Dash® 3000/4000/5000 Patient Monitor

Operator's Manual

2023896-026   Revision A

GE Medical Systems

Information Technologies

gemedical.com

NOTE

Due to continuing product innovation, specifications in this manual are subject to change without notice. The information in this manual supports software versions 5.4 or later.

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Contents

CE Marking Information

Compliance

The Dash® 3000/4000/5000 patient monitor bears CE mark CE-0459 indicating its conformity with the provisions of the Council Directive 93/42/EEC concerning medical devices and fulfills the essential requirements of Annex I of this directive. The product is in radio-interference protection class A in accordance with EN 55011.

The country of manufacture can be found on the equipment labeling.

The product complies with the requirements of standard EN 60601-1-2 "Electromagnetic Compatibility - Medical Electrical Equipment".

The system meets the requirements of EN 60601-1-2 (2001) Medical Electrical Equipment, Part 1: General Requirements for Safety, 2. Collateral Standard: Electromagnetic compatibility — Requirements and tests.

Exceptions

Users should be aware of known RF sources, such as radio or TV stations and hand-held or mobile two-way radios, and consider them when installing a medical device or system.

Be aware that adding accessories or components, or modifying the medical device or system may degrade the EMI performance. Consult with qualified personnel regarding changes to the system configuration.

Radio and Telecommunication Terminal Equipment Directive

The monitor contains a transmitter. The transmitter bears a CE mark indicating conformity with the essential requirements specified in Article 3 of the Council Directive 1999/5/EC of 9 March 1999 concerning Radio Equipment and Telecommunications Terminal Equipment (R&TTE).

The essential requirements are as follows:

Article 3.1 (a) Health Safety; the product complies with the particular medical device safety standards specified in the Medical Device Directive 93/42/EEC: EN 60601-1/1990 + A1: 1993 + A2: 1995: Medical electrical equipment. General requirements for safety.

Article 3.1 (b) EMC; the product complies with:

■ EN 60601-1-2 (2001) Medical electrical equipment: Part 1: General requirements for safety - 2. Collateral standard: Electromagnetic compatibility - requirements and test.

■ ETS 300 826 (1997): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for 2.4 GHz wideband transmission systems and HIgh PErformance Radio Local Area Network (HIPERLAN) equipment".

Article 3.2 Protection of the Radio Spectrum: the product complies with: ETSI EN 300 328 (2003): "Radio Equipment and Systems (RES); Wideband transmission systems; Technical characteristics and test conditions for data transmission equipment operating in the 2.4 GHz ISM band and using spread spectrum modulation techniques.

General Information

■ This manual is an integral part of the product and describes its intended use. It should always be kept close to the equipment. Observance of the manual is a prerequisite for proper product performance and correct operation and ensures patient and operator safety.

■ The symbol ⚠ means ATTENTION: Consult accompanying documents.

■ Information which refers only to certain versions of the product is accompanied by the model number(s) of the product(s) concerned. The model number is given on the nameplate of the product.

■ The warranty does not cover damages resulting from the use of accessories and consumables from other manufacturers.

■ GE is responsible for the effects on safety, reliability, and performance of the product, only if:

♦ assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by GE;

♦ the electrical installation of the relevant room complies with the requirements of the appropriate regulations; and,

♦ the device is used in accordance with the instructions for use.

■ All publications conform with the product specifications and applicable EN publications on safety and essential performance of electromedical equipment as well as with applicable UL and CSA requirements and AHA recommendations valid at the time of printing.

■ The quality management system complies with the international standards ISO 9001 and ISO 13485, and the Council Directive on Medical Devices 93/42/EEC.

1 Introduction

Equipment Information

Intended Use

The intended use of this device is to monitor physiologic parameter data on adult, pediatric and neonatal patients within a hospital or facility providing patient care.

Physiologic data includes the parameters covered in this manual. The monitoring system is also intended to provide physiologic data over the optional network to clinical information systems. This information can be viewed, trended, stored and printed.

Safety Statements

The safety statements presented in this chapter refer to the equipment in general and, in most cases, apply to all aspects of the monitor. There are additional safety statements in the parameter chapters which are specific to that monitored parameter.

The order in which safety statements are presented in no way implies order of importance.

Dangers

Danger statements identify an imminent hazard which, if not avoided, will result in death or serious injury. No danger statements apply to this monitoring system.

Warnings

Warning statements identify a potential hazard or unsafe practice which, if not avoided, could result in death or serious injury.

The following warning statements apply to this monitoring system:

WARNING
ACCIDENTAL SPILLS — To avoid electric shock or device malfunction, liquids must not be allowed to enter the device. If liquids have entered a device, take it out of service and have it checked by a service technician before it is used again.

WARNING

ACCURACY — If the accuracy of any value viewed on the monitor, central station, or printed on a graph strip is questionable, determine the patient's vital signs by alternative means. Verify that all equipment is working correctly.

WARNING

ALARMS — Do not rely exclusively on the audible alarm system for patient monitoring. Adjustment of alarm volume to a low level or off during patient monitoring may result in a hazard to the patient. Remember that the most reliable method of patient monitoring combines close personal surveillance with correct operation of monitoring equipment.

After connecting the monitor to the central station and/or nurse-call system, verify the function of the alarm system.

The functions of the alarm system for monitoring of the patient must be verified at regular intervals.

WARNING

BEFORE USE — Before putting the system into operation visually inspect all connecting cables for signs of damage. Damaged cables and connectors must be replaced immediately.

Before using the system, the operator must verify that it is in correct working order and operating condition.

Periodically, and whenever the integrity of the product is in doubt, test all functions.

WARNING

CABLES — Route all cables away from patient's throat to avoid possible strangulation.

WARNING

CONDUCTIVE CONNECTIONS — Extreme care must be exercised when applying medical electrical equipment. Many parts of the human/machine circuit are conductive, such as the patient, connectors, electrodes, transducers. It is very important that these conductive parts do not come into contact with other grounded, conductive parts when connected to the isolated patient input of the device. Such contact would bridge the patient's isolation and cancel the protection provided by the isolated input. In particular, there must be no contact of the neutral electrode and ground.

WARNING

DEFIBRILLATION — Do not come into contact with patients during defibrillation. Otherwise serious injury or death could result.

WARNING

DISCHARGE TO CLEAR PATIENT DATA — When admitting a new patient, you must clear all previous patient data from the system. To accomplish this, disconnect patient cables then do a discharge.

WARNING

DISCONNECTION FROM MAINS — When disconnecting the system from the power line, remove the plug from the wall outlet first. Then you may disconnect the power cord from the device. If you do not observe this sequence, there is a risk of coming into contact with line voltage by inserting metal objects, such as the pins of leadwires, into the sockets of the power cord by mistake.

WARNING

DISPOSAL — Dispose of packaging material, observing the applicable waste control regulations and keeping it out of children's reach.

WARNING

EXPLOSION HAZARD — Do not use this equipment in the presence of flammable anesthetics, vapors or liquids.

WARNING

WIRELESS COMMUNICATION INTERFERENCE — Wireless LAN equipment contains an intentional RF radiator that has the potential of interfering with other medical equipment, including patient implanted devices.

Before installation and any time new medical equipment is added to the Wireless LAN coverage area, complete the following tests:

- Software version 5.3 or earlier — Perform the electromagnetic compatibility test as described in the Wireless LAN Configuration Guide.
- Software version 5.4 or later — Perform the ad-hoc tests AND the electromagnetic compatibility test as described in the Wireless LAN Configuration Guide.

WARNING

INTERFACING OTHER EQUIPMENT — Devices may only be interconnected with each other or to parts of the system when it has been determined by qualified biomedical engineering personnel that there is no danger to the patient, the operator, or the environment as a result. In those instances where there is any element of doubt concerning the safety of connected devices, the user must contact the manufacturers concerned (or other informed experts) for proper use. In all cases, safe and proper operation should be verified with the applicable manufacturer's instructions for use, and system standard EN 60601-1-1 must be complied with.

WARNING

 — Before using the monitor for the first time, please read the "Safety Statements" on page 1-2.

WARNING

INTRACARDIAC APPLICATION — When applying devices intracardially, electrically conductive contact with parts connected to the heart (pressure transducers, metal tube connections and stopcocks, guide wires, etc.) must be avoided in all cases.

To prevent electrical contact, we recommend the following:

- Always wear isolating rubber gloves.
- Keep parts that are conductively connected to the heart isolated from the ground.
- Do not use tube fittings or stopcocks made of metal.

During intracardiac application of a device, a defibrillator and pacemaker whose proper functioning has been verified must be kept at hand.

WARNING

LEAKAGE CURRENT TEST — When interfacing with other equipment, a test for leakage current must be performed by qualified biomedical engineering personnel before using with patients.

WARNING

PATIENT AMBULATION — A patient must be assisted if ambulating with a roll-stand mounted monitor.

WARNING

POWER SUPPLY — The device must be connected to a properly installed power outlet with protective earth contacts only. If the installation does not provide for a protective earth conductor, disconnect the monitor from the power line and operate it on battery power, if possible.

All devices of a system must be connected to the same power supply circuit. Devices which are not connected to the same circuit must be electrically isolated when operated.

WARNING

PROTECTED LEADWIRES — Only use protected leadwires and patient cables with this monitor.
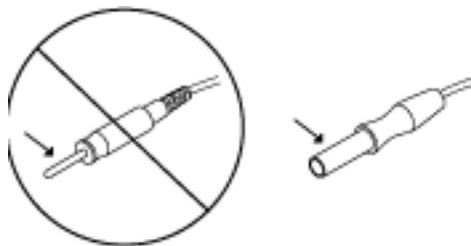
The use of unprotected leadwires and patient cables creates the potential for making an electrical connection to ground or to a high voltage power source which can cause serious injury or death to the patient.

WARNING

RATE METERS — Keep pacemaker patients under close observation. Rate meters may continue to count the pacemaker rate during cardiac arrest and some arrhythmias. Therefore, do not rely entirely on rate meter alarms.

WARNING

SITE REQUIREMENTS — For safety reasons, all connectors for patient cables and sensor leads are designed to prevent inadvertent disconnection, should someone pull on them.

Do not route cables in a way that they may present a stumbling hazard.

For devices installed above the patient, adequate precautions must be taken to prevent them from dropping on the patient.

WARNING

 — If an error message appears DURING operation, it is the physician's responsibility to decide whether the unit is still suitable for patient monitoring. As a general rule, monitoring should only continue in extremely urgent cases and under the direct supervision of a physician. The unit must be repaired before being used again on a patient.

If an error message appears AFTER power-up, the unit must be repaired before being used on a patient.

WARNING

 — If connecting a monitor to a central station, verify the alarm system is functional by temporarily changing one of the alarm limits to initiate an alarm.

Cautions

Caution statements identify a potential hazard or unsafe practice which, if not avoided, could result in minor personal injury or product/property damage.

The following caution statements apply to this monitoring system:

CAUTION

ACCESSORIES (SUPPLIES) — To ensure patient safety, use only parts and accessories manufactured or recommended by GE.

Parts and accessories used must meet the requirements of the applicable EN 60601 series safety standards and essential performance standards, and/or the system configuration must meet the requirements of the EN 60601-1-1 medical electrical systems standard.

CAUTION

ACCESSORIES (EQUIPMENT) — The use of ACCESSORY equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall

include:

- use of the accessory in the PATIENT VICINITY; and

- evidence that the safety certification of the ACCESSORY has been performed in accordance to the appropriate EN 60601-1 and/or EN 60601-1-1 harmonized national standard.

CAUTION

BATTERY POWER — If a device equipped with an optional battery pack will not be used or not be connected to the power line for a period of over six months, remove the battery.

CAUTION

BEFORE INSTALLATION — Compatibility is critical to safe and effective use of this device. Please contact your local sales or service representative prior to installation to verify equipment compatibility.

CAUTION

CO_2 PARAMETER INTERFERENCE — Capnostat CO_2 sensors with a serial number 26104 or greater require a separation distance of 0.25 meters (10 inches) from the Wireless LAN device to minimize potential interference.

CO_2 sensors with a serial number less than 26104 require a separation distance of 2.5 meters (8.2 feet) and are not recommended for use on monitoring equipment equipped with the Wireless LAN option.

CAUTION

DEFIBRILLATOR PRECAUTIONS — Patient signal inputs labeled with the CF and BF symbols with paddles are protected against damage resulting from defibrillation voltages. To ensure proper defibrillator protection, use only the recommended cables and leadwires.

Proper placement of defibrillator paddles in relation to the electrodes is required to ensure successful defibrillation.

CAUTION

DISPOSABLES — Disposable devices are intended for single use only. They should not be reused as performance could degrade or contamination could occur.

CAUTION

DISPOSAL — At the end of its service life, the product described in this manual, as well as its accessories, must be disposed of in compliance with the guidelines regulating the disposal of such products. If you have questions concerning disposal of the product, please contact GE or its representatives.

CAUTION

ELECTROCAUTERY PRECAUTIONS — To prevent unwanted skin burns, apply electrocautery electrodes as far as possible from all other electrodes, a distance of at least 15 cm/6 in. is recommended.

CAUTION

ELECTRODES — Whenever patient defibrillation is a possibility, use non-polarizing (silver/silver chloride construction) electrodes for ECG monitoring. Polarizing electrodes (stainless steel or silver constructed) may cause the electrodes to retain a residual charge after defibrillation. A residual charge will block acquisition of the ECG signal.

CAUTION

EMC — Magnetic and electrical fields are capable of interfering with the proper performance of the device. For this reason make sure that all external devices operated in the vicinity of the monitor comply with the relevant EMC requirements. X-ray equipment or MRI devices are a possible source of interference as they may emit higher levels of electromagnetic radiation.

CAUTION

INSTRUCTIONS FOR USE — For continued safe use of this equipment, it is necessary that the listed instructions are followed. However, instructions listed in this manual in no way supersede established medical practices concerning patient care.

CAUTION

LOSS OF DATA — Should the monitor at any time temporarily lose patient data, the potential exists that active monitoring is not being done. Close patient observation or alternate monitoring devices should be used until monitor function is restored.

If the monitor does not automatically resume operation within 60 seconds, power cycle the monitor using the power on/off switch. Once monitoring is restored, you should verify correct monitoring state and alarm function.

CAUTION

MAINTENANCE — Regular preventative maintenance should be carried out annually. You are responsible for any requirements specific to your country.

CAUTION

MPSO — The use of a multiple portable socket outlet (MPSO) for a system will result in an enclosure leakage current equal to the sum of all individual earth leakage currents of the system if there is an interruption of the MPSO protective earth conductor. Do not use an additional extension cable with the MPSO as it will increase the chance of the single protective earth conductor interruption.

CAUTION

NEGLIGENCE — GE does not assume responsibility for damage to the equipment caused by improperly vented cabinets, improper or faulty power, or insufficient wall strength to support equipment mounted on such walls.

CAUTION

OPERATOR — Medical technical equipment such as this monitor/monitoring system must only be used by persons who have received adequate training in the use of such equipment and who are capable of applying it properly.

CAUTION

POWER REQUIREMENTS — Before connecting the device to the power line, check that the voltage and frequency ratings of the power line are the same as those indicated on the unit's label. If this is not the case, do not connect the system to the power line until you adjust the unit to match the power source.

In U.S.A., if the installation of this equipment will use 240V rather than 120V, the source must be a center-tapped, 240V, single-phase circuit.

This equipment is suitable for connection to public mains as defined in CISPR 11.

CAUTION

RESTRICTED SALE — U.S. federal law restricts this device to sale by or on order of a physician.

CAUTION

SINGLE PATIENT USE — This equipment is designed for use on one patient at a time. Using this equipment to monitor different parameters on different patients at the same time compromises the accuracy of data acquired.

CAUTION

SUPERVISED USE — This equipment is intended for use under the direct supervision of a licensed health care practitioner.

CAUTION
VENTILATION REQUIREMENTS — Set up the device in a location which affords sufficient ventilation. The ventilation openings of the device must not be obstructed. The ambient conditions specified in the technical specifications must be ensured at all times.

Notes

Note statements provide application tips or other useful information.

The following note statements apply to this monitoring system:

- Put the monitor in a location where you can easily see the screen and access the operating controls.
- This product is not likely to cause abnormal operation of other patient-connected equipment such as cardiac pacemaker or other electrical stimulators. Exceptions are noted in the pacemaker monitoring section, if applicable.
- This product is protected against the effects of cardiac defibrillator discharges to ensure proper recovery, as required by test standards. (The screen may blank during a defibrillator discharge but recovers within seconds as required by test standards.)
- This equipment is suitable for use in the presence of electrosurgery.
- Users should be aware of a possible time discrepancy between the waveforms from the telemetry device and the waveforms hardwired to the monitor. Users should not consider these waveforms to be synchronous. If absolute synchronicity is desired, *COMBO* mode should be discontinued and the ECG waveