO_2$ box displays the oxygen saturation in percent.


**RESPIRATION BOX**

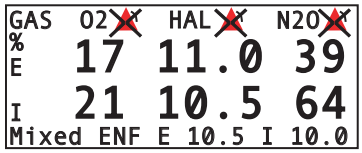
The Respiration box, to the right of the $SpO_2$ box, displays the respiration rate and respiration source (i.e. $CO_2$).




**$CO_2$ BOX**

This box displays numerical values for expired and inspired $CO_2$. The label *EXP* stands for expired (end-tidal) $CO_2$ and *INS* stands for inspired $CO_2$. The current *Flow Rate* is displayed in the upper right corner.

### GAS BOX



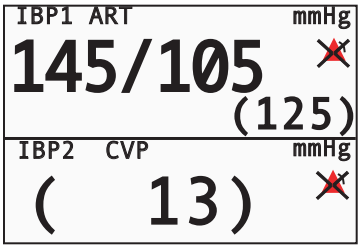

Numeric data for oxygen and agent gases appear in the same box. The oxygen value is listed first followed by the primary halogenated agent and nitrous oxide concentrations. The top line lists expired values and the second line lists inspired values. Values are always shown in percent. An alarm inhibit icon displays to the right of each header to indicate alarm limits set to *OFF*.

The label *Mixed* appears before secondary agent concentrations listed at the bottom of the gas parameter box. This indicates that more than one agent is detected in the system and measures the secondary agent detected. The abbreviated name of the secondary agent is located after the *Mixed* label.

The label *Wrong* appears before secondary agent concentrations listed at the bottom of the gas parameter box. The system detects an agent other than one set in the configuration of the system. If using more than one agent, set the *Agent to Monitor* selection in the *PARAMS* menu to *Auto*. The abbreviated name of the secondary agent is located after the *Wrong* label.

If the internal gas features are shut off in the *PARAMS* menu, the displayed values are replaced by the word *OFF* in each location.

### IBP BOXES



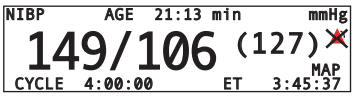

The monitor displays the systolic, diastolic, and mean pressure pulsatile waveforms. The systolic and diastolic values are shown in large text. The mean value (MAP) is displayed below the systolic and diastolic values in smaller characters. All MAP values are shown in parenthesis.

Non-pulsatile waveforms have only a mean value. Non-pulsatile waveforms mean values are shown in large text and are centered in the box.

**NIBP BOX**

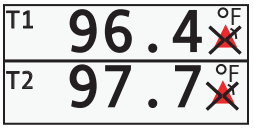

The NIBP numerical box is located near the center of the screen below the waveforms. It displays the systolic, diastolic, and mean pressure after a NIBP reading has completed. The systolic and diastolic values are shown in large text. The mean value (*MAP*) is displayed to the right of the systolic and diastolic values in smaller characters. *MAP* values are shown in parenthesis.

When there is no valid reading, dashes are displayed. A valid reading is dashed after 30 minutes. If a valid reading is displayed, the age of the reading is displayed. After 30 minutes the age of the measurement goes to dashes; if there is no valid reading, the age also appears as dashes.




If a cycle time is set, the interval is displayed. Otherwise the cycle time displays the word *OFF* in the NIBP box. If a cycle time is active, the amount of time remaining until the next NIBP reading is scheduled is displayed at the bottom right of the box.

**TEMPERATURE BOXES**




The top temperature numerical box is dedicated to temperature channel 1. The lower box is dedicated to channel 2. The units (°F or °C) appear in the upper right corner of each box.

Main Menu

The main menu area is directly under the Temperature and NIBP boxes on the left-hand side of the screen. There are up to eight selectable soft keys located on the screen as shown below.

**NOTE:** The ***Veris*** 8600 screen layout depends on the configuration of the monitor.

| | | | |
|---|---|---|---|
| ALARMS | PARAMS | DISPLAY | ZERO IP1 |
| ADM/DIS | CONFIG | PRINT | ZERO IP2 |

**Figure 2-5: Main Menu**

One of the eight softkeys is always highlighted. If the user pushes the menu knob the menu window associated with the highlighted softkey is displayed and the menu knob control goes to that new window. Different soft keys are selected by turning the menu knob clockwise or counterclockwise until the desired key is highlighted.

*ZERO IP1* and *ZERO IP2* do not access settings windows. On units without IBP the *ZERO IP1* and *ZERO IP2* boxes are blank.

More information about the soft keys and their function is explained in “Softkey Functions (Main Menu)” on page 2-14.

Alarm and Message Areas

The two alarm lines are located under the NIBP numerical box. All alarm and error messages for NIBP, respiration, and temperature are displayed in this area. ECG, $SpO_2$, $CO_2$, $O_2$, $N_2O$, Agent, and IBP high and medium alarms are displayed here if there is not an active waveform associated with them. All low level messages are displayed in the top alarm line. The bottom line is for informational messages and advisory level alerts only.

The informational, low, and medium level alarm warnings are colored yellow and the high alarm warning messages are red. For more information about alarms see “Alarm Description” on page 3-1.

System Status Box

The system status box is located directly below the two lines reserved for alarms and messages.

**BATTERY WARNING ICONS**

There is space reserved for two battery icons. The battery icons represent the state of the internal rechargeable batteries. See “Battery Indicators” on page 2-2 and “Charging the Battery” on page 2-1 for a complete description of the icons and battery charging.

**PATIENT SIZE MODE**

The next item in the status line is the patient mode. This message lets the user know what the patient size or mode the system is in: *ADULT*, *PEDIATRIC*, or *NEONATE*. The default physiological alarm limits may change depending on which mode is currently in use.

Patient Information and Clock

A Patient Information Bar runs along the bottom of the display. This area displays the last name (12 characters), the first name (10 characters) and middle initial (one character) of the patient, the hospital identification number for the patient (16 characters), and the patient’s room number (five characters).

A clock appears to the extreme right of the patient information. This displays both current date and time.

**Keypad**

There are nine keypad buttons, including the ON/OFF button and the eight dedicated function keys. Some of the keys have two functions. The primary function is activated with a momentary press of the key. A secondary function, if present, is activated when the key is pressed and held for two seconds.

| Key | Function |
|---|---|
|  On/Off | Power button. Press to activate the patient monitor and press and hold to turn the monitor off. |
|  Freeze | A single press of this key freezes all waveforms on the screen. Numeric data continues to be updated for monitored parameters.<br>A second press of this key resumes continuous waveform display. |
|  NIBP Cycle/Stat | Press the key momentarily to display the NIBP cycle popup menu on the screen.<br>Press and hold this key to begin a Stat measurement. |
|  NIBP | NIBP measurement start key.<br>Press the key again to cancel an NIBP measurement. |
|  Print | Press once to begin printing or for serial output.<br>Press a second time to stop printing. |
|  Silence | Press this key momentarily to begin a 2 minute alarm silence.<br>Press and hold the key to permanently silence the alarms.<br>Press the key again, a second time, to resume normal alarms. |
|  Default | Press this key momentarily to access custom default profiles.<br>Press and hold the key to alter custom default profiles (password `MEDRAD` required). |
|  Trend | Displays the trend table when pressed momentarily.<br>Press the key to exit the trend window.<br>While the trend table displays, press and hold to access the trend settings menu. |
|  Stand By | Press this key momentarily to enter standby mode.<br>Press the key again to exit the standby mode. |

When any of the keys is pressed once, a single audible beep notifies the user that a primary function has been activated. When a key is pressed and held a double beep notifies the user that a secondary function is selected.

**Softkey Functions (Main Menu)**

Softkeys are selected by turning the menu knob clockwise or counterclockwise until the desired softkey is highlighted. In the sample below the *ALARMS* softkey is highlighted indicating that the alarm settings window displays if the menu knob is pressed.

| | | | |
|---|---|---|---|
| ALARMS | PARAMS | DISPLAY | ZERO IP1 |
| ADM/DIS | CONFIG | PRINT | ZERO IP2 |

**Figure 2-6: Main Screen Menu**

If the menu knob is rotated, any window associated with the highlighted softkey is displayed when the menu knob is pressed. The menu knob then controls scrolling through that new menu window.

**NOTE**: For monitors without invasive blood pressure the two softkeys at the right end of the main menu are disabled and blank. The invasive blood pressure zero buttons do not activate windows.

The top item (*EXIT*) on each menu window automatically highlights when the window is activated. The user may simply press the menu knob a second time to exit each window without making changes.

At the bottom of the first window there may be selections allowing access to subordinate windows. Some windows and settings discussed in this manual may not be present if the feature is not installed in the monitor. If an alarm has been turned *OFF* in the *PARAMS* window, settings in other windows, such as alarm limits, may be disabled.

Changing Settings

Turn the menu knob to highlight items on these menu windows. Press the menu knob to select the item. A single short beep is generated. The key press beep is audible even when alarms are silenced.

Some of the settings require a letter or number to be entered. Rotate the menu knob to select the desired character. Press the menu knob to select the character.

If an error is made while entering in the *ADM/DIS* screen, a left arrow character can be selected in order to back over the existing text. The down arrow character can be selected to jump to the next line.

The arrow characters are not available when entering passwords.

### Saved Setting Profiles

Alarms and parameter default settings may be independently modified as part of a customized default profile. Setting changes generally remain after the monitor is power cycled.

- Changes made to the settings remain in current memory until a patient is discharged or the monitor is left without power.
- If the monitor loses its current setting it returns to the last profile selected from the memory. If no profile has ever been selected, the initial profile is *CUSTOM DEFAULTS* and begins with the same settings as the Factory Default Settings listed in “Factory Defaults” on page 2-38.
- The permanent Factory Default profile can be accessed and restored in the *CONFIG* window.
- The user defined profiles can be accessed and restored by pressing the DEFAULT key.

Making and saving settings profiles is described later in this manual. Also see “Unit and Configuration Defaults” in Appendix B for instructions for loading *CONFIGURATION* defaults (*Base System, Cardiac System* or *Anesthesia System*, depending upon your unit’s configuration).

### ALARMS Softkey

| | | | |
|---|---|---|---|
| **ALARMS** | PARAMS | DISPLAY | ZERO IP1 |
| ADM/DIS | CONFIG | PRINT | ZERO IP2 |

**Figure 2-7: ALARMS Softkey Selected**

This softkey allows access to all the parameter alarm settings. When the menu is activated by pressing the menu knob, an alarm limit settings window appears. The alarm window appears as the *Adult*, *Pediatric*, or *Neonate* window as set in the third item *Patient size*.

EXIT

| | | | |
|---|---|---|---|
| Alarm Volume | | 5 | |
| ECG Lead Fail | | MEDIUM | |
| Patient size | | Adult | |
| | | HIGH | LOW |
| Heart Rate | | 150 | 40 |
| SpO2 | | OFF | 90 |
| NIBP Systolic | | 200 | 50 |
| NIBP Diastolic | | 100 | 30 |
| NIBP Mean | | 150 | 50 |
| Temperature 1 | °F | 100.0 | 93.0 |
| Temperature 2 | °F | 100.0 | 93.0 |
| Respiration | | 36 | OFF |
| CO2 Ins | mmHg | 10 | 5 |
| CO2 Exp | mmHg | 55 | 20 |
| O2 Ins | % | 100 | 18 |
| O2 Exp | % | 100 | OFF |
| Apnea | | 20 seconds | |
| Other Alarms | | No Action | |

**Figure 2-8: Alarm Settings Window (Adult)**

The pediatric and adult settings initially are identical, as factory defaults, but can be adjusted independently and saved as desired.

EXIT

| | | | |
|---|---|---|---|
| Alarm Volume | | 5 | |
| ECG Lead Fail | | MEDIUM | |
| Patient size | | Neonate | |
| | | HIGH | LOW |
| Heart Rate | | 180 | 90 |
| SpO2 | | OFF | 90 |
| NIBP Systolic | | 140 | 35 |
| NIBP Diastolic | | 80 | 30 |
| NIBP Mean | | 100 | 35 |
| Temperature 1 | °F | 100.0 | 93.0 |
| Temperature 2 | °F | 100.0 | 93.0 |
| Respiration | | 60 | 14 |
| CO2 Ins | mmHg | 10 | 5 |
| CO2 Exp | mmHg | 55 | 20 |
| O2 Ins | % | 100 | 18 |
| O2 Exp | % | 100 | OFF |
| Apnea | | 20 seconds | |
| Other Alarm Setups | | No Action | |

**Figure 2-9: Alarm Settings Window (Neonate)**

Primary ALARMS Window

**ALARM VOLUME**

The alarm volume can be set from 1 to 10. If the volume is set to 1 it returns as 2 if the monitor is power cycled. To turn off the alarms use the SILENCE key. See “Alarms and Messages” in Section 3 for more information about alarms.

**ECG LEAD FAIL**

This is an adjustable alarm level setting for a condition where the monitor cannot detect connected ECG leads. Set this according to the protocols of the facility or to the specific patient need.

**ALARMS SETTINGS BY PATIENT SIZE**

The monitor retains separate alarm settings for three different patient sizes. When the patient size mode is changed to *Adult*, *Pediatric*, or *Neonate*, the monitor recalls alarm limit settings specific to each patient size.

The extended alarm limit windows for the optional features also have size specific versions. As in the main screen, the pediatric alarm settings are the same as adult in the Factory Default profile.

To set all the alarm limits, adjust the settings as necessary including the extended windows that appear under *Other Alarm Setups*. Then change to the next patient size and adjust the settings again including the extended windows. Repeat setting changes as necessary for each patient size.

**ALARM LIMITS**

Alarms activate when a high alarm limit is exceeded or the measured value drops below a low alarm limit. *High* and *Low* limit values can be set to the same values. In such a case the monitor alarms when any value but the selected value is measured.

**⚠CAUTION⚠**

- Turning an alarm limit off disables both the audible and visual portion of the alarm.
- Some alarms automatically reset when the monitor is power cycled. See “Alarms at Start Up” on page 3-3 for details.

The low limit alarm can never be set higher than the high limit alarm. The high limit adjustment is similarly restricted. When adjusting limit values some of the range may not be available because the monitor does not display ranges beyond the point that the other limit is set.

Alarm limits cannot be changed for monitoring modules that are turned off. If an alarm limit cannot be selected, check the *PARAMS* menu to confirm the module is turned on.

### OTHER ALARM SETUPS

Activation of the *Other Alarm Setups* option at the bottom of the first alarms window may reveal additional alarms screens if other parameter modules are detected when the system is powered up.

Invasive Blood Pressure Alarm Settings

This selection is not available in Base or BasePlus configurations. Select *Inv. BP Setup* to view the window. Alarm limits can be set by IBP channel or by IBP site location.

EXIT

| | Systolic | | Diastolic | | Mean | |
|---|---|---|---|---|---|---|
| | HIGH | LOW | HIGH | LOW | HIGH | LOW |
| IBP 1 | 200 | 50 | 100 | 30 | 150 | 50 |
| IBP 2 | | | | | 15 | 1 |

Default Alarm Limits by Site

| | Systolic | | Diastolic | | Mean | |
|---|---|---|---|---|---|---|
| | HIGH | LOW | HIGH | LOW | HIGH | LOW |
| ART | 200 | 50 | 100 | 30 | 150 | 50 |
| PA | 40 | 15 | 15 | 5 | 20 | 10 |
| LV | 200 | 60 | 40 | 0 | 120 | 60 |
| RV | 50 | 20 | 20 | 0 | 30 | 10 |
| LA | | | | | 15 | 1 |
| RA | | | | | 15 | 1 |
| CVP | | | | | 15 | 1 |
| ICP | | | | | 15 | 1 |

<<< BACK

**Figure 2-10: IBP Alarm Settings Window**

The alarm limits in effect (current) are the two IBP channels shown at the top of the screen. These can be set to pulsatile or non-pulsatile sites. The limits at the bottom of the screen are used if the IBP site location is changed in the *PARAMS* window.

The site alarm limits are for defaults settings only. Invasive blood pressure for *LA*, *RA*, *CVP*, and *ICP* are non-pulsatile and do not report values for systolic and diastolic pressure.

Agent Gas Alarms

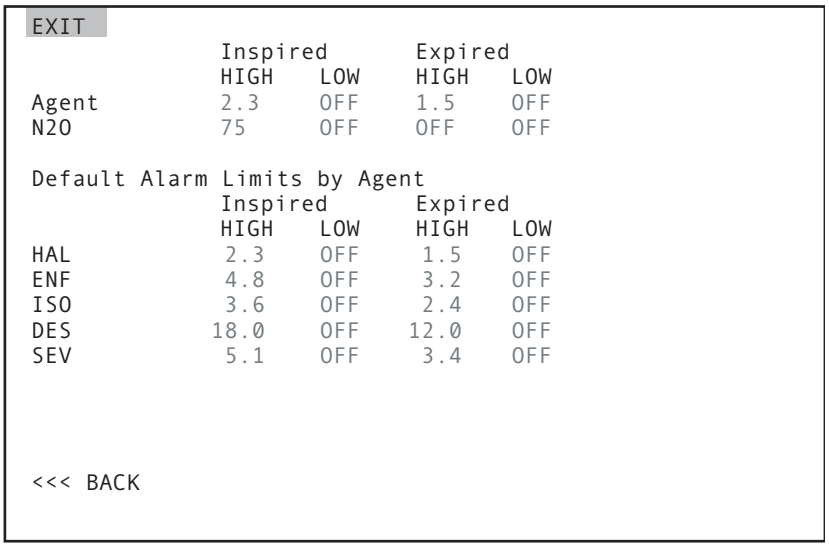



**Figure 2-11: Agent Gas Alarm Setting Window**

This selection is only available in Anesthetic and Anesthetic with Temperature configurations. Select *Agent Setup* from *Other Alarm Setups* to view the window shown above.

The agent alarm window appears initially the same for adult, pediatric, and neonate mode. Agent alarm limits can be set independently and saved, or stored as defaults if desired.

Any changes made are saved immediately to current memory.

**PRIMARY HALOGENATED AGENT ALARM LIMITS**

The first setting of the agent alarm window is the primary halogenated alarm limits. The primary agent is determined in the *PARAMS* menu and is discussed later in this section.

The settings for the current primary agent can be changed in the *PARAMS* menu. If the primary agent is changed, the corresponding limits for the new primary agent are applied from the default alarm limits listed for each specific gas. Each time the primary agent gas is changed any previous changes made directly to the first setting “primary agent” are lost.

**NOTE**: Parameter limit alarms for the remaining four monitored non-primary agents are not active even though their numerical values may appear on the main screen as a mixed (secondary) agent. Any halogenated agent not designated or determined as the primary agent (that exceeds its threshold limit) is treated as a component of a mixed gas for alarm purposes.

**NITROUS OXIDE ALARM LIMITS**
The second setting is for the nitrous oxide ($N_2O$) alarm limits.

**MONITORED HALOGENATED AGENTS**
The ***Veris*** 8600 monitor provides alarm limit settings for halothane, enflurane, isoflurane, desflurane and sevoflurane. Only one of these five monitored gases has active alarm limits depending on which has been designated or automatically determined as the primary agent for monitoring.

The anesthetic agents go by other names, as shown in the table below. It is the responsibility of the physician to correctly recognize and administer anesthetic gases. The ***Veris*** 8600 monitor uses international standard abbreviations, also shown in the table below.

| Generic Agent Name | Alternate Agent Name | International Standard Abbreviation |
|---|---|---|
| Halothane | Fluothane | HAL |
| Enflurane | Ethrane | ENF |
| Isoflurane | Forane | ISO |
| Desflurane | Suprane | DES |
| Sevoflurane | | SEV |

**PARAMS Softkey (Physiological Parameters)**

| | | | |
|---|---|---|---|
| ALARMS | PARAMS | DISPLAY | ZERO IP1 |
| ADM/DIS | CONFIG | PRINT | ZERO IP2 |

**Figure 2-12: PARAMS Softkey Selected**

When this softkey is activated a parameter settings window appears. This softkey allows access to the physiological parameter settings. Each of the sampling modules is listed here and can be turned on and off. Gaps may appear in the menu if features are not installed.

```
EXIT

HR Source                    Smart
Gating                       OFF
ECG                          ON
  Cable                      5 lead
  Filter                     Monitor
  Display Range              MEDIUM
  Auto lead switching        YES
  Color                      ¤

IBP 1  SITE ART RANGE 0 TO 200  ZERO None Color ¤
IBP 2  SITE CVP RANGE 0 TO 20   ZERO None Color ¤



NIBP                     ON            GASES         ON
  NIBP tone              NONE
  Color                  ¤

ECG/IBP/SPO2 Tone Vol    5
Other Params Menus       No Action
```

**Figure 2-13: Parameter Window**

Selecting *Other Params Menus* activates additional windows:

- *$SPO_2$, RESP, TEMP Menu*
- *Gas Menu*

Primary PARAMS Window

**MONITORING MODULE ON/OFF SELECTION**

Each monitoring module (*$SpO_2$*, *ECG*, *NIBP*, *IBP*, *Temperature*, *Gas*, and *Respiration*) can be turned *OFF* or *ON* in the *PARAMS* softkey window. The waveforms, numerical parameters, and messages for that module do not display. The audible alarms associated with that module are also disabled. The *ON/OFF* setting or absence of a monitoring module can also affect the Smart Heart Rate function.

**COLOR SETTINGS**

At the end of some monitoring module settings, *Color* appears to the right with color samples. The color sample indicates the current color selected for the display of the numerical values and waveforms for the monitoring module. The numerical values and the waveforms always have matching colors with the exception of the breath by breath display, which is always in white.

The colors can be changed as desired. Select the color setting to access the color sample box. Turn the knob to scroll through the possible colors and press the knob to enter the selection. Colors red, yellow, blue, green, orange, violet, light gold, and white may be selected.

**SMART HEART RATE**

When *Smart* is selected for *HR Source*, the monitor generates a numerical heart rate value from the remaining operating modules if a higher lever module is turned off or lost. If the ECG signal is lost or turned off, the monitor automatically switches to another available source. The order is:

- ECG
- IBP
- $SpO_2$
- NIBP

The monitor generates a heart rate from the ECG module, the IBP module, the $SpO_2$ module, or from the NIBP (in that order of preference). The NIBP heart rate is updated with each NIBP measurement rather than being continuously updated with the ECG, IBP, or $SpO_2$ waveform data. When the heart rate is based on NIBP data the numerical heart rate value is removed 2 minutes after the last NIBP measurement was completed.

If a specific parameter is selected for HR Source, and that parameter is lost, the monitor does not switch to another parameter for the heart rate.

**GATING**

The gating function can be set to *OFF*, *ECG Wave*, *$SpO_2$ Wave*, *ECG Pulse*, or *$SpO_2$ Pulse*.

**ECG CABLE**

The monitor can be set to 3 lead or 5 lead ECG.

**NOTE:** Base and BasePlus models only have 3 lead capabilities.

**ECG FILTER**

The ECG is set to *Monitor* mode for optimal filtering and cannot be changed by the user.

**DISPLAY RANGE**

This setting controls the ECG signal gain. If it is set too high, the signal may exceed the valid range for monitoring. The high level alarm message *ECG: SENS TOO HIGH* displays. If this occurs, lower the sensitivity setting. For general monitoring use the medium setting.

**ECG AUTO LEAD SWITCH**
The *PARAMS* window settings for *Auto Lead Switching* are described in “ECG Auto Lead Switching” on page 5-16. For general use, these can both be set to the *On* position.

**IBP SETTINGS**
The two IBP channels can be configured separately. The choices are:

- Arterial (*ART*),
- Pulmonary Artery (*PA*),
- Left Atrial (*LA*),
- Right Atrial (*RA*),
- Central Venous (*CVP*),
- Right Ventricle (*RV*),
- Left Ventricle (*LV*),
- Intracranial (*ICP*), or
- Off.

The ranges for IBP waveform display are also independently selectable.

The IBP channels can be zeroed using the setting from the *PARAMS* window or from the main menu softkey, whichever is more convenient.

**IBP AUTO-RANGING**
The monitor provides auto-ranging for each IBP channel individually. When auto-ranging is selected for a channel in the *PARAMS* window, the monitor determines the best display range based on previous extremes of the waveform.

The scale changes to exceed the waveform maximums by at least 5 mmHg. The auto-ranging occurs when the *PARAMS* window is exited. If the past extremes of the waveforms are exceeded, clipping occurs. The new range remains until auto ranging is selected again or specific range values are set in the *PARAMS* window.

**NIBP SETTINGS**
The NIBP can be set to generate a tone upon completion of each measurement.

**NOTE**: Press the NIBP CYCLE/STAT key to access the cycle settings.

**HEART RATE TONE VOLUME**
This feature can be set at the bottom of the first *PARAMS* window. The tone can be set to volumes 1 through 10 or *OFF*. This setting only controls the tone volume associated with the heart rate rhythm. It is not affected by adjustments to *Alarm Volume* or the SILENCE feature.

$SpO_2$, Respiration, Temperature Menu

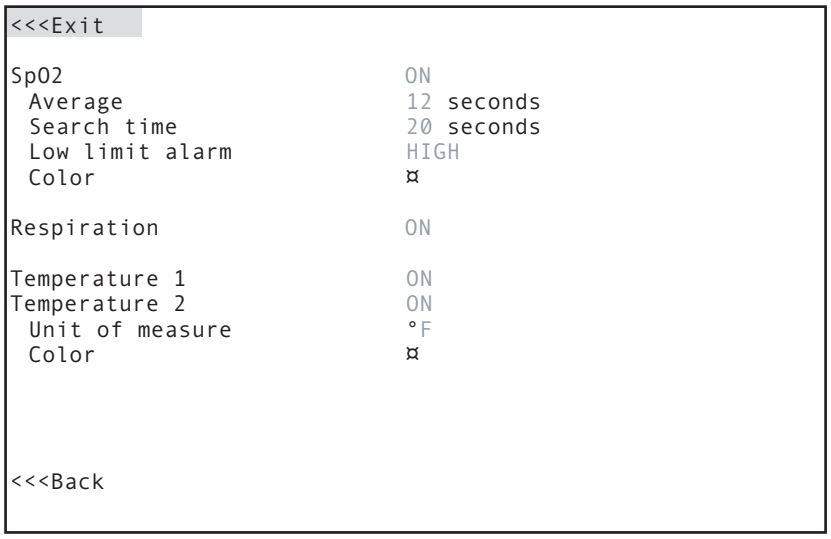



**Figure 2-14: $SpO_2$, Respiration, Temperature Parameter Window**

#### $SpO_2$ SETTINGS

There are three settings specific to the $SpO_2$ module; *Average*, *Search Time*, and *Low Limit Alarm*.

*$SpO_2$ Average* sets the duration of the interval over which the $SpO_2$ value is averaged. The settings for each are listed in seconds.

*$SpO_2$ Search Time* sets the time interval from the time the pulse signal is lost until the *$SpO_2$ SEARCH* message appears.

The *$SpO_2$ Low Limit Alarm* can be set to either high or medium priority as desired. The monitor generates an alarm of that level when the low limit threshold is passed.

#### RESPIRATION

Respiration is only available if the ***Veris*** monitor has $CO_2$ (Anesthetic and Anesthetic with Temperature models only). The source is always $CO_2$.

#### TEMPERATURE SETTINGS

The temperature channels can be turned *ON* or *OFF* and can be set to read in either Celsius (C) or Fahrenheit (F).

Gas Settings

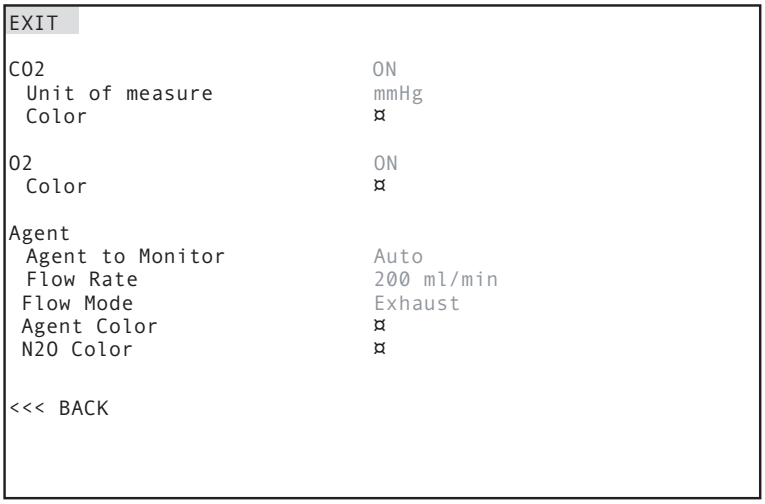



**Figure 2-15: Gas Settings**

**$CO_2$ UNIT OF MEASURE**
The $CO_2$ numerical data can be displayed as mm/hg, Torr, kPa, or volume percent.

**AGENT TO MONITOR**
The primary agent for monitoring must be correctly entered depending on the monitoring alarm characteristic desired by the user. The monitor has two modes of agent gas monitoring. The user may select a specific halogenated agent to be designated as the primary agent. The user may otherwise set the monitor to automatically detect and identify the current primary gas of a mixture.

**NOTE:** If the user manually selects the primary agent for monitoring it must be correctly entered.

**⚠WARNING⚠**

- Always confirm the primary agent selection before use. Incorrect primary agent setting may result in erroneous limit alarms. Alarm characteristics of the monitor are altered when automatic primary agent detection is activated.
- Never substitute a primary agent setting for a different halogenated agent, or any agent not listed! The agent detection is specific to the listed gases only.
- The alarm *WRONG AGENT* appears when the primary agent (that is manually selected by the physician) does not match the primary agent detected. The *WRONG AGENT* alarm is deactivated when automatic primary agent detection is selected.

**⚠WARNING⚠**

- The halogenated agent waveform and waveform label may automatically change to a different halogenated agent when automatic primary agent detection is used. If no primary agent is detected, dashes appear in the waveform label when automatic primary agent detection is used.

The primary agent is the halogenated agent having the highest concentration during mixed gas conditions. Where only one halogenated agent is to be used, the single agent should always be the primary agent. The primary agent can be set to halothane, isoflurane, enflurane, desflurane, sevoflurane, or automatic.

The selected primary halogenated agent has its own set of alarm limits as described earlier in this section. This is for use when the primary agent is selected manually. When automatic primary agent detection is used, the agent alarm limits are updated at the time of identification from the *Default Alarm Limits by Agent* settings. If the primary agent is redefined automatically, the alarm limits are again updated from the agent specific limits defined in the menu.

**FLOW RATE**

The *Flow Rate* setting adjusts the amount of air that is drawn in by the gas monitoring system. The monitor provides accurate values in either 100, 150, or 200 ml/min settings. It is recommended that the 200 ml/min setting be used for better response time.

**FLOW MODE**

The flow mode of the ***Veris*** monitor is permanently set to exhaust and cannot be changed.

**DISPLAY Softkey**

| | | | |
|---|---|---|---|
| ALARMS | PARAMS | DISPLAY | ZERO IP1 |
| ADM/DIS | CONFIG | PRINT | ZERO IP2 |

**Figure 2-16: DISPLAY Softkey Selected**

This softkey allows access to the display settings. When activated, the display settings window appears. The monitor can display up to six waveforms and has user selectable waveform slot configurations. See “Waveform Slots” on page 2-6 for a list of displayed waveforms.

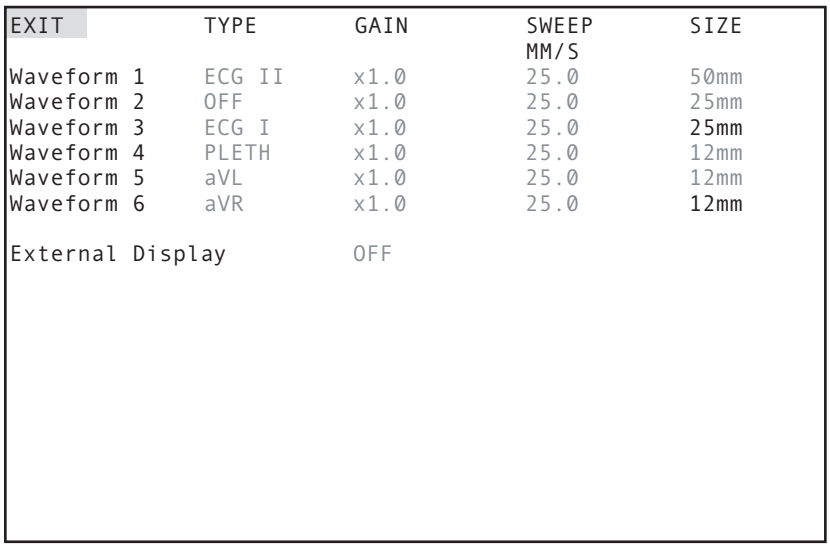



**Figure 2-17: Display Settings Window**

Waveform Description

The waveform area is located in the upper left-hand portion of the display. The monitor has the capability to display six waveforms simultaneously. The top waveform slots 1, 2, and 3 are 25 mm in height. Waveform slots 4, 5, and 6 are 12.5 mm in height. Slots can be configured in a variety of ways as described in the following text.

The waveforms may be adjusted in size and dimension by using the settings provided. The gain listed on the *DISPLAY* window settings increases the display size of the waveforms. It does not control the amplification gain of the source signal or the height of the slot where the waveform appears.

The parameters for the waveforms displayed are user selectable with the exception of the first slot, which is always an ECG waveform. The user can select which lead to display for the ECG waveform in the first slot.

Double Height Slots

The monitor can display waveforms in three 25mm slots and three smaller 12.5mm slots.

- Two 25mm slots can be combined to form one 50mm slot.
- Two 12.5mm slots in the, bottom group, can be combined together to form one 25mm slot.
- No more than two slots can be combined to form a larger waveform display area

**NOTE:** Slots 3 and 4 cannot be combined.

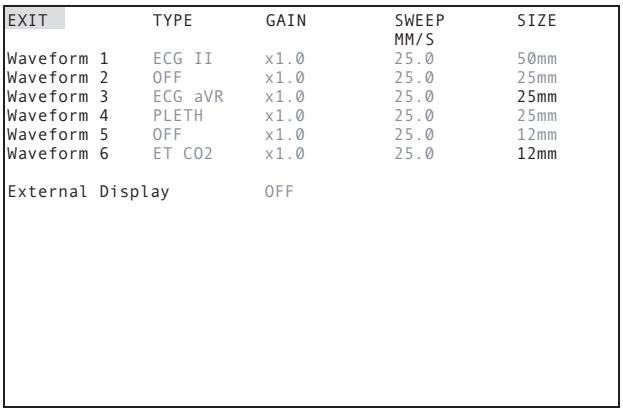



**Figure 2-18: Display Settings Window with Combined Slots**

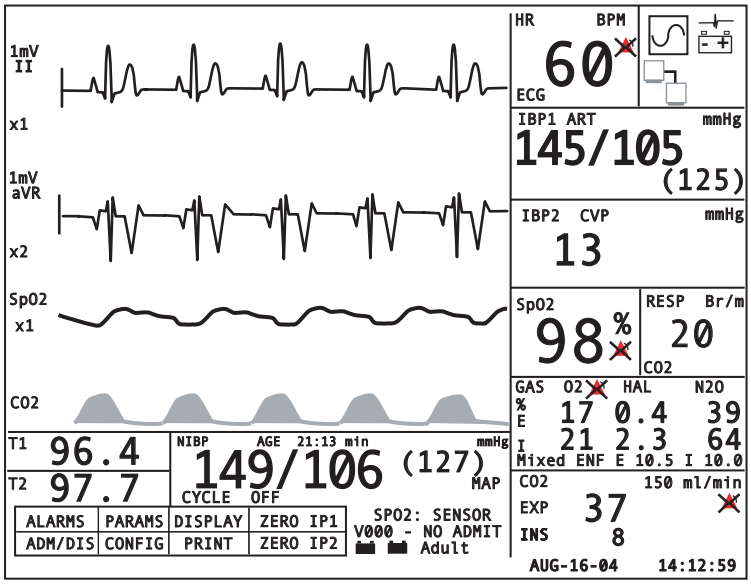



**Figure 2-19: Double Height Slots**

To combine slots to form larger areas to display waveforms set the lower slot *TYPE* to *OFF*. The slot above automatically increases in size to fill the space.

Each waveform slot displays the parameter or source along the left edge of the screen. The colors of the waveforms are user selectable in the *PARAMS* window. The numerical parameters colors match the selected waveform color whenever possible.

Cascaded Slots

The monitor can cascade a waveform into the next lower slot and it is then displayed as twice or three times its original length.

The cascaded data is a continuous band of waveform using the sweep speed as set in the original waveform slot. The gain and range settings are the same for the entire cascaded waveform. The waveform label and scale are not shown for slots where data has been cascaded from a higher slot.

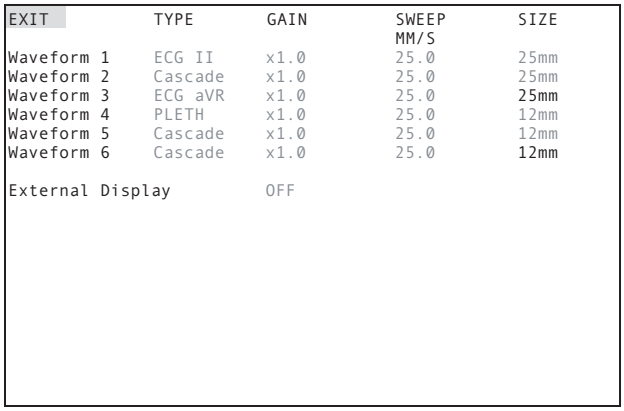



**Figure 2-20: Display Window, Cascaded Slots**

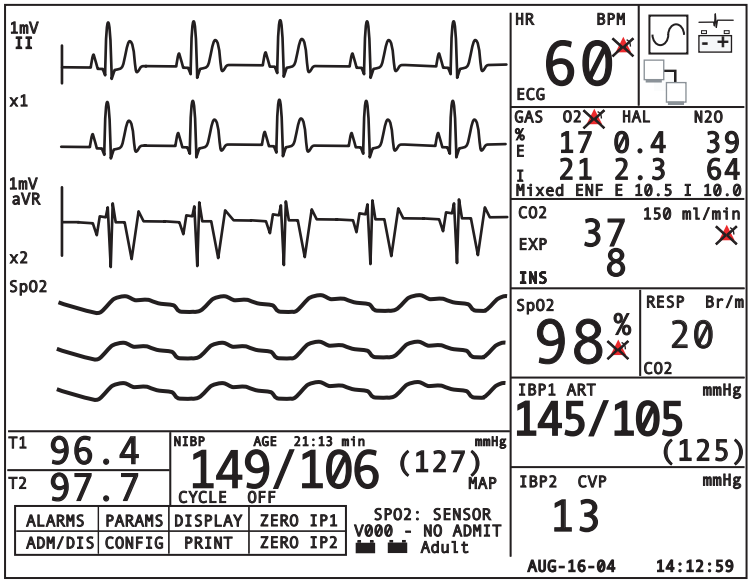



**Figure 2-21: Cascaded Slots**

To cascade a waveform into the next lower slot, set the lower slot *TYPE* to *CASCADE*. The waveform above automatically cascades into the next lower slot. You can cascade slots 1-2-3, or slots 4-5-6.

**NOTE:** The display is set up in separate groups of three slots so a waveform cannot be cascaded from slot 3-4.

Cascade and the double height feature can be applied to the upper and lower groups of slots independently. It is also not possible to cascade (double height) waveforms.

Gain and Sweep

The *GAIN* and *SWEEP* settings found in the *DISPLAY* menu can also be used to modify the way waveforms are displayed on the screen.

The upper three (25mm) slots of the display allow for larger waveforms to display. Gain settings from the upper set of slots do not correspond to the gain settings of the lower three slots. In order to obtain identical waveform sizes in the top and bottom slots, set the gain of the lower three slots one step higher than the top three slots.

A minimum of four and a half seconds worth of data at a sweep speed of 25mm per second is displayed. Waveforms can have sweep speeds of 50, 25, 12.5 or 6.25 mm per second.

**ADM/DIS Softkey (Admit/ Discharge)**

| | | | |
|---|---|---|---|
| ALARMS | PARAMS | DISPLAY | ZERO IP1 |
| ADM/DIS | CONFIG | PRINT | ZERO IP2 |

**Figure 2-22: ADM/DIS Softkey Selected**

A patient may be admitted or discharged in the *ADM/DIS* window, however it is only necessary to correctly specify the *Patient Size* since this adjusts the monitoring defaults.

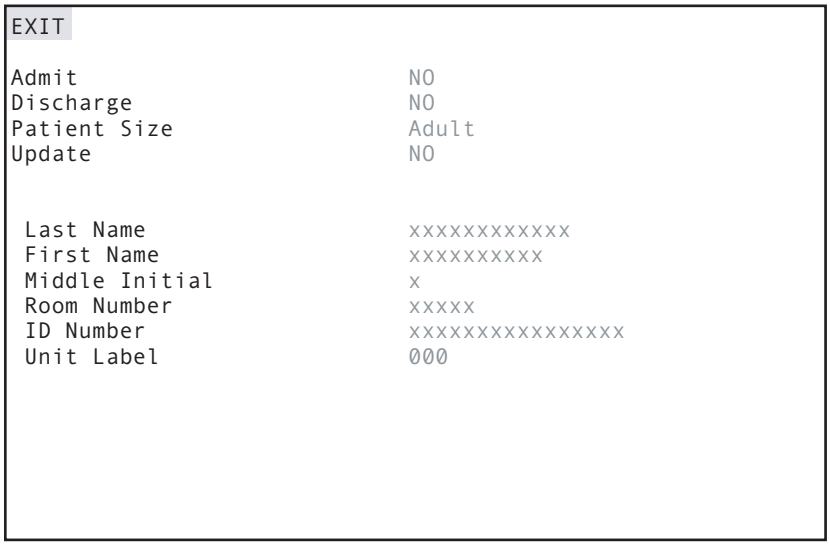



**Figure 2-23: Admit/Discharge Window**

**NOTE**: *Patient Size* can be also set in the *ALARMS* window. This is the same setting and it can be changed in either location.

**NOTE**: The *Unit Label* is for future use.

Admitting and Discharging Patients

**⚠CAUTION⚠**

- It is recommended that the admit and discharge feature be used between each patient so that there is a clear break between patient histories in the memory. This also ensures that label headers are properly printed out for each patient.
- It is possible to admit a blank patient. If this is done, there is no patient data label on printed reports. Data from various patients could appear to merge together onto one trend table or graph.
- It is not necessary to admit a patient for the monitor to function properly. There is no audible alarm for the “no admit” condition. A message appears in the informational message box indicating that no patient has been admitted.

**⚠CAUTION⚠**

- The discharge feature returns the monitor to the user default profile last selected. If no user profiles have ever been selected on a new monitor the *CUSTOM DEFAULTS* found in the first position in the defaults window is used.

Adult/Pediatric/Neonatal (Patient Size)

The monitor is designed to look at the *Patient Size* information selected in the *ADM/DIS* window and determine whether the monitor should use the *Adult*, *Pediatric*, or *Neonatal* alarm settings while monitoring.

The patient mode is determined by patient size and is displayed in the System Status Line.

When *Patient Size* is changed in the *ADM/DIS* window, the monitor determines which window appears when the *ALARMS* softkey is selected. By changing *Patient Size*, the user effectively changes all the alarm limits for all the monitoring modules. The *Patient Size* setting also adjusts the maximum NIBP pressure limit. For *Adult* and *Pediatric* the limit is 300 mmHg. The limit for *Neonate* is 150 mmHg.

Patient Information

To enter, change, or update patient information:

1. Set the menu to *ADM/DIS* and press the knob.
2. Go to *Patient Size* and check that it is correct. Change to *Adult*, *Pediatric*, or *Neonate* as necessary.
3. Turn the knob to *Update* and set to *YES*. Press the knob. The patient data field can now be selected.
4. Go to the patient name and identity fields. Turn the knob to select the desired field. Press the knob to go to the blank line. Turn the knob to select the correct letter.

   **NOTE**: Letters and digits may be entered using the rotary knob. Two arrow characters also appear among the letters and digits. Selecting the back arrow allows corrections to be made. The down arrow skips directly to the next line when finished entering a line.
5. Fill in the remaining patient information blanks as desired.
6. Select *EXIT* to return to the main screen. The patient data is updated on the main screen.
7. Exit the *ADM/DIS* window and re-enter before attempting to admit a patient.

### Procedure for Admitting a Patient

To admit a patient, proceed as follows:

1. Set the menu to *ADM/DIS* and press the knob. the *ADM/DIS* window appears. If the patient data needs to be updated use the patient information procedure.
2. Rotate the knob to highlight *Admit*. The admit selection is not available if a patient has already been admitted.
3. Press the knob to select *Admit*. Turn the knob to *YES*. The message *NEW PATIENT* is also entered into the trend memory.

   **NOTE**: If there is no patient data a blank patient is admitted.
4. Turn the knob back to *EXIT* to return to the main screen, or proceed to update patient information.

### Procedure for Discharging a Patient

To discharge a patient, proceed as follows:

1. Set the menu to *ADM/DIS* and press the knob. the *ADM/DIS* window appears.
2. Rotate the knob to highlight *Discharge*. The discharge selection is not available if a patient has not been admitted.
3. Press the knob to select *Discharge*. Turn the knob to *YES*.
4. The monitor responds with a confirmation screen.
5. Turn the knob to *YES* and press to confirm.
6. The monitor clears the patient data fields and returns the monitor to the last user default profile that was selected.
7. The monitor enters *Standby Mode* (or *Agent Standby Mode* if the monitor has anesthetic options).

   **NOTE**: The monitor enters *Standby Mode* after a patient is discharged so that the monitor does not record extraneous data into the trend memory while sensors and electrodes are removed from the patient. The message *NEW PATIENT* is also entered into the trend memory at the point of discharge.
8. Press the orange STAND BY key to return to the main screen.

**CONFIG Softkey (System Configuration)**

| | | | |
|---|---|---|---|
| ALARMS | PARAMS | DISPLAY | ZERO IP1 |
| ADM/DIS | CONFIG | PRINT | ZERO IP2 |

**Figure 2-24: CONFIG Softkey Selected**

This softkey allows access to the configuration settings. When activated a configuration settings window appears.

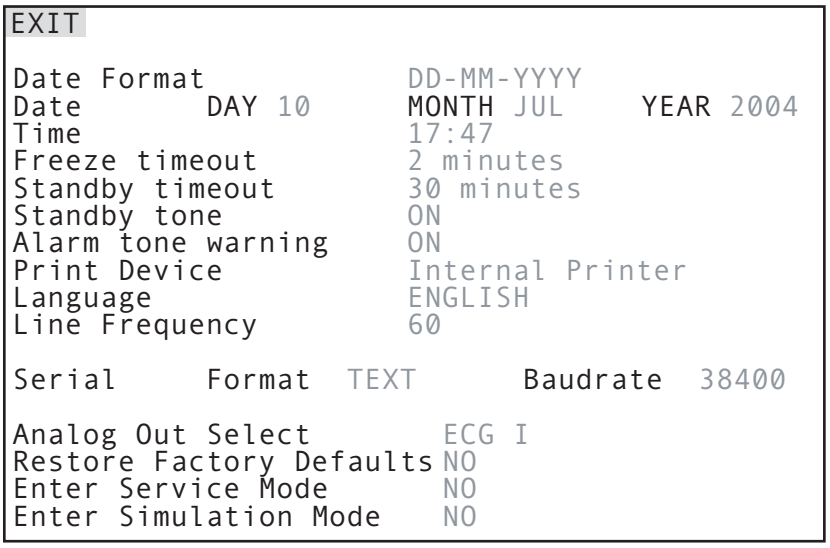



**Figure 2-25: System Configuration Window**

This window contains settings that are related to the general function of the overall monitor. The window also has some settings that may affect physiological monitoring.

**⚠CAUTION⚠**

- The *Alarm Tone Warning* and *Standby Timeout* settings can permanently disable alarm functions. See “ECG” in Section 5 for more information on Alarms.
- The *Line Frequency* setting affects the $SpO_2$ filter function.
- The *Return to Factory Defaults* setting may make changes affecting all of the physiological monitoring modules.

The printing and communications settings are discussed in “Printing and Data Ports” on page 12-1 of this manual. Service mode and Simulation Mode are described in the ***Veris** 8600 Service Manual*.

Password Protection

Several settings on the *CONFIG* and the *Enter Network Config* screens are password protected. These are functions that generally should not be changed during use and their settings should be adjusted by supervisory personnel, your MEDRAD representative, or other qualified service personnel. These include; *Standby Timeout*, *Alarm Tone Warning*, *Line Frequency*, *Enter Service Mode*, and *Enter Simulation Mode*. Contact MEDRAD Service or your local representative about service passwords.

Date Format

The date format can be set to display or print *Day-Month-Year* or *Month-Day-Year*.

Time/Date Setting

The *Time* and *Date* are set in the *CONFIG* softkey window. Changing the time and date while monitoring a patient does not affect the accurate display of patient data, but it clears any recorded trend data.

Freeze Timeout

The FREEZE function can be set to freeze the waveform frame from 30 seconds to five minutes. Choosing *OFF* causes the FREEZE key to hold the screen permanently until the FREEZE key is pressed again. The FREEZE key also captures waveforms that are obscured by dialog boxes and pop-up windows. When the FREEZE key is pressed the waveforms are redrawn on the screen. The FREEZE function forces an exit from the current pop-up window or dialog box.

Standby Timeout

The *Standby Timeout* can be set to disable the monitor from 5 minutes to 2 hours. Choosing *OFF* causes the STAND BY key to disable the monitor permanently until the STAND BY key is pressed again. This setting is password protected. The factory default value is *30 minutes*.

Standby Tone

When set to *ON* the monitor produces a single low pitched beep every minute during *Standby Mode*. When set to *OFF* there is no tone to remind the user that the monitor is in *Standby Mode*.

Alarm Tone Warning

When set to *ON* the monitor produces a low pitched double beep every two minutes during the permanent silence condition. When set to *OFF* there is no tone to remind the user that the silence condition is active.

**NOTE**: Set this safeguard according to your facility protocols and according to local safety regulations for medical devices.

Print Device

The print device can be set to *Internal Printer, Serial,* or *OFF.*

- Set to *Internal Printer* to print data to the thermal printer on the optional remote display.
- Set to *Serial* to print to an external printer or download to a computer.
- Set to *OFF* to disable the printing feature.

See “Printing and Data Ports” on page 12-1 for more information.

Language Settings

The following languages are available in the monitor; *ENGLISH*, *FRENCH*, *GERMAN*, *ITALIAN*, *SPANISH, JAPANESE,* and *PORTUG.* (Portuguese).

To change the language:

1. Press the ON/OFF key to start the monitor.
2. Turn the menu knob until the *CONFIG* softkey is highlighted.
3. Press the menu knob in to select the *CONFIG* softkey. The configuration window appears.
4. Turn the knob until the *Language* setting is highlighted.
5. Press the knob to select the *Language* setting. The current language shown to the right is highlighted.
6. Turn the knob until the desired language appears.
7. Press the knob again to select the new language.
8. Exit the configuration window.

The language should be properly set when saving user default profiles. The correct language can then be restored using only the DEFAULT key and the default profile dialog box when an unfamiliar language is set on the monitor.

In situations where the monitor has been left for over 24 hours without power or charged batteries, the *Language* setting as well as other defaults may be lost. In this condition the monitor reverts to the *Language* set in the last selected user default profile. *ENGLISH* is the default language when no other has been selected.

### PRINT Softkey

| | | | |
|---|---|---|---|
| ALARMS | PARAMS | DISPLAY | ZERO IP1 |
| ADM/DIS | CONFIG | PRINT | ZERO IP2 |

**Figure 2-26: PRINT Softkey Selected**

**NOTE:** The printer is only found in the remote display. Printer settings may be adjusted from the main monitor or the remote display.

The *PRINT* softkey allows access to the printer settings window.

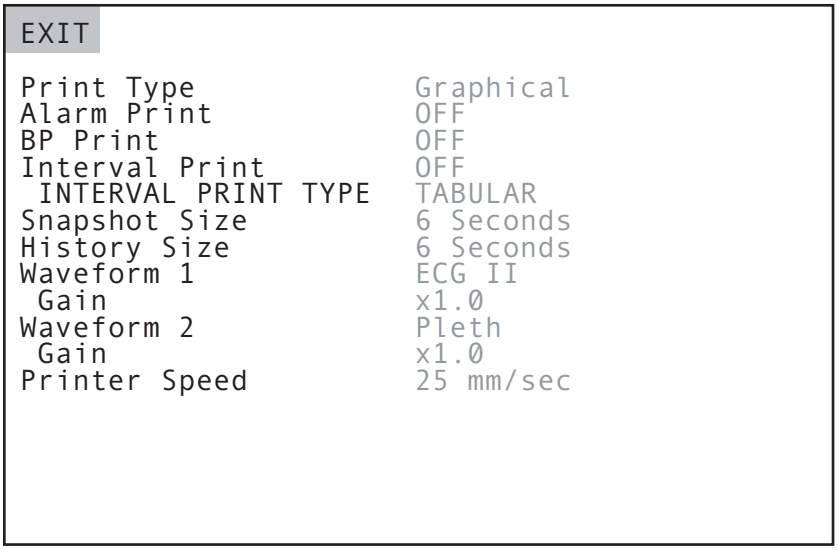



**Figure 2-27: Print Configuration Window**

If the internal thermal printer does not respond, check the *CONFIG* menu. The *Printer Device* must be set to *Internal Printer*. If the monitor returns to factory defaults the *CONFIG* setting returns to *Serial*.

The setting *Alarm Print* causes the monitor to print all parameters upon the activation of a new high or medium level alarm.

See “Printing and Data Ports” on page 12-1 for more information on printing.

#### TABULAR PRINTING

Numerical values for all current parameters are printed.

#### GRAPHICAL PRINTING

If both *Waveform 1* and *2* have been set to a physical parameter the print out is a split dual waveform. If only one of the waveforms is turned on, a single waveform is printed using the entire waveform area. If both waveforms are turned off, the waveform area of the print out is blank.

## Default Settings

Factory Defaults

**ALARMS SETTINGS**

| Alarm | Type | Range | Adult | Pediatric | Neonate | |
|---|---|---|---|---|---|---|
| Alarm Volume | | 1-10 | 5 | 5 | 5 | |
| ECG lead fail | | high, medium, low | medium | medium | medium | |
| Heart Rate | High | 80-250, Off | 150 | 150 | 180 | |
| Heart Rate | Low | 20-160, Off | 40 | 40 | 90 | |
| $SpO_2$ | High | 70-98, Off | Off | Off | Off | |
| $SpO_2$ | Low | 1-98, Off | 90 | 90 | 90 | |
| NIBP Systolic | High | 75-240, Off | 200 | 200 | 140 | |
| NIBP Systolic | Low | 50-150, Off | 50 | 50 | 35 | |
| NIBP Diastolic | High | 50-180, Off | 100 | 100 | 80 | |
| NIBP Diastolic | Low | 15-50, Off | 30 | 30 | 30 | |
| NIBP Mean | High | 70-200, Off | 150 | 150 | 100 | |
| NIBP Mean | Low | 25-125, Off | 50 | 50 | 35 | |
| Temperature 1 | High | 68.0-111.0°F, Off | 100.0°F | 100.0°F | 100.0°F | * |
| Temperature 1 | Low | 68.0-111.0°F, Off | 93.0°F | 93.0°F | 93.0°F | * |
| Temperature 2 | High | 68.0-111.0°F, Off | 100.0°F | 100.0°F | 100.0°F | * |
| Temperature 2 | Low | 68.0-111.0°F, Off | 93.0°F | 93.0°F | 93.0°F | * |
| Respiration | High | 6-120, Off | 36 | 36 | 60 | * |
| Respiration | Low | 6-120, Off | 4 | 4 | 14 | * |
| $CO_2$ Inspired | High | 0-100 mmHg, Off | 10 mmHg | 10 mmHg | 10 mmHg | * |
| $CO_2$ Inspired | Low | 0-100 mmHg, Off | 5 mmHg | 5 mmHg | 5 mmHg | * |
| $CO_2$ Expired | High | 0-100 mmHg, Off | 55 mmHg | 55 mmHg | 55 mmHg | * |
| $CO_2$ Expired | Low | 0-100 mmHg, Off | 20 mmHg | 20 mmHg | 20 mmHg | * |
| $O_2$ Inspired | High | 18-100%, Off | 100 | 100 | 100 | * |
| $O_2$ Inspired | Low | 18-100% | 18 | 18 | 18 | * |
| $O_2$ Expired | High | 18-100%, Off | 100 | 100 | 100 | * |
| $O_2$ Expired | Low | 18-100%, Off | Off | Off | Off | * |
| Apnea | | 5-60, Off | 20 | 20 | 20 | * |
| IBP1 Systolic | High | 0 to 240, Off | 200 | 200 | 140 | * |
| IBP1 Systolic | Low | 0 to 240, Off | 50 | 50 | 50 | * |
| IBP1 Diastolic | High | 0 to 240, Off | 100 | 100 | 80 | * |
| IBP1 Diastolic | Low | 0 to 240, Off | 30 | 30 | 30 | * |
| IBP1 Mean | High | -10 to 240, Off | 150 | 150 | 100 | * |
| IBP1 Mean | Low | -10 to 240, Off | 50 | 50 | 40 | * |
| IBP2 Systolic | High | 0 to 240, Off | | | | * |
| IBP2 Systolic | Low | 0 to 240, Off | | | | * |
| IBP2 Diastolic | High | 0 to 240, Off | | | | * |
| IBP2 Diastolic | Low | 0 to 240, Off | | | | * |
| IBP2 Mean | High | -10 to 240, Off | 15 | 15 | 15 | * |
| IBP2 Mean | Low | -10 to 240, Off | 1 | 1 | 1 | * |

* Only on units with these parameters.

| Alarm | Type | Range | Adult | Pediatric | Neonate | |
|---|---|---|---|---|---|---|
| ART Systolic | High | 0 to 240, Off | 200 | 200 | 140 | * |
| ART Systolic | Low | 0 to 240, Off | 50 | 50 | 50 | * |
| ART Diastolic | High | 0 to 240, Off | 100 | 100 | 80 | * |
| ART Diastolic | Low | 0 to 240, Off | 30 | 30 | 30 | * |
| ART Mean | High | -10 to 240, Off | 150 | 150 | 100 | * |
| ART Mean | Low | -10 to 240, Off | 50 | 50 | 40 | * |
| PA Systolic | High | 0 to 240, Off | 40 | 40 | 40 | * |
| PA Systolic | Low | 0 to 240, Off | 15 | 15 | 15 | * |
| PA Diastolic | High | 0 to 240, Off | 15 | 15 | 15 | * |
| PA Diastolic | Low | 0 to 240, Off | 5 | 5 | 5 | * |
| PA Mean | High | -10 to 240, Off | 20 | 20 | 20 | * |
| PA Mean | Low | -10 to 240, Off | 10 | 10 | 10 | * |
| LA Mean | High | -10 to 240, Off | 15 | 15 | 15 | * |
| LA Mean | Low | -10 to 240, Off | 1 | 1 | 1 | * |
| LV Systolic | High | 0 to 240, Off | 200 | 0 | 0 | * |
| LV Systolic | Low | 0 to 240, Off | 60 | 0 | 0 | * |
| LV Diastolic | High | 0 to 240, Off | 40 | 0 | 0 | * |
| LV Diastolic | Low | 0 to 240, Off | 0 | 0 | 0 | * |
| LV Mean | High | -10 to 240, Off | 120 | 0 | 0 | * |
| LV Mean | Low | -10 to 240, Off | 60 | 0 | 0 | * |
| RA Mean | High | -10 to 240, Off | 15 | 15 | 15 | * |
| RA Mean | Low | -10 to 240, Off | 1 | 1 | 1 | * |
| RV Systolic | High | 0 to 240, Off | 50 | 0 | 0 | * |
| RV Systolic | Low | 0 to 240, Off | 20 | 0 | 0 | * |
| RV Diastolic | High | 0 to 240, Off | 20 | 0 | 0 | * |
| RV Diastolic | Low | 0 to 240, Off | 0 | 0 | 0 | * |
| RV Mean | High | -10 to 240, Off | 30 | 0 | 0 | * |
| RV Mean | Low | -10 to 240, Off | 10 | 0 | 0 | * |
| CVP Mean | High | -10 to 240, Off | 15 | 15 | 15 | * |
| CVP Mean | Low | -10 to 240, Off | 1 | 1 | 1 | * |
| ICP Mean | High | -10 to 240, Off | 15 | 15 | 15 | * |
| ICP Mean | Low | -10 to 240, Off | 1 | 1 | 1 | * |
| Primary Inspired | High | 0.1-20.0%, Off | 2.3 | 2.3 | 2.3 | * |
| Primary Inspired | Low | 0.0-10.0%, Off | OFF | OFF | 1.5 | * |
| Primary Expired | High | 0.1-20.0%, Off | 1.5 | 1.5 | 1.5 | * |
| Primary Expired | Low | 0.0-10.0%, Off | OFF | 1.5 | OFF | * |
| $N_2O$ Inspired | High | 20-100%, Off | 75 | 75 | 75 | * |
| $N_2O$ Inspired | Low | 1-50%, Off | OFF | OFF | OFF | * |
| $N_2O$ Expired | High | 20-100%, Off | OFF | OFF | OFF | * |
| $N_2O$ Expired | Low | 1-50%, Off | OFF | OFF | OFF | * |

* Only on units with these parameters.

| Alarm | Type | Range | Adult | Pediatric | Neonate | |
|---|---|---|---|---|---|---|
| HAL Inspired | High | 0.1-20.0%, Off | 2.3 | 2.3 | 2.3 | * |
| HAL Inspired | Low | 0.0-10.0%, Off | OFF | OFF | OFF | * |
| HAL Expired | High | 0.1-20.0%, Off | 1.5 | 1.5 | 1.5 | * |
| HAL Expired | Low | 0.0-10.0%, Off | OFF | OFF | OFF | * |
| ENF Inspired | High | 0.1-20.0%, Off | 4.8 | 4.8 | 4.8 | * |
| ENF Inspired | Low | 0.0-10.0%, Off | OFF | OFF | OFF | * |
| ENF Expired | High | 0.1-20.0%, Off | 3.2 | 3.2 | 3.2 | * |
| ENF Expired | Low | 0.0-10.0%, Off | OFF | OFF | OFF | * |
| ISO Inspired | High | 0.1-20.0%, Off | 3.6 | 3.6 | 3.6 | * |
| ISO Inspired | Low | 0.0-10.0%, Off | OFF | OFF | OFF | * |
| ISO Expired | High | 0.1-20.0%, Off | 2.4 | 2.4 | 2.4 | * |
| ISO Expired | Low | 0.0-10.0%, Off | OFF | OFF | OFF | * |
| DES Inspired | High | 0.1-20.0%, Off | 18.0 | 18.0 | 18.0 | * |
| DES Inspired | Low | 0.0-10.0%, Off | OFF | OFF | OFF | * |
| DES Expired | High | 0.1-20.0%, Off | 12.0 | 12.0 | 12.0 | * |
| DES Expired | Low | 0.0-10.0%, Off | OFF | OFF | OFF | * |
| SEV Inspired | High | 0.1-20.0%, Off | 5.1 | 5.1 | 5.1 | * |
| SEV Inspired | Low | 0.0-10.0%, Off | OFF | OFF | OFF | * |
| SEV Expired | High | 0.1-20.0%, Off | 3.4 | 3.4 | 3.4 | * |
| SEV Expired | Low | 0.0-10.0%, Off | OFF | OFF | OFF | * |

* Only on units with these parameters.

**MONITORING PARAMETERS**

| Parameter | Selectable Options | Factory Default |
|---|---|---|
| HR Source | Smart, ECG, IBP, SPO2, NIBP | Smart |
| Gating | Off, ECG Wave, $SpO_2$ Wave, ECG Pulse, $SpO_2$ Pulse | Off * |
| ECG | On, Off | On |
| ECG Cable | 5 Lead, 3 Lead | 3 Lead (Base, BasePlus)<br>5 Lead (Other models) |
| ECG Filter | Monitor | Monitor |
| Sensitivity | High, Medium, Low | Medium |
| Auto lead switching | Yes, No | Yes |
| IBP 1 Site | ART, PA, LA, RA, LV, RV, CVP, ICP, OFF | ART * |
| IBP 1 Range | -10 to 10, 0 to 20, 0 to 30, 0 to 40, 0 to 60, 0 to 100, 0 to 150, 0 to 200, 0 to 300, and Auto-ranging | 0 to 200 * |
| IBP 1 Zero | None, One, All | None * |
| IBP 2 Site | ART, PA, LA, RA, LV, RV, CVP, ICP, OFF | CVP * |
| IBP 2 Range | -10 to 10, 0 to 20, 0 to 30, 0 to 40, 0 to 60, 0 to 100, 0 to 150, 0 to 200, 0 to 300, and Auto-ranging | 0 to 20 * |
| IBP 2 Zero | None, One, All | None * |
| NIBP | On, Off | On |
| NIBP Tone | End, None | None |
| Heart Rate Tone Volume | 1-10, Off | 5 |
| $SpO_2$ | On, Off | On |
| $SpO_2$ Average | 3, 6, 9,12,15,18, 21 | 12 |
| $SpO_2$ Search Time | 10, 20, 30, 40 | 20 |
| $SpO_2$ Low Limit Alarm | High, Medium | High |
| Respiration | On, Off | On |
| Temperature 1 | On, Off | On * |
| Temperature 2 | On, Off | On * |
| Unit of measure | °F, °C | °F * |
| $CO_2$ Unit of measure | Percent, mmHg, KPa, Torr | mmHg * |
| Agent to Monitor (Primary) | Halothane, Enflurane, Isoflurane, Desflurane, Sevoflurane, Automatic | Automatic * |
| Gas Flow Rate | 100, 150, 200 mL | 200 mL * |
| Flow Mode | Exhaust | Exhaust * |

* Only on units with these parameters.

**CONFIGURATION SETTINGS**

| Configuration | Selectable Options | Factory Default |
|---|---|---|
| Date Format | DD-MM-YYYY; MM-DD-YYYY | DD-MM-YYYY |
| Date | Day, Month, Year | (Not Applicable) |
| Time | Hour, Minute | (Not Applicable) |
| Freeze Timeout | 30 seconds, 1, 2, 3, 4, 5 minutes, Off | 2 min |
| Standby Timeout | 5, 10, 15, 30, 45 minutes, 1, 2 hrs, Off | 30 min |
| Standby Tone | On, Off | On |
| Alarm Tone Warning | On, Off | On |
| Printer Device | Serial, Internal Printer, Off | Internal Printer (w/remote)<br>Serial (w/o remote) |
| Language | English, French, German, Italian, Spanish, Portuguese, Japanese | English |
| Line Frequency | 50, 60 Hz | (By Destination) |
| Serial Format | TEXT, CSV, CUSP | CUSP |
| Baud Rate | 2400, 4800, 9600, 19200, 38400, 57600, Hi Speed | Hi Speed |
| Analog Out Select | ECG I, II, III, aVR, aVL, aVF, V; Resp, Pleth, IBP 1, IBP 2, $EtCO_2$, $O_2$, Agent, Off | ECG I |
| Restore Factory Defaults | Yes, No | No |
| Enter Service Mode | Yes, No | No |
| Enter Simulation Mode | Yes, No (password protected) | No |
| Enter Network Configuration | Yes, No (password protected) | No |

**NETWORK CONFIGURATION SETTINGS**

| | | |
|---|---|---|
| Sync Type | Serial, Fiber Optic, Fiber-Wireless, Wireless | Serial |
| IP Address | nnn.nnn.nnn.nnn | Set at factory |
| Netmask | nnn.nnn.nnn.nnn | Set at factory |
| Port | nnnnn | Set at factory |
| Connect Type | Peer-to-Peer, Access Point | Peer-to-Peer |
| Channel | 1-14 | 10 |
| SSID | 16 characters | Set at factory |

* Only on units with these parameters.

**PRINTER SETTINGS**

| Setting | Selectable Options | Factory Default |
|---|---|---|
| Print Type (Demand) | Graphical, Tabular | Graphical |
| Alarm Print | Off, Graphical, Tabular | Off |
| BP Print | Off, Graphical, Tabular | Off |
| Interval Print | Off, 1, 2, 5, 10, 15, 30, 60 minutes 2, 4, 8,12, 24 hours (1, 2, 5, 10, 15, 20, 30 seconds only if *Printer Device* is set to *Serial*) | Off |
| Interval Print Type | Graphical, Tabular | Tabular |
| Snapshot Size | 6,12,18, 24 seconds | 6 seconds |
| History Size | 6,12 seconds | 6 seconds |
| Waveform 1 | ECG I, II, III, V, aVR, aVL, aVF, PLETH, IBP 1, IBP 2, $EtCO_2$, $O_2$, Agent, $N_2O$, Off | ECG II |
| Gain (waveform 1) | x0.5, x1.0, x2.0, x4.0 | x1.0 |
| Waveform 2 | ECG I, II, III, V, aVR, aVL, aVF, PLETH, IBP 1, IBP 2, $EtCO_2$, $O_2$, Agent, $N_2O$, Off | PLETH |
| Gain (waveform 2) | x0.5, x1.0, x2.0, x4.0 | x1.0 |
| Printer Speed | 12.5, 25.0, 50.0 mm/sec | 25.0 mm/sec |

**DISPLAY SETTINGS**

| Setting | Selectable Options | Factory Default |
|---|---|---|
| Waveform 1: | | |
| Type: | Lead I, Lead II, Lead III, Lead V, Lead avL, Lead avR, Lead avF, and Off | ECG II |
| Gain: | 0.5x, 1x, 2x, or 4x | 1x |
| Sweep: | 6.25, 12.5, 25, or 50 mm per second | 25 mm per second |
| Size: | 25 or 50 mm | 50 mm |
| Waveform 2: | | |
| Type: | Lead I, Lead II, Lead III, Lead V, Lead avL, Lead avR, Lead avF, Pleth, IBP 1, IBP 2, $EtCO_2$, $O_2$, Primary Halogenated Agent, $N_2O$, Breath by Breath, Cascade, and Off | Off |
| Gain: | 0.5x, 1x, 2x, or 4x | 1x |
| Sweep: | 6.25, 12.5, 25, or 50 mm per second | 25 mm per second |
| Size: | 25 or 50 mm | 25 mm |

| Setting | Selectable Options | Factory Default |
|---|---|---|
| Waveform 3: | | |
| Type: | Lead I, Lead II, Lead III, Lead V, Lead avL, Lead avR, Lead avF, Pleth, IBP 1, IBP 2, $EtCO_2$, $O_2$, Primary Halogenated Agent, $N_2O$, Breath by Breath, Cascade, and Off | ECG I |
| Gain: | 0.5x, 1x, 2x, or 4x | 1x |
| Sweep: | 6.25, 12.5, 25, or 50 mm per second | 25 mm per second |
| Size: | 25 mm | 25 mm |
| Waveform 4: | | |
| Type: | Lead I, Lead II, Lead III, Lead V, Lead avL, Lead avR, Lead avF, Pleth, IBP 1, IBP 2, $EtCO_2$, $O_2$, Primary Halogenated Agent, $N_2O$, Breath by Breath, and Off | PLETH |
| Gain: | 0.5x, 1x, 2x, or 4x | 1x |
| Sweep: | 6.25, 12.5, 25, or 50 mm per second | 25 mm per second |
| Size: | 12 or 25 mm | 12 mm |
| Waveform 5: | | |
| Type: | Lead I, Lead II, Lead III, Lead V, Lead avL, Lead avR, Lead avF, Pleth, IBP 1, IBP 2, $EtCO_2$, $O_2$, Primary Halogenated Agent, $N_2O$, Breath by Breath, Cascade, and Off | aVL |
| Gain: | 0.5x, 1x, 2x, or 4x | 1x |
| Sweep: | 6.25, 12.5, 25, or 50 mm per second | 25 mm per second |
| Size: | 12 or 25 mm | 12 mm |
| Waveform 6: | | |
| Type: | Lead I, Lead II, Lead III, Lead V, Lead avL, Lead avR, Lead avF, Pleth, IBP 1, IBP 2, $EtCO_2$, $O_2$, Primary Halogenated Agent, $N_2O$, Breath by Breath, Cascade, and Off | aVR |
| Gain: | 0.5x, 1x, 2x, or 4x | 1x |
| Sweep: | 6.25, 12.5, 25, or 50 mm per second | 25 mm per second |
| Size: | 12 or 25 mm | 12 mm |

# 3 — Alarms and Messages

## Alarm Description

The ***Veris*** monitor provides both audible and visible alarm indicators to alert the operator of system status changes and physiological parameter alarms.

Alarms are provided for all monitored parameters. Each parameter limit alarm condition triggers both audible and visible alarms until one of the following events occurs:

- The parameter value returns to within the alarm limit.
- The alarm limit is set beyond the present parameter value.
- The SILENCE key is pressed. (Audible alarms only)
- The monitor is placed in *Standby Mode*.

**NOTE:** The *Alarm Limits* menu only displays the parameters present in the configuration.

### Remote Display Alarms

The alarms that appear and sound on the patient monitor also appear and sound on the optional remote display. The delay time for the alarm from the patient monitor to the remote display is less than 1 second. Alarms can be silenced or turned off from the remote display as if they were silenced or turned off at the patient monitor.

### Audible Alarms

All alarms conform to EN 475 requirements. Informational messages and system alerts do not have an audible alarm component.

#### HIGH PRIORITY ALARMS

The high priority alarm consists of a pair of audible bursts. Each burst consists of 5 tone pulses. The pair of bursts repeat every eight seconds. For each burst there is a short delay between the third and fourth pulse. The frequency of each pulse is 1000 Hz.

#### MEDIUM PRIORITY ALARMS

Each medium priority alarm consists of an audible burst of three pulses repeated approximately every 25 seconds. The frequency of each pulse is 800 Hz.

#### LOW PRIORITY ALARMS

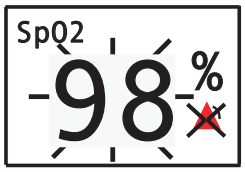
Each low priority alarm consists of an audible burst of two pulses repeated approximately every 15 seconds. The frequency of each pulse is 350 Hz.

#### ADVISORY ALERTS

Each advisory alert consists of an audible burst of two pulses repeated approximately every 5 minutes. The frequency of each pulse is 300 Hz.

Visible Alarms

In addition to audible alarms, visual text and symbol alarms are displayed on the screen. Each message or symbol is specific to its respective parameter or condition.




**FLASHING NUMERICAL PARAMETERS**

If a physiological parameter exceeds a high limit or falls below a low limit value, the numerical value displayed flashes. This function cannot be suspended and is visible when pop-up menus are activated.


**ALARM MESSAGE LINES**

There is space for two text lines provided directly below the NIBP box. If multiple alarms are active, they alternate in the alarm area. The bottom line is used for the informational messages and advisory alerts.

Low level alarms and informational level messages are displayed in this area for the vital signs that have a waveform displayed. For parameters that do not have a waveforms displayed, all level of alarms are reported in the Alarm Message Lines.

Informational, low, and medium level alarm text messages appear in yellow and high alarm warning messages appear in red.


**WAVEFORM SLOT VISUAL ALARMS**

When a high or medium alarm occurs for a vital sign that has an active waveform, the message appears in the top center of the waveform traces in large text. If there are multiple alerts to be displayed in a waveform slot, the messages alternate.

If the waveform exists in multiple slots, either through cascade or duplicate waveforms from alternate leads, the waveform messages only occur in the top most slot.

Waveform Slot Alarms are not visible during the following conditions.

- The waveform is not selected to be displayed.
- A pop-up window or menu covers the waveform slot.

If a high or medium level alarm message cannot be displayed in the waveform slot due to a pop-up window, the alarm message displays in the Alarm Message Lines near the bottom of the screen.

Waveforms Frozen

If a waveform is “frozen” and data is still being acquired, high and medium alarm messages appear based on the real-time data being acquired, not the “frozen” waveform.

Alert Icons

There are three alert icons that may appear on the main screen.

**SUSPENDED ALARM ICONS**

The alarm inhibit icon appears in the parameter boxes when an individual parameter's alarms are turned *OFF*.

When a red bell icon appears in the top waveform slot, all the monitor's audible alarms have been silenced. The duration of the silence condition appears to the right of the bell icon.

2 Min = 2 minutes
∞ = permanent

Visual alarms continue to be displayed as described.

**BATTERY ICONS**

Battery icons appear in the System Status Line indicating battery status when AC (Mains) power is not available and battery charging status when AC (Mains) is connected. The batteries change color depending on their charge status. A battery icon with a cardiac waveform also appears in the Heart Rate parameter box to indicate the status of the ECG module battery. See "Battery Indicators" on page 2-2 for more information about battery status and charging.

## Special Alarm Conditions

The monitor's alarms may be adjusted to suit the specific needs of the clinical environment. Special functions are included for the benefit of the user, so that "nuisance alarms" during patient setup do not become distracting to the caregiver. *Alarm Silence* and *Standby Mode* are available for this purpose. There are additional safeguards included to protect against the misuse of these functions.

Alarms at Start Up

Audible alarms do not occur until the first valid measurement has occurred for that parameter. Visual messages and alarms are present immediately when a module is activated.

Alarm Silence

A SILENCE key is provided on the front panel of the monitor.

**SILENCE 2 MINUTES**


Pressing this key momentarily begins a two minute alarm silence. The alarm icon appears in the System status Line followed by the message *2 Min* in white text.

New high and medium level alarms end the two minute silence when the alarm condition occurs.

Pressing the SILENCE key a second time ends the silence condition and normal alarms resume.

**PERMANENT SILENCE**

**⚠CAUTION⚠**

- All alarms are silenced, including those at higher levels, until the permanent silence is ended.

Press and hold the SILENCE key to permanently silence the alarms. The alarm icon appears in the System Status Line followed by an infinity symbol. Notice that the long key-press tone occurs after holding the key in for two seconds, confirming that permanent silence was selected.

Pressing the SILENCE key a second time ends the silence condition and normal alarms resume.

Alarms tone warning (Warning Tone)

During a permanent alarm silence condition, and when this safeguard is activated, an *Alarms tone warning* (Warning Tone) occurs when a new high or medium level alarm is generated. The tone is a low pitched double beep the same as the long key press tone.

A password is required to turn this function off. The *Alarms tone warning* function can be set in the *CONFIG* menu.

Alarm Volume

The alarm volume can be set to levels 1 to 10 with 10 being the loudest. This can be set in the *ALARMS* menu.

The alarm volume cannot be set to *OFF*. To permanently silence the monitor press and hold the SILENCE key.

**NOTE**: This function does not change the volume of the audible heart rate. The pulse tone volume is adjusted separately in the *PARAMS* menu.

**NOTE:** The *Alarm Limits* menu only displays the parameters present in the configuration.

Minimum Volume Auto-Reset

When the monitor is powered on, the last alarm volume setting resumes, except when the previous volume setting was 1. In this case the monitor returns with a volume setting of 2. This function cannot be disabled.

**Standby Mode**

This is a function on Base, Base Plus, and all Cardiology systems. This function may be set in the *CONFIG* menu. It is not password protected. All functions and alarms are suspended in *Standby Mode*. The screen appears blank and the message *STANDBY MODE* displays in large red characters.

If the *Standby Tone* is set to *ON*, The monitor beeps once every minute when in *Standby Mode*. There is a single low pitched beep to alert the user that the monitor has been left in *Standby Mode*.

**Agent Standby Mode**

This is a function on all Anesthesiology systems. The *AGENT STANDBY MODE* message appears in the top waveform slot in large red letters. The symbol for permanent alarm silence also appears at the top of the display.

The SILENCE key is not active during *Agent Standby Mode*. All audible alarms are suspended until the STAND BY key is pressed.

The *Agent Standby Mode* is provided so that the ***Veris*** monitor can be set up and checked with an anesthetic delivery system prior to clinical use without generating distracting alarms.

Perform any preparatory procedures as required by your hospital's protocols.

Press the STAND BY key to begin patient monitoring. The standby message disappears and normal alarms resume. The SILENCE key also returns to normal operation.

**Standby Mode Timeout**

This is a function on Base, Base Plus, and all Cardiology systems and affects the *Standby Mode*. The *Standby Mode Timeout* can be set in the *CONFIG* softkey menu. The monitor automatically returns to monitoring within a specified amount of time. The range can be set from 5 minutes to 2 hours, or *OFF*. A password is required to change the setting for this safeguard.

**$SpO_2$ Low Limit Auto-Reset**

If the $SpO_2$ alarm limit level is set below 85%, the monitor automatically returns to the value 90% each time the monitor is turned on. If the *CUSTOM DEFAULTS* are set with an $SpO_2$ low limit value above 85%, the monitor automatically returns to the higher value each time the monitor is turned on. This function cannot be disabled.

**$SpO_2$ Low Limit Off Alarm**

There is an alarm message generated if the *$SpO_2$ Low Limit* is set to *OFF*. The message *LOW SAT OFF* appears in yellow text in the Alarm Message Lines. This alarm message continues to display regardless of the $SpO_2$ module being set to on or off in the *PARAMS* menu.

The monitor also displays the alarm alarm inhibit icon in the lower right corner of the $SpO_2$ numerical display box. The red alarm inhibit icon is normally displayed when any $SpO_2$ limit is turned off.

### Triggering an Alarm

A patient alarm is activated only when the value of one of the patient's parameters exceeds one of the alarm limits. For example, if the high saturation limit is set to 97%, the ***Veris*** monitor sounds an alarm when the patient's $SpO_2$ reaches 98%. **It will ***not*** alarm at 97%**.

Similarly, if the low saturation limit is set to 90%, the alarm sounds when the patient's $SpO_2$ falls to 89% or below.

**⚠WARNING⚠**

- To trigger an alarm, the patient's value must *exceed* the parameter's limit.

### Alarms Testing

To check and ensure that the audible and visual alarm limit settings are operating as expected, the user may do so by performing the following suggested procedure:

1. Apply power to the monitor. Observe that all displays and LEDs illuminate.
2. Place the $SpO_2$ probe on your finger. Allow readings to stabilize.
3. Observe the pulse rate that is being displayed and adjust the low pulse rate limit to a value greater than the observed pulse rate value.
4. Verify that the low pulse rate violation message is displayed on the LCD message bar and that the alarm tone sounds.
5. Once verified, return the low pulse rate or $SpO_2$ waveform limit to the previously set value, or to one that is required for the patient to be monitored.

**Alarm Message List**

Included here is a list of messages, alerts, and alarms that may appear in the waveform slots or in the system message lines of the display.

**Shared Source Alarms**

Alarms and messages for heart rate may be generated by more than one parameter.

| | Priority | Description |
|---|---|---|
| LOW PULSE RATE | High | The heart rate value has dropped below the value set in the *ALARMS* menu. This can be generated from the ECG, IBP, $SpO_2$, or the NIBP module. |
| HIGH PULSE RATE | High | The heart rate value has exceeded the value set in the *ALARMS* menu. This can be generated from the ECG, IBP, $SpO_2$, or the NIBP module. |

**ECG Alarms**

| | Priority | Description |
|---|---|---|
| ECG:LOST | High | The ECG amplitude is too low. Check electrodes, lead wires, and cables. If necessary, change to a different lead. |
| ECG:LA LEAD OFF | User Selectable | The left arm lead is off. Reconnect the lead. |
| ECG:LL LEAD OFF | User Selectable | The left leg lead is off. Reconnect the lead. |
| ECG: V LEAD OFF | User Selectable | The chest lead is off. Reconnect the lead. |
| ECG:LEADS OFF | User Selectable | The ECG leads are off. Either the right leg is off or there is more than one lead off. Check the lead(s). |

**$SpO_2$ Alarms**

| | Priority | Description |
|---|---|---|
| $SpO_2$: ERROR | Low | The monitor has detected a fault with the $SpO_2$ function. Contact MEDRAD Service or your local representative. |
| $SpO_2$:SENSOR | Low | The $SpO_2$ sensor is not properly positioned. |
| $SpO_2$:HIGH AMBIENT | Low | The $SpO_2$ module is reading excessive light. Shield the sensor or reduce the amount of ambient light. |
| $SpO_2$:SEARCH | Low | The module cannot find a pulse in $SpO_2$ signal. |
| $SpO_2$:SIGNAL | Low | The $SpO_2$ signal is too weak to measure. Check sensor site for low perfusion and reposition sensor if necessary. |
| $SpO_2$:LOST | Medium | The monitor is receiving no $SpO_2$ signal. Check sensor site for low perfusion and reposition sensor if necessary. |
| $SpO_2$:NO SENSOR | Low | The $SpO_2$ sensor or extension cable is missing or defective. Connect or replace the sensor or the extension cable. |

| | Priority | Description |
|---|---|---|
| LOW $SpO_2$ | High/Medium | The $SpO_2$ value has dropped below the value set in the *ALARMS* menu. This alarm can be set to high or medium priority in the *PARAMS* menu. |
| HIGH $SpO_2$ | Medium | The $SpO_2$ value has exceeded the value set in the *ALARMS* menu. |
| LOW SAT OFF | Informational | The $SpO_2$ low limit has been set to *OFF* in the *ALARMS* menu. |

**Temperature Alarms**

| | Priority | Description |
|---|---|---|
| TEMP1: NO PROBE | Low | Probe is not present for temperature channel 1. |
| TEMP1:BAD PROBE | Low | Temperature probe for temperature channel 1 is defective. |
| TEMP1: NOT READY | Low | Set-up period for temperature channel 1 |
| TEMP1:ERROR | Low | The monitor has detected a fault with the temperature module for temperature channel 1. Contact the MEDRAD Service Department. |
| LOW TEMP1 | Medium | Temperature value for temperature channel 1 dropped below the value set in the *ALARMS* menu. |
| HIGH TEMP1 | Medium | The temperature value for temperature channel 1 has exceeded the value set in the *ALARMS* menu. |
| TEMP2: NO PROBE | Low | Probe is not present for temperature channel 2. |
| TEMP2:BAD PROBE | Low | Temperature probe for temperature channel 2 is defective. |
| TEMP2: NOT READY | Low | Set-up period for temperature channel 2 |
| TEMP2:ERROR | Low | The monitor has detected a fault with the temperature module for temperature channel 2. Contact the MEDRAD Service Department. |
| LOW TEMP2 | Medium | Temperature value for temperature channel 2 dropped below the value set in the *ALARMS* menu. |
| HIGH TEMP2 | Medium | The temperature value for temperature channel 2 has exceeded the value set in the *ALARMS* menu. |

**NIBP Alarms**

| | Priority | Description |
|---|---|---|
| BP: SYS HIGH | Medium | The systolic value has exceeded the value set in the *ALARMS* menu. |
| BP: SYS LOW | Medium | The systolic value has dropped below the value set in the *ALARMS* menu. |
| BP: DIA HIGH | Medium | The diastolic value has exceeded the value set in the *ALARMS* menu. |
| BP: DIA LOW | Medium | The diastolic value has dropped below the value set in the *ALARMS* menu. |
| BP: MAP HIGH | Medium | The mean arterial pressure value has exceeded the value set in the *ALARMS* menu. |
| BP: MAP LOW | Medium | The mean arterial pressure value has dropped below the value set in the *ALARMS* menu. |
| BP: CALIB ERROR | Low | The monitor had detected a fault with the calibration. Cycle the power to the monitor. If the problem persists, contact MEDRAD Service or your local representative. |
| BP: CHECK CUFF | Low | Displayed when a neonatal cuff is used while the monitor is in the adult or pediatric mode. Switch to neonatal mode when using a neonatal cuff. Can also indicate a leak in the cuff, or the cuff is wrapped too loosely. |
| BP: EXCES MOTION | Low | Patient motion or shivering is interfering with an accurate reading. |
| BP: LO PULSE AMP | Low | Pulse amplitude is too low. Reposition cuff. |
| BP: NO DEFLATE | Low | The monitor was unable to deflate the NIBP cuff. Disconnect the cuff and contact MEDRAD Service or your local representative. |
| BP: MAX TIME | Low | Maximum time (2 minutes) allowed for measuring the blood pressure has been exceeded. Repeat measurement. |
| BP: MAX PRESSURE | Low | Maximum allowed cuff pressure (300 mmHg adult or 150 mmHg neonatal) has been attained. |
| BP: PLEASE WAIT | Informational | The cuff has not completely deflated. Wait for deflation and then press NIBP key again. |
| BP: ERROR | Low | The monitor has detected a fault with the NIBP function. Contact MEDRAD Service or your local representative. |
| BP: NOISE | Low | The monitor was unable to take a blood pressure reading due to noise on the NIBP signal. Keep the patient still while the NIBP reading is being taken. |
| BP: NOT TAKEN | Low | The monitor was unable to take a blood pressure reading. Check cuff position. |

**IBP Alarms**

| | Priority | Description |
|---|---|---|
| HR LOST | High | The heart rate value has dropped below the detectable limit for the channel. Verify that the correct site has been selected for the channel. This message is only generated for channels set to ART or PA sites. |
| HIGH SYS | Medium | The systolic value has exceeded the value set in the *ALARMS* menu. |
| LOW SYS | Medium | The systolic value has dropped below the value set in the *ALARMS* menu. |
| HIGH DIA | Medium | The diastolic value has exceeded the value set in the *ALARMS* menu. |
| LOW DIA | Medium | The diastolic value has dropped below the value set in the *ALARMS* menu. |
| HIGH MAP | Medium | The mean arterial pressure value has exceeded the value set in the *ALARMS* menu. |
| LOW MAP | Medium | The mean arterial pressure value has dropped below the value set in the *ALARMS* menu. |
| OFF SCALE | Informational | The IBP value has exceeded the scale for the channel, and the waveform has been clipped. Adjust the range to display the entire waveform. |
| NO XDUCER | Informational | Transducer is not connected to the channel. Check cable connections and verify that the correct transducer is being used. |
| BAD XDUCER | Informational | An incorrect or damaged transducer is connected to the channel. Specified transducers must have an impedance greater than 300 ohms. |
| FACT CAL | Medium | There is an error in the factory calibration memory. IBP monitoring is suspended until corrected. Contact MEDRAD Service or your local representative. |
| ZERO GOOD | Informational | The IBP zero calibration for the channel was successful. The zero pressure point has been adjusted to the current ambient room pressure. |
| ZERO FAIL | Informational | The zero calibration was unsuccessful. Calibration was aborted due to detection of beat or pressure fluctuations. Contact MEDRAD Service or your local representative if the monitor continues to fail calibration. |
| NOT ZEROED | Informational | The transducer needs to be zeroed. Calibrate the monitor with the transducer. |

**NOTE**: IBP alarms are preceded by the specific site and channel number such as *ART1:NO XDUCER*.

**Capnometry ($CO_2$) Alarms and Messages**

| | Priority | Description |
|---|---|---|
| LOW $EtCO_2$ | Medium | The end-tidal $CO_2$ value has dropped below the value set in the *ALARMS* menu. |
| HIGH $EtCO_2$ | Medium | The end-tidal $CO_2$ value has exceeded the value set in the *ALARMS* menu. |
| LOW $INCO_2$ | Medium | The inspired $CO_2$ value has dropped below the value set in the *ALARMS* menu. |
| HIGH $INCO_2$ | Medium | The inspired $CO_2$ value has exceeded the value set in the *ALARMS* menu. |
| LOW RESP | Medium | The respiration value has dropped below the value set in the *ALARMS* menu. This is generated from the capnography module. |
| HIGH RESP | Medium | The respiration value has exceeded the value set in the *ALARMS* menu. This is generated from the capnography module. |

**Agent Gas Alarms and Messages**

| | Priority | Description |
|---|---|---|
| AGT:NO BREATH | High | No breath detected. Check patient for apnea. Check sampling device and adjust placement if necessary. May indicate a leak in the breathing circuit. |
| AGT:OCCLUSION | Medium | The sampling line or water trap to the ***Veris*** monitor is completely blocked. The ***Veris*** monitor attempts to clear the block by drawing the occlusion into the water trap. Replace sampling line as necessary. |
| $CO_2$: BENCH FAIL | Low | A hardware failure has been detected. Contact MEDRAD Service or your local representative. |
| $CO_2$: NO EXHAUST | Low | Scavenging line on the ***Veris*** monitor is blocked or the scavenging system is defective. Remove blockage or correct gas scavenging system. |
| AGT:IR FAIL | Low | A hardware failure has been detected. Contact MEDRAD Service or your local representative. |
| AGT:PNEUMATICS | Low | A hardware failure has been detected. Contact MEDRAD Service or your local representative. |
| $O_2$:SENSOR | Low | The $O_2$ cell inside the monitor is expended and must be replaced. Contact MEDRAD Service or your local representative. |
| REPLACE TRAP | Medium | The ***Veris*** monitor trap needs to be replaced. |
| AGT: BAD CAL | Low | The ***Veris*** monitor was unable to calibrate agent gas detector. Contact MEDRAD Service or your local representative. |

| | **Priority** | **Description** |
|---|---|---|
| AGT: AUTO CAL | Quiet Medium | The agent bench is doing an auto calibration. |
| AGT: WARMING | Informational | The ***Veris*** monitor has not attained full accuracy for agent concentrations. |
| AGT: DISCONNECT | Informational | There is an agent bench hardware error. |
| WRONG AGENT | High | The primary agent that the operator has selected does not match the highest concentration agent detected by the analyzer. Check the primary agent setting and the agent delivery system immediately. This alarm is not active when automatic primary agent detection is selected. |
| MIXED AGENT | Medium | More than one halogenated agent is present. |
| LOW INS AGENT | Medium | The inspired agent value has dropped below the value set in the *ALARMS* menu. |
| HIGH INS AGENT | Medium | The inspired agent value has exceeded the value set in the *ALARMS* menu. |
| LOW EXP AGENT | Medium | The expired agent value has dropped below the value set in the *ALARMS* menu. |
| HIGH EXP AGENT | Medium | The expired agent value has exceeded the value set in the *ALARMS* menu. |
| LOW INS $N_2O$ | Medium | The inspired $N_2O$ value has dropped below the value set in the *ALARMS* menu. |
| HIGH INS $N_2O$ | Medium | The inspired $N_2O$ value has exceeded the value set in the *ALARMS* menu. |
| LOW EXP $N_2O$ | Medium | The expired $N_2O$ value has dropped below the value set in the *ALARMS* menu. |
| HIGH EXP $N_2O$ | Medium | The expired $N_2O$ value has exceeded the value set in the *ALARMS* menu. |
| AGT:INSERT TRAP | Medium | The water trap on the ***Veris*** monitor is not inserted. Trap is partially blocked, wrong type of trap, or defective. Replace trap. |
| AGT:MANUAL MODE | Informational | The monitor is set to manual identification of a selected primary agent. The *WRONG AGENT* warning appears if the selected agent does not match the detected primary agent. |
| AGT:AUTOMATIC | Informational | The monitor is set to automatic identification of the current primary agent. |

**Oxygen Monitoring ($O_2$) Alarms**

| | Priority | Description |
|---|---|---|
| LOW $EtO_2$ | Medium | The expired $O_2$ value has dropped below the value set in the *ALARMS* menu. |
| HIGH $EtO_2$ | Medium | The expired $O_2$ value has exceeded the value set in the *ALARMS* menu. |
| LOW $INO_2$ | Medium | The inspired $O_2$ value has dropped below the value set in the *ALARMS* menu. |
| HIGH $INO_2$ | Medium | The inspired $O_2$ value has exceeded the value set in the *ALARMS* menu. |

**System Alerts**

| | Priority | Description |
|---|---|---|
| LOW BATTERY | Advisory | Battery power is low. Recharge batteries. |
| NO ADMIT | Informational | The patient has not been admitted in the *ADM/DIS* menu. |
| WAVEFORM FROZEN | Informational | The user has selected the waveforms to be frozen. Press the FREEZE key again to resume normal display. |
| ECG OFF | Informational | The ECG module has been turned off. |
| PRINT: PAPER OUT | Informational | The printer on the remote display has detected the end of the paper roll. |
| PRINT: HEAD UP | Informational | Paper is loaded and manual lever is up on the remote display. Move the lever to the down position. Check for paper jam. |
| PRINT: Vp ERROR | Informational | Internal printer communication problem on the remote display. Contact MEDRAD Service. |
| PRINT: TEMP ERR | Informational | The thermal printing element on the remote display is not at the correct temperature. Contact MEDRAD Service or your local representative. |
| V*xxx* - NO ADMIT | Informational | The patient has not been admitted and wireless communication is not setup. The numbers following the “V*xxx*” indicate the unit’s wireless network indentifier. |
| CONM H/W ERROR | Low | Indicates that the NIBP board is not communicating. |
| VSM H/W ERROR | Low | Indicates that the Vital Signs Module (VSM) board is not communicating. |
| IBP H/W ERROR | Low | Indicates that the IBP board is not communicating. |

# 4 — Trends

**Description**

The trend memory stores patient data at regular intervals for review at a later time. Trend data can be reviewed by printing it out on the remote display's built-in printer, through the serial port, or on the screen. Trend data is date and time stamped.

To view the tabular trend, press the TREND key and the table appears in the lower channels of the waveform display.

Trend Interval

The trend interval can be changed by pressing and holding the TREND key while viewing the tabular trend. A second window appears which allows you to change the trend interval by rotating the control knob.

Trend data for each parameter is stored as follows:

- $SpO_2$ value is stored every 30 seconds at the zero and 30 seconds mark.
- The precedent heart rate is stored every 30 seconds at the zero and 30 second marks. This data is recorded from secondary sources if the primary sources are unavailable.
- Respiration value is stored every 30 seconds at the zero and 30 seconds mark.
- NIBP storage is determined by cycle time interval, demand and stat readings. Every NIBP reading is stored in the trend memory.
- Continuous temperature readings are stored every 30 seconds at the zero and 30 seconds mark.
- Inspired and expired $CO_2$ and $O_2$ data is stored every 30 seconds at the zero and 30 seconds mark.
- IBP data is stored every 30 seconds at the zero and 30 seconds mark.
- Agent and $N_2O$ data is stored every 30 seconds at the zero and 30 seconds mark.

Capacity

The trend memory can store up to 24 hours of trend data at 30 second intervals, with a maximum of 480 NIBP readings and/or tabular trend markers in a 24 hour interval.

When the trend memory is filled to maximum capacity, the new trend data begins to overwrite the oldest trend data in the memory.

Trend Screen Update

The table is not updated while it is being viewed. Scroll up to view data that is recorded after the trend screen is activated. The trend screen automatically returns to the main screen after 45 seconds.

## Trend Setup

Up to two parameters may be viewed in graphical format in the trend window. Change the trend view in the *Trend Setup* window.

To view trends:

1. Press the TREND key to enter the trend window.
2. Either the *Tabular* or *Graphics Trend* appears.
3. Press and hold the TREND key to enter the *Trend Setup* window.
4. Set the trend type to *Graphical* or *Tabular*.
5. Press the TREND key. The trend displays.
6. Rotate the knob clockwise to see older data.
7. Press and hold the TREND key to exit trends.

Selecting *EXIT* returns to the main screen. Press the TREND key again to return to the trend display after changing the settings.

**NOTE**: The trend setting window defaults to *Tabular Trend*. The Settings for *Trend Interval*, *First Trend Parameter* and *Second Trend Parameter* are not visible until the *Trend Type* is set to *Graphical*.

If *Graphical* is selected, set the *Trend Interval* and *Trend Parameters* as desired.

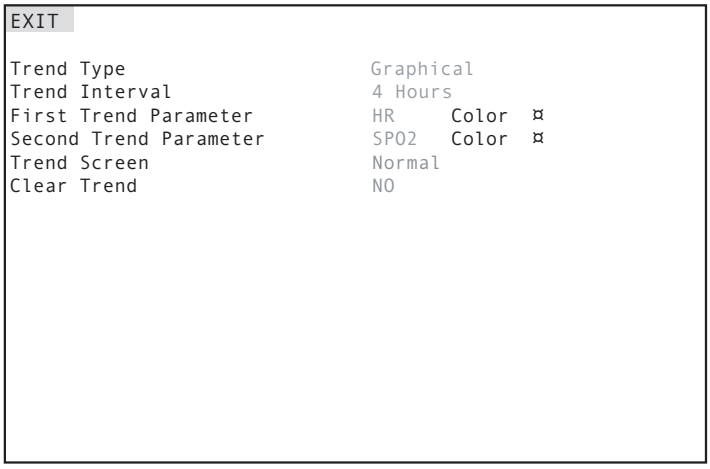



**Figure 4-1: Graphical Trend Setup Window**

If *Tabular* is selected, the *Trend Screen* is set to *Basic Trend Display* for Base and Cardiology models. On Anesthesia models select *Basic Trend Display* or *Advanced Trend Display*. Select *YES* or *NO* for *Use parameter colors*.

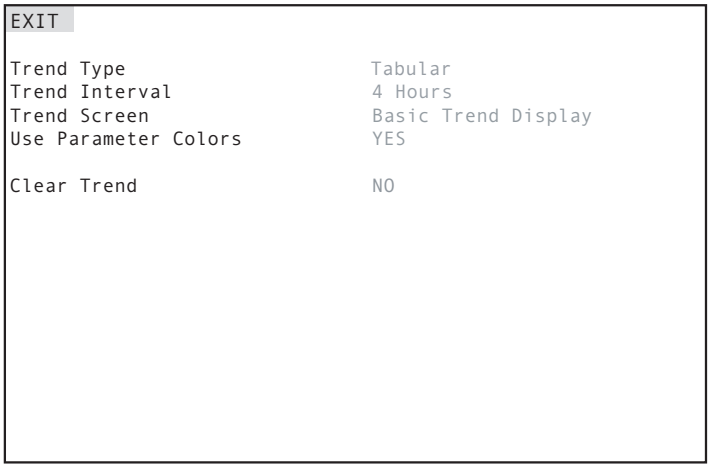



**Figure 4-2: Tabular Trend Setup Window**

## Graphical Trends

The graphical trend window covers the lower five waveform slots. The physiological parameter and the unit of measurement is listed vertically on the left side for the first displayed line graph. The second line graph is labeled vertically on the right side.

The graphical trend window displays for about 45 seconds before timing out. The trend window does not update automatically. The trend window updates each time it is accessed.

The most current data is always displayed on the right side. Time stamps for the selected *Trend Interval* are indicated below the line graphs.

### Scrolling the Graph

The trend window can be set to display up to 24 hours of data. Rotating the knob clockwise scrolls the graph to show older data. Rotating the knob counter-clockwise scrolls back towards the most current data.

The rate of advance varies with the selected *Trend Interval*.

| Trend Interval | Minutes per each click |
|---|---|
| 2 hours | 1 |
| 4 hours | 2 |
| 8 hours | 4 |
| 12 hours | 6 |
| 24 hours | 12 |

The time stamps are updated each time the knob is rotated. It is not possible to scroll past the current time.

The trend graph resets to the current time stamp upon exiting to the main screen and returning to the trend window. The trend graph remains at the selected time location while entering and returning from the trend settings window.

### Interruption Due to Power Cycling or Standby Mode

The graphical trend has gaps due to power cycling of the monitor. If the period of missing data is within the last 24 hour period the gaps appear where the power was turned off. The graphical trend also has gaps when the monitor is placed in *Standby Mode*. These gaps are defined with gray backgrounds.

If the power was turned off or the *Standby Mode* existed for a period of more than a day, a blank period is inserted between the new and old data. The new data begins on a new window with new time stamps. The gap between the monitoring sessions is equal to the *Trend Interval* in length.

Graphical Trend Display

Two physiological parameters may be displayed at the same time in the graphical trend window. For IBP and NIBP the pressure values for diastolic, systolic and mean will be represented. The line graphs are shown in the color selected by the user for trend displays.

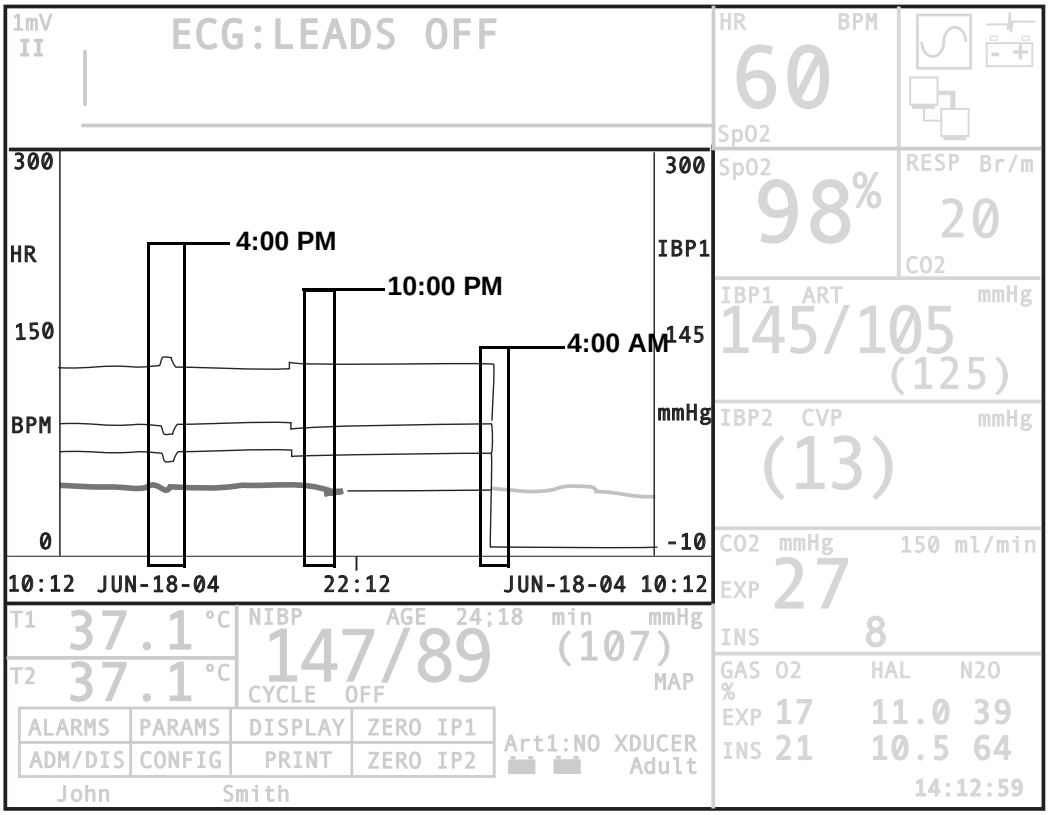



**Figure 4-3: Graphical Trend Screen**

The sample graphical trend screen above shows HR and arterial IBP data from IBP channel one (IBP1). The IBP data is displayed as a set of thinner black lines for systolic, MAP, and diastolic values respectively. (On the monitor screen the IBP data is represented in the color selected by the user.) The lowest of the four lines is the HR information. The color of the heart rate line is user-selectable in the *Trend Setup* menu.

**NOTE:** The color of the heart rate waveform remains the color the user set it as. The illustration above shows changes merely to highlight the waveform as it changes its source.

| | |
|---|---|
| 10:12 a.m. | Monitoring began. |
| 4:00 p.m. | IBP event is recorded. |
| 10:00 p.m. | ECG leads removed. (HR defaults to IBP) |
| 4:00 a.m. | IBP lines removed. (HR defaults to $SpO_2$) |
| 10:12 a.m. | Current HR from $SpO_2$ source. |

## Tabular Trends

Tabular Trend Markers

Various messages appear in the tabular trend to indicate that system events have occurred. A complete list is as follows:

| | |
|---|---|
| STNDBY ON | STNDBY OFF |
| AGT STNDBY ON | AGT STNDBY OFF |
| AUDIO ON | AUDIO OFF |
| FREEZE ON | FREEZE OFF |
| SIM ON | SIM OFF |
| NEW PAT | POWER |

**NOTE**: Permanent silence and two minute silence are both recorded as an *AUDIO ON/OFF* event in the tabular trend table.

Trend Messages

The trend also records messages in the trend table that indicate the status of the monitor at that time. The time and date stamp is also recorded when a marker is recorded. All messages appear in the trend table regardless of the interval selected for the table or the time that the message occurred. Markers are recorded for:

- Standby Mode is entered or exited (*STNDBY ON*/*STNDBY OFF*);
- Agent Standby Mode is entered or exited (*AGT STNDBY ON*/*AGT STNDBY OFF*);
- Silence Mode (both two minute and permanent) is entered or exited (*AUDIO ON*/*AUDIO OFF*);
- Waveforms are frozen or unfrozen (*FREEZE ON*/*FREEZE OFF*);
- Power is turned on or off (*POWER*); or
- A new patient is admitted or discharged via the *ADM/DIS* window (*NEW PAT*).

  **NOTE**: If the patient size is changed while admitting a new patient all the previous trend data is cleared.

At midnight the monitor records the date change into the trend table. This does not occur if the monitor was turned off at midnight.

Data Format

The parameters are listed in the first column followed by the units.

- Time stamps at the half minute mark are displayed with a plus “+” sign.
- Measured parameters that exceed or drop below alarm limits are highlighted.
- When a sampling module is on and no value can be determined for the parameter, three dashes “---” are displayed in the trend table.
- If a sampling module is turned off in the *PARAMS* window, the word *OFF* displays in the trend.
- If a sampling module is turned on and no valid measurement has been taken, the word *ERR* displays in the trend if the parameter has an error condition.
- If there is no NIBP data for a particular time stamp, the NIBP trend area is left blank.

**NOTE:** The Trends are automatically cleared when the *DATE/TIME* is changed.

| | 18-JUN-04 | 11:45+ | 11:45 | 11:44+ | 11:44 | 11:43+ | 11:43 |
|---|---|---|---|---|---|---|---|
| RATE | BPM | 60E | 60E | 60E | 60E | | |
| SpO2 | % | 99 | 99 | 99 | 98 | NEW | POWER |
| NIBP SYS | mmHg | | | | | PAT | |
| DIA | mmHg | | | | | | |
| MAP | mmHg | | | | | | |
| TEMP 1 | ˚F | 98.6 | 98.6 | 98.6 | 98.6 | | |
| TEMP 2 | ˚F | 98.6 | 98.6 | ERR | ERR | | |
| RESP | Br/m | 20C | 20C | 20C | 20C | | |
| IBP1 SYS | mmHg | 145 | 144 | 144 | 146 | | |
| DIA | mmHg | 105 | 105 | 105 | 105 | | |
| MAP | mmHg | 125AR | 124AR | 124AR | 126AR | | |
| IBP2 SYS | mmHg | | | | | | |
| DIA | mmHg | | | | | | |
| MAP | mmHg | 13CV | 13CV | 13CV | 13CV | | |

**Figure 4-4: Sample Trend Table (Base and Cardiology)**

For the trend table shown the interval is set to 30 seconds.

Anesthesia units display two trend screens. The default is *Basic Trend Display*. Select *Advanced Trend Display* for *Trend Screen* in the *Trend Setup Window* to view the second tabular trend screen.

The *Basic Trend Display* screen displays:

- Heart rate
- $SpO_2$
- NIBP (Systolic, Diastolic, and MAP)
- Temp 1 and 2
- Respiration
- $CO_2$ (Inspired and Expired)
- $O_2$ (Inspired and Expired)
- Agent (Inspired and Expired)
- $N_2O$ (Inspired and Expired)

| | 18-JUN-04 | | 11:45+ | 11:45 | 11:44+ | 11:44 | 11:43+ | 11:43 |
|---|---|---|---|---|---|---|---|---|
| RATE | | BPM | 60E | 60E | 60E | 60E | | |
| SpO2 | | % | 99 | 99 | 99 | 98 | NEW | POWER |
| NIBP | SYS | mmHg | | | | | PAT | |
| | DIA | mmHg | | | | | | |
| | MAP | mmHg | | | | | | |
| TEMP | 1 | °F | 98.6 | 98.6 | 98.6 | 98.6 | | |
| TEMP | 2 | °F | 98.6 | 98.6 | ERR | ERR | | |
| RESP | | Br/m | 20C | 20C | 20C | 20C | | |
| CO2 | INS | mmHg | 8 | 8 | 8 | 8 | | |
| | EXP | | 27 | 27 | 27 | 27 | | |
| O2 | INS | % | 21 | 21 | 21 | 21 | | |
| | EXP | | 17 | 17 | 17 | 17 | | |
| AGT | INS | % | 10.5H | 10.5H | 10.5H | 10.5H | | |
| | EXP | | 11.0 | 11.0 | 11.0 | 11.0 | | |
| N2O | INS | % | 64 | 63 | 64 | 64 | | |
| | EXP | | 39 | 39 | 39 | 39 | | |

**Figure 4-5: Sample Basic Trend Display Table**

The *Advanced Trend Display* screen displays:

- IBP1 (Systolic, Diastolic, and MAP)
- IBP2 (Systolic, Diastolic, and MAP)

| | 18-JUN-04 | | 11:45+ | 11:45 | 11:44+ | 11:44 | 11:43+ | 11:43 |
|---|---|---|---|---|---|---|---|---|
| IBP1 | SYS | mmHg | 145 | 144 | 144 | 146 | | |
| | DIA | mmHg | 105 | 105 | 105 | 105 | | |
| | MAP | mmHg | 125AR | 124AR | 124AR | 126AR | | |
| IBP2 | SYS | mmHg | | | | | | |
| | DIA | mmHg | | | | | | |
| | MAP | mmHg | 13CV | 13CV | 13CV | 13CV | | |

**Figure 4-6: Sample Advanced Trend Display Table**

**NOTE:** The *Advanced Trend Display* screen only displays IBP information. To view trend data of the other parameters, you must reset *Trend Screen* in the *Trend Setup Window* to *Basic Trend Display.*

**HEART RATE SOURCE INDICATION**
The source of the heart rate data is indicated by a letter following each heart rate value.

- E = electrocardiogram,
- I = invasive blood pressure,
- S = pulse oximetry and
- N = Non-invasive blood pressure.

**IBP SITE INDICATION**
The IBP site is indicated by a letter following each mean value.

- AR = Arterial (ART)
- PA = Pulmonary Artery (PA)
- CV = Central Venous (CVP)
- RA = Right Atrial (RA)
- LA = Left Atrial (LA)
- IP = Intracranial (ICP)
- RV = Right Ventricle (RV)
- LV = Left Ventricle (LV)

**RESPIRATION SOURCE INDICATION**
The source of the respiration data is indicated by a letter following each respiration value.

- C = capnometer ($CO_2$ module).

**AGENT SOURCE INDICATION**
The agent source is indicated by a letter following the inspired value for the agent.

- H = Halothane
- E = Enflourane
- I = Isoflourane
- D = Desflurane
- S = Sevoflurane
- U = Unknown

### Clearing the Memory

To clear the trend memory:

1. Press the TREND key to display the trend.
2. Press and hold TREND key again to display the trend setup window.
3. Select the clear trend option and select *YES* to confirm the clearing of the trend data.

The trend memory is automatically cleared when:

- The time and/or date are changed in the menu
- The patient size is changed (adult/pediatric/neonate).

# 5 — ECG

## Theory of Operation

### Heart Rate

The heart rate is determined primarily from the ECG waveform data.

The monitor has a user selectable smart heart rate function. It automatically uses alternate sources to determine heart rate, if the primary source becomes unavailable.

- The IBP pulse rate is used if the ECG waveform data is unavailable.
- The $SpO_2$ pulse rate is used if the ECG and the IBP waveforms are not available.
- The NIBP pulse rate is used if the ECG, the $SpO_2$, and the IBP waveforms are not available.

Response times for ECG heart rate meter change from 80 BPM to 40 BPM and from 80 BPM to 120 BPM is less than or equal to 10 seconds.

**NOTE**: The accuracy and range of the heart rate depends upon the source. See “Specifications” in Appendix C.

**NOTE**: The NIBP-based heart rate is not a continuous measurement and is only current during an NIBP measurement.

### ECG Measurement

The electrocardiogram (ECG or EKG) records the changing potential generated by electrical activity of the heart.

Electrical currents influenced by the cardiac impulse flow through the body tissue around the heart. Electrodes, placed on the skin on opposite sides of the heart, transmit the electrical potentials to circuitry in the ECG module, which in turn amplifies, digitizes (converts analog signals to digital signals), and transmits this information to the ***Veris*** 8600 patient monitor by means of light pulses traveling through fiber optic cable.

The ***Veris*** 8600 patient monitor ECG circuitry filters these received signals. The signals are used to display the ECG waveform to the user and to create a waveform and a pulse for scanner gating. Two different filter types are used. One filter is employed to display the ECG signal while the second filters the signal for gating purposes. For more information on gating see “Gating Signals” on page 5-3

**METHOD**

To obtain an overall view of the heart's electrical activity, three or five electrodes attached to a leadset detect electrical impulses from the patient's heart to the skin. The monitor calculates the difference in electrical force between two electrode sites. Electrode polarity (positive, negative, or ground) depends on the cable receptacle the lead cable is attached to and the lead selected on the monitor screen.

The ECG circuitry amplifies, filters, and digitizes (converts analog signals to digital signals) the received electrical potentials. The ECG module converts these electrical signals into light pulses which the monitor receives and converts back into a recognizable signal.

The ECG design provides for standard 3-lead, or on some systems 5-lead, monitoring. The 3-lead ECG provides conventional bipolar limb leads (I, II, III). The 5-lead ECG provides additional aVR, aVL, aVF, and V views.

The monitor has automatic lead switching capability for 5-lead monitoring, which may be selected by the user. If a lead becomes detached or is unmeasurable, the monitor can automatically display an alternate lead view using the remaining leads.

**STABILITY OF ACCURACY**

The accuracy of the monitor is not affected by arrhythmia or other physiological conditions where the electrocardiogram amplitude and heart rate are within the detectable limits specified for the monitor. The monitor has signal filtering in the 60 Hz and 50 Hz bands that reduce electrical interference from the AC (mains) power sources.

The accuracy of the ECG is affected by the static and gradient magnetic fields. Determine only rate and rhythm with the patient in the presence of a static and gradient magnetic field.

If a defibrilator is used on a patient, the ECG traces disappear. The traces resume within 10 seconds after defibrilation is complete.

ECG module

The ECG module uses a Fiber Optic Transmit/Receive technology. The ECG module is a battery-powered, fiber optic interface from the patient to the monitor.

Gating Signals

The input gating signal is derived from any one of two sources—ECG or Plethysmogram ($SpO_2$) waveform and is available in 2 user-selectable forms, pulse or waveform. An icon of the gating signal source and a visual indication appears at the upper left corner of the heart rate numerical display box.

**ECG GATING**

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 ECG module, which in turn transmits this information to the ***Veris*** monitor by means of light pulses. This information is further transmitted to the ECG gating interface. The ECG gating interface then produces a signal out, which can be used by the MR scanner electronics to cardiac gate an MR scan. The coupling between the ECG module and the ***Veris*** monitor, and between the ***Veris*** monitor and the gating interface, provides complete isolation of the patient from the gating interface and MR scanner.

**ECG Monitoring (Electrocardiogram)**

The following instructions describe procedures for preparing a patient for ECG monitoring.

Shown below is the patient monitor with a fiber optic cable, ECG module, and a 3-lead leadset (left) and a 5-lead leadset (right) attached.

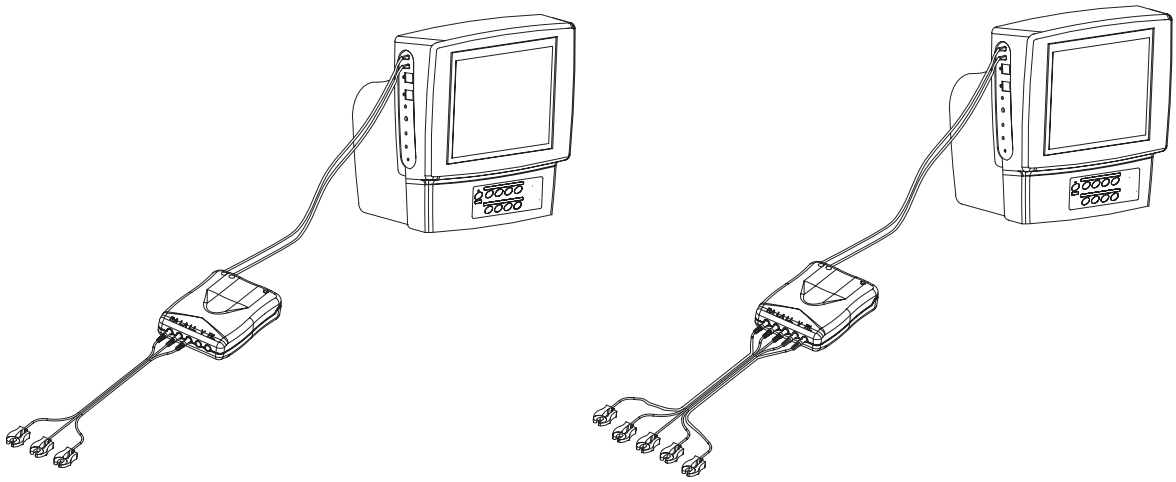


**Figure 5-7: ECG Cable Connection with the ECG Module**

**⚠WARNING⚠**

- Use only recommended leadsets. The use of leadsets not recommended could result in injury, such as patient burns. Use only the leadset that is included with your ***Veris*** monitor.
- Use only recommended electrodes. The use of other electrodes could result in injury, such as patient burns. Use only ConMed Invisatrace electrodes or other electrodes specifically recommended by Medrad with the ***Veris*** monitor.
- The ECG signal is not intended for diagnostic use. Interference due to static and gradient magnetic fields can occur. Determine only rate and rhythm during ECG use.
- This device is not intended for intracardiac ECG applications. Use the ECG monitor and accessories only as directed.
- Do not place defibrillator paddles on or next to ECG patient electrodes. Contact between defibrillator paddles and ECG electrodes could injure the patient.
- The conductive parts of the ECG electrodes should not come in contact with other conductive parts, including earth ground. Such contact could result in patient injury, death, or equipment damage.

## ⚠WARNING⚠

- There is no defibrillator synchronization output on the ***Veris*** monitor. Make no connections between the ***Veris*** system and a defibrillator.
- PACEMAKER PATIENTS: This device does not include pacemaker spike rejection capability. Heart rate readouts derived from the ECG patient connections are likely to display erroneous high or erratic rates when a pacemaker is in use. Keep pacemaker patients under close surveillance. For pacemaker patients it may be advisable to select the $SpO_2$ function as the primary heart rate source.
- The heart rate calculated by the ECG module may be affected by cardiac arrhythmia.
- Leakage currents may increase if other equipment is interconnected to the patient. The increased leakage currents may present a hazard to the patient.

## ⚠CAUTION⚠

- ECG electrodes can cause skin irritation. Change the electrodes and reposition every 24 hours or sooner if there is sign of inflammation.
- Place the ECG module out of the imaging volume. Make certain that the module is stationary (i.e., not moving or vibrating)
- All metallic wires going into the magnet bore will drain off RF power; the fiber optic cables are non-conductive and will not drain off power or heat up. For RF exposures up to specific absorption rates (SAR) of 2.0 W/kg, the ECG leads will not cause patient burns when they are properly insulated and free of loops. Monitoring of ECG at very high RF exposures, above 2.0 W/kg, is not recommended for the general patient population. Such monitoring should be attempted on conscious patients with good temperature reflex so they may warn the operator of excessive heat at monitoring sites.
- All cables should be watched carefully during patient loading and unloading to avoid entanglement with the patient table mechanisms. Cables and the ECG module should not be permitted to swing or move during scanning to avoid baseline wander.
- The "T" wave may become excessively large or inverted with the patient in the magnetic field. This effect is due to electromagnetic flow induced voltage and may interfere with QRS detection. Try other leads and/or electrode placements for best results.

Protection

The ECG module protection against electric shock is of Type CF with protection against the effects of defibrillation.

ECG Performance

The ***Veris*** monitor properly counts normal rhythms with T-Wave heights to 80% of the QRS height at a heart rate of 80 BPM.

**⚠WARNING⚠**

- The presence of tall T-waves greater than 80% of the R-wave may result in a double counting of beats.

The ***Veris*** 8600 monitor complies to AAMI EC13-2002 with exceptions. The monitor does not reject beats of 10ms or less in duration and 1mV or less in amplitude per EC13 section 5.2.6.

The monitor employs a one Hertz filter that allows extraction of ECG waveforms in an MRI environment. Although this design deviates from requirements of EC13 per sections 5.2.9.7 and 5.2.9.8, there is a minimal affect to the aspect ratio, impulse response and the ST component of the ECG waveform.

The ***Veris*** monitor does not provide pacemaker pulse detection and pacer indication per EC13 section 5.2.9.12 and ESU suppression is not provided per section 5.2.9.14. Since the monitor is intended for indoor use, the functional ECG temperature range is specified as 15° C to 35° C.

Electrode Selection

MEDRAD recommends using ConMed Invisatrace electrodes. These electrodes are MRI safe.

See “Accessories” in Appendix D for a complete list of recommended electrodes and accessories.

**ECG Module Interface**

The ECG module is a battery-powered, fiber optic interface from the patient to the monitor. The module has five color-coded connectors along its front surface to interface with the ECG leadsets and 2 color-coded fiber-optic connectors on the rear surface to interface with the ***Veris*** monitor.

**NOTE:** The ECG module protection against electric shock is of type CF, with protection against the effects of defibrillation.

**NOTE:** Always keep the ECG module on the charger when not in use, or when anticipating a period of prolonged inactivity.

The ECG module contains an internal, rechargeable battery. A power switch is provided on the rear of the module. When the monitor is not in use, make certain that the power switch on the ECG module is off to extend battery life. The battery is not user-serviceable and cannot be replaced.

ECG Module Ports And Switches

The following graphic and table details the ports and switches on the ECG module.

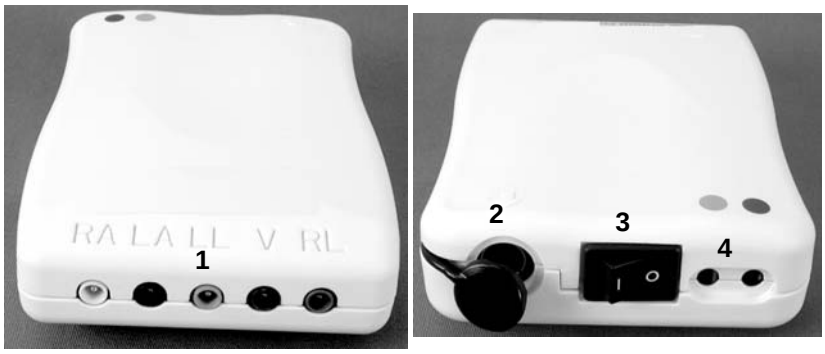



**Figure 5-8: ECG Module Ports, Switches**

| Item | Name | Description |
|---|---|---|
| **1** | Patient Connectors | Color-coded connections for ECG leadset. |
| **2** | Battery charger connection | Port for plugging the ECG module to the charger. |
| **3** | Power Switch | This is the power on/off switch. |
| **4** | Connection to monitor | Fiber optic input/output connections to send ECG signal to the monitor. |

### ⚠WARNING⚠

- Do not charge the ECG module battery while the ECG module is connected to the patient! Charging the ECG module battery during patient use can lead to electric shock through the leadset.
- Do not take the ECG module charger into the magnet room! The ECG module charger contains ferromagnetic material and may be attracted to the magnet, resulting in patient or operator injury.
- The ECG module contains non-servicable batteries. Improper disposal of batteries may result in explosion, leakage, or personal injury. Do not open the batteries. Do not dispose of the batteries in a fire. Follow all local regulations concerning the disposal of spent Lithium-Ion batteries or contact Medrad for assistance.

### ⚠CAUTION⚠

- Only use the ***Veris*** ECG module charger to charge the module. Use of other chargers may damage the module and/or charger. Do not use the charger on other devices as this may damage the charger and/or device.

**NOTES:**
When not in use, turn off the ECG module to extend battery life.

Charge the ECG module at least once per week.

Keep the charger cover on the ECG module closed, except when the module is being charged. This protects the connector from moisture or foreign objects.

Battery Condition

When the module is connected and switched on, the ECG module battery icon on the monitor display indicates the status of the battery.

| | |
|---|---|
| GREEN: | The battery is good; greater than 7 hours of continuous use remaining |
| YELLOW: | The battery is low; less than 7 hours of continuous use remaining. Charge the module as soon as possible. |
| BLACK: | The battery is dead or no communication. Check the power switch and the fiber optic cable. Recharge the battery prior to use. |

Charging the Battery

Charge the ECG module at least once per week using the provided charger. Charge the module only when it is not in use and not connected to a patient.

1. Plug the charger into an AC outlet, outside the magnet room.
2. Ensure the ECG module is disconnected from the patient and that the module power switch is in the OFF position.
3. Open the charger cover on the ECG module.

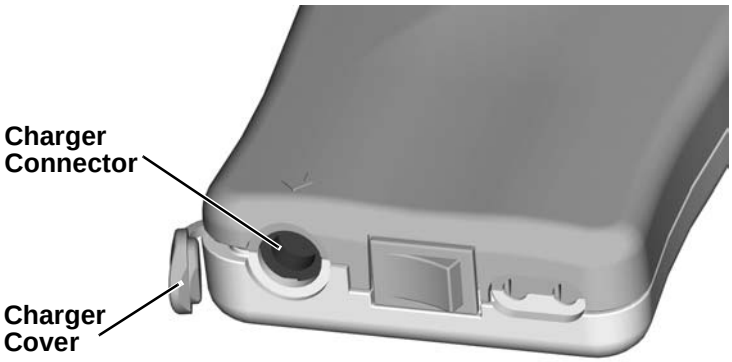



**Figure 5-9: Charger Connector Detail**

4. Align the arrow on the charger cable with the arrow on the ECG module and insert the cable firmly into the module.

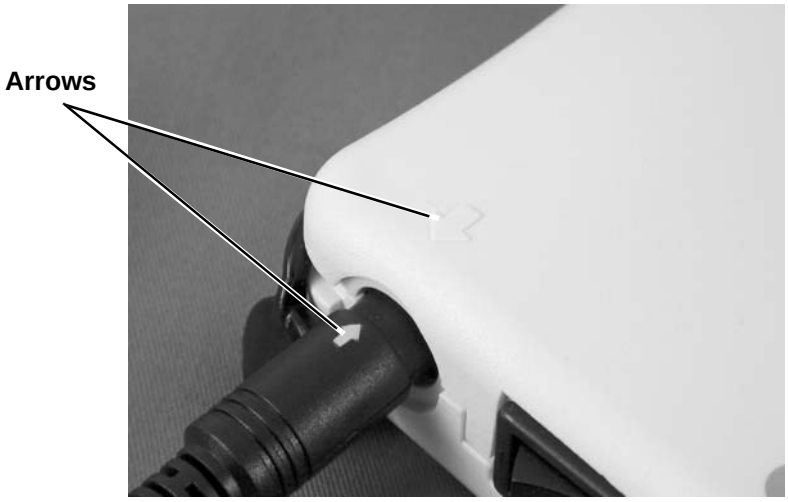



**Figure 5-10: Align the Arrows**

5. Confirm that the module is charging by observing the indicator on the charger and using the instructions printed on the charger.

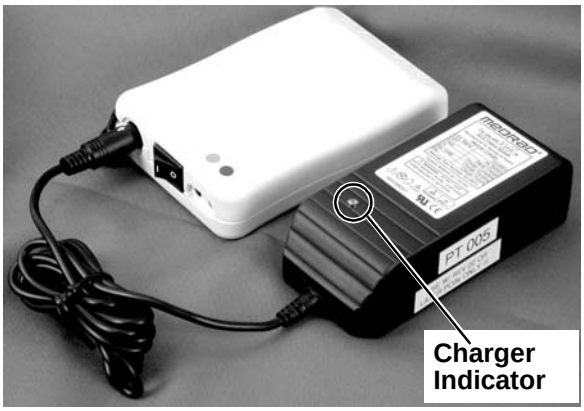



**Figure 5-11: Charging with Indicator Light**

6. The ECG module charges in 3 hours or less. Observe the charger indicator to determine when the module is fully charged.
7. Remove the charger cable from the module and close the charger connector cover.

## ECG Monitoring

### Patient Preparation

Proper patient preparation and placement of the electrodes is the single most important factor in obtaining a good ECG signal.

1. Have a thorough understanding of the patient's history. This may assist in determining where electrodes are placed.
2. Prepare the patient by ensuring that hair is removed from the locations where you intend to place the electrodes. Use Nu-Prep gel with cotton gauze or a washcloth. A small amount of Nu-Prep gel should be applied to the cotton gauze or wash cloth. The area where the electrode is to be placed should then be thoroughly cleaned by rubbing it in a circular motion.
3. ConMed Invisitrace electrodes are recommended for use with the ***Veris*** monitor. They should be placed on the prepared locations ensuring that they securely adhere to the skin surface.

   **NOTES**:
   Do not use alcohol. Alcohol removes electrolytes from the skin and decreases the quality of the electrical contact.

   Medrad recommends the use of ConMed Invisitrace electrodes. These electrodes are MRI compatible. See "Accessories" in Appendix D for a complete list of recommended electrodes and accessories.

   Use three (or five) new, MR-compatable electrodes.

**⚠WARNING⚠**

- Connect only MEDRAD approved 3-lead or 5-lead ECG cables from the patient to the ECG module. Do not connect any other signal source to the ECG module.
- When positioning the patient in the MR scanner, locate the electrodes less than four inches from each other and do not loop the leadset. Insulate the leadset from the patient. It is not dangerous for loops to form in the fiber optic cable.

**⚠CAUTION⚠**

- Use only accessories designated for use with this monitor. Use of accessories not designated for use with the ***Veris*** monitor can cause inaccurate measurements and/or a safety hazard for the patient.
- Do not allow the conductive parts of the patient electrodes to contact other conductive parts, including ground (earth).

**⚠CAUTION⚠**

- Static magnetic fields can cause reversible electrocardiogram changes. Determine only rate and rhythm with the patient in the presence of a static magnetic field.
- High Frequency (HF) surgical equipment may affect the operation of the ECG unit. The system is not designed to operate in the presence of ESU interference.

Lead Placement

The monitor provides ECG options for 3- and 5-lead patient setups. The following instructions describe both the 3- and 5-lead configurations. It is important to use the MEDRAD recommended leadset to ensure patient safety.

**⚠CAUTION⚠**

- When positioning the patient in the MR scanner, locate the electrodes less than four inches from each other and do not loop the leadset. Insulate the leadset from the patient.

**3-LEAD SETUP**

The three major planes that detect electrical activity are Lead I, Lead II, and Lead III, known as the standard or conventional bipolar limb leads. Lead II (RA and LL), commonly known as the standard lead configuration, is often used for monitoring because its waveform characteristics are typically most prominent. For general monitoring purposes, Leads I and II are most commonly used.

- Lead I produces good P waves, reflecting atrial activity.
- Lead II produces good QRS complexes, reflecting ventricular activity.

Place the electrodes on the patient as shown in the illustration below. Leads I, II, III may be selected in the monitor's *DISPLAY* window.

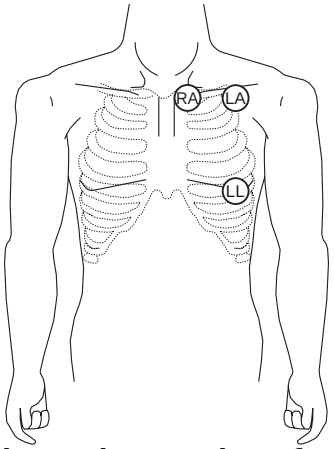



**Figure 5-12: Electrode Locations for 3-Lead Setup**

**5-LEAD SETUP**

Place the electrodes on the patient in the 5-lead configuration as shown in the illustration below. Leads I, II, III, aVL, aVF, aVR, or V may be selected in the monitor's *DISPLAY* window.

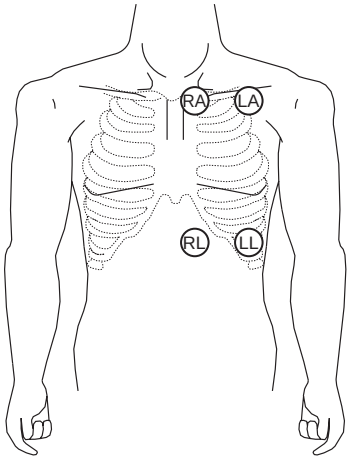



**Figure 5-13: Electrode Locations for 5-Lead Setup**

The V lead (chest lead) in a 5-lead configuration can be placed in one of six standard positions.

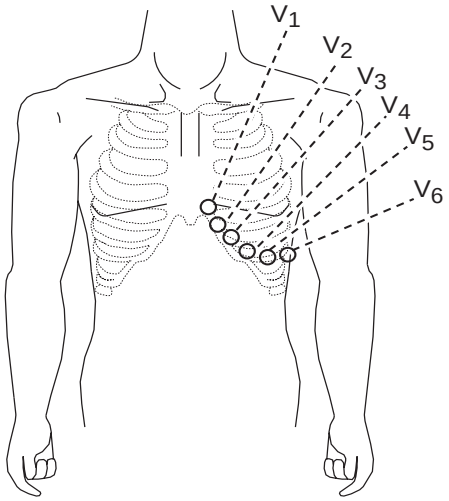



**Figure 5-14: Electrode Locations for the V Lead**

Connecting Patient to the Monitor

**NOTE:** Inspect the ECG module cable and connections regularly for signs of mechanical damage (e.g., cracked insulation, crimped, or bent wires).

1. Attach the electrodes as described in “Lead Placement” on page 5-12 and following.
2. Press the ON/OFF or STANDBY button on the ***Veris*** monitor.
3. Make sure the ECG function is *ON*.
   a. Select the *PARAMS* menu with the menu knob.
   b. Select *ECG*.
   c. Rotate and press the menu knob to select *ON*.
4. Choose the appropriate lead set cable and select this on the monitor.
   a. Select the *PARAMS* menu with the menu knob.
   b. Select *LEAD SET*.
   c. Rotate and press the menu knob to select the correct lead set.
   d. Select *EXIT* to return to the main display.
5. Connect the color-coded graphite lead wires to the corresponding connections on the ECG module.

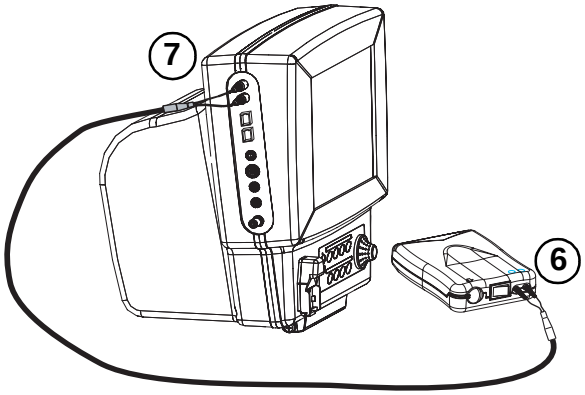



**Figure 5-15: ECG Module Connected to Monitor**

6. Connect the color-coded fiber optic cable to the corresponding colors on the ECG module.
7. Connect the color-coded fiber optic cable to the corresponding ECG connections on the main monitor.

**NOTES:**
To remove the fiber optic ECG cable, grip the cable connectors at the end of the cable and pull back firmly. Do not pull on the fiber optic cable to remove it from the monitor or ECG module.

To remove the lead set from the ECG module, grip the connectors at the module end of the lead and pull straight out. Do not pull on the leads themselves.

The ECG leads and connections should be inspected regularly for signs of mechanical damage (e.g., cracked insulation, crimped or bent wires).

8. Turn on the ECG module. The ECG module battery icon should display on the monitor screen.

   GREEN: Communication is established and the battery is good.

   YELLOW: Communication is established but the battery is low.

   BLACK: Communication is not established or the battery is dead.

   An informational message should appear that the leads are not connected to the patient.

9. Setup the display for the desired lead set combinations.

   a. Select the *DISPLAY* menu with the menu knob.

   b. Select the desired waveform.

   c. Select an ECG lead combination and configure other display parameters. See “DISPLAY Softkey” on page 2-27 for a detailed description of configuring the display.

10. Keep the ECG module outside of the patient imaging volume.

    **NOTES:**
    Position the ECG module out of the imaging plane. (On the shoulder if scanning the chest or torso or in the antecubital space if scanning the neck or head.)

    Make certain that the ECG module is stationary (not moving or vibrating).

11. Carefully attach the color-coded lead set to the electrodes (White=RA, Black=LA, Red=LL, Green=RL, and Brown=V), ensuring good connections.

12. The ECG waveform(s) should display on the monitor in approximately 5 seconds.

Completion of ECG Monitoring

To remove the ECG module cable, grip the cable connectors and pull back firmly. Do not pull on the cable to remove it from the monitor.

**ECG Auto Lead Switching**

The monitor may have the ability to display alternate leads in cases of fault in the selected lead while the unit is set for 5 lead ECG.

The monitor uses the RA electrode in deriving all lead views. Therefore, failure of the RA electrode results in no leads being available. The monitor identifies the RA electrode as having failed with the message *ECG LEADS OFF*. The same message displays when both the LA and LL electrodes fail.

Lead failure assumes that the signal is lost from an electrode that is required for the desired lead view. Loss of a signal from unnecessary electrodes does not cause lead switching.

Primary Lead

The monitor identifies a primary lead that is used to report heart rate numerical data. If no leads are displayed, the primary lead defaults to lead II. If ECG waveforms are displayed, the monitor selects the waveform closest to the top of the screen as the primary lead. Lead switching only occurs in the primary lead view.

Lead failure during monitoring causes one of the following results:

1. If a failure occurs in the primary lead, while currently being displayed, the system attempts to switch from the current lead view to an alternate lead view.

   The system switches to a valid (non-failed) lead view if a valid lead exists. The failed electrode is indicated by an alarm message. The slot label of the primary lead visibly changes to the new lead view. The alternate waveform is drawn in the slot.

2. If the failure occurs for Lead II, while no ECG leads are displayed, the primary lead is changed to an alternate lead. The smart heart rate is determined from the new lead view. No lead switching is apparent from the main screen.

3. If no alternate is available for a primary lead, an *ECG: LEADS OFF* alarm is generated. The smart heart rate defaults to the next available source, indicated by a change of the heart rate numerical display. No lead switching occurs.

4. If the required electrodes for a displayed non-primary lead are not available, an error message displays. The waveform becomes a straight line. No lead switching occurs.

When the lead fail condition is corrected, the system reverts back to the original lead that displayed before the fail condition occurred.

Alternate Lead Priority

The ECG monitor automatically determines lead switching as shown below.

**NOTE:** Lead switching is only available in 5-lead setup.

| **5 Lead** | | | | | |
|---|---|---|---|---|---|
| **Electrode Off** | **LL** | **LA** | **RA** | **V** | **RL** |
| Primary Lead | Alternative Lead | | | | |
| Lead I | NONE | II | III | — | — |
| Lead II | NONE | — | III | — | — |
| Lead III | NONE | II | — | — | — |
| Lead V | NONE | II | III | II | — |
| Lead aVL, aVR, aVF | NONE | II | III | — | — |

In cases indicated by a dash, no switching occurs, since the electrode is unused for that selected lead. In cases where LL fails, no switching occurs because that electrode is required for each selectable lead configuration.

**Gating Interface**

The source of the gating signal may arise from the ECG or $SpO_2$. The gating signal from either of these sources may be delivered to the scanner in two user-selectable forms—waveform or pulse.

- **Waveform output**: one of the following: 1mV ECG waveform or a plethysmogram ($SpO_2$) waveform.
- **Pulse output**: 1mV pulse amplitude and 50 msec pulse width, synchronous with the r-wave or corresponding peak of the plethysmogram ($SpO_2$) waveform.

The delay time from detection of the ECG signal at the patient to the input of the MR scanner is less than or equal to 5 milliseconds.

**Waveform Output** 

**Pulse Output** 

One of two icons appears in the upper left corner of the heart rate numerical display box. These icons represent the gating signal output—either waveform or pulse. The icon is the same color as the ECG waveform color. See Step 6 below.

The gating function is user-selectable: *OFF*, *ECG Waveform*, *ECG Pulse*, *$SpO_2$ Waveform*, or *$SpO_2$ Pulse*. The default is *OFF*.

1. Connect the cable appropriate for the scanner to the GATING connection on the ***Veris*** patient monitor.

   **NOTE:** The gating cable must be IEC 950 or IEC 60950 compliant.

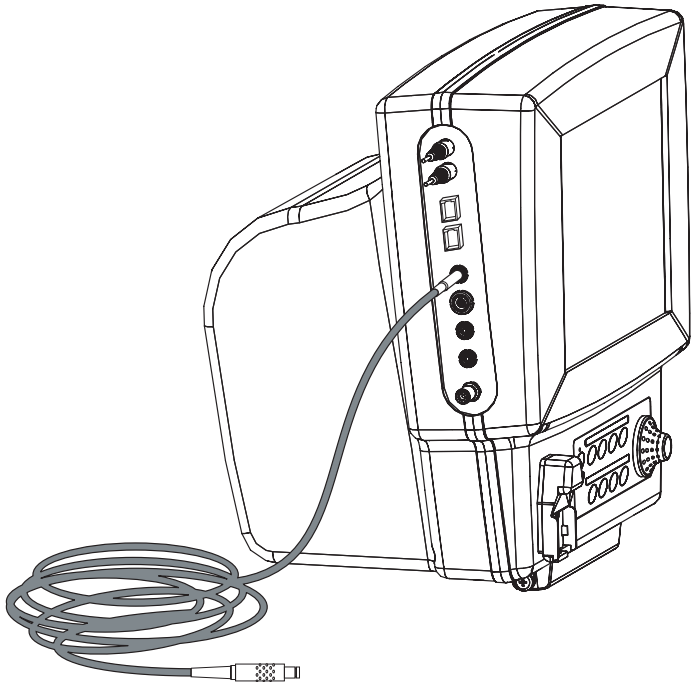


**Figure 5-16: ECG Gating Connection**

2. Connect the MR scanner end of the cable to the scanner interface receptacle.

   **NOTES**:
   To remove the gating cable, grip the cable connectors from both ends and pull back firmly. Do not pull on the gating cable to remove it from the monitor or scanner.

   Inspect the gating cable and connections regularly for signs of mechanical damage (e.g., cracked insulation, crimped, or bent wires).

3. Setup the display for the desired lead view for the gating source in the *Waveform 1* position.

   a. Select the *DISPLAY* menu with the menu knob.

   b. Select *Waveform 1*.

   c. Select the ECG lead to use for the ECG gating source. See “DISPLAY Softkey” on page 2-27 for a detailed description of configuring the display.

4. Using the *PARAMS* menu select *Gating* and then select either *ECG Wave* or *ECG Pulse*.

5. Configure the scanner in accordance with the manufacturer’s recommendations. If using the universal EGC gating cable, always select Lead II on the scanner console.

   **NOTE:** In the event that the desired lead view is not available, the monitor switches to alternate lead views if possible, using the priorities specified in “ECG Auto Lead Switching” on page 5-16.

6. An ECG waveform displays if the ECG waveform is selected for gating. If a pulse is selected a spike appears in place of the waveform. The waveform or “spike” is transmitted to the MR system.

   **NOTE:** Always select *LEAD II* on the MR scanner console. If you wish to use another configuration (I, II, III, aVL, aVR, or aVF), make this change at the ***Veris*** 8600 patient monitor. Selecting a lead configuration other than II at the MR scanner console may result in incorrect or no gating action.

7. The *LEAD SELECT* control on the patient monitor can select either *LEAD I*, *II*, or *III* (or, with 5-lead configuration, *aVL*, *aVR*, or *aVF*).

8. In the event one of the leads is disconnected, *LEAD OFF* displays on the patient monitor screen.

# 6 — NIBP

## Theory of Operation

The monitor uses ComfortCuff™ technology to determine non-invasive blood pressure by means of oscillometry. The oscillometric method detects volume displacements within the artery and senses pressure variations within the blood pressure cuff during inflation. The monitor uses cuffs ranging in size from neonate to adult thigh.

### Heart Rate

The NIBP pulse rate is used if the ECG, the $SpO_2$, and the IBP pulse rates are not available. See “Heart Rate” on page 5-1 for more information.

### Comfort Cuff™ Technology

ComfortCuff™ technology measures NIBP while the cuff inflates. Consequently, a measurement is obtained more quickly and with less discomfort than with monitors which measure NIBP during cuff deflation.

### Description of NIBP Measurement

The NIBP cuff begins to inflate at the beginning of the NIBP measurement cycle. As the cuff pressure approaches the diastolic pressure of the patient, the cuff pressure waveform begins to indicate the pulse waveform (see “Figure 6-1: NIBP Cuff Pressure and Pulse over Time” on page 6-2). The cuff pressure at this point is equal to the patient’s diastolic pressure, which is stored by the monitor.

As cuff pressure continues to increase, the pulse waveform (as measured from BP cuff pressure fluctuation) becomes stronger, reaching its maximum at the patient's mean arterial pressure (i.e., when cuff pressure = mean BP). The monitor stores this value as mean pressure.

As cuff pressure increases further, it approaches the patient’s systolic pressure, and the cuffs pulse waveform decreases in amplitude. The cuff pulse waveform disappears at the point where cuff pressure is equal to the patient’s systolic pressure.

When the monitor determines that the cuff waveform has decreased to zero amplitude, it stores the cuff pressure value as the systolic pressure, and releases the pressure from the cuff. This typically occurs at about 10 mmHg over the patient’s systolic pressure. The cuff then rapidly deflates.

### NIBP Clinical Testing and Accuracy

This device was clinically tested per the requirements of EN 1060 and AAMI SP-10. The NIBP module as installed in the ***Veris*** 8600 monitor has been tested to meet the performance specifications listed in this manual.

Cuff Inflation and Pressure Protection

The maximum cuff inflation rate is 15 mmHg/sec. The software limits inflation to 300 mmHg adult, 300 mmHg pediatric, or 150 neonate. A secondary circuit limits maximum possible cuff pressure to 316 mmHg in adult/pediatric mode and 158 mmHg in neonatal mode. Cuff pressure is allowed to remain above 30 mmHg for a maximum of 2 minutes.

The monitor automatically deflates the cuff if the time limit is violated. The monitor contains hardware protection for overpressure conditions, pressure transducer failures, or microprocessor and pump control circuit failures.

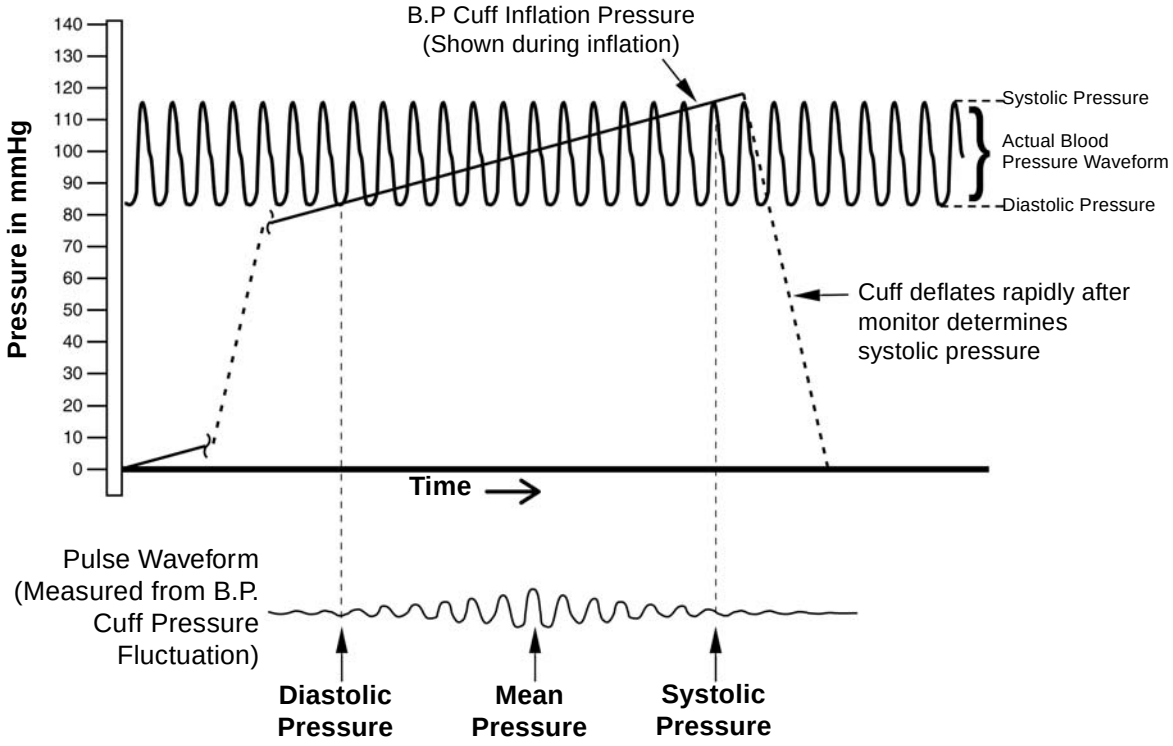



**Figure 6-1: NIBP Cuff Pressure and Pulse over Time**

**NIBP Monitoring**

The following instructions describe procedures for preparing a patient for monitoring using the ComfortCuff™ NIBP module.

Shown below is the monitor with an adult size blood pressure cuff and 5 meter extension tubing. This adult arm cuff is one of many blood pressure cuffs available. Use only NIBP accessories recommend by MEDRAD. See “Accessories” in Appendix D.

The monitor has a quick connect/disconnect fitting for the NIBP extension tubing. The patient end of the tubing has a threaded fitting that accepts any MEDRAD NIBP cuff.

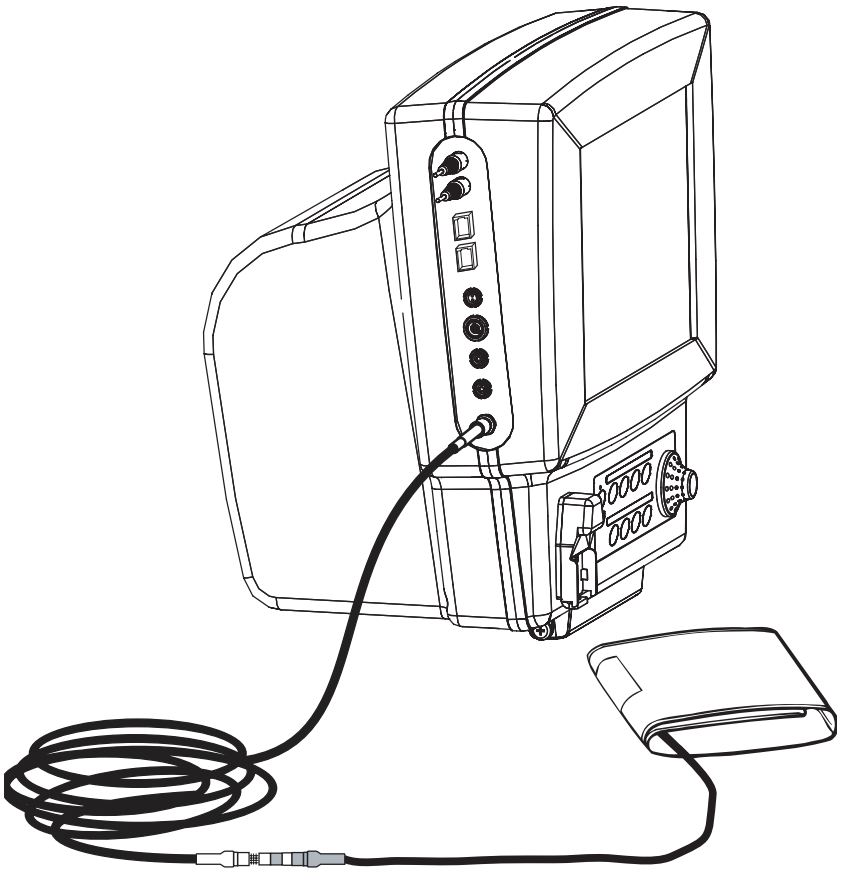


**Figure 6-1: NIBP Cuff Connection**

**⚠WARNING⚠**

- Check the patient frequently to ensure the NIBP cuff is not causing prolonged impairment of the patient’s circulation.
- Repeated use of the STAT mode should be avoided. Prolonged or repeated use can lead to patient bruising.

**⚠CAUTION⚠**

- Proper cuff size and placement is essential for accurate blood pressure measurement.
- The accuracy of noninvasive blood pressure readings may be adversely affected by the presence of drugs or therapies which alter the patient's cardiovascular dynamics.
- The sensitivity of blood pressure measurement may be affected when monitoring patients with intra-aortic balloon pumps.
- Ensure that the NIBP extension tubing is not compressed or restricted in any way.

**NOTE:** The interval timer does not start until the NIBP key is pressed.

**Selecting Cuffs and Hoses**

MEDRAD blood pressure cuffs and extension tubes are recommended for use with this monitor. Use of other brands of cuffs may cause inaccurate measurements.

Proper cuff size and placement is essential to assure accurate blood pressure measurement. The recommended cuff width-to-length ratio is about 2:1, so that if the cuff width is 40% of arm circumference, the cuff bladder length encircles 80% of the arm. A cuff that is too narrow results in falsely high pressure readings. A cuff that is too wide results in falsely low pressure readings.

The cuff shown below on the left is too small for the arm, therefore, full cuff pressure is never applied to the artery. This causes an erroneously high blood pressure reading. The cuff shown on the right is of adequate width for the arm, and full cuff pressure is applied to the brachial artery.

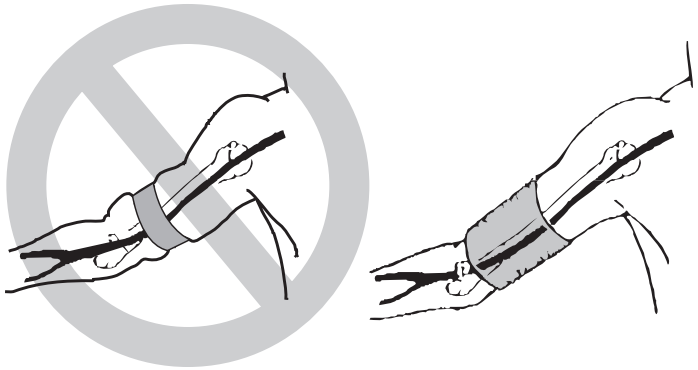


**Figure 6-2: Blood Pressure Cuff Size**

Cuffs for thighs are available for large patients or those where neither arm is available for cuff placement. Blood pressure measured at the thigh is typically 20-30 mmHg higher (when the patient is standing, not prone) than blood pressure measured at the upper arm.

Cuffs for pediatric and neonate patients are also available in a variety of sizes. See “Accessories” in Appendix D for available cuffs.

**Placing the NIBP Cuff**

Wrap the cuff snugly around the extremity, leaving enough room between the cuff and the extremity for two fingers. If the cuff is too loose, it cannot be inflated properly and may cause errors in measured BP values.

- It is best to wrap a bare extremity; putting the cuff over clothing may cause errors in measured values.
- Care should be taken to center the dot on the cuff directly over the brachial artery. (Shown below as a circle with a vertical line).
- The extension tube should not be twisted or kinked.

The end of the cuff (marked by an index line) should fall inside the range marked clearly on the inside of the cuff. If not, use a different size cuff.

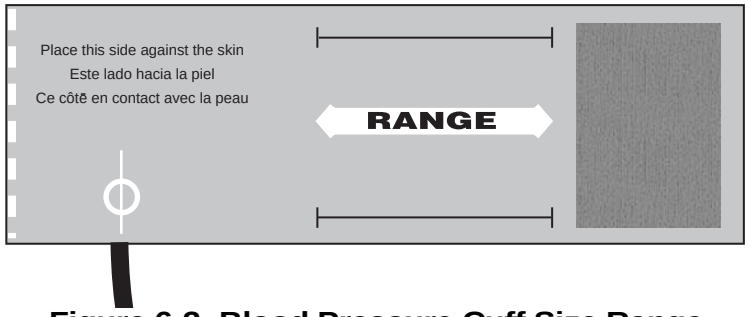



**Figure 6-3: Blood Pressure Cuff Size Range**

**Procedure**

1. Check the System Status Line for the correct mode. The status line indicates *Adult*, *Pediatric*, or *Neonate*.
2. Select a cuff as described previously in this section.
3. Connect the BP cuff to the extension tube.
4. Connect the extension tube to the monitor.
5. Secure the cuff around the patient's extremity.
6. Make sure there are no kinks or other obstructions in the extension tube extending from the cuff.
7. Press the NIBP key on the front keypad of the monitor.

Pressing the NIBP key causes the monitor to take one measurement. The monitor may make a second attempt if there is excessive motion during the first attempt to take a measurement.

Press momentarily the NIBP CYCLE/STAT key to begin taking Stat NIBP measurements. NIBP measurements are then taken repetitively for 5 minutes. The numerical parameters on the display are updated with each measurement.

If an NIBP cycle time has been selected the monitor automatically takes NIBP measurements at scheduled intervals. Press the NIBP key to begin measuring at automatic intervals.

If the monitor is placed in *STANDBY MODE* or *AGENT ALARM STANDBY MODE*, the monitor does not take NIBP cycle time readings.

**Taking NIBP Measurements**

For optimum accuracy, the patient should keep the cuffed part of the arm at the same level as the heart. NIBP measurement points above the level of the heart give reduced pressure values. Measurement points below the heart level give increased values. These errors are due to the weight of the blood.

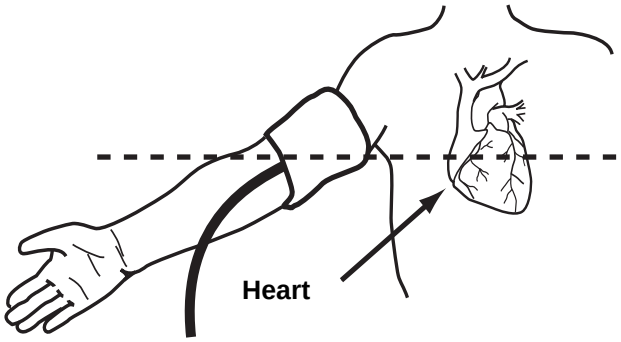



**Figure 6-4: Arm Position for NIBP Measurement**

An average measurement on a non-moving patient takes less than 40 seconds. At the end of each measurement, the cuff automatically deflates. The monitor automatically attempts a second measurement (with no displayed error message) if it cannot calculate a blood pressure on the first inflation.

If a patient experiences a sudden dramatic drop in blood pressure, the system may not measure the blood pressure on the first attempt. The system automatically attempts another pressure measurement, and detects the change on the second attempt.

Do not compress the cuff or the extension tube externally. Compression of the cuff or the extension tube causes measurement error. For optimum accuracy, the patient should remain still during blood pressure measurement. Excessive patient motion may adversely affect any oscillometric NIBP device.

# 7 — $SpO_2$

## Theory of Operation

The monitor uses Digital Oximetry (DOX™) technology to measure blood oxygen saturation ($SpO_2$).

### Heart Rate

The $SpO_2$ pulse rate is used if the ECG and the IBP pulse rates are not available. See “Heart Rate” on page 5-1 for more information.

### Definition

Hemoglobin exists in the blood in several forms:

- Oxygenated (Oxyhemoglobin)
- Reduced (Deoxyhemoglobin)
- Dyshemoglobins (carboxyhemoglobin and methemoglobin.)

In the monitor, $SpO_2$ (pulse arterial oxygen saturation) is the ratio of oxygenated hemoglobin to the sum of oxygenated hemoglobin plus hemoglobin which is available for binding to oxygen, as expressed in the following formula:

$$\text{percent oxygen saturation} = \frac{\text{oxyhemoglobin}}{\text{oxyhemoglobin} + \text{deoxyhemoglobin}} \times 100$$

Dyshemoglobins, such as carboxyhemoglobin and methemoglobin, are not directly measured and therefore are not factored into the measurement.

### DOX™ Digital Oximetry

The monitor does not use analog circuitry for signal processing. Digital signal processing in the microprocessor results in lower noise from circuitry components, resulting in a cleaner signal and better performance under low perfusion conditions. There is also improved rejection of noise from the patient and environment, due to the availability of the “true,” unfiltered sensor signal for digital signal processing.

### Method

The digital pulse oximeter measures oxygen saturation and pulse rate using the principles of spectrophotometry and plethysmography. The sensor is completely non-invasive, and there is no heat source that could burn the patient.

The pulse oximeter sensor contains two types of LEDs. Each type emits a specific wavelength of light. Since oxygenated hemoglobin and deoxygenated hemoglobin absorb light selectively and predictably, the amounts of these two compounds can be determined by measuring the intensity of each wavelength that passes through the measuring site.

The light from the LEDs shines into a pulsating vascular bed. A photodetector located opposite or alongside the LEDs measures the intensity of each wavelength transmitted through the monitoring site. The light intensity is converted to an electrical signal, which is input to the monitor. The effects of skin pigmentation, venous blood, and other tissue constituents are eliminated by separating out the pulsating absorption data.

### $SpO_2$ Clinical Testing and Accuracy

All MEDRAD oximeters (DOX™ compatible) have $SpO_2$ calibration tables which were originally generated by monitoring desaturated human patients or volunteers and matching their displayed $SpO_2$ value to the value determined by sampling arterial blood and measuring functional $SaO_2$ with a clinical laboratory grade multi wavelength optical oximeter (i.e. CO-oximeter). The final $SpO_2$ calibration curve was then generated based upon numerous patients' data over the range of 40 to 99% $SaO_2$. All accepted data were taken from patients with dyshemoglobin (i.e., carboxyhemoglobin, methemoglobin) concentrations near zero.

This oximeter is a two-wavelength device, which is calibrated to measure functional $SpO_2$ only when dyshemoglobin concentrations are near zero. The accuracy specifications of this device will not be met with high concentrations of dyshemoglobins. Significant concentrations of carboxyhemoglobin results in a higher displayed $SpO_2$ value than is actually present in the patient.

Special MR-compatible sensors help provide for patient safety in the MR environment because the sensor cable is made of a material that does not conduct electricity even if the cable is looped within the MR scanner. For the same reason, the sensor and cable are immune to electromagnetic interference, such as might be produced by high frequency (HF) surgical equipment. Each MR-compatible sensor uses a fiber optic light guide to carry light from the light sources to the patient. A separate light guide brings light, which has passed through the patient, to the light detector. The light sources and detector are located in the connector housing of the fiber optic sensor.

### Gating Signals

The input gating signal is derived from any one of two sources—ECG or Plethysmogram ($SpO_2$) waveform and is available in 2 user-selectable forms, pulse or waveform. An icon of the gating signal source and a visual indication appears at the upper left corner of the heart rate numerical display box.

#### $SpO_2$ GATING

$SpO_2$ gating is dependent upon the patient's peripheral perfusion at the location where the sensor is placed. The pulse oximeter sensor is placed on the selected location of the patient. The signal generated from the patient's pulse is transmitted through fiber optic cables to the transducer portion of the $SpO_2$ cable where it is converted to an electrical signal. The electrical signal is sent to the ***Veris*** monitor and then to the scanner which may be used to trigger the sequence.

**SpO$_2$ Monitoring Procedures (Pulse Oximetry)**

The following instructions describe procedures for preparing a patient for SpO$_2$ monitoring.

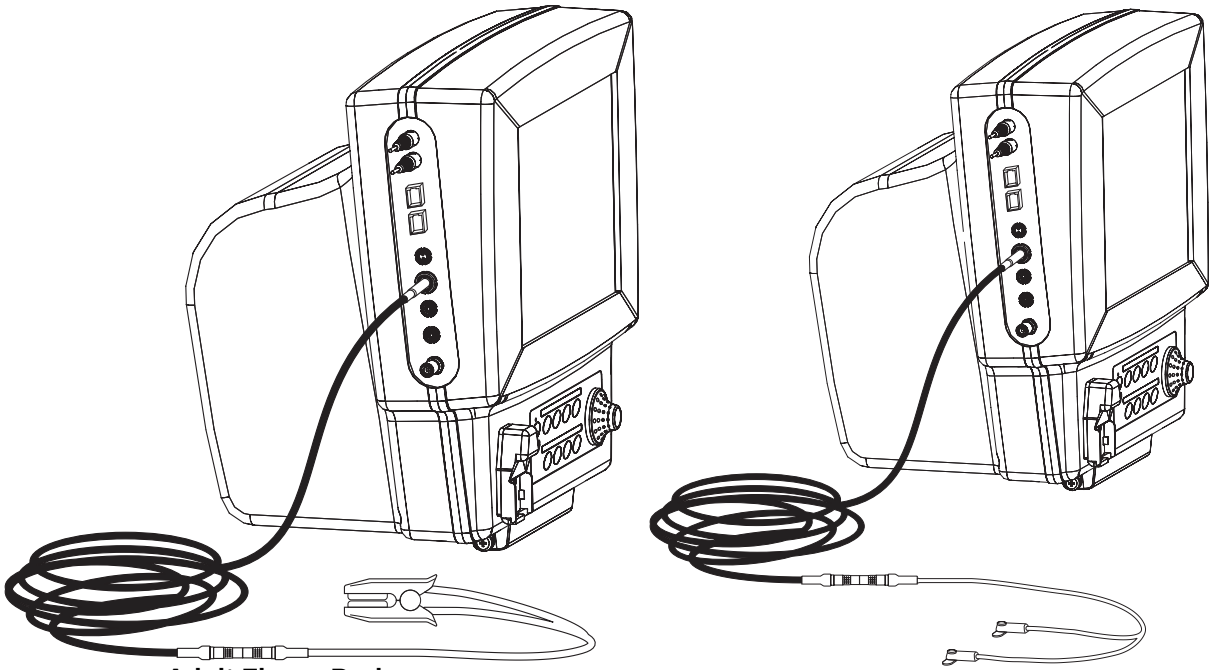
There are three SpO$_2$ sensors available:

- Adult finger-toe clip
- Pediatric finger-toe clip
- Neonate probe

Shown below are two of these attached to a sensor extension cable.

The sensor is connected to the ***Veris*** monitor by means of an extension cable. The sensor extension cable contains electrically conductive material. Do not extend or coil the SpO$_2$ sensor extension cable into the magnet bore.

The monitor's SpO$_2$ extension cable accepts only fiber optic sensors.



**Adult Finger Probe** **Neonate Probe**

**Figure 7-1: Sensor Connection for SpO$_2$**

**⚠CAUTION⚠**

- The pulse oximeter sensor may cause skin irritation and pressure necrosis. Inspect the pulse oximeter sensor site every two to four hours or per hospital protocol. Move the sensor to a different location if skin irritation is present.
- Excessive amounts of motion at the sensor sites may cause errors in reading. Attempt a reading when motion has stopped, or move the sensor to another site.
- The sensor extension cable contains electrically conductive material. Do not coil or extend the sensor extension cable into the magnet bore!
- To remove the $SpO_2$ connector, grip the connector's retaining ring (in the middle of the connector) and pull back gently. The retaining ring slides back and unlocks the connector. Do not attempt to unscrew.

**Attaching the Probe to the Monitor**

1. Press the ON/OFF or STANDBY button to turn on the monitor.
2. Connect the $SpO_2$ sensor extension cable to the monitor. Align the red dot on the monitor's $SpO_2$ receptacle with the red dot on the black $SpO_2$ connector housing. Push the connector firmly into the receptacle.
3. Select the appropriate probe and attach the probe to the patient (refer to the next section). Attach the probe's connector to the $SpO_2$ sensor extension cable.

**Attaching the Probe to the Patient**

Select the appropriate probe and application technique from the following pictures and descriptions. The selected probe should be cleaned before use.

**⚠CAUTION⚠**

- Attaching the probe too tightly to the skin may generate inaccurate readings (by reducing blood flow to the target area) and cause blisters on the patient's skin. (Lack of skin respiration, not heat, causes the blisters.)
- The protection against the effects of electric shock of the Pulse oximeter function is of type BF. This protection is contained in the fiber optic sensor cable.

**⚠CAUTION⚠**

- Fiber optic sensors can be damaged if subjected to severe stress, such as pulling, bending, or crushing. The sensor (including the connector cable) should not be stepped on, jerked or bent into a very tight arc (radius less than 2 inches). It is recommended to use tape to strain-relieve the fiber optic cable to the patient couch before attaching the sensor to the patient.
- Reposition the probe at least once every 24 hours to allow the patient's skin to respire.
- Do not extend or coil the $SpO_2$ sensor extension cable into the magnet bore. There is a potential for thermal heating of the extension cable, caused by the interaction between the MR system's RF energy and the electrically conductive sensor extension cable.
- Use only oximeter probes supplied with, or specifically intended for use with, the ***Veris*** 8600 patient monitor.
- Significant levels of dysfunctional hemoglobins, such as carboxyhemoglobin or methemoglobin, affects the accuracy of the $SpO_2$ measurement.
- $SpO_2$ measurement may be affected in the presence of high ambient light. Shield the probe area (with a surgical towel, for example) if necessary.
- Dyes introduced into the bloodstream, such as methylene blue, indocyanine green, indigo carmine and fluorescein, may result in inaccurate $SpO_2$ readings.
- Any condition that restricts blood flow, such as use of a blood pressure cuff or extremes in systemic vascular resistance, may cause an inability to determine accurate pulse and $SpO_2$ readings.
- The light source portion of the $SpO_2$ sensor must be properly positioned over the nail bed for the plethysmographic waveform to appear.
- The $SpO_2$ waveform display is not necessarilly directly proportional to pulse volume. The $SpO_2$ waveform display is not automatically gain adjusted.
- Remove fingernail polish or false fingernails before applying $SpO_2$ probes. Fingernail polish or false fingernails may cause inaccurate $SpO_2$ readings.

Finger Probe Application for Adults

1. Attach the finger probe to the patient as shown. Be sure to fully insert the patient's finger into the probe. Run the fiber optic cable away from the hand. For patients with long fingernails, use the neonatal probe.
2. Apply the sensor with the light source positioned directly over the nail-bed, and the detector over the fleshy portion of the finger.

**NOTES:**
Do not tape over the pulse oximeter sensor housing. Taping over the housing may cause injury and sensor failure due to excessive pressure. If the sensor needs to be secured, place tape over the cable, immediately behind the sensor.

The sensor must be properly positioned for a plethysmographic waveform to appear. Placing tape too tightly around an extremity reduces blood flow, thus diminishing the amplitude of the plethysmographic waveform.

If possible, do not place the pulse oximeter sensor on the same extremity as the blood pressure cuff or an arterial line. Place the pulse oximeter sensor on the side of the patient opposite the blood pressure cuff or an arterial line. The occlusion of the blood flow during blood pressure determinations could affect saturation readings.

The pulse oximeter sensor is light sensitive. Too much ambient light makes it difficult for the system to provide accurate readings. The system provides a high ambient light alarm message when it is necessary to shield the sensor from extraneous light sources such as phototherapy light or infrared heating lamps.

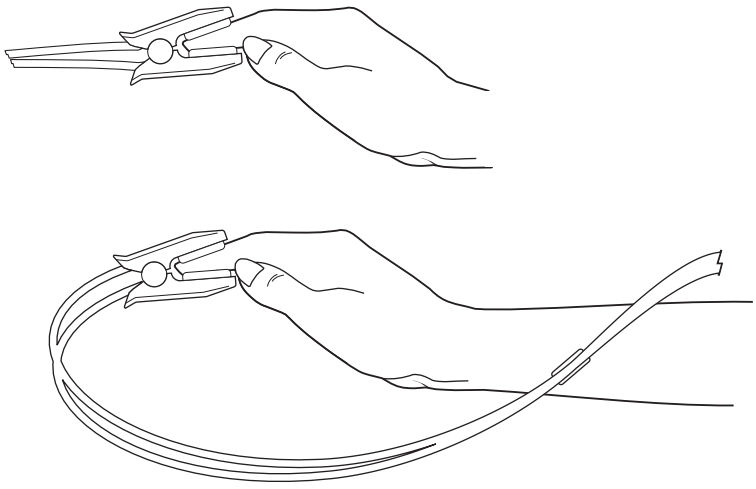


**Figure 7-2: Finger Sensor Placement**

Neonate Probe Placement

In situations where a finger sensor is not practical, a MEDRAD neonate probe can be used. The sensor pads are small, light-weight, and adjustable.

The neonate probe can be placed using adhesive tape. Special care should be taken not to restrict blood flow in the finger tip.

**TAPE PREPARATION OF NEONATE PROBE**

Attach the two sides of the neonate probe to a pre punched neonate tape strip as shown in “Figure 7-3: Tape Prep for Neonate Probe Placement”. Select either the standard or small separation as appropriate. When using the neonate probe on a toe, it can be helpful to cut the tape strip along the length.

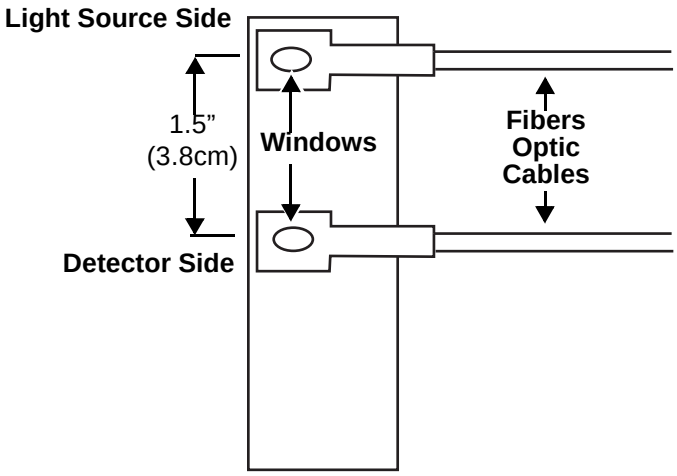



**Figure 7-3: Tape Prep for Neonate Probe Placement**

**FINGER**

**NOTE:** Proper application of the neonate probe on the finger is essential. See “Figure 7-4: Neonate Probe Finger Placement”

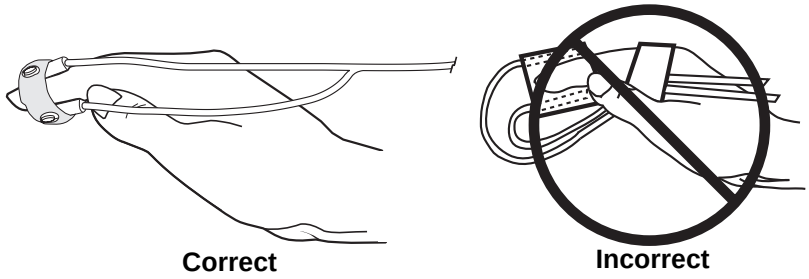



**Figure 7-4: Neonate Probe Finger Placement**

1. Attach the neonate probe to a pre punched neonate tape strip as shown in “Figure 7-3: Tape Prep for Neonate Probe Placement”. Select either the standard or small separation as appropriate.

2. Remove the backing from the light source side of the neonate tape.

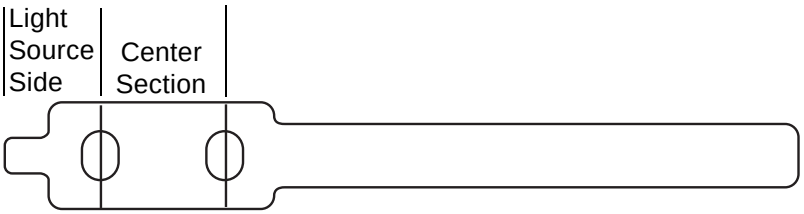



**Figure 7-5: Neonate Probe Tape**

3. Attach the neonate probe to the patient with the light source side to the fingernail.
4. Remove the backing from the center section of the neonate tape. See “Figure 7-5: Neonate Probe Tape” on page 7-8.
5. Line up the light source side with the detector side so the source and detector are in the same plane.

   **NOTE:** The fiber optic cables run along the finger toward the wrist.
6. Remove the backing from the remaining portion of the tape and secure the probe and cable. Do not to over-tighten the tape.

**TOE**

1. Attach the neonate probe to a pre punched neonate tape strip.
2. Remove the backing from the light source side of the neonate tape. See “Figure 7-5: Neonate Probe Tape” on page 7-8.
3. Attach the probe to the patient's toe as shown with the light source side on the toenail.

   **NOTE:** The fiber optic cables run along the foot toward the heel.
4. Remove the backing from the center section of the neonate tape. See “Figure 7-5: Neonate Probe Tape” on page 7-8.
5. Line up the light source with the detector side so the source and detector are in the same plane.
6. Remove the backing from the remaining portion of the tape and secure the sensor and cable with neonate tape being careful not to over-tighten the tape.

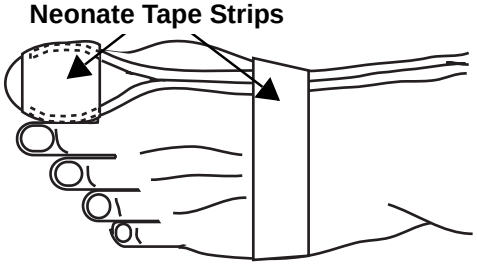



**Figure 7-6: Neonate Probe Toe Placement**

**FOOT (INFANTS)**

1. Attach the neonate probe to a neonate tape strip.
2. Remove the backing from the light source side of the neonate tape. See “Figure 7-5: Neonate Probe Tape” on page 7-8.
3. Attach the neonate probe to the infant's foot as shown in “Figure 7-7: Neonate Probe Foot Placement (Infants)”, just behind the small toe. Attach the sensor with the light source side on the top or outside of the foot to keep the detector side away from ambient light.
4. Remove the backing from the center section of the neonate tape. See “Figure 7-5: Neonate Probe Tape” on page 7-8.
5. Line up the light source side with the detector side, so the source and detector are in the same plane.
6. Remove the backing from the remaining portion of the tape and secure the neonate probe with neonate tape, being careful not to over-tighten the tape.

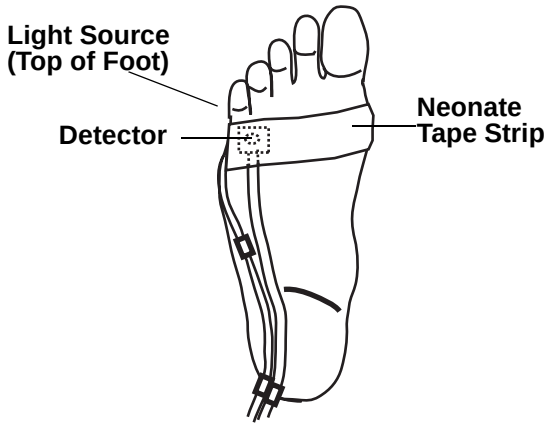



**Figure 7-7: Neonate Probe Foot Placement (Infants)**

### $SpO_2$ Peripheral Gating

Peripheral ($SpO_2$) gating provides an alternative to ECG gating. (See “Gating Interface” on page 5-18.) It utilizes the signal obtained from the pulse oximeter sensor.

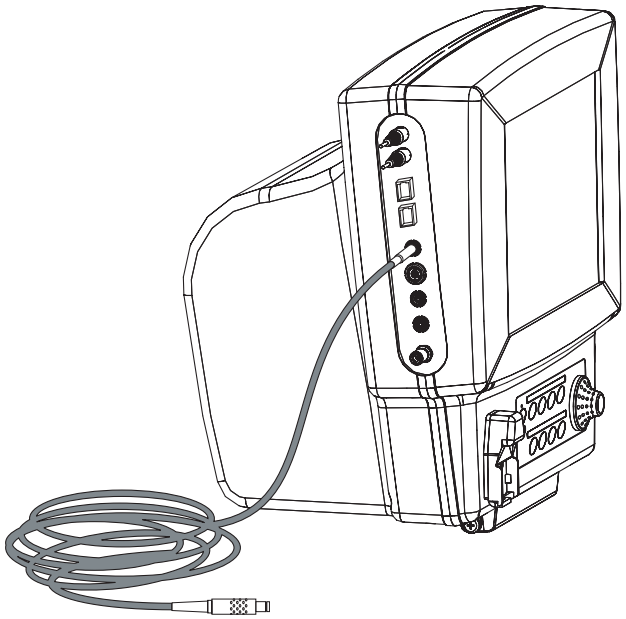


**Figure 7-8: $SpO_2$ Peripheral Gating Connection**

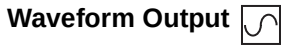
The pulse oximeter signal is obtained from the patient and displayed on the monitor. To utilize the peripheral gating function on the monitor a cable is attached to the GATING connector of the monitor with the distal end connected to the $SpO_2$ receptacle of the MR scanner.

**NOTE:** Gating cables are scanner specific. If a specific cable does not exist for your particular scanner, the universal cable may be used.

The source of the gating signal may arise from the ECG or $SpO_2$. The gating signal from either of these sources may be delivered to the scanner in two user-selectable forms—waveform or pulse.

- **Waveform output**: one of the following: 1mV ECG waveform or a plethysmogram ($SpO_2$) waveform.
- **Pulse output**: 1mV pulse amplitude and 50 msec pulse width, synchronous with the r-wave or corresponding peak of the plethysmogram ($SpO_2$) waveform.

The delay time from detection of the $SpO_2$ signal at the patient to the input of the MR scanner is less than or equal to 20 milliseconds.

**Waveform Output** 

**Pulse Output** 

One of two icons appears in the upper left corner of the heart rate numerical display box. These icons represent the gating signal output—either waveform or pulse. The icon is the same color as the $SpO_2$ waveform color when $SpO_2$ is selected for gating.

The gating function is user-selectable: *OFF*, *ECG Waveform*, *ECG Pulse*, *$SpO_2$ Waveform*, or *$SpO_2$ Pulse*. The default is *OFF*.

1. Connect the cable appropriate for the scanner to the GATING connection on the ***Veris*** patient monitor.

   **NOTE:** The gating cable must be IEC 950 or IEC 60950 compliant.

2. Connect the MR scanner end of the cable to the scanner interface receptacle.

   **NOTES**:
   To remove the gating cable, grip the cable connectors from both ends and pull back firmly. Do not pull on the gating cable to remove it from the monitor or scanner.

   Inspect the gating cable and connections regularly for signs of mechanical damage (e.g., cracked insulation, crimped, or bent wires).

3. With the menu knob select the *PARAMS* menu.
4. At *Gating* select either *$SpO_2$ Wave* or *$SpO_2$ Pulse*.
5. Configure the scanner in accordance with the manufacturer's recommendations.

# 8 — IBP

## Theory of Operation

The IBP monitoring module is intended for direct pressure monitoring using an intra-arterial catheter, a continuous flushing system, and an IBP transducer. The IBP module provides analog to digital conversion of the transducer signal.

The IBP module processes continuous digital patient data that can be displayed as waveform and numerical values. The module supports up to two separate IBP channels simultaneously. For arterial and pulmonary artery IBP measurements the numerical values for systolic, diastolic, and mean pressure are computed and displayed.

### Heart Rate

The IBP pulse rate is used if the ECG pulse rate data is unavailable. See “Heart Rate” on page 5-1 for more information.

### Method of Measurement

The IBP module uses standard invasive pressure monitoring techniques. A bridge transducer is measured by a highly accurate analog to digital converter. The measuring circuit uses a 5 volt excitation voltage that provides a transfer function of 25 micro-volts per mmHg of pressure.

The signal is buffered and brought to the A/D converter, which is configured for a full scale signal of ±25 millivolts. The circuit has a potential measuring range of ±1000 mmHg of pressure. This range is restricted to -20 to +300 mmHg for actual monitoring purposes. There is no analog amplification of the transducer signal.

The module uses a rate of 50 samples per second for each of the two independent IBP channels. The resulting measurement resolution is slightly less than 0.5 mmHg. The numerical IBP value is reported by the 8600 monitor at a resolution of 1 mmHg.

Non-pulsatile IBP sites (LA, RA, CVP, or ICP) are reported as mean numerical values. The non-pulsatile mean value is an average of the last 200 samples taken over a period of approximately 4 seconds. The values for pulsatile sites (ART, PA, RV, and LV) are reported as an average of the last eight calculated values.

The IBP heart rate is reported as an average of the last 16 heart rate values. The software also scans for sudden changes in heart rate and overrides the averaging function when the condition occurs.

### IBP Clinical Testing and Accuracy

The invasive blood pressure module is in compliance with applied standard IEC 60601-2-34 and has been tested to meet the performance specifications listed in this manual. The module as installed in the ***Veris*** monitor has been clinically tested for performance with a variety of patients and specific disposable invasive blood pressure transducers.

**IBP Monitoring**

Invasive Blood Pressure (IBP) allows monitoring of Real-Time Invasive Blood Pressure with the use of a Blood Pressure Transducer. The transducer converts the hydrostatic signals into electrical signals which are displayed graphically on the monitor.

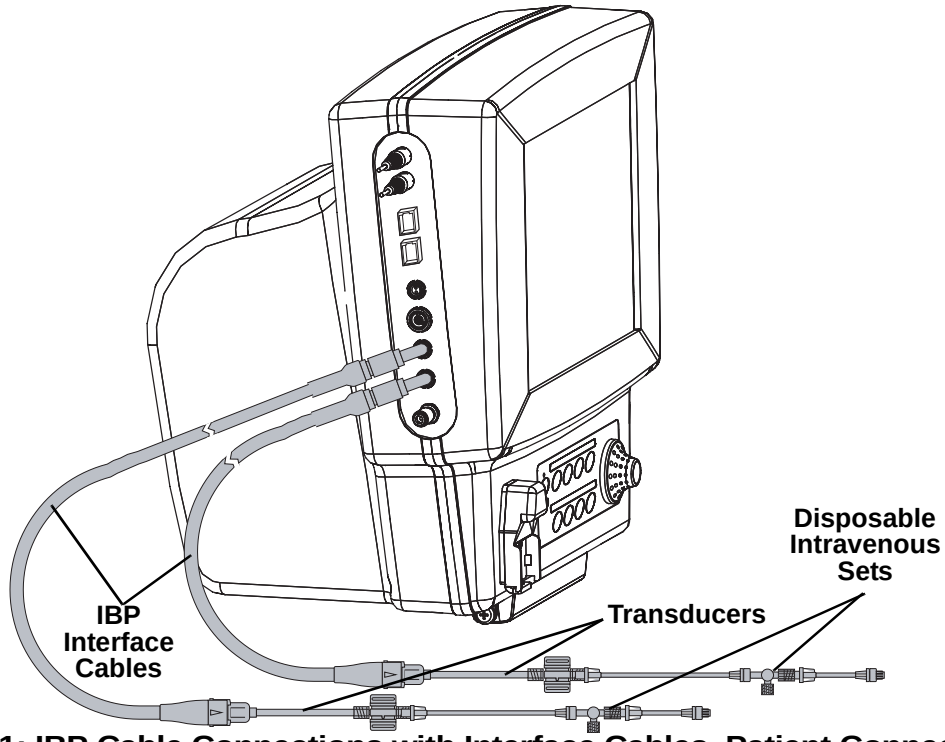



**Figure 8-1: IBP Cable Connections with Interface Cables, Patient Connections**

**Invasive Blood Pressure Transducers and Interface Cables**

As for all accessories, cables and transducers should comply with UL and IEC standards for medical equipment. Use only pressure transducers which have been recommended by MEDRAD. Please note that MEDRAD does not sell or distribute transducers. The following are examples of disposable transducers which meet the Medrad specification of an electrical cable that does not exceed 14 inches in length:

- Abbott Transpac IV (REF 42582-05)
- B. Braun Combitrans (REF 5202620)
- Edwards/Baxter Truwave (REF PX600F & PX260)
- Medex Transtar (REF MX950)

**⚠WARNING⚠**

- Use transducers whose electrical cable length does not exceed 14 inches. Failure to follow this instruction could produce a patient burn or shock hazard resulting in serious injury or death.

IBP Interface Cable

There are 4 IBP interface cables. Each one is specific for a particular transducer. The cables can be connected to the monitor through IBP1 (Port Channel 1), IBP2 (Port Channel 2), or both.

Transducer specifications and the interface cable which fits each specific type are listed in Appendix F: "IBP Transducer Specifications”.

**⚠WARNING⚠**

- Failure to follow proper invasive blood pressure monitoring and insertion techniques may cause clots leading to cerebral or pulmonary embolism resulting in serious patient injury or death. Follow all manufacturer’s instructions and precautions provided with the transducer and intra-arterial catheter.
- Do not coil or extend the IBP interface cable in the magnet bore. This could result in patient shock or burn. All cables must be straight, not coiled, and routed down the center of the scanner table.
- Use transducers with an electrical cable length of 14” or less.

**⚠CAUTION⚠**

- Do not place the IBP transducer in the bore of the magnet. This could result in degraded measurement accuracy. Ensure the transducer is outside of the magnet bore.
- Place only the disposable tubing portion of the IBP kit in the magnet bore to ensure patient safety and improve measurement accuracy. Use a disposable set which is a minimum of four feet (1219 mm) in length.
- Calibrate (zero), the transducer when changing or modifying transducer tubing.
- When changing or modifying a transducer tubing set, ensure that the entire fluid path is free of air bubbles. Do not allow air bubbles to enter the the catheter.

**IBP Monitoring Procedure**

The following instructions describe procedures for preparing a patient for invasive blood pressure monitoring. We recommend IBP transducers that have a required specification of 5 microvolts/mmHg. and the frequency response at 20 hertz. There are several to choose from.

Each IBP channel has its own dedicated IBP port that is located on the side of the monitor.

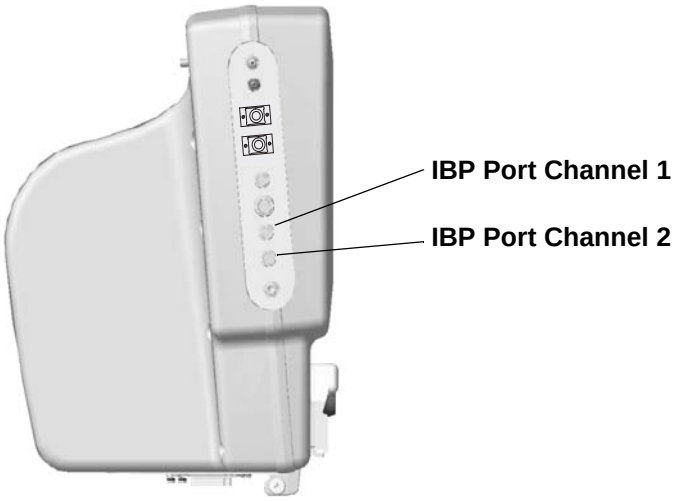



**Figure 8-2: IBP Ports**

The IBP ports are customized 5-pin female sockets and are designed to accept only MEDRAD compatible IBP interface cables.

The transducer specifications and information for obtaining transducer cables is located in Appendix F: "IBP Transducer Specifications" of this manual.

IBP Safety

**⚠WARNING⚠**

- Do not extend the distal portion of the transducer with the micro-chip into the bore of the magnet.

**⚠CAUTION⚠**

- The accuracy of invasive blood pressure readings may be adversely affected when used on patients with intra-aortic balloon pumps.
- For accurate performance, IBP transducers must conform with the specification designated by MEDRAD, Inc. Follow the instructions provided with your transducer.
- Accuracy of the IBP measurement can be affected by poor setup of the transducer or fluid system. Follow hospital protocols for invasive blood pressure monitoring.
- Possible shock hazard. Avoid using metal components in IBP fluid systems.

Setup and User Calibration

The IBP monitoring system requires the clinician to periodically calibrate the monitor. The air vent stopcock of the transducer is opened and the transducer is exposed to the ambient room pressure. The monitor reads the transducer signal and makes adjustments to compensate for small changes in the transducer and/or ambient pressure.

This operation is described as having “zeroed” the IBP monitor. Each time a new IBP site is setup, the clinician must zero that channel. The channels may be zeroed together or independently.

Although waveforms are always present, the monitor does not show numerical values until the monitor is zeroed. While the monitor calibrates, it is possible to observe the correction of the waveform.

The monitor must be zeroed when:

- The monitor is powered up.
- The transducer is changed or the cable is re-inserted.
- The patient size is changed; *Adult*, *Pediatric*, or *Neonatal* Mode.

It is recommended that the IBP channels be zeroed at least every 8 hours when sustained IBP monitoring is necessary.

To zero the IBP channels for monitoring:

1. Setup the IBP fluid system and transducer according to hospital protocols.
2. Verify that the correct alarm limits are entered into the *ALARMS* window of the monitor.

3. Connect the IBP interface cable to the ***Veris*** monitor.
4. Connect the appropriate IBP interface cable to the transducer.
5. The monitor displays the message *NOT ZEROED* in the informational alarm line. The message appears independently for each channel.

   **NOTE**: If a waveform slot is set to display IBP, the monitor shows a waveform immediately. This waveform is representative of the physiological patient data, but is not yet scaled until the IBP lines are properly zeroed. No numerical values are displayed for a channel until it has been zeroed.
6. Select *PARAMS* and open the first window of parameters.

```
EXIT

HR Source                    Smart
Gating                       OFF
ECG                          ON
 Cable                       5 lead
 Filter                      Monitor
 Display Range               MEDIUM
 Auto lead switching         YES
 Color                       ¤

IBP 1  SITE ART RANGE 0 TO 200  ZERO None Color ¤
IBP 2  SITE CVP RANGE 0 TO 20   ZERO None Color ¤



NIBP                    ON            GASES         ON
 NIBP tone              NONE
 Color                  ¤

ECG/IBP/SPO2 Tone Vol   5
Other Params Menus      No Action
```

**Figure 8-3: Setting IBP in the PARAMS Window**

**NOTE**: The example window shown contains factory default values. Reset the parameters as required for actual monitoring conditions.

7. Verify that the channels are set to the correct IBP sites.
8. Verify that the pressure range is set correctly.

9. Set the transducer to the zero calibration position. Generally this requires opening a stopcock on the transducer to allow an ambient room pressure reading. Follow the directions for your transducer.
10. Go to the *PARAMS* window by selecting and pressing the *PARAMS* softkey with the menu knob.
11. Go to the *IBP 1* or *IBP 2* parameters. Move the cursor to the *ZERO* selection item in the *PARAMS* window. Set *ZERO* to *One* to begin zero calibration.

    **NOTE**: The *ZERO* setting can be changed to *All* to begin zero calibration of both IBP channels at the same time. The stopcock must be open on each transducer to be zeroed.
12. When you zero the channel, numerical values appear in the IBP box in the lower right corner of the main display. The message *ZERO GOOD* briefly appears.
13. Exit the *PARAMS* window.
14. Return the transducer to its normal monitoring position. The numerical values for pulsatile IBP sites appears and displayed IBP waveforms resume their normal shape.

**NOTE**: the monitor cannot calibrate to a zero offset that exceeds ± 150 mmHg. The monitor reports a *ZERO FAIL* message. Contact MEDRAD Service or your local representative if you cannot zero the monitor.

**NOTE**: According to information I found and conversion used: at an elevation of 2,000 meters (6,561.7 ft.) the transducer will not calibrate.

Zero Calibration (Quick)

You can quickly zero the IBP channels using the softkeys on the main menu.

1. Open the transducers to atmosphere pressure.
2. Turn the menu knob to highlight *ZERO IBP1* (or *ZERO IBP2*) from the main menu.
3. Press in the menu knob to begin the zero calibration of the selected IBP channel.
4. Wait until the message *ZERO GOOD* appears in the alarms message area.
5. Close the transducers.

Clinical Use and Arterial Waveforms

A variety of physiological conditions alters the appearance of the IBP pressure waveforms. Conditions such as hypertension, shock, obstruction of the aorta, aortic valve disease, and pericarditis can affect the arterial pressure waveform.

The arterial waveforms may also be affected by poor setup. The more common problems affecting arterial waveforms are overdamping, catheter whip and lack of periodic calibration.

Overdamping is caused by air bubbles, thrombus formation at the tip of the catheter, or lodging of the catheter tip against the vessel wall. Overdamping exhibits itself as a poorly defined waveform without a noticeable dicrotic notch.

Catheter whip is caused by excessive movement of the catheter tip within the vessel. Catheter whip exhibits itself as an erratic or noisy waveform.

As described above, zero the IBP channels at least every eight hours or according to hospital protocol.

Disparity between invasive and non-invasive blood pressure values normally occurs due to the difference in the measurement technique. Cuff pressure (NIBP) tends to be 5 to 10 mmHg lower than invasive (IBP) measurements. This disparity can be even more pronounced in hypothermic patients and with poorly arranged IBP tubing.

**NOTE**: Position transducers at the same height as the patient's heart for optimal measurement accuracy.

# 9 — Temperature

## Theory of Operation

The ***Veris*** monitor uses a fiber-optic thermometer to measure temperature. This provides accurate and reliable measurements in the MRI environment.

This sensor probe features an environmentally inert, non-conductive, non-metallic, miniature probe, making it ideal for harsh operating conditions like the MRI environment, which includes conditions where high levels of electromagnetic interference (EMI) such as RF field or high voltages exist. The probe itself is inert to chemical and biological agents and is ideally suited to applications where a completely non-reactive sensor is required or where other types of sensors would malfunction or become damaged.

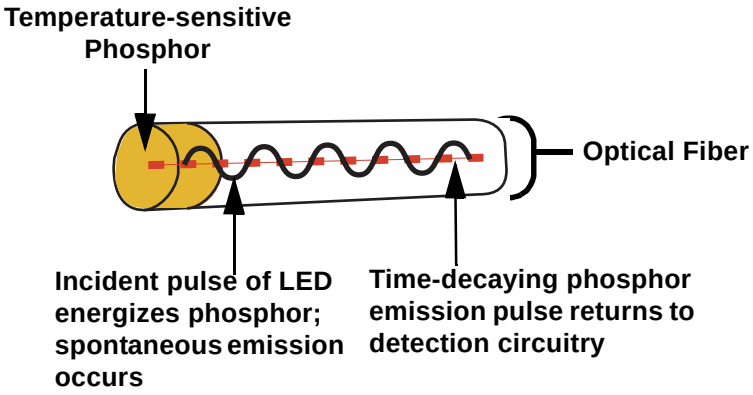



**Figure 9: Temperature Probe Signals**

The temperature system is comprised of a probe, a fiber optic cable, and the optoelectronic sensor head containing detection optics, signal processing, and interfaces. The probe itself contains a patented, highly temperature-sensitive phosphor as its sensing element, and both the probe and phosphor are protected by a fluoropolymer sheath. The standard cable length is 3 meters.

The temperature system uses a fluorodecay sensing technique. Pulsed light from an LED is sent down the optical fiber to energize the phosphor. The time decaying glow of the phosphor changes with temperature and is transmitted back to the sensor head where it is converted to a temperature reading. The temperature system uses a unique ratio measurement system to minimize inaccuracies due to signal loss from the fiber and connector.

The temperature system is fully calibrated at the factory.

**Temperature Monitoring Procedures**

The ***Veris*** monitor system provides for two temperature probes, allowing for patient temperature measurements from two different locations. The user is not required to use both probes simultaneously nor is one probe dominant over the other.

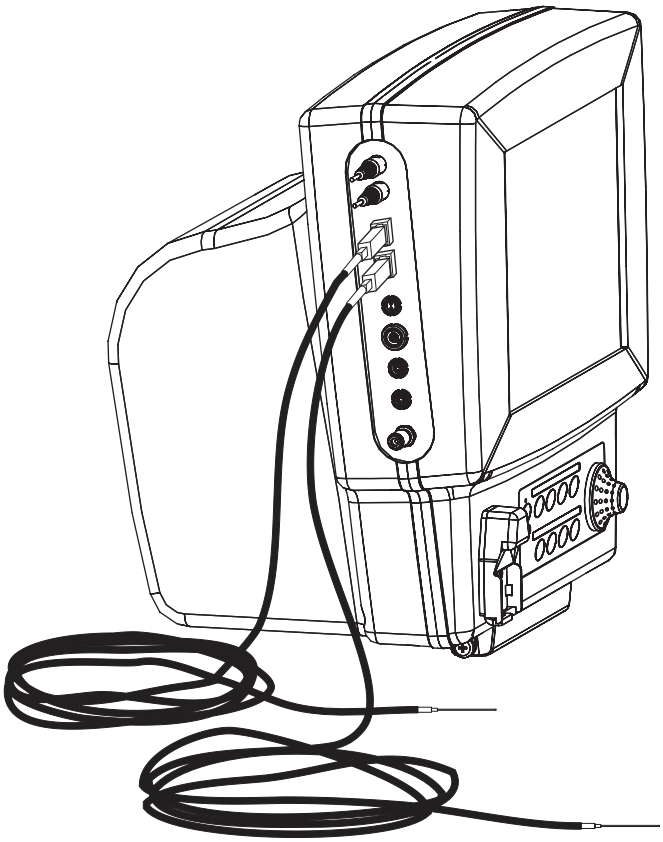


**Figure 9-1: Temperature Probe Connection**

Skin surface temperature monitoring is intended for the detection of hypothermic and hyperthermic conditions. The skin temperature sensor is designed for placement on the surface of the skin only.

To insure the proper performance of the temperature accessories, follow the precautions listed below.

**⚠WARNING⚠**

- Skin abrasion and tissue burn hazard! Separate the monitor and temperature cables from electrocautery systems; keep both active and ground electrodes of the electrocautery system in close proximity so that the temperature sensor is outside the radio-frequency current field.

**⚠CAUTION⚠**

- Forced mating of the connectors without proper alignment may cause damage to the connectors and interruption in electrical continuity and optical alignment.
- During use, do not entwine the cable with other electrical cables.
- To remove the temperature connector, press on the locking clip and pull straight out. Do not pull on the temperature sensor cable to remove the temperature connector from the monitor.
- Fiber optic sensors can be damaged if subjected to severe stress, such as pulling, bending, or crushing. The sensor (including the connector cable) should not be stepped on, jerked, or bent into a very tight arc (radius less than 1 cm). It is recommended to use tape to strain relieve the fiber optic cable to the patient couch before attaching the sensor to the patient.
- Reposition the probe at least once every 24 hours to allow the patient's skin to respire.

## Directions for Use with Skin Surface Probe

### Preparing the Equipment

1. Press the ON/OFF or STANDBY button to turn on the monitor. Check the monitor settings for the correct setup.
2. Connect the temperature probes to the monitor.

   **NOTE:** Take care to align the temperature sensor plug so that the locking clip on the plug lines up correctly with the receptacle on the side of the monitor. Forced mating of the connectors without proper alignment may cause damage to the connectors and interruption in electrical continuity.

   **NOTE:** The monitor's temperature connection accepts any MEDRAD fiber-optic temperature accessory.
3. Unwind the cable from the protective card and peel the sensor from the card.

### Attaching the Temperature Probe to the Patient

MEDRAD recommends attaching the temperature probes at either the Axillary or Femoral location as shown in "Figure 9-2: Temperature Probe Locations" below.

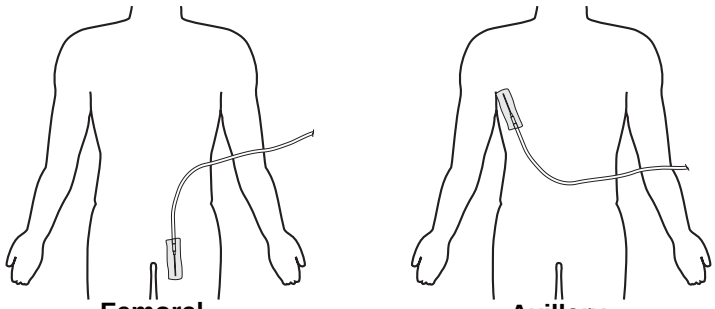



**Figure 9-2: Temperature Probe Locations**

4. Prepare the skin site according to established protocol. Prepare the patient by ensuring that any hair is removed from the location(s) where you intend to place the temperature probe(s).
5. Adhere the sensor to the skin site. Apply tape length-wise along the cable, directly over the flouroptic sensor as well as to the cable sheath.

# 10 — Anesthetic Agents

## Theory of Operations

### Integrated $CO_2$ and Agent Gas Detector

The integrated detector measures carbon dioxide ($CO_2$), nitrous oxide ($N_2O$), and five halogenated anesthetic agent gases using the same sample collection path and testing apparatus. The analyzer uses proprietary High IQ™ technology to identify and quantify agent gases. There are no moving parts, reducing size of the detector and enhancing reliability.

The ***Veris*** monitor uses the sidestream method of measuring $CO_2$ and anesthetic agent gases. Gas is drawn through a nasal cannula or sample line. The gas sample enters the monitor from a sampling tube into a water trap, which removes water vapor and particulate matter from the gas sample. The gas then enters the $CO_2$ (agent) detector where it is analyzed.

### Agent Gas Measurement

The agent detector samples gas breathed by the patient through a sidestream circuit. It measures the concentrations of $CO_2$, $N_2O$, and halogenated anesthetic agents in the sampled gas. The detector uses far-infrared measurements to identify concentrations of halothane, enflurane, isoflurane, sevoflurane, desflurane anesthetic agents and their mixtures.

The analyzer uses the principles of infrared absorption spectrometry to measure anesthetic gases. The integrated detector determines the concentrations of anesthetic gases and $CO_2$ by measuring the optical absorption of the sampled patient gas at a number of specific wavelengths in the medium to long-wave infrared region.

#### AGENT ACCURACY OF MEASUREMENT

The accuracy of a single agent measurement is defined by the formula,

$$m - (0.04m + 0.1\%) \leq x \leq m + (0.04m + 0.1\%)$$

where "**m**" is equal to the measurement in percent and "**x**" is the tolerance range.

Example of 5% HAL measurement, calculating the high limit of the tolerance range.

$$(5\%\ \text{HAL} \times 0.04_{\text{Reading}}) + 0.1\%_{\text{Absolute}} = 0.3\%$$

$$5\%\ \text{HAL} + 0.3\%_{\text{Tolerance}} = 5.3\%$$

Final tolerance range is 4.7% to 5.3% HAL.

## Gas Monitoring Procedures

The following instructions describe procedures for preparing a patient for $CO_2$, $O_2$, $N_2O$, and agent (AGT) monitoring.

### Sampling Circuit Connections

The monitor uses a sidestream gas sampling circuit composed of a water trap, a sampling line and a sampling device. The water trap is a combination filter and moisture condenser. The same circuit is used for $CO_2$, $O_2$, $N_2O$, and agent monitoring.

Shown below is the patient monitor with a water trap and sample line connection. Please refer to “Accessories” in Appendix D for part numbers.

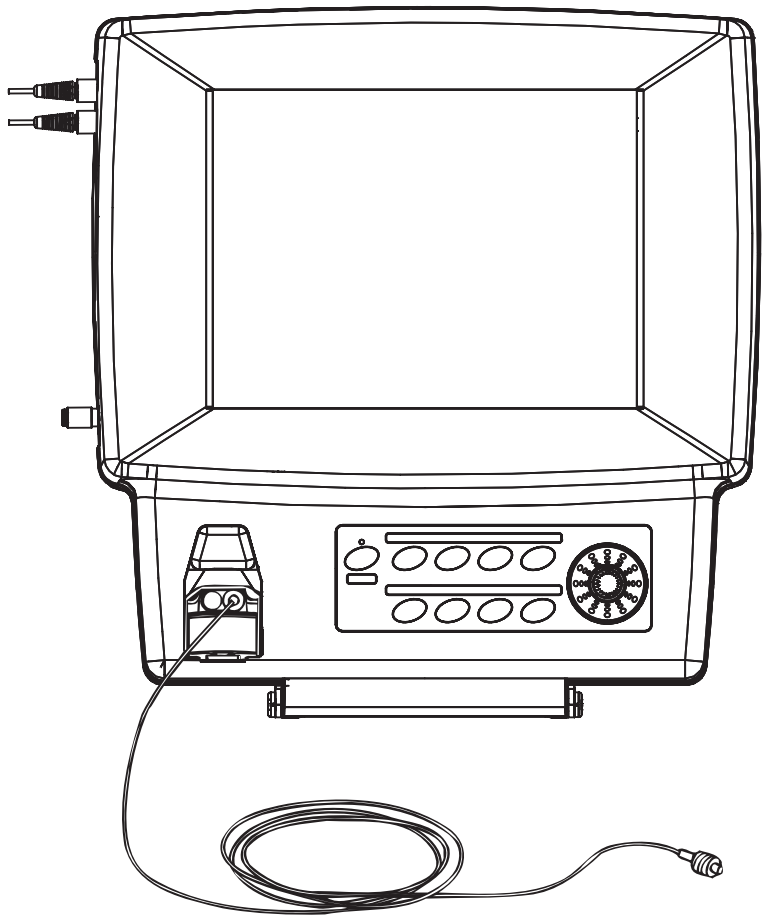


**Figure 10-1: Gas Sampling Connection**

The monitor’s gas sampling connection (from the water trap) accepts gas sampling lines using the Luer style connections. It is important to use the recommended water trap and combinations in order to provide the correct flow rates for monitoring purposes.

## Gas Monitoring Safety

The following instructions describe precautions and contraindications for gas monitoring. Use all safety procedures and protocols for anesthetic safety as designated by your health care facility.

**⚠WARNING⚠**

- Do not use this monitoring system in conjunction with highly flammable anesthetics such as cyclopropane or ether.
- The monitoring system is not intended for monitoring gas mixtures containing methoxyflurane or halogenated hydrocarbons not specifically listed as a monitored gas.
- Environmental pollution of nitrous oxide and halogenated agents may cause accuracy errors. Always use anesthetic gas scavenging systems (AGSS) with the monitoring system.
- Infectious agents may be transferred between patients through the return of the monitor's exhaust to the patient's breathing circuit.
- Infectious agents may be transferred between patients through contaminated masks and nasal cannulas. Change the sample devise and sampling line before use with each new patient.
- Never attach intravenous tubes to gas sampling connections. Gas sampling lines may be inadvertently connected to intravascular fluid systems; allowing air into a blood vessel.
- Use MEDRAD MRI compliant supplied gas cylinders only for verification of gas readings. They are suitable for use in the MRI environment. See “Accessories” in Appendix D for part numbers.

**⚠CAUTION⚠**

- Use only MEDRAD water traps with this monitor.
- Care should be taken to prevent gas tubing from being obstructed in any way by the scanner table or other equipment.
- Change sample lines and sampling devices between each patient. Infectious agents may be transmitted through reuse of sampling lines.
- Do not connect the monitor’s exhaust for return flow to the breathing circuit. Infectious agents may be transmitted through reverse flow from sampling devices.
- Use of longer sampling lines or extensions increases the monitor’s response time and can affect accuracy.

Water Trap

The water trap has a connection located at the top that fits up and into the gas receptacle of the monitor.

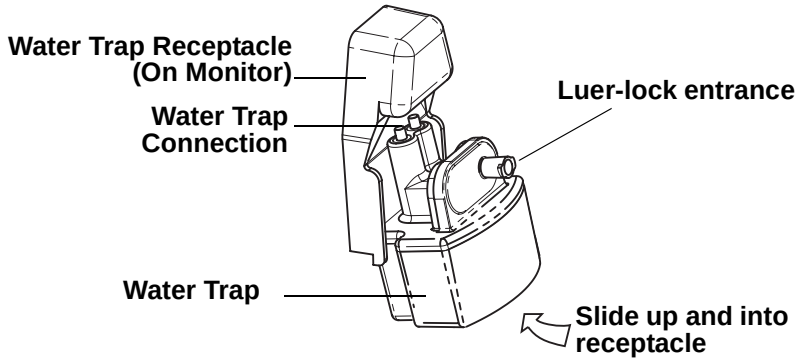



**Figure 10-2: WaterChek™ 2+ Water Trap**

The trap slides out of the front receptacle and can be quickly replaced if it becomes filled or occluded. The front of the WaterChek™ 2+ water trap has a female Luer-lock sampling line entrance.

Sampling Devices

Shown below is a typical gas sampling device (nasal cannula) attached to a sample line. This nasal cannula is used for both $CO_2$, $O_2$, $N_2O$, and agent (AGT) monitoring.

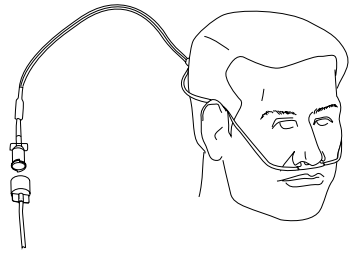


**Figure 10-3: Nasal Cannula**

If using the nasal cannula, position it directly under the patient's nose with the prongs extending into the nostrils. Slide the adjuster forward to close the loop around the head.

The nasal cannula is intended for single patient use only. Alternate sampling devices such as masks may be used if they have a female Luer-locking sampling entrance. Intubation breathing circuits require a sampling entrance near the connection to the endotracheal tube.

The divided nasal cannula delivers $O_2$ and samples for $CO_2$.

Intubated Patients

The monitor can be used with intubated patients. Use recommended water traps and breath circuit adaptors. Check the trap reservoirs regularly. Check the breath circuit regularly for leaks or disconnections. Follow the directions provided with your endotracheal tube for additional precautions.

**⚠CAUTION⚠**

- Additional adaptors between the endotracheal tube and the sampling entrance should not exceed five centimeters.

Standard breath circuit configurations are shown below beginning with a common endotracheal tube with a 15mm outside diameter. The circuit then extends to meet a standard 22mm inside diameter ventilation flex tube. Confirm the proper fit of all breath circuit components before attempting patient monitoring.

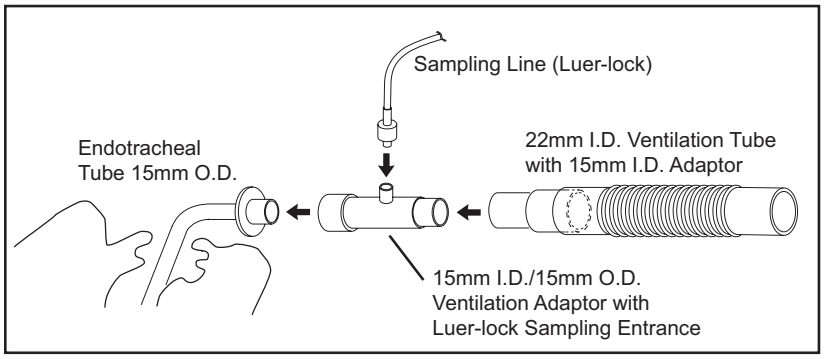



**Figure 10-4: Straight Ventilation Adaptor Setup**

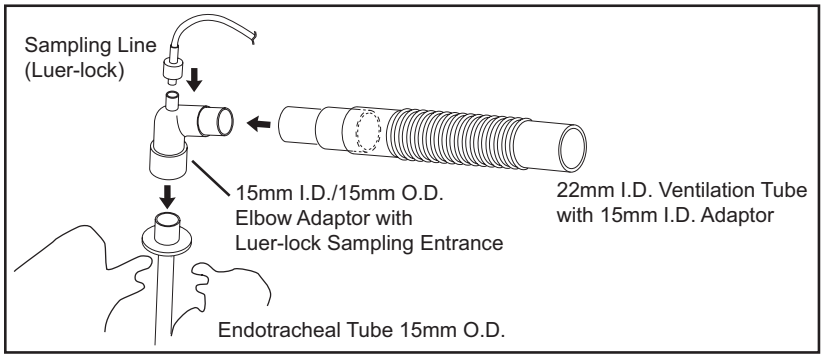



**Figure 10-5: Elbow Ventilation Adaptor Setup**

Calibration and Startup

The monitor automatically begins an auto-calibration sequence when powered up. During this time the monitor may display a flat capnogram for approximately ten seconds. When the calibration and warm up sequence is over the system messages disappear and normal operation begins.

Procedure for Gas Monitoring

1. Check the *Flow Rate* settings in the *PARAMS* softkey window.
2. Slide the WaterChek™ water trap into the gas receptacle of the monitor.
3. If anesthetic agents are being used, attach a scavenging line to the exhaust port at the pedestal of the monitor. A waste gas recovery system should be used.
4. Attach a sample line to the Luer fixture located on the front of the WaterChek™ water trap.
5. Make sure the sampling line is not kinked or pinched.
6. Attach a patient sampling device to the sampling line. Use either a nasal cannula, mask or ventilation tube adapter.
7. Replace sampling devices, lines, and water traps if they become blocked or filled.

Occlusions

The monitor displays a visual message *AGT: OCCLUSION* if the gas sampling system is blocked. If the sampling line or water trap becomes partially blocked, the item should be replaced.

Anesthetic Gas Exhaust Recovery

Always use an exhaust gas recovery system when using anesthetic gasses. A scavenging kit can be used to connect the monitor to a gas scavenging system.

1. Slide the tube over the nozzle of the exhaust port located on the back of the monitor base, near the DC power cord.
2. Connect female Luer-lock end to an exhaust recovery system.

A straight adaptor 19mm O.D./19mm I.D. with a male Luer-lock entrance is provided with the scavenging kit to provide a connection to scavenging tubing.

The monitor displays *AGT: NO EXHAUST* if the scavenging line is blocked.

# 11 — $CO_2$, $O_2$, and $N_2O$

## Theory of Operation

Respiration

Respiration is measured via the $CO_2$ monitoring module and is only available in Anesthesia models.

Capnometry (Measurement of $CO_2$)

The ***Veris*** monitor measures $CO_2$ concentrations and sends data suitable for a continuous waveform display. The monitor also detects end-tidal and fractional Inspired $CO_2$ levels and displays the numerical values. End-tidal $CO_2$ ($EtCO_2$) is defined as the maximum $CO_2$ concentration at the end of expiration. The monitor measures the $CO_2$ concentration and displays the numerical value. The $EtCO_2$ value is updated continuously with each breath cycle. The amount of $CO_2$ in the gas mixture inhaled by the patient is the fractional Inspired $CO_2$ ($FICO_2$).

The monitor measures $CO_2$ using the principles of infrared absorption spectrometry. An unknown concentration of gas ($CO_2$) is calculated by comparing its absorption of infrared light to that of a known standard. The absorption of light is directly related to the concentration of the gas. As infrared light passes through the sample gas chamber, the light transmitted is converted to a voltage signal. The monitor converts the voltage into $CO_2$ concentration data that can be expressed numerically or as waveforms. The Beer's Law calculation is performed by the software of the ***Veris*** monitor.

Infrared analysis of the gas samples is done using Beer's Law. The formula for Beer's Law is as follows:

$$I = I_0 e^{-\varepsilon(\lambda)cd}$$

$I$ Infrared value of measured sample.

$I_0$ Infrared value of light source.

$e$ Exponential function.

$\varepsilon(\lambda)$ Extinction coefficient.

$c$ Concentration of the gas sample

$d$ Distance measured through the sample

**CONDITIONS OF USE**

The ***Veris*** monitor has been calibrated with dry NIST-traceable calibration gases at room temperature and pressure (~ 21C, 740 mmHg). Given the small effect of water vapor on agent gas and $CO_2$ measurements and the monitor's built-in temperature and pressure measurements and compensations, this method of gas analysis per EN 864 is best described as ATPS (Ambient Temperature and Pressure, Saturated; 21C, 750mmHg, 100% Humidity Saturated).

The ***Veris*** monitor is suitable for sustained pressure (breathing circuit) monitoring environments and has been tested per Clause 102 (Sustained Pressure) of EN 864.

**STABILITY OF ACCURACY**

The monitor has an internal barometer and thermistor that allow compensation for changes over a range of temperature and atmospheric pressures. The monitor complies with EN 864 standards for cyclical pressure. The module as installed in the ***Veris*** monitor has been clinically tested for performance with a variety of patients.

## Measuring Oxygen ($O_2$)

The ***Veris*** monitor uses the sidestream method of measuring $O_2$. The gas is sampled from the same gas intake system used in $CO_2$ monitoring. The water trap removes moisture and particulate matter from the gas samples.

**METHOD**

The gas sample is measured using a reactive oxygen cell. The oxygen sensor is a galvanic electrochemical cell that works by a process known as “oxidation reduction.”

Oxygen from the air comes in contact with a highly reactive metal, reacts with the metal and produces a current. As the oxygen reacts, this reactive metal is gradually being used up. Once the metal is used up, the cell is depleted and can no longer sense oxygen.

The cell generates a voltage output proportional to the amount of oxygen in the sampled gas. This oxygen cell has an internal thermistor and circuitry that adjusts the output voltage based on current temperature of the cell.

The voltage is read by the microprocessor and an $O_2$ measurement is generated using predictive circuitry. This predictive function enhances response time of the $O_2$ monitoring module.

The relationship between gas concentration and pressure is calculated by the microprocessor. The numerical value displayed by the monitor ($O_2$ Calculated) is generated using the following formula.

$$O_2 \text{ Calculated} = O_2\text{Measured} \times \frac{20.9}{O_2\text{Ambient}} \times \frac{P_C}{P_0}$$

The measured $O_2$ predictive value is multiplied by a fixed value derived from room pressure divided by room ambient oxygen levels. The measurement is further adjusted by multiplying the ratio of the pressure determined at calibration ($P_C$) with the current pressure ($P_0$).

There is a negligible effect on $O_2$ measurements due to humidity.

**CONDITIONS OF USE**

The $O_2$ function is appropriate for measuring respiratory $O_2$ concentrations in all patient populations. The $O_2$ monitor is suitable for use in breathing systems and with the use of inhalation anesthetic agents.

**STABILITY OF ACCURACY**

The oxygen cell contains temperature correction circuitry. The oxygen sensor temperature is maintained at a nominal 40 degrees Celsius to maintain a consistent performance.

## $CO_2$ Monitoring Procedure

Allow the $CO_2$ monitor to warm up and auto-calibrate before use. It is necessary to have the water trap sampling line attached so that the monitor draws the correct air flow.

When a patient is connected, the monitor begins displaying the end-tidal and inspired $CO_2$ values in the parameter box. The capnogram waveform, if selected as a displayed waveform, provides a graphic representation of the patient's respiration cycle.

The source of the numeric respiration rate is determined through capnography.

### USE OF NITROUS OXIDE

Since nitrous oxide has a similar infrared signature to that of $CO_2$, and it affects absorption of $CO_2$, special care must be taken when measuring $CO_2$ while anesthetics are being used.

### INTERFERING GASSES FOR $CO_2$

The monitor will report small changes in $CO_2$ when anesthetic agents and oxygen are used. Expected $CO_2$ changes are provided here for the purpose of comparison.

**For Gas mixtures of 5% $CO_2$**

| Agent | Agent Volume* | Change of $CO_2$ |
|---|---|---|
| Oxygen | 95% | -0.5% |
| $N_2O$ | 89% | +0.7% with $N_2O$ compensation |
| Halothane | 3% | +0.2% |
| Enflurane | 5% | +0.4% |
| Isoflurane | 5% | +0.4% |
| Sevoflurane | 5% | +0.4% |
| Desflurane | 15% | +0.5% |

* Gas mixtures balanced with nitrogen.

**$O_2$ Monitoring Procedures**

When a patient is connected, the monitor begins displaying the expired and inspired $O_2$ numerical values in the parameter box. All procedures for patient setup, water traps, and occlusions apply to the $O_2$ measurement because the sample is taken from the same source.

Interfering Gasses for $O_2$

The monitor reports small changes in $O_2$ when anesthetic agents and oxygen are used. Expected $O_2$ changes are provided here for the purpose of comparison.

**For Gas mixtures of $O_2$**

| Agents | Balance | Change of $O_2$ |
|---|---|---|
| Helium 50% | Oxygen 50% | +0.7% |
| $N_2O$ 65%, CO2 5% | Oxygen 30% | +0.7% |
| $N_2O$ 80% | Oxygen 20% | +1.3% |
| Halothane 4%, $N_2O$ 66% | Oxygen 30% | +0.8% |
| Enflurane 5%, $N_2O$ 65% | Oxygen 30% | +0.7% |
| Isoflurane 5%, $N_2O$ 65% | Oxygen 30% | +0.1% |
| Sevoflurane 5%, $N_2O$ 65% | Oxygen 30% | -0.4% |
| Desflurane 15%, $N_2O$ 55% | Oxygen 30% | -2.7% |

**$N_2O$ Monitoring**

**⚠WARNING⚠**

- Environmental pollution of nitrous oxide and halogenated agents may cause accuracy errors. Always use anesthetic gas scavenging systems (AGSS) with the monitoring system.

# 12 — Printing and Data Ports

**Description**

The optional remote display is equipped with a thermal dot-matrix printer which is located on the top of the unit. The ***Veris*** remote display is capable of printing all vital signs parameters in tabular (text) format. The remote display can also produce graphical (waveform) formats as specified by the user.

**NOTE**: The main monitor does not have an internal printer. Printing can only be done if the system has a remote display.

Snapshot Size

The period of time (in a graphical print) that starts 4.5 seconds prior to pressing the PRINT key and lasting the duration of the *Snapshot* setting in the print menu (6, 12, 18, or 24 seconds). (i.e. if the print type is set to graphical and snapshot is set to 6 seconds then the ***Veris*** prints out the waveform data selected 4.5 seconds prior to a PRINT keypress and 1.5 seconds after the PRINT keypress).

History Size

*History Size* is a period of time defined by the user that is prior to the snapshot time period. *History Size* can be selected as 6 or 12 seconds.

**Safety**

**⚠WARNING⚠**

- Do not take the remote display into the MR Scanner room. The remote display contains ferromagnetic material and can be strongly attracted to the magnet causing a safety hazard.

**NOTE:** The remote display can only operate if the main monitor is turned on. All audible and visual information displayed on the main monitor is heard and seen on the remote unit in virtually real time. A symbol displays in the upper right-hand corner of the screen to indicate both devices are connected and active. The remote display has access to all the same functions as the main monitor except for the *NIBP TEST* and *OPTION CONFIGURATION* modes.

## Print Modes

**Demand Print**

If the print type is set to tabular, pressing the PRINT key causes an immediate print-out of the vital signs numbers, date, time and patient data in a “tabular” text format.

If the print type is set to graphical, pressing the PRINT key causes an immediate print-out of the selected waveforms for a duration as selected by “snapshot size.”

**Continuous Print**

If print type is set to *Graphical*, pressing and holding the PRINT key for two seconds causes the selected waveforms to print out continuously (until the PRINT key is pressed again) at 12.5mm/sec or 25mm/sec. If set to 50mm/sec, it defaults to 25mm/sec.

**Alarm Print**

The remote display issues a printout if a high or medium alarm occurs, as selected by the user in the *PRINT* softkey window.

If the *Print Type* is set to *Tabular*, a “tabular demand print format” is issued if an alarm setting is violated.

If the *Print Type* is set to *Graphical* and *Snapshot Size* is set to 6 seconds, if an alarm setting is violated a graphical print strip is issued displaying:

- a 6 second snapshot,
- plus history size,
- the waveforms selected in the print menu.

This strip represents the history size added to the snapshot data.

**BP Print**

The remote display issues a printout at the completion of a successful non-invasive blood pressure reading, as selected by the user in the print menu.

If *Print Type* is set to *Tabular*, a tabular demand print format is issued at the end of a successful non-invasive blood pressure reading. If *Print Type* is set to *Graphical* and *Snapshot Size* is set to 6 seconds a 6 second graphical print strip is issued displaying the waveforms selected in the print menu at the completion of a successful noninvasive blood pressure reading.

**Interval Print**

Interval prints are periodic automatic printouts as selected by the user in the *Print* menu. They are either *Graphical* or *Tabular* as selected in the *PRINT* window.

**Freeze Print**

A freeze print is initiated by depressing the PRINT key after setting the monitor in “freeze” mode (pressing the FREEZE key). The printout is determined by the settings in the *Print* menu. This strip represents the history size added to the snapshot data.

If print type is set to *Graphical*, the waveforms selected are printed out. The data printed is for a history time period followed by a snapshot time period.

If *Print Type* is set to *Tabular*, a demand tabular print is issued using the “frozen” numeric vital signs data on the screen.

Trend Print

After displaying a trend on the ***Veris*** screen (by pressing the TREND key), press the PRINT key to print the trend data displayed on the screen. If the monitor is set for *Tabular* trends, then the printout is tabular; if the monitor is set for *Graphical* trends, then the printout is graphical.

Press and hold the PRINT key (while a trend is displayed on the monitor's screen) to print all of the stored Trend data.

If *Serial* is selected as the *Print device* (in the *CONFIG* menu) and the user is in the Trend screen, the following occurs:

- A short key press causes the serial port to output the trend records the user is viewing;
- A long key press causes the serial port to output the entire trend records.

## Print Formats

The internal thermal dot-matrix printer is capable of printing vital signs parameters in tabular (text) or graphical (waveforms). Select the printout format in the PRINT softkey menu.

### Tabular Printing

A header is printed containing the monitor model, the operating software revision, the time and date, and the patient information. The title for each parameter follows.

Numerical values for all current parameters are printed. The sample below shows a tabular print out.

```
MEDRAD Veris    Rev 4.2D
07-10-04         8:50:11
NAME: SMITH
      JOHN             Q

ID:4680592421
Room number:101

07-10-04  8:50:11
HR   ( ECG )   60   BPM
SpO2           98   %
RESP ( CO2 )   20   Br/m
TEMP   96.4    97.7  F
 GAS  EXP     INS
 CO2   37       8   mmHg
 O2    17      21   %
 HAL   11.0*   10.5*%
 N2O   39      64   %
ART1 145 /105*(125 )mmHg
CVP2          ( 13 )mmHg
```

**Figure 12-1: Tabular Printout**

### Graphical Printing

If both waveform 1 and 2 have been set to a physical parameter the print out will be a split dual waveform. If only one of the waveforms is turned on, a single waveform will be printed using the entire waveform area. If both waveforms are turned off, the waveform area of the print out is blank.

Selectable options for waveforms are ECG *I, II, III, V, aVR, aVL, aVF, PLETH, IBP I, IBP II, Et $CO_2$, $O_2$, AGT, $N_2O$,* and *OFF*.

Numerical values for heart rate, $SpO_2$, NIBP, temperature, respiration, $EtCO_2$, $INCO_2$, $EtO_2$, $INO_2$, INS AGT, EXP AGT, INS $N_2O$, and EXP $N_2O$ are printed above and below the waveform grid.

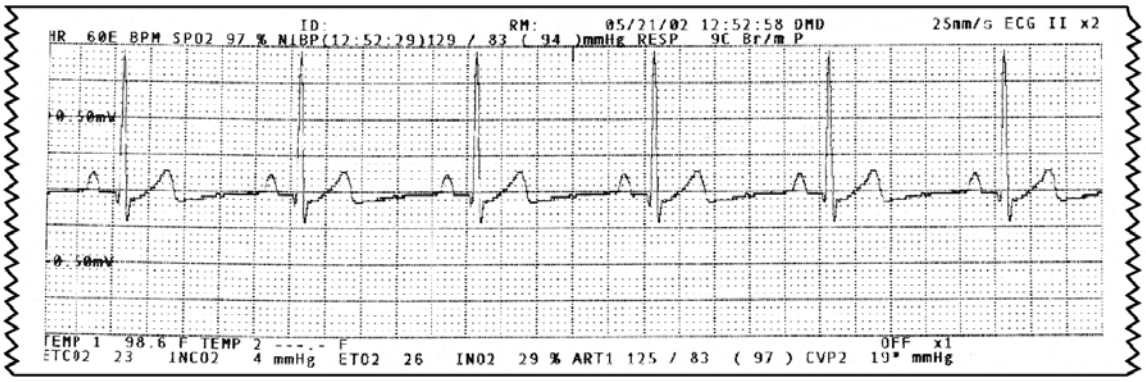



**Figure 12-2: Single Waveform Printout**

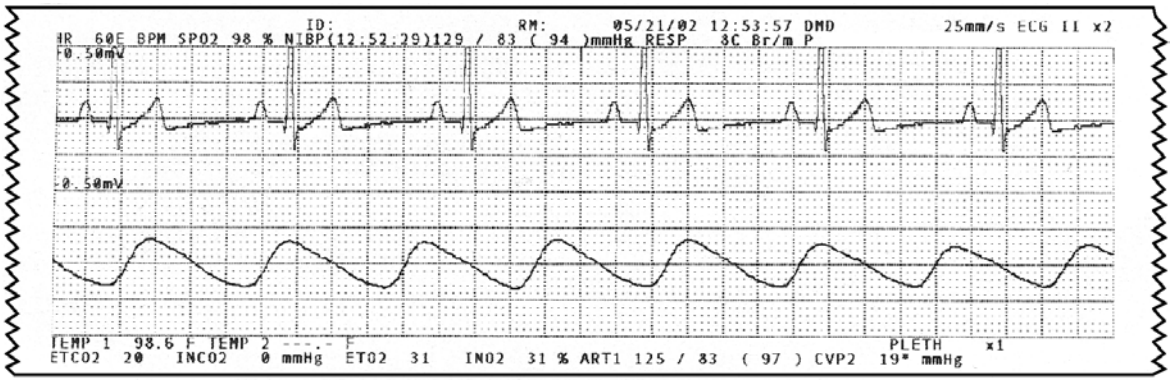



**Figure 12-3: Dual Waveform Printout**

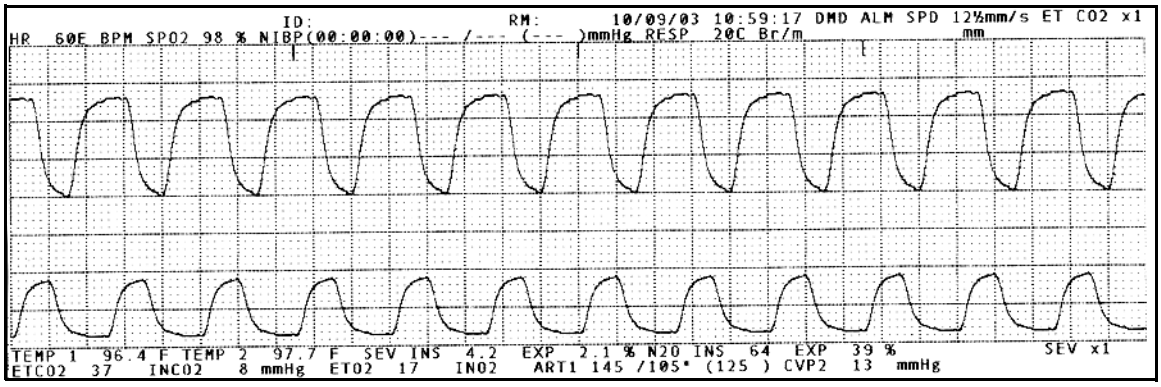



**Figure 12-4: Sample Agent with $CO_2$ Printout**

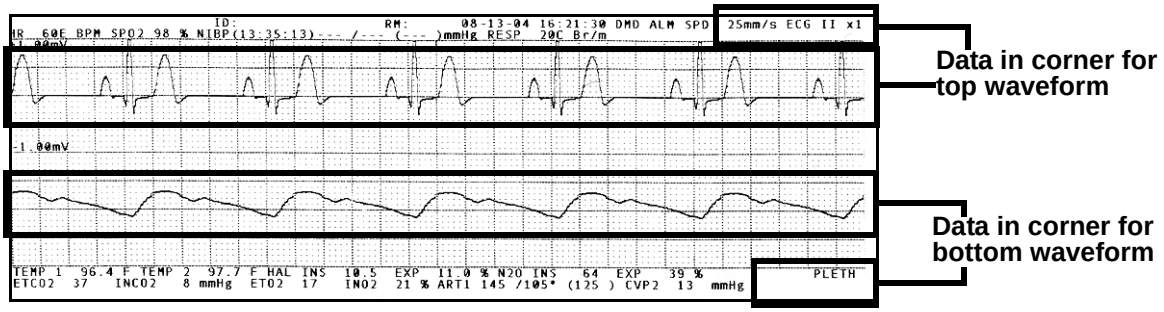



**Figure 12-5: Sample ECG with Pleth Printout**

The printout can be configured with a variety of waveform pairs. The example above shows an ECG waveform and a plethysmographic waveform. The top waveform information appears in the upper right corner of the printout. The lower waveform information appears in the lower right corner of the printout.

The example above is the shortest printed waveform view available. Longer printouts can be configured in the *PRINT* menu.

An asterisk (*) after a parameter value represents when the system alarmed for that parameter.

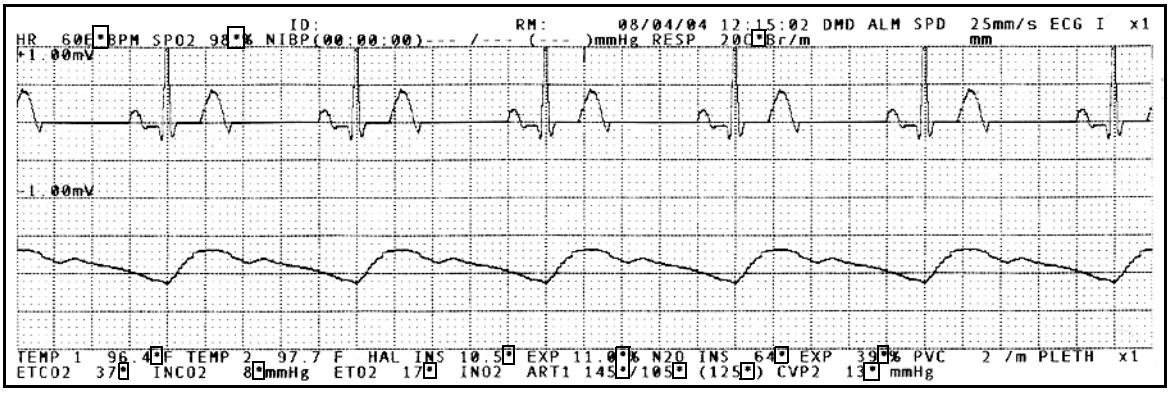


**Figure 12-6: Alarms Noted with Asterisks**

**Changing Printer Paper**

The monitor uses thermal paper. The paper must be loaded with the thermal reactive side down as shown in the pictures below.

Open the printer door and remove the old spool.

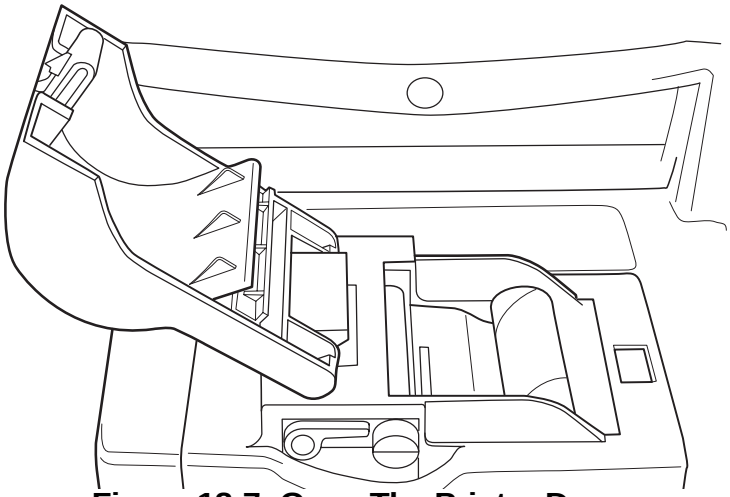


**Figure 12-7: Open The Printer Door**

Insert the paper between the rollers.

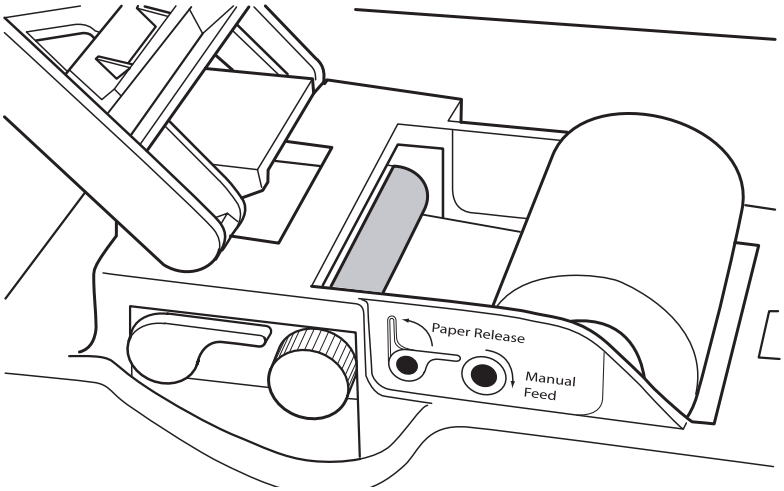



**Figure 12-8: Insert Paper**

The paper automatically feeds when the paper is inserted.

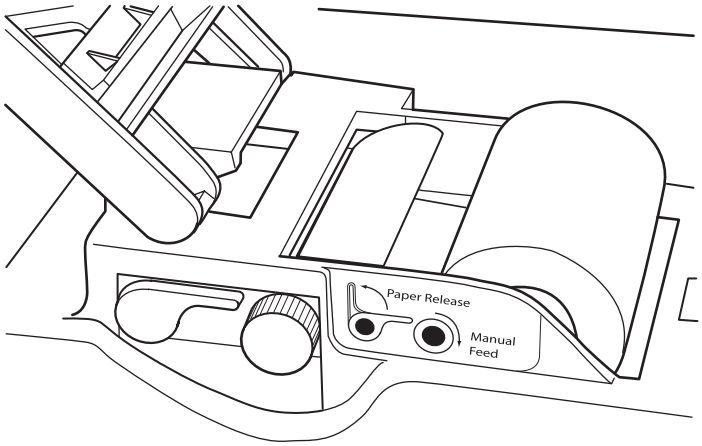



**Figure 12-9: Feed Paper**

Close the paper door while sliding the end of the paper through the slot in the door.

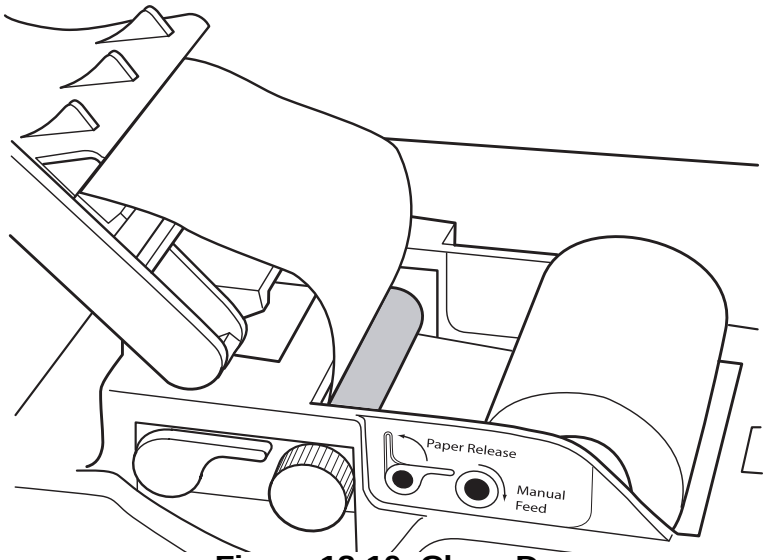



**Figure 12-10: Close Door**

**Data Output Ports**

The ***Veris*** monitor supports a variety of communication connections. The communications ports are located along the left edge of the back of the remote display. The ports are as follows:

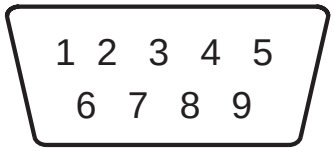
- COM1 Port, RS232 Serial DB-9
- COM2 Port, MiniDIN 8, Service/Analog

**NOTE:** Any serial cables connected to the ports must be IEC 950 or IEC 60950 compliant. Any peripherals connected to the monitoring devices must be IEC 950 or IEC 60950 compliant.

COM1 Port

The monitor uses a serial port (DB-9 female) for the external data output port and for loading system software updates. The monitor uses a standard RS232 communication protocol with no flow control.

**NOTE**: This connection has a protective cover that needs to be removed before use.




Pinout,
DB-9 connector

**PINOUT CHART**

| Pin | Signal |
|---|---|
| 1 | (Unused) |
| 2 | RX1 |
| 3 | TX1 |
| 4 | (Unused) |
| 5 | Ground |
| 6 | (Unused) |
| 7 | (Unused) |
| 8 | (Unused) |
| 9 | (Unused) |

**Figure 12-11: COM1 Pinout Diagram**

**SERIAL PRINTING**

The COM 1 port supports sending data to an external serial printer or computer terminal. To send the data as described in the beginning of this section to the COM 1 port, the print device must be set to *Serial* in the *CONFIG* menu. Printing is then routed to the COM1 port instead of the internal printer.

Set the serial format to *TEXT* in the *CONFIG* menu to simulate the tabular printout of the internal printer. Set the serial format to *CSV* in the *CONFIG* menu to create a “comma separated variable” table. The CSV format can be used by software programs. A description of the CSV format is located at the end of this section.

**SENDING DATA TO A COMPUTER**

Use a serial download cable to connect to standard male DB-9 computer serial ports. A common computer terminal program and an unused RS232 serial port is needed for external communications.

MEDRAD recommends using the Windows HYPERTRM.EXE program provided with MS Windows 95 or later operating systems. HYPERTRM.EXE can be found in the Windows accessory directory. For older computers using MS Windows 3.1, the communications program TERMINAL.EXE can be found in the Windows directory.

Set the monitor to interval printing with serial output selected. With the computer terminal connected, a data file may be collected. The file may then be further evaluated by computer. See the description for CSV format at the end of this section.

**TERMINAL CONFIGURATION**

The cable connections should be completed and the terminal program should be configured before attempting to send data.

The recommended settings are as follows:

| | |
|---|---|
| Baud Rate: | 9600 or 19200 |
| Parity: | No Parity |
| Stop Bits: | 1 |
| Data Bits: | 8 |
| Hardware Control: | None |

**EXTERNAL SERIAL PRINTER ACCESORY**

The selected external printer must be configured so that it can communicate with the monitor. Follow the configuration instructions provided with your printer.

The required settings are as follows:

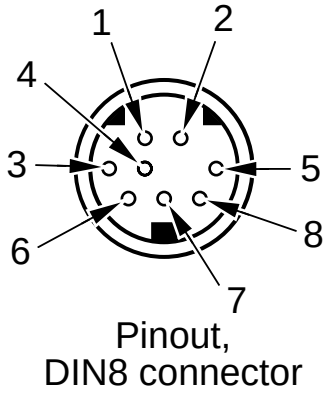
| | |
|---|---|
| Baud Rate: | 9600 or 19200 |
| Parity: | No Parity |
| Stop Bits: | 1 |
| Data Bits: | 8 |

COM2 Port

The monitor uses the COM2 serial port (8-pin Mini DIN) for loading system software updates and for reprogramming the monitor. The communications ability of this port is for service use only.

There is also an analog output signal available at pin 2. For information about sending analog data to a plotter or chart recorder contact MEDRAD Technical Support.

The connector pinouts are shown below.




**PINOUT CHART**

| Pin | Signal |
|---|---|
| 1 | Boot 2 |
| 2 | Analog Wave |
| 3 | RX 2 |
| 4 | Ground |
| 5 | TXL |
| 6 | TX3 |
| 7 | RX3 |
| 8 | Boot 1 |

**Figure 12-12: COM2 Port Pinout Diagram.**

**Video Port**

The monitor provides a DB-15 VGA video port that is functional on monitors with TFT screens.

**CSV Data Format**

The Comma-Separated Variable output presents the data in a form that is easily imported into a spreadsheet application where further analysis can be done on the data. The data is output in ASCII format with each field (time, heart rate, $SpO_2$, IBP, $CO_2$, $O_2$, agent, $N_2O$, temperature, temperature type [degrees F or C], systolic, diastolic, and map) separated with a comma. Using the Windows 3.1 TERMINAL.EXE program and EXCEL (4.0), here is an example of how it may be used:

1. Connect the COM1 port to the serial port on the computer.
2. Start Terminal from the Accessories menu.
3. Choose Settings|Communications to set the computer's connector to the proper port. Check communications settings.
4. Choose Transfers|Receive Text File. Assign a name to the data (e.g. DATA.TXT) and press OK.
5. At this point, all data transmitted from the monitor will appear on the screen and will be saved in DATA.TXT.
6. When all the desired data has been accumulated, choose Transfers|Stop to close DATA.TXT.
7. Start EXCEL and choose File|Open.
8. Enter/Click on the file name and press the Text button.
9. For Column Delimiter, choose "Comma". For File Origin, choose "Windows (ANSI)". Then choose OK.
10. Choose OK again from the Open dialog to open and display DATA.TXT.

The data will be organized in a table by field. Using the EXCEL presentation options, this data could be graphed, printed in tabular form, or analyzed statistically in some other way.

# Appendix A: Maintenance

This section contains recommended procedures for maintenance, and an operational checkout of the ***Veris*** 8600 patient monitor. Routine maintenance and inspection will:

- Ensure continued performance of the patient monitor.
- Reduce the possibility of equipment malfunction.

## Cleaning and Disinfecting

**⚠WARNING⚠**

- Shock Hazard! Turn the power off and disconnect the AC power cable before cleaning the monitor and sensor.

- Shock Hazard! Never immerse the monitor in any liquid. The monitor has an internal power source that is active when the unit is unplugged.

- Shock Hazard! Do not clean the main monitor or accessories with the patient attached to the monitor.

- Shock Hazard! Remove the power cord from the base of the patient monitor to isolate any AC (Mains) power from the patient monitor.

- Shock Hazard! Remove the power cord from the remote display to isolate any AC (Mains) power from the remote display.
- Remove the main monitor from the MR Scanner room environment to a safe location for cleaning purposes. Avoid using cleaning products that are kept in ferromagnetic containers.
- Avoid using ferromagnetic tools in any maintenance procedure.
- Improper disposal of batteries may result in explosion, leakage, or personal injury. Do not open the batteries. Do not dispose of the batteries in a fire. Follow all local and national regulations concerning the disposal of spent Lead-acid and Lithium-Ion batteries, or contact MEDRAD for assistance.

**⚠CAUTION⚠**

- Do not use abrasive cleaners on the monitor or on any sensors or probes. Abrasive cleaners can damage the monitor, sensors, and probes.
- The exterior surface of the monitor, except for the display screen, may be wiped clean with alcohol and dried with a soft, dry cloth. It is best to use a cotton cloth to clean the monitor. Paper towels or tissues can scratch the surface of the display.

**⚠CAUTION⚠**

- Do not use full strength alcohol on the display screen. Repeated use of strong cleaners can damage the screen. Clean the display window by wiping it with a clean, soft, lint-free cloth sprayed with common glass cleaner. Do not spray glass cleaner directly on the display.

Pulse Oximeter Sensors

**⚠CAUTION⚠**

- Do not immerse any MEDRAD pulse oximeter sensor connector in any liquid. Doing so may damage the connector.

The $SpO_2$ sensor may be wiped clean with alcohol. The $SpO_2$ sensor may be disinfected by placing the pads and cable in a 2% glutaraldehyde solution. Place only the sensor paddles and cable in the solution.

Blood Pressure Cuffs

The reusable blood pressure cuff may be cleaned by wiping it with a damp cloth or sponge. If necessary, the cuff may be disinfected by wiping with 70% alcohol, mild bleach solution, or other disinfectant. Disposable blood pressure cuffs are for single patient use and are not intended to be disinfected.

The cloth cuff and neoprene bag may be sterilized with commercially available disinfectants such as ethylene oxide (EtO). Rinse thoroughly to remove any residual disinfectants. Do not allow liquids to enter the neoprene bag. The cloth cuff may also be sterilized in an autoclave.

If the cuffs become grossly soiled with blood or other body fluids, the cloth cuffs should be laundered by hand or machine. The dacron cloth cuff may be laundered or sterilized by first removing the neoprene inflation bag. Feed the inflation tube back through the hole and then pull out the cloth flap.


**Figure A-1: Remove Inflation Bag from Cuff**

Roll up the inflation bag and slide it out the open slot in the cloth cuff. Be sure to observe the following laundering precautions (disposable cuffs and neoprene inserts should not be laundered).

- Remove the inflatable bag from the cuff before laundering or sterilizing the cuff.
- Strong bleach solutions will damage the cuff.
- Temperatures over 275° F (135° C) will damage the cuff.
- Close the Velcro® fastener before laundering the cuff.
- Soaking the cuff in dark-colored solutions may stain or discolor the cuff.

Hand laundering (as opposed to machine laundering) prolongs the life of the cuff. Wash the cuff in warm, soapy water. Rinse the cuff thoroughly. After cleaning the cuff, allow the cuff to air dry, then insert the inflation bag in the cuff.

Temperature

The temperature cable and probe may be wiped clean with alcohol. The temperature cable and probe may be disinfected by wiping the cable and probe in a 2% glutaraldehyde solution. Do not place either the cable nor the probe in the solution.

**TEMPERATURE PROBE**

Clean the probe according to the hospital protocol for cleaning of reusable equipment cables and probes. Typically this protocol consists of the following:

1. Disconnect the cable from the monitor and temperature sensor (probe).
2. Wipe the probe with a nonabrasive cloth moistened with a mild detergent and warm water or disinfectant. Dry thoroughly.
3. Do not use solvents to clean the probe.
4. Do not allow the probe connectors and contact points to come in contact with liquids.
5. Do not fully immerse the probe in liquids.
6. Do not autoclave or EtO sterilize the probe.

### Accidental Wetting

**⚠WARNING⚠**

- Shock Hazard! The monitor is an AC powered device and an immersed monitor presents a danger to anyone who handles the device.

The action to be taken following accidental wetting of the equipment is as follows:

1. Turn the power off! Disconnect the AC power cord from the monitor, remote display, or power supply.
2. If monitoring a patient, transfer the patient to another monitor as quickly as possible.
3. Use a clean, dry towel or cloth to remove the liquid from the housing.
4. The monitor, remote display, or power supply should be inspected by a service technician as soon as possible.
5. If the internal mechanism is saturated, allow the liquid to drain out for 24 hours before shipping.
6. If liquid has entered the monitor, remote display, or power supply, it needs to be dried and cleaned internally. Full testing is required before the monitor, remote display, or power supply can be used. Contact the MEDRAD Service Department as soon as possible.

Time is critical! The longer any liquid remains in the monitor, remote display, or power supply, the more damage it can do. It is important to service the monitor, remote display, or power supply immediately after any liquid is spilled into it.

**Annual Safety Tests**

The monitor and remote display should be electrically tested annually. The safety tests should be performed only by experienced service technicians. Refer to the ***Veris*** *8600 Service Manual* for additional information.

System Testing

The monitor has built-in system tests which should be performed regularly. However, the tests should be performed by qualified service personnel only.

Service Checks

If the monitor shows any signs of physical damage, contact MEDRAD Service immediately.

Have a qualified service technician perform the following performance and safety checks annually.

- Perform complete functional testing of the monitor.
- Test the monitor for electrical leakage and withstanding voltage.

Do not remove the cover. Refer all servicing to a qualified technician. Descriptions of these tests can be found in the ***Veris*** *8600 Service Manual*. Some tests may require specialized equipment.

**Maintenance Schedule**

Your ***Veris*** 8600 patient monitor must be properly maintained to ensure that it is in peak operating condition. Your individual maintenance system and schedule depends upon how your monitor is used, the type of procedures performed, and frequency of use. The following maintenance schedule is recommended for the system:

| | |
|---|---|
| Every Patient | • Clean and disinfect the sensor cables and sensor.<br>• Inspect the accessories and cables for damage.<br>• Change the gas sampling device and sampling line.<br>• Check the NIBP function.<br>• Change the water trap |
| Every Day | • Charge the batteries as necessary. If not using the monitor on a patient, keep it plugged into the power supply for continuous charging.<br>• Test the NIBP function. |
| Every Week | • Charge the ECG module battery.<br>• Compare temperature function with another temperature source. |
| Every 3 Months | • Clean the exterior of the unit (or clean as needed).<br>• Fully charge the batteries.<br>• Check the $O_2$ cell. Change if necessary. |
| Every Year | • Perform the annual safety tests described above.<br>• Perform NIBP calibration and safety test<br>• Verify the $CO_2$ and agent gas auto-calibration. Calibrate if necessary.<br>• Change the $O_2$ cell.<br>• Check the $CO_2$ absorber. Change if necessary<br>• Check the gas flow rate. Adjust if necessary. |

MEDRAD also recommends that a complete system calibration and performance checkout be performed annually. Contact MEDRAD Factory Service, or your local MEDRAD office for complete details.

In the United States, Canada, and Europe, the MEDRAD Service Department offers Preventive Maintenance Programs. These annual programs greatly assist in maintaining accuracy and reliability, and can also extend the life of the system. Contact MEDRAD for details, In Europe, contact your local MEDRAD office or your local authorized dealer for further information. Refer to “In Case of Emergency Contact” on page xi.

**NOTES:** If not using the monitor on a patient, keep it plugged into the power supply for continuous charging.

Failures which occur due to lack of proper maintenance will not be covered under warranty.

Local regulations or hospital protocol may require electrical leakage checks at more frequent intervals. If this applies, local regulations for leakage must be followed.

**Long-Term Storage**

No special preparation is necessary for long term storage of the monitor.

**Disposal**

At the end of its useful life, the monitor and its accessories may be disposed of according to your institution's policies and procedures and any local and national policies and procedures for disposal of patient-contact medical waste. Discard disposable medical waste according to your institution's policies and procedures to prevent biological contamination.

Alternately, the monitor and its accessories may be returned to MEDRAD, Inc., for safe disposal. The shipping address is:

MEDRAD, Inc.
One Medrad Drive
Indianola, PA 15051-0780

# Appendix B: Unit and Configuration Defaults

### Restoring the Unit Default Profile

A set of unit defaults are pre loaded into the non-volatile memory of the monitor. These defaults can be used as they exist, or can be used as the basis for creating your own default profile.

The unit default profile can be modified or renamed or replaced if desired. If you modify the unit defaults it is recommended that you rename them.

1. Press the DEFAULT button. The *Restore Unit Defaults* menu appears. The *SELECT* option and the currently active profile are both highlighted.
2. Press the menu knob to scroll through the choices.
3. Turn the knob to *ACCEPT*.
4. Press the menu knob once. The message *Action Completed* is highlighted.
5. Press the menu knob to re-establish the profile. The monitor returns to the main menu.

### Default Settings

Unit Default Settings

Customized defaults can be saved for use at a later time. Starting from the monitor's main screen, do the following:

1. Set specific defaults for parameters and alarms. These are set through the *ALARMS*, *PARAMS*, *DISPLAY*, *CONFIG*, and *PRINT* softkeys.
2. Press and hold the DEFAULT button located on the front panel. The *Set Unit Defaults* dialog box appears.

   **NOTE:** If the *Set Unit Defaults* dialog box that prompts you to enter a password did not appear, you did not hold the button in properly. In this case, turn the knob to highlight and select *CANCEL*, or you could lose the settings just created.

3. Enter the password MEDRAD (required to save the customized default):
   - Turn the menu knob to highlight a single letter or number.
   - Press the menu knob to select that letter or number.
   - Continue for each letter and number of the password.
   - After pressing the menu knob for the last figure of the password, the monitor indicates acceptance of the password by displaying the *Set Unit Defaults* window.
4. When the *Set Unit Defaults* window displays, both *SELECT* and *CUSTOM DEFAULTS* are highlighted.

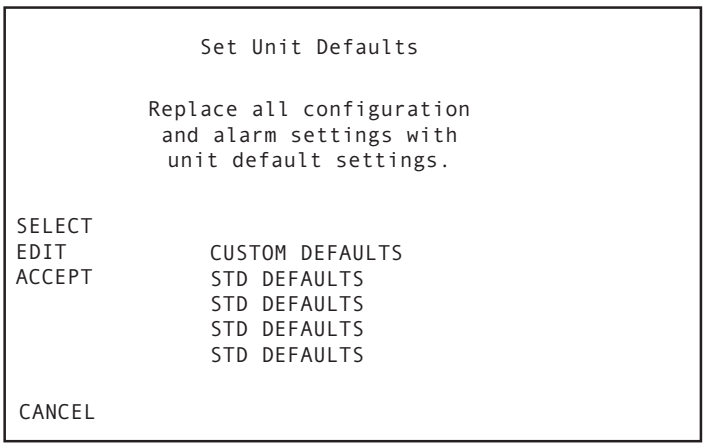



**Figure B-1: Set Unit Defaults Screen**

**NOTE:** Selecting a value in *Set Unit Defaults* window is different than other windows. At this point in this procedure, the right column of this window is active.

5. With both *SELECT* and *CUSTOM DEFAULTS* highlighted in the *Set Unit Defaults* window, press the menu knob to scroll the highlight bar down the right-hand column list to the desired default to be changed. Press to select.
6. Turn the menu knob to scroll the highlight bar to *EDIT*. Press to select. The selected default remains highlighted as the menu knob is rotated. The first letter of the selected default is highlighted when the menu knob is pressed.
7. Change the label to the new default name by turning the menu knob to select the first letter in the new name for the default. Press to select. The next letter is automatically highlighted. Continue for the remaining letters of the new default name.
8. After completing the last letter of the new name, press the menu knob until the **entire** label name is highlighted. This indicates that entry is complete, but not accepted.

9. To accept the new label name, turn the menu knob to highlight *ACCEPT* and press to select. The message *Action Completed* appears.

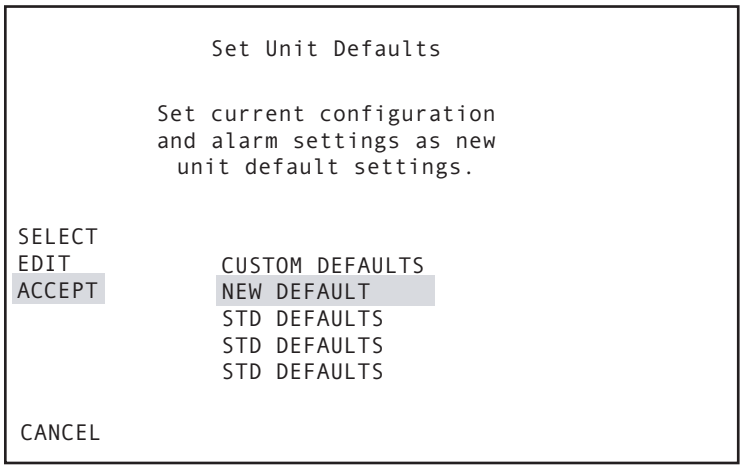



**Figure B-2: Set Units Defaults After Modifications**

10. Press the menu knob. Your new default set of is saved in memory.
11. Press the ON/OFF button, located on the front panel, to turn off the monitor.

Configuration Default Settings

1. From the *Set Unit Defaults* screen, press and hold the DEFAULT key again. The *Install Configuration Defaults* screen displays. (See Figure B-3: ”Install Configuration Defaults Screen”).

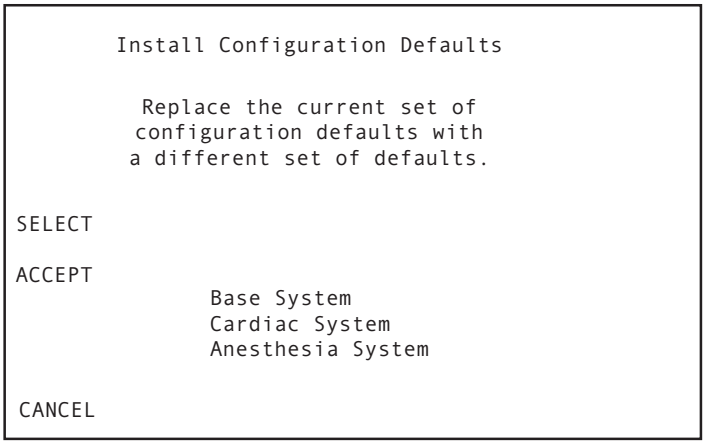



**Figure B-3: Install Configuration Defaults Screen**

The *Install Configuration Defaults* screen permits choosing which set of 3 defaults are available to the user.

The selection procedure works the same as in the previous screens.

1. WIth the *SELECT* feature highlighted, press the menu knob to select from *Base System, Cardiac System* or *Anesthesia System* (depending upon your unit's configuration).
2. Turn the menu knob to select *ACCEPT*. The message *Action Completed* appears. Press the menu knob to effect the change.

**Configuration Settings for Unit Defaults**

The configuration settings for the three configuration setup defaults are the same as the basic hospital configuration settings except for the following, grouped by menu:

*PARAMS* Menu Settings

| Setting | Base | BasePlus | Cardiac | Cardiac with Temp | Anesthesia | Anesthesia with Temp |
|---|---|---|---|---|---|---|
| Audible Tone Volume | 5 | 5 | 5 | 5 | 5 | 5 |
| $CO_2$ | | | | | ON | ON |
| $O_2$ | | | | | ON | ON |
| HR Source | Smart | Smart | Smart | Smart | Smart | Smart |
| Gating | | | OFF | OFF | OFF | OFF |
| ECG | ON | ON | ON | ON | ON | ON |
| ECG Cable | 3 lead | 3 lead | 5 lead | 5 lead | 5 lead | 5 lead |
| ECG Filter | Monitor | Monitor | Monitor | Monitor | Monitor | Monitor |
| Auto Lead Switching | NO | NO | YES | YES | YES | YES |
| IBP1 Site | | | ART | ART | ART | ART |
| IBP 1 Range | | | 0 to 200 | 0 to 200 | 0 to 200 | 0 to 200 |
| IBP 1 Zero | | | None | None | None | None |
| IBP2 Site | | | CVP | CVP | CVP | CVP |
| IBP 2 Range | | | 0 to 20 | 0 to 20 | 0 to 20 | 0 to 20 |
| IBP 2 Zero | | | None | None | None | None |
| NIBP | ON | ON | ON | ON | ON | ON |
| NIBP Tone | None | None | None | None | None | None |
| NIBP Cycle Time | OFF | OFF | OFF | OFF | OFF | OFF |
| $SpO_2$ | ON | ON | ON | ON | ON | ON |
| $SpO_2$ Average | 12 | 12 | 12 | 12 | 12 | 12 |
| $SpO_2$ Search Time | 20 | 20 | 20 | 20 | 20 | 20 |
| $SpO_2$ Low Limit Alarm | High | High | High | High | High | High |
| Respiration | | | | | ON | ON |
| Respiration source | | | | | $CO_2$ | $CO_2$ |
| Temp1 | | | | ON | | ON |
| Temp2 | | | | ON | | ON |
| Unit of Measure | | | | °F | | °F |
| $CO_2$ Unit of Measure | | | | | mmHg | mmHg |
| Agent to Monitor (Primary) | | | | | Automatic | Automatic |
| Gas Flow Rate | | | | | 200 ml | 200 ml |
| Flow Mode | | | | | Exhaust | Exhaust |

*PRINT* Menu Settings

| Setting | Base | BasePlus | Cardiac; Cardiac w/Temp—w/o Remote Display | Cardiac; Cardiac w/Temp—w/Remote Display | Anesthesia; Anesthesia w/Temp—w/o Remote Display | Anesthesia; Anesthesia w/Temp—w/o Remote Display |
|---|---|---|---|---|---|---|
| Print Type (Demand) | na | Graphical | na | Graphical | na | Graphical |
| Alarm Print | na | OFF | na | OFF | na | OFF |
| BP Print | na | Off | na | Off | na | Off |
| Interval Print | na | Off | na | Off | na | Off |
| Interval Print Type | na | Tabular | na | Tabular | na | Tabular |
| Snapshot Size | na | 6 seconds | na | 6 seconds | na | 6 seconds |
| History Size | na | 6 seconds | na | 6 seconds | na | 6 seconds |
| Waveform 1 | na | ECG II | na | ECG II | na | ECG II |
| Gain (waveform 1) | na | x1.0 | na | x1.0 | na | x1.0 |
| Waveform 2 | na | PLETH | na | PLETH | na | PLETH |
| Gain (waveform 2) | na | x1.0 | na | x1.0 | na | x1.0 |
| Printer Speed | na | 25.0 mm/sec | na | 25.0 mm/sec | na | 25.0 mm/sec |

***** Available as an option if the system has a remote display

*DISPLAY* Menu Settings

| Setting | Base/BasePlus | All Cardiac and Anesthesia Units |
|---|---|---|
| Waveform 1 | ECG II,x1,25,25 | ECG II,x1,25,25 |
| Waveform 2 | OFF | OFF |
| Waveform 3 | ECG I,x1,25,25 | ECG I,x1,25,25 |
| Waveform 4 | PLETH,x1,25,25 | PLETH,x1,25,25 |
| Waveform 5 | OFF | aVL |
| Waveform 6 | OFF | aVR |

*ALARMS* Menu Settings

| Setting | Base | BasePlus | Cardiac | Cardiac with Temp | Anesthesia | Anesthesia with Temp |
|---|---|---|---|---|---|---|
| Heart Rate (High) | | | | | | |
| Adult, Pediatric | 150 | 150 | 150 | 150 | 150 | 150 |
| Neonate | 180 | 180 | 180 | 180 | 180 | 180 |
| Heart Rate (Low) | | | | | | |
| Adult, Pediatric | 40 | 40 | 40 | 40 | 40 | 40 |
| Neonate | 90 | 90 | 90 | 90 | 90 | 90 |
| $SpO_2$ (High) | OFF | OFF | OFF | OFF | OFF | OFF |
| $SpO_2$ (Low) | 90 | 90 | 90 | 90 | 90 | 90 |
| NIBP Systolic (High) | | | | | | |
| Adult, Pediatric | 200 | 200 | 200 | 200 | 200 | 200 |
| Neonate | 140 | 140 | 140 | 140 | 140 | 140 |
| NIBP Systolic (Low) | | | | | | |
| Adult, Pediatric | 50 | 50 | 50 | 50 | 50 | 50 |
| Neonate | 35 | 35 | 35 | 35 | 35 | 35 |
| NIBP Diastolic (High) | | | | | | |
| Adult, Pediatric | 100 | 100 | 100 | 100 | 100 | 100 |
| Neonate | 80 | 80 | 80 | 80 | 80 | 80 |
| NIBP Diastolic (Low) | | | | | | |
| Adult, Pediatric | 30 | 30 | 30 | 30 | 30 | 30 |
| Neonate | 30 | 30 | 30 | 30 | 30 | 30 |
| NIBP Mean (High) | | | | | | |
| Adult, Pediatric | 150 | 150 | 150 | 150 | 150 | 150 |
| Neonate | 100 | 100 | 100 | 100 | 100 | 100 |
| NIBP Mean (Low) | | | | | | |
| Adult, Pediatric | 50 | 50 | 50 | 50 | 50 | 50 |
| Neonate | 35 | 35 | 35 | 35 | 35 | 35 |
| Temperature 1/2 (High) | na | na | na | 100 | na | 100 |
| Temperature1/ 2 (Low) | na | na | na | 93 | na | 93 |
| Respiration (High) | | | | | | |
| Adult, Pediatric | na | na | na | na | 36 | 36 |
| Neonate | na | na | na | na | 60 | 60 |
| Respiration (Low) | | | | | | |
| Adult, Pediatric | na | na | na | na | 4 | 4 |
| Neonate | na | na | na | na | 14 | 14 |
| $CO_2$ Inspired (High) | na | na | na | na | 10 | 10 |
| $CO_2$ Inspired (Low) | na | na | na | na | 5 | 5 |
| $CO_2$ Expired (High) | na | na | na | na | 55 | 55 |
| $CO_2$ Expired (Low) | na | na | na | na | 20 | 20 |

| Setting | Base | BasePlus | Cardiac | Cardiac with Temp | Anesthesia | Anesthesia with Temp |
|---|---|---|---|---|---|---|
| $O_2$ Inspired (High) | na | na | na | na | 100 | 100 |
| $O_2$ Inspired (Low) | na | na | na | na | 18 | 18 |
| $O_2$ Expired (High) | na | na | na | na | 100 | 100 |
| $O_2$ Expired (Low) | na | na | na | na | OFF | OFF |
| IBP1 Systolic (High) | | | | | | |
| Adult, Pediatric | na | na | 200 | 200 | 200 | 200 |
| Neonate | na | na | 140 | 140 | 140 | 140 |
| IBP1 Systolic (Low) | | | | | | |
| Adult, Pediatric | na | na | 50 | 50 | 50 | 50 |
| Neonate | na | na | 50 | 50 | 50 | 50 |
| IBP1 Diastolic (High) | | | | | | |
| Adult, Pediatric | na | na | 100 | 100 | 100 | 100 |
| Neonate | na | na | 80 | 80 | 80 | 80 |
| IBP1 Diastolic (Low) | | | | | | |
| Adult, Pediatric | na | na | 30 | 30 | 30 | 30 |
| Neonate | na | na | 30 | 30 | 30 | 30 |
| IBP1 Mean (High) | | | | | | |
| Adult, Pediatric | na | na | 150 | 150 | 150 | 150 |
| Neonate | na | na | 100 | 100 | 100 | 100 |
| IBP1 Mean (Low) | | | | | | |
| Adult, Pediatric | na | na | 50 | 50 | 50 | 50 |
| Neonate | na | na | 40 | 40 | 40 | 40 |
| IBP2 Mean (High) | na | na | 15 | 15 | 15 | 15 |
| IBP2 Mean (Low) | na | na | 1 | 1 | 1 | 1 |
| ART Systolic (High) | | | | | | |
| Adult, Pediatric | na | na | 200 | 200 | 200 | 200 |
| Neonate | na | na | 140 | 140 | 140 | 140 |
| ART Systolic (Low) | | | | | | |
| Adult, Pediatric | na | na | 50 | 50 | 50 | 50 |
| Neonate | na | na | 50 | 50 | 50 | 50 |
| ART Diastolic (High) | | | | | | |
| Adult, Pediatric | na | na | 100 | 100 | 100 | 100 |
| Neonate | na | na | 80 | 80 | 80 | 80 |
| ART Diastolic (Low) | | | | | | |
| Adult, Pediatric | na | na | 30 | 30 | 30 | 30 |
| Neonate | na | na | 30 | 30 | 30 | 30 |
| ART Mean (High) | | | | | | |
| Adult, Pediatric | na | na | 150 | 150 | 150 | 150 |
| Neonate | na | na | 100 | 100 | 100 | 100 |

| Setting | Base | BasePlus | Cardiac | Cardiac with Temp | Anesthesia | Anesthesia with Temp |
|---|---|---|---|---|---|---|
| ART Mean (Low) | | | | | | |
| Adult, Pediatric | na | na | 50 | 50 | 50 | 50 |
| Neonate | na | na | 40 | 40 | 40 | 40 |
| PA Systolic (High) | na | na | 40 | 40 | 40 | 40 |
| PA Systolic (Low) | na | na | 15 | 15 | 15 | 15 |
| PA Diastolic (High) | na | na | 15 | 15 | 15 | 15 |
| PA Diastolic (Low) | na | na | 5 | 5 | 5 | 5 |
| PA Mean (High) | na | na | 20 | 20 | 20 | 20 |
| PA Mean (Low) | na | na | 10 | 10 | 10 | 10 |
| LA Mean (High) | na | na | 15 | 15 | 15 | 15 |
| LA Mean (Low) | na | na | 1 | 1 | 1 | 1 |
| LV Systolic (High) | | | | | | |
| Adult | na | na | 200 | 200 | 200 | 200 |
| Pediatric, Neonate | na | na | 0 | 0 | 0 | 0 |
| LV Systolic (Low) | | | | | | |
| Adult | na | na | 60 | 60 | 60 | 60 |
| Pediatric, Neonate | na | na | 0 | 0 | 0 | 0 |
| LV Diastolic (High) | | | | | | |
| Adult | na | na | 40 | 40 | 40 | 40 |
| Pediatric, Neonate | na | na | 0 | 0 | 0 | 0 |
| LV Diastolic (Low) | | | | | | |
| Adult | na | na | 0 | 0 | 0 | 0 |
| Pediatric, Neonate | na | na | 0 | 0 | 0 | 0 |
| LV Mean (High) | | | | | | |
| Adult | na | na | 120 | 120 | 120 | 120 |
| Pediatric, Neonate | na | na | 0 | 0 | 0 | 0 |
| LV Mean (Low) | | | | | | |
| Adult | na | na | 60 | 60 | 60 | 60 |
| Pediatric, Neonate | na | na | 0 | 0 | 0 | 0 |
| RA Mean (High) | na | na | 15 | 15 | 15 | 15 |
| RA Mean (Low) | na | na | 1 | 1 | 1 | 1 |
| RV Systolic (High) | | | | | | |
| Adult | na | na | 50 | 50 | 50 | 50 |
| Pediatric, Neonate | na | na | 0 | 0 | 0 | 0 |
| RV Systolic (Low) | | | | | | |
| Adult | na | na | 20 | 20 | 20 | 20 |
| Pediatric, Neonate | na | na | 0 | 0 | 0 | 0 |
| RV Diastolic (High) | | | | | | |
| Adult | na | na | 20 | 20 | 20 | 20 |
| Pediatric, Neonate | na | na | 0 | 0 | 0 | 0 |

| Setting | Base | BasePlus | Cardiac | Cardiac with Temp | Anesthesia | Anesthesia with Temp |
|---|---|---|---|---|---|---|
| RV Diastolic (Low) | | | | | | |
| Adult | na | na | 0 | 0 | 0 | 0 |
| Pediatric, Neonate | na | na | 0 | 0 | 0 | 0 |
| RV Mean (High) | | | | | | |
| Adult | na | na | 30 | 30 | 30 | 30 |
| Pediatric, Neonate | na | na | 0 | 0 | 0 | 0 |
| RV Mean (Low) | | | | | | |
| Adult | na | na | 10 | 10 | 10 | 10 |
| Pediatric, Neonate | na | na | 0 | 0 | 0 | 0 |
| CVP Mean (High) | na | na | 15 | 15 | 15 | 15 |
| CVP Mean (Low) | na | na | 1 | 1 | 1 | 1 |
| ICP Mean (High) | na | na | 15 | 15 | 15 | 15 |
| ICP Mean (Low) | na | na | 1 | 1 | 1 | 1 |
| Primary Inspired (High) | na | na | na | na | 2.3 | 2.3 |
| Primary Inspired (Low) | na | na | na | na | OFF | OFF |
| Primary Expired (High) | na | na | na | na | 1.5 | 1.5 |
| Primary Expired (Low) | na | na | na | na | OFF | OFF |
| $N_2O$ Inspired (High) | na | na | na | na | 75 | 75 |
| $N_2O$ Inspired (Low) | na | na | na | na | OFF | OFF |
| $N_2O$ Expired (High) | na | na | na | na | OFF | OFF |
| $N_2O$ Expired (Low) | na | na | na | na | OFF | OFF |
| HAL Inspired (High) | na | na | na | na | 2.3 | 2.3 |
| HAL Inspired (Low) | na | na | na | na | OFF | OFF |
| HAL Expired (High) | na | na | na | na | 1.5 | 1.5 |
| HAL Expired (Low) | na | na | na | na | OFF | OFF |
| ENF Inspired (High) | na | na | na | na | 4.8 | 4.8 |
| ENF Inspired (Low) | na | na | na | na | OFF | OFF |
| ENF Expired (High) | na | na | na | na | 3.2 | 3.2 |
| ENF Expired (Low) | na | na | na | na | OFF | OFF |
| ISO Inspired (High) | na | na | na | na | 3.6 | 3.6 |
| ISO Inspired (Low) | na | na | na | na | OFF | OFF |
| ISO Expired (High) | na | na | na | na | 2.4 | 2.4 |
| ISO Expired (Low) | na | na | na | na | OFF | OFF |
| DES Inspired (High) | na | na | na | na | 18.0 | 18.0 |
| DES Inspired (Low) | na | na | na | na | OFF | OFF |
| DES Expired (High) | na | na | na | na | 12.0 | 12.0 |
| DES Expired (Low) | na | na | na | na | OFF | OFF |
| SEV Inspired (High) | na | na | na | na | 5.1 | 5.1 |
| SEV Inspired (Low) | na | na | na | na | OFF | OFF |

| Setting | Base | BasePlus | Cardiac | Cardiac with Temp | Anesthesia | Anesthesia with Temp |
|---|---|---|---|---|---|---|
| SEV Expired (High) | na | na | na | na | 3.4 | 3.4 |
| SEV Expired (Low) | na | na | na | na | OFF | OFF |

## Other Alarm Settings

| All models | Value |
|---|---|
| Alarm Volume | 5 |
| Apnea | 20 seconds |
| ECG Lead Fail | Medium |

# Appendix C: Specifications

**ECG**

| | | |
|---|---|---|
| ECG System | Lead Selection: | 3-Lead; I, II, III<br>5-Lead; I, II, III, aVR, aVL, aVF, V |
| | Frequency Response: | Monitor; 1-40Hz (-3dB) |
| | Safety Standards: | UL60601-1<br>CAN/CSA C22.2 No. 601.1-M90<br>IEC 60601-1, IEC 60601-2-27 |
| | EMC Standards: | IEC 60601-1-2 2nd Edition, CISPR11 Class B |
| ECG Module | Dimensions: | 13.34cm. x 9.14 cm. x 3.10cm.<br>(5.25 in. x 3.60 in. x 1.22 in.) |
| | Lead Connectors: | 3 or 5 Lead, Standard AAMI (DIN 42-802) |
| | Lead Connector Color Code: | American Heart Association (AHA) |
| | Patient Isolation: | Type CF |
| | Defibrillation Protection: | Yes |
| | Electrosurgery Protection: | No |
| | HF Equipment Protection: | No |
| | Pacemaker Pulse Rejection: | No |
| | Battery: | Rechargeable 7.4V, 1.5Ah Lithium-Polymer, internal, not user-serviceable, see “Disposal” on page A-7 for disposal instructions |
| | Battery Life: | Approximately 40 hours of continuous use |
| | Low Battery Indication: | Indication provided at approximately 7 hours of continuous use remaining |
| | Protection Against Water Ingress: | IPX1 |
| | MR Environment Safety: | MR Safe |
| Leadset | Description: | MR-Compatible, Radio Translucent, 14in (35.6 cm) |
| | Configurations: | 3-Lead: RA (White); LA (Black); LL (Red)<br>5-Lead: RA (White); LA (Black); LL (Red); V (Brown); RL (Green) |
| | Lead Color Code: | AHA |
| | MR Environment Safety: | MR Safe |

| | | |
|---|---|---|
| ECG Module Charger | Dimensions: | 12.0cm. x 5.3cm. x 3.8cm.<br>(4.73 in. x 2.1 in. x 1.5 in.) |
| | AC Input: | 100-250VAC, 50/60Hz |
| | AC Input Connection: | Universal IEC inlet; use supplied cord |
| | Output: | 600mA at 7.4VDC |
| | Charge Time: | Less than 3 hours |
| | Classification: | Class II Medical Power Supply |
| | MR Environment Safety: | NOT safe for use in Magnet Room |
| | Charge Status Indicator (Green LED): | No Battery; Off<br>Charge Pending; Blip (10% ON)<br>Rapid Charge; Flash (50%)<br>Charge Complete; On<br>Charge Failure; Blip |
| **$SpO_2$** | Range: | 1-99%. |
| | Resolution: | 1 percent of full scale |
| | Accuracy: | ± 2 percent of full scale at 70 – 99%;<br>± 3 percent of full scale at 50 – 69%.<br>< 50% oxygen saturation is unspecified. |
| | Averaging Time: | User selectable:<br>3, 6, 9, 12, 15, 18, and 21 seconds. |
| | Search Time: | User selectable: 10, 20, 30, and 40 seconds. |
| | Indications | Plethysmographic waveform, Numeric display. |
| | Method: | Dual wavelength LED, Fiber Optic |
| | Modes: | Adult/Pediatric/Neonate |
| | Operation: | Continuous Use |
| | Sensor Wavelength: | 660nm/905nm |
| | Sensor Power: | <80mW |
| **Heart Rate** | Source: | Smart Switching;<br>ECG (primary), IBP, Pleth, NIBP |
| | Range: | 20-300 bpm (ECG, IBP, Pleth)<br>30-240 bpm (NIBP) |
| | Accuracy: | ± 1bpm or 1% (ECG, IBP, Pleth)<br>± 1 bpm or ±1% (NIBP) |
| | Pulse Tone: | Selectable, On/Off |

| | | |
|---|---|---|
| **Gating** | Signal Source: | ECG, $SpO_2$ |
| | Pulse output: | 50msec (±10%) pulse width, synchronous with the r-wave or corresponding peak of the plethysmogram waveform. |
| | Waveform output: | One of the following, 1.5mV (±0.5mv) ECG or plethysmogram waveform. |
| | Gating Signal Delay: | ≤10 milliseconds (ECG), ≤20 milliseconds ($SpO_2$) |
| | Visual Indication: | Icon at the upper right corner of the display (ECG parameter box). |
| | Function: | User selectable: Off, ECG Waveform or Pulse, $SpO_2$ Waveform or Pulse.<br>The gating function provides gating signals 97% of the time or greater after the first 2 pulses of a scanner RF sequence. |
| **Temperature** | Channels: | 2 |
| | Technique: | Fluoroptic Thermometer |
| | Range: | 68°F to 113°F (20°C to 45°C) |
| | Accuracy: | 68° – 94.8°F, ±0.5%<br>95° – 107.5°F, ±0.2%<br>107.6° – 113°F, ±0.5% |
| | Sensor Type: | Reusable, Fiber Optic Surface Probe. |
| **NIBP** | Technique: | Oscillometric measure upon inflation |
| | Measurement Time: | <40 seconds average; standard adult cuff |
| | Automatic Measurement Cycles: | 2, 3, 5, 10, 15, 30, 60 min; 2, 4 hrs |
| | Measurable Pressure Range: | Adult; 30 to 300 mmHg<br>Pediatric; 30 to 300 mmHg<br>Neonatal; 20 to 150 mmHg |
| | Resolution: | 1 mmHg |
| | Transducer Accuracy: | The greater of ± 2 mmHg or 2% of reading |
| | STAT mode: | 5 min of consecutive readings |

| | | |
|---|---|---|
| **Invasive Blood Pressure** | Channels: | 2 |
| | Transducer Sites: | Selectable:<br>ART, PA, LA, RA, CVP, ICP, RV, LV |
| | Pressure Range: | -10mmHg to 300mmHg (increments of 1mmHg) |
| | Zero Offset: | ±150 mmHg |
| | Transducer Sensitivity: | 5µV/V/mmHg |
| | Resolution: | 1 mmHg |
| | Excitation Voltage: | 5 volts ± 0.1 volt |
| | Accuracy: | ±1 mmHg or ±1%, whichever is greater |
| | Scale Range: | -10 to 10, 0 to 20, 0 to 30, 0 to 40, 0 to 60, 0 to 100, 0 to 150, 0 to 200, 0 to 300, and Automatic |
| | Defibrillation Protection: | Yes |
| Transducer | Frequency Response: | 20 Hz |
| | Transducer Impedance: | > 300 ohms |
| | Transducer Sensitivity: | 5 micro volts per volt per mmHg |
| | Pressure Range: | -20 mmHg to 300 mmHg |
| **Capnometry ($CO_2$)** | Method: | Sidestream; non-dispersive infrared (NDIR) |
| | Range: | 0-99 mmHg, 0-12.5%, 0-12.5 kPa, 0-99 Torr |
| | Resolution: | 1 mmHg, 0.1%, 0.1 kPa, 1 Torr |
| | Accuracy: | ±0.2% abs. or 4% of reading for breath rates up to 60 bpm |
| | Maximum Rise Time: | With a concentration of 10% $CO_2$, 10-90% of maximum:<br>350 milliseconds at 100 ml/min<br>300 milliseconds at 150 ml/min<br>250 milliseconds at 200 ml/min |
| | Response Time: | 7.0 seconds (100 ml/min)<br>5.0 seconds (150 ml/min)<br>4.0 seconds (200 ml/min) |
| | Calibration: | Auto-calibrating |
| | Units: | mmHg; Volume Percent; kPa; Torr |
| | Display: | Inspired $CO_2$, Expired $CO_2$ (End-Tidal) Numerical values, capnograph, and breath by breath $ETCO_2$ bar graph. |
| **$CO_2$ Respiration** | Source: | Capnogram |
| | Range: | 1 to 100 breaths/minute |
| | Resolution: | 1 breath/minute |
| | Accuracy: | The greater of ± 2 breaths/minute or ±2% of reading |

**Halogenated Agents**

| | |
|---|---|
| Method: | Sidestream; non-dispersive infrared |
| Units: | Volume Percent |
| Resolution: | 0.1 Volume Percent |
| Range: | Halothane; 0 to 10.0 vol. %<br>Isoflurane; 0 to 10.0 vol. %<br>Enflurane; 0 to 10.0 vol. %<br>Desflurane; 0 to 20.0 vol. %<br>Sevoflurane; 0 to 10.0 vol. % |
| Accuracy: | ± (0.1% abs. + 4% of reading) for breath rates up to 60 bpm. |
| Identification Threshold: | Halothane; 0.2 vol. %<br>Isoflurane; 0.3 vol. %<br>Enflurane; 0.3 vol. %<br>Desflurane; 0.3 vol. %<br>Sevoflurane; 0.3 vol. % |
| Mixed Gas Threshold: | 0.2 vol. % + 10% of total concentration for breath rates up to 60 bpm. |
| Primary Agent Identification: | User Selectable or Automatic |
| Mixed Agent Identification: | Automatic (secondary agent) |
| Maximum Rise Time: | With a concentration of 10% of the halogenated agent, 10-90% of maximum:<br>650 msec. for (10-90%) at 100 ml/min<br>500 msec. for (10-90%) at 150 ml/min<br>400 msec. for (10-90%) at 200 ml/min |
| Maximum System Response Time: | 7.5 seconds (100 ml/min)<br>5.5 seconds (150 ml/min)<br>4.5 seconds (200 ml/min) |
| Warm-up Time: | 1 minute to first waveforms<br>< 20 minutes to full accuracy |
| Calibration: | Auto-calibrating |
| Auto Zeroing: | Occurs 30 to 60 minutes<br>Duration 3.0 to 7.0 seconds |
| Display: | Primary agent inspired and expired numerical values, Primary agent waveform, Secondary (mixed) agent numerical values |
| Effect of Interfering Gases: | Ethyl alcohol: Negligible<br>Metabolic ketones, Acetone: Negligible<br>Carbon dioxide: Negligible<br>Nitrous oxide: Negligible<br>Helium: Negligible<br>Ether: Contraindicated<br>Cyclopropane: Contraindicated<br>Methoxyflurane: Contraindicated |

| | | |
|---|---|---|
| **Nitrous Oxide ($N_2O$)** | Method: | Sidestream; non-dispersive infrared (NDIR) |
| | Range: | 0 to 99 volume percent |
| | Resolution: | 1% |
| | Accuracy: | ± (1.5% abs. + 4% of reading) for breath rates up to 60 bpm. |
| | Identification Threshold: | 5% (for single and mixed agents) |
| | Maximum Rise Time: | With a concentration of 100% $N_2O$, 10-90% of maximum:<br>(10-90%) 400 milliseconds at 100 ml/min<br>(10-90%) 300 milliseconds at 150 ml/min<br>(10-90%) 250 milliseconds at 200 ml/min |
| | Maximum System Response Time: | 7.0 seconds (100 ml/min)<br>5.0 seconds (150 ml/min)<br>4.0 seconds (200 ml/min) |
| | Calibration: | Auto-calibrating |
| | Units: | Percent |
| | Display: | Numerical Inspired $N_2O$, Expired $N_2O$; $N_2O$ waveform |
| **Oxygen Monitoring ($O_2$)** | Units: | Percent |
| | Display: | Inspired $O_2$, expired $O_2$<br>Numerical values, waveform |
| | Method: | Oxidation-reduction galvanic cell |
| | Range: | 0-100% |
| | Resolution: | 1% |
| | Accuracy: | ± 3 vol. % (0 - 90%)<br>± 4 vol. % (91- 100%) |
| | Maximum Rise Time: | With a concentration of 80% $O_2$, 0-90% of maximum<br>700 milliseconds at 100 ml/min<br>550 milliseconds at 150 ml/min<br>500 milliseconds at 200 ml/min |
| | Maximum System Response Time: | 8.0 seconds (100 ml/min)<br>5.5 seconds (150 ml/min)<br>4.5 seconds (200 ml/min) |
| **Pneumatics** | Flow rate: | 100, 150, 200 ml/min, User Selectable |
| | Occlusion Clearing: | Automatic |
| | Filters: | WaterChek™ $2^+$ |
| | Sample Lines: | 16 foot |
| | Pneumatic Sound Pressure: | 45 dBa maximum @ 1 meter |

| | | |
|---|---|---|
| **Alarms** | Characteristics: | EN 475, Adjustable |
| | Indication: | Audible; Visual |
| | Levels: | High, Medium, Low, Informational, Medium Quiet, Informational Quiet |
| | Settings: | User Defaults, Hospital Defaults, Factory Defaults |
| | Alarm Modes: | Adult/Pediatric/Neonate, High and low limit settings for each mode. |
| | Volume: | User Adjustable (1-10) |
| | Silence: | Yes; 2 minutes or permanent |
| **Trend Reports** | Types: | Tabular and Graphical |
| | Trend memory: | 24 hours (with NIBP every 3 minutes) |
| | Tabular Intervals: | 30 sec., 1, 2, 5,10, 30 min., 1, 2, 4 hrs. |
| | Graphical Span: | 2, 4, 8, 12, or 24 hours |
| | Data Types: | HR, $SpO_2$, Temp., Resp., $EtCO_2$, $INCO_2$, Expired $O_2$, Inspired $O_2$, NIBP (Systolic, Diastolic, Mean) IBP (Systolic, Diastolic, Mean) Agents, $N_2O$ |
| **Printer (Remote Display only)** | Recorder Type: | Internal thermal line printer |
| | Data Formats: | Single or dual waveform; Tabular |
| | Paper Speed: | 12.5 or 25mm/sec continuous. (Snapshot at 50mm/sec) |
| **Controls** | Screen: | 10.4" active color TFT |
| | Resolution: | 640 x 480 pixels |
| | Waveforms: | 6, maximum |
| | Waveform Display Gain: | .5×, 1×, 2×, 4× user selectable |
| | Waveform Sweep Speed: | 6.25, 12.5, 25 or 50 mm/sec, selectable |
| | Display Update Period: | 1.0 second |
| | Keys: | 9; membrane-activated |
| | Rotary knob: | Push and rotate; 24 steps/turn |
| | Languages: | English, French, German, Italian, Portuguese, Spanish, Japanese |
| **System Outputs (Remote Display Only)** | Comm Ports: | RS 232-compatible, digital DB9 (COM 1); mini-DIN8 (COM 2) |
| | Analog Output: | mini-DIN8, Selectable waveform output, Range: -2 to 3 volts, Any Waveform (1 volt signal); Plethysmograph or Capnogram |
| | Video Port: | Serial VGA Compatible |

**Environmental**

| | |
|---|---|
| Operating Temperature: | 15° to 35°C (59° to 95°F) |
| Storage Temperature: | -5° to 50°C (23° to 122°F) |
| Operating and Storage Humidity: | 15% to 90%; non-condensing |
| Operating atmospheric pressure: | 69 and 110 kPa |
| Non-operating atmospheric pressure: | 48 and 110 kPa |
| Type of Protection: | Class I Equipment |
| Degree of Protection: | Type CF, Defibrillator-Proof |
| Compatible scanners: | 0.5T, 1.0T, 1.5T, and 3.0T static magnetic field strengths |
| Protection against ingress: | Monitor: IPX1(Complies with the ingress protection test specified in EN 60601-2-27 ECG Safety Standard.)<br>Remote: IPX0.<br>Power Supply: IPX2. |

**Mechanical/Electrical**

| | | |
|---|---|---|
| Power Supply | Size: | 34.3 cm x 20.3 cm x 7.6 cm<br>13.5 inches x 8.0 inches x 3.0 inches |
| | Weight: | 8.2 kg (18 lbs) |
| | Operation: | Continuous Use |
| | Mechanical Shock: | Negligible effect up to 40G |
| | Vibration: | Negligible effect up to 0.5G at 200Hz |
| | Power Requirements: | 35VA, typical |
| | Voltage: | 100-120, 220-240VAC; 50/60 Hz |
| | RF emissions: | Below 0dBµV at 1 meter within 1MHz. |
| Remote Display | Size: | 25.4 cm x 31.8 cm x 35.6 cm<br>10.0 inches x 12.5 inches x 14.0 inches |
| | Weight: | 5.45 kg (12 lbs) |
| | Operation: | Continuous Use |
| | Mechanical Shock: | Negligible effect up to 40G |
| | Vibration: | Negligible effect up to 0.5G at 200Hz |
| | Power Requirements: | 35VA, typical |
| | Voltage: | 100-120, 220-240VAC; 50/60 Hz |
| | RF emissions: | Below 0dBµV at 1 meter within 1MHz. |
| | Time to receive data from patient monitor: | < 1 second |

Main Monitor

| | |
|---|---|
| Size: | Monitor Top Enclosure:<br>26.7 cm x 36.8 cm x 36.8 cm<br>(10.5 inches x 14.5 inches x 14.5 inches) |
| | Main Monitor System (Depth/Width/Height at Base):<br>61.0 cm x 50.8 cm x 152.4 cm<br>(24 inches x 20 inches x 60 inches) |
| Weight: | Monitor Top Enclosure: 9.1 kg (20 lbs) |
| | Main Monitor System: 59.0 kg (130 lbs) |
| Operation: | Continuous Use |
| Mechanical Shock: | Negligible effect up to 40G |
| Vibration: | Negligible effect up to 0.5G at 200Hz |
| Power Requirements: | 400VA, typical |
| Voltage: | 100-120, 220-240VAC; 50/60 Hz |
| Number of Batteries: | 2 |
| Battery Life: | Minimum of 10 hours on a fully charged battery. |
| Recharge time: | Approximately 12 hours, from a discharged voltage of 10.6 volts to a charged voltage of 13.7 volts at ambient conditions (23°C ± 2°C). |
| RF emissions: | Below 0dBµV at 1 meter within 1MHz of scanner center frequencies. |

All specifications are subject to change without notice.

# Appendix D: Accessories

| | Accessory Description | MEDRAD Part Number |
|---|---|---|
| **ECG Accessories** | | |
| ECG Module | ECG Module (complete with battery) | 3010459 |
| ECG Electrode Accessories | Fiber Optic ECG Cable, Duplex, 5m | 3010460 |
| | ECG Lead set, 3 conductor | 3010461 |
| | ECG Electrodes,3/strip, 1 Box, 30/box (10 sets) | 3006324 |
| | ECG Lead set, 5 conductor | 3010473 |
| | ECG Electrodes,5/strip, 1 Box, 50/Box (10 sets) | 3010511 |
| | NuPrep,1 Tube | 3006321 |
| ECG Gating Accessories | ECG Gating Cable, Phillips ACS/NT | 3010474 |
| | ECG Gating Cable, Phillips Intera | 3010558 |
| | ECG Gating Cable, GE | 3010475 |
| | ECG Gating Cable, Siemens Sonata/Symphony | 3010559 |
| | ECG Gating Cable, Universal | 3010477 |
| **$SpO_2$ Accessories** | | |
| $SpO_2$ Probes | Pulse Oximeter Probe, Adult, 2m | 3010462 |
| | Pulse Oximeter Probe, Pediatric, 2m | 3010794 |
| | Pulse Oximeter Probe, Neonatal, 2m | 3010795 |
| | Pulse Oximeter Extension Cable, 3m | 3010463 |
| $SpO_2$ Peripheral Gating Accessories | Pulse Oximeter Gating Cable, Philips | 3010561 |
| | Pulse Oximeter Gating Cable, GE | 3010562 |
| | Pulse Oximeter Gating Cable, Siemens | 3010563 |

**NIBP Accessories**

| | | |
|---|---|---|
| Reusable Cuffs | Blood Pressure Cuff, Adult, 25-35cm | 3010466 |
| | Blood Pressure Cuff, Small Adult/Pediatric, 18-26cm | 3010467 |
| | Blood Pressure Cuff, Large Arm, 33-47cm | 3010469 |
| | Blood Pressure Cuff, Thigh, 44-66cm | 3010470 |
| | NIBP Connection Tube, 5 meters | 3010471 |
| Disposable Cuffs | Disp. Blood Pressure Cuff, 3-6cm (1 box of 10) | 3010520 |
| | Disp. Blood Pressure Cuff, 4-8cm (1 box of 10) | 3010531 |
| | Disp. Blood Pressure Cuff, 6-11cm (1 box of 10) | 3010532 |
| | Disp. Blood Pressure Cuff, 7-13cm (1 box of 10) | 3010533 |
| | Disp. Blood Pressure Cuff, 8-15cm (1 box of 10) | 3010534 |
| | Disp. Blood Pressure Cuff, Child, 10-19cm (1 box of 10) | 3010468 |
| **IBP Accessories** | IBP interface Cable, Abbot,5m | 3010478 |
| | IBP interface Cable, Baxter,5m | 3010479 |
| | IBP interface Cable, Braun,5m | 3010480 |
| | IBP interface Cable, Medex,5m | 3010536 |
| **Temperature Accessories** | Skin Temperature Probe | 3010515 |
| **Agent Accessories** | Sample lines, 16 foot (1 box of 25) | 3011468 |
| | Disposable Nasal Cannula (1 box of 10) | 3011484 |
| | Divided Nasal Cannula (1 box of 10) | 3011485 |
| | Pediatric Nasal Cannula (1 box of 10) | 3011507 |
| | Pediatric Divided Nasal Cannula (1 box of 10) | 3011508 |
| | WaterChek2+ Water Trap (1 box of 30) | 3010487 |
| | Scavenging Adapter & Exhaust Line | 3010962 |
| | $O_2$ Sensor | 3010970 |
| | $CO_2$ Absorber | 3010971 |

| | | |
|---|---|---|
| **Miscellaneous Accessories** | Printer Paper - 5 rolls | 3010961 |
| | AC to DC Power Supply (does not include DC or AC cables) | 3010555 |
| | Select one DC Power cable from the list below: | |
| | DC power Cable, 8 meters (25ft.) | 3010556 |
| | DC power Cable, 15 meters (50ft.) | 3010557 |
| | Select one AC Power cord from the list below: | |
| | AC power Cable, North American | 3005946 |
| | AC power Cable, International | 3005182 |
| | Main Battery | 3011506 |
| | Fuse, Remote Display (1.0A/250V, Type T) | |
| | Fuse, Power Supply (3.15A/250V, Type L) | 3009595 |
| **Publications** | | |
| Operation Manuals | ***Veris*** 8600 Operation Manual - English | 3010796 |
| | ***Veris*** 8600 Operation Manual - Dutch | 3011448 |
| | ***Veris*** 8600 Operation Manual - French | 3011449 |
| | ***Veris*** 8600 Operation Manual - German | 3011450 |
| | ***Veris*** 8600 Operation Manual - Italian | 3011451 |
| | ***Veris*** 8600 Operation Manual - Japanese | 3011452 |
| | ***Veris*** 8600 Operation Manual - Portuguese | 3011453 |
| | ***Veris*** 8600 Operation Manual - Spanish | 3011454 |
| | ***Veris*** 8600 Operation Manual - Swedish | 3011455 |
| | ***Veris*** 8600 Operation Manual - Multi Language CD | 3010988 |
| Help Cards | Help Cards - English | 3010797 |
| | Help Cards - Dutch | 3010991 |
| | Help Cards - French | 3010992 |
| | Help Cards - German | 3010993 |
| | Help Cards - Italian | 3010994 |
| | Help Cards - Japanese | 3010995 |
| | Help Cards - Portuguese | 3010996 |
| | Help Cards - Spanish | 3010997 |
| | Help Cards - Swedish | 3010998 |
| Installation and Service | ***Veris*** 8600 Patient Monitor Service Manual - English | 3010798 |
| | ***Veris*** 8600 Remote Display Service Manual - English | |
| | ***Veris*** 8600 Patient Monitor Service Manual - English (CD) | 3010990 |
| | ***Veris*** 8600 Patient Monitor Service Schematic Manual - English (CD) | 3010989 |
| | Installation Instructions | 3010799 |

# Appendix E: Troubleshooting

**General Troubleshooting**

- Ensure proper placement of monitor and accessories in and around the magnet bore.
- Check the graphite cables for fraying or other deterioration.
- Check that all connections are secure.
- Ensure that the batteries are charged in the main monitor and in the ECG module.

**Troubleshooting Table**

This section lists the possible causes of monitor problems. Use this table to identify and locate any causes for the malfunction.

| Symptom | Problem | Solution |
|---|---|---|
| Main monitor won't power up (On/Off LED is dark) | • Batteries are discharged | Connect monitor to the power supply and recharge the batteries. |
| Remote display won't power up (On/Off LED is dark) | • AC power cord is not securely connected to monitor<br>• AC outlet off or unpowered<br>• Fuses are blown (Located above AC connection) | Connect AC power cord to wall outlet<br>Connect power cord to a live outlet<br>Replace AC fuses |
| Display is blank or not readable | • Batteries are discharged<br>• AC power cord is not securely connected to the remote display | Connect monitor to the power supply and recharge the batteries.<br>Connect AC power cord to the remote display |
| NIBP air leak | • Defective cuff<br>• Defective hose<br>• Pneumatic tube leaks or defective valve | Replace Cuff<br>Replace Hose<br>Contact MEDRAD Service Department. |
| NIBP not functioning | • NIBP is disconnected.<br>• Software problem | Ensure NIBP cable and extension cable are securely connected.<br>Contact MEDRAD Service Dept. |
| $SpO_2$ not functioning | • $SpO_2$ cables are disconnected.<br>• Software problem | Ensure $SpO_2$ cable and extension cable are securely connected.<br>Contact MEDRAD Service Dept. |
| ECG noise or intermittent function | • Poor skin preparation<br>• Poor electrode placement<br>• Defective fiber optic cable<br>• Line Frequency/Filter wrong<br>• Defective ECG module | Re-prep the patient<br>Reposition/replace electrodes<br>Replace fiber optic cable<br>Check ECG settings<br>Replace ECG module |

| Symptom | Problem | Solution |
|---|---|---|
| Trap error or $CO_2$ malfunction | • Trap is plugged or leaks<br>• $O_2$ Cell is loose | Replace trap<br>Tighten $O_2$ Cell |
| $O_2$ not responding ($CO_2$ functioning ok) | • $O_2$ Cell depleted | Replace $O_2$ Cell |
| No sound from speaker | • Volume turned down | Set volume higher in *Configuration* window. |
| COM 1 serial interface doesn't work | • Set to internal printer | Reset monitor to external printer |

If the above Troubleshooting tips don't resolve the problem, see your bio-medical personnel or contact MEDRAD's Customer Service.

# Appendix F: IBP Transducer Specifications

**IBP Specifications**

Invasive Blood Pressure

| | |
|---|---|
| Channels: | 2 |
| Transducer Sites: | Selectable; ART, PA, LA, RA, CVP, ICP |
| Pressure Range: | -20mmHg to 300mmHg |
| Excitation Voltage: | 5 volts (± 0.1 volt) |
| Transducer Sensitivity: | 5µV/V/mmHg |
| Resolution: | 1 mmHg |
| Accuracy: | ±1 mmHg or ±1%, whichever is greater |
| Scale Range: | -10 to 10, 0 to 20, 0 to 30, 0 to 40, 0 to 60, 0 to 100, 0 to 150, 0 to 200, 0 to 300, and Auto Ranging |

**Transducer Specifications**

Transducer Impedance: > 300 ohms

Transducer Sensitivity: 5 micro volts per volt per mmHg

Pressure Range: -20 mmHg to 300 mmHg

**⚠CAUTION⚠**

- Interface cables and adapters can introduce extra impedance as well as inaccuracy due to poor connections. Consult with your transducer manufacturer, before using additional accessories with the ***Veris*** monitor.

**Transducer Cables**

Invasive blood pressure transducers are available with a variety of cable and connection styles. Consult with your transducer provider for specific transducers for use with MEDRAD, Inc., products. Transducers that are specifically cable terminated for the ***Veris*** monitor can be purchased through Fogg System Company, Inc. of Denver, Colorado, www.foggsystem.com.

**Compliance**

As for all accessories, cables and transducers should comply with UL and IEC standards for medical equipment.

**Defibrillation Protection**

The MEDRAD-IBP module and port connection is defibrillation proof. Consult your transducer supplier for information about defibrillation protection of specific transducers and IBP fluid systems.

High Frequency Interference

The ***Veris*** monitor does not employ any external, protective isolating devices that are required to be used in conjunction with invasive blood pressure monitoring accessories during high frequency electrosurgery/electrocautery procedures. Use of invasive blood pressure transducers with internal isolation between the electronic bridge and the wetted parts is recommended for all IBP applications.

# Appendix G: Wireless Communication

**Wireless Network Communication Interface**

The ***Veris*** 8600 telemetry technology allows for RF communication up to 10 meters in the Faraday cage utilizing 2.4 gigahertz RF communication. The main monitor and remote display support a wireless network communication interface according to the 802.11b standard.

**Operation**

**⚠WARNING⚠**

- Do not take the remote display into the MR Scanner room. The remote display contains ferromagnetic material and can be strongly attracted to the magnet causing a safety hazard.

The remote display is an option to the ***Veris*** Cardiac and Anesthesia configurations.The remote display is standard on the ***Veris*** BasePlus configuration. The remote display looks similar to the main monitor that is in the MR room. The remote display must be in the control room and communicate to the main monitor via a wireless or hardwire serial connection. The remote display offers a way to control the ***Veris*** main monitor from the control room without going into the MR room. The remote display and main monitor are sychronized; what displays on the main monitor displays on the remote display at the same time. For example, if the user changes an alarm setting, both units display the *ALARMS* menu and the change as it takes place.

When the remote display is turned on, it displays the message *Please Wait Until Synchronization* until it synchronizes with the main monitor. The main monitor sends its configuration, trend, and current screen configuration data to the remote display. This causes the main monitor and the remote display to be in the same state with the same data.

**NOTE**: The remote display and main monitor cannot synchronize if they are at different software revisions. If the main monitor and the remote display cannot syncronize because the software revision is different, then the remote display displays the message *Remote and Main have incompatible Software*.

After the main monitor and the remote display synchronize, the remote display mirrors what the main monitor is doing. The main monitor is the master. An icon displays in the heart rate (HR) parameter box, on both the remote display and the main monitor, to show that the main monitor and the remote display are communicating. (For more information on the heart rate parameter box, go to “ECG BOX” on page 2-9.)

If communications are lost, the remote display displays the message *Please Wait Until Synchronization* and the units cycle through the synchronization process again after communications are restored. The communication icon on the main monitor (in the heart rate parameter box) does not display until communication is restored.

The remote display contains the internal printer. For more information on printing, see “Printing and Data Ports” in Section 12.

# Appendix H: Battery and Fuse Specifications

### Battery Specifications

Main Monitor Batteries

**NOTE**: Batteries in the main monitor are not externally accesible. Replacement of batteries must be done by a qualified service technician and the unit must be tested afterwards. Refer to the Service Manual for battery replacement.

| | |
|---|---|
| Number of Batteries: | 2 |
| Type: | Sealed lead acid |
| Voltage: | 12 Volt |
| Amp-hour: | 17 amp-hour |
| Battery Life: | Minimum of 10 hours on a fully charged battery. |
| Recharge time: | Approximately 12 hours, from a discharged voltage of 10.6 volts to a charged voltage of 13.7 volts at ambient conditions (23°C ± 2°C). |
| Storage Time, Shelf Life: | Charged battery, maximum 12 months with periodic recharge at intervals specified by the manufactur |

**Fuse Specifications**

Remote Display Fuses

Number: 2
Type: T, Slow acting
Amps: 1 amp
Voltage: 250 volts

Main Monitor Fuses

**NOTE**: Fuses in the main monitor are not externally accesible. Replacement of fuses must be done by a qualified service technician and the unit must be tested afterwards. Refer to the Service Manual for fuse replacement. The fuses are found on the Main PCB:

F1: 3A Time Delay, carries 15mA
F2: 4A Time Delay, carries 3A peak
F3: 3A Time Delay, carries 15mA
F4: 1A Time Delay, circuit not used in Veris
F5: 5A Time Delay, carries 4.5A peak
F6: 4A Time Delay, carries 2.5A peak

Power Supply Fuses

Number: 2
Type: T
Amps: 5 amps
Voltage: 250 volts

**NOTE**: Fuses on the power supply board are not externally accesible. Replacement of fuses must be done by a qualified service technician and the unit must be tested afterwards. Refer to the Service Manual for fuse replacement.

Number: 2
Type: H
Amps: 6.3 amps
Voltage: 250 volts

**Fuse Removal/Replacement**

Remote Display

There are two AC power fuses located at the rear of the remote display directly above the AC power entry socket. Remote displays use 1A 250V Slo Blo fuses.

1. Press in the side clips (at the same time) with a tool and lift out the small, black access cover. The two fuse sockets are visible.

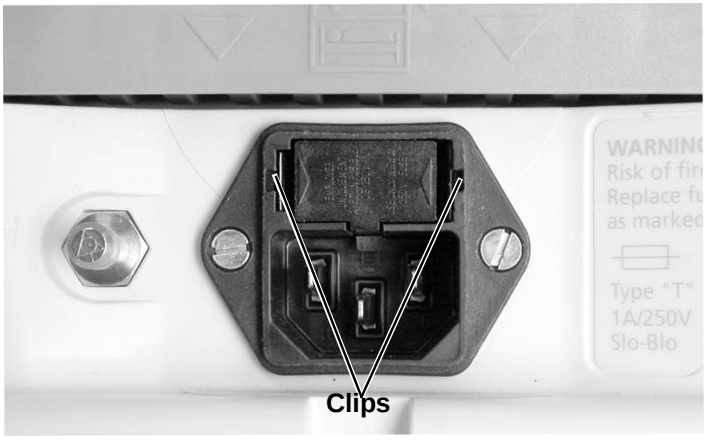



**Figure H-1: Remove the Fuse Cover**

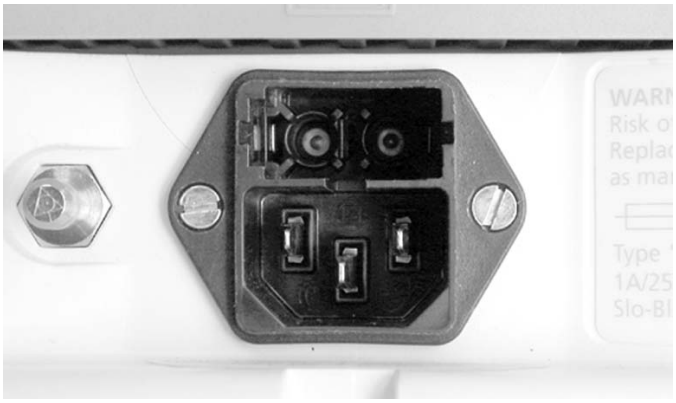


**Figure H-2: Fuses Exposed**

2. Gently pull the fuses out of the fuse cover assembly.

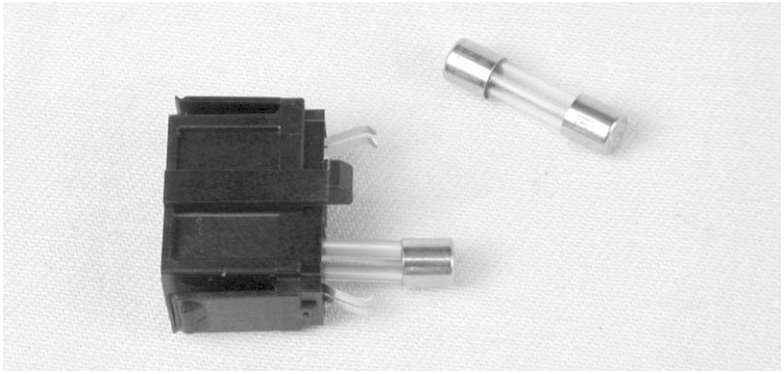


**Figure H-3: Fuses Pulled**

3. Reassemble in reverse order.

Power Supply

There are two AC power fuses located at the AC input side of the power supply directly above the AC power entry socket. Power supplies use 5A 250V slow acting fuses.

1. Pry the cover from the fuse well above the AC cord.
2. Gently remove the fuse assembly and remove the spent fuse(s).
3. Replace fuses and reassemble in reverse order.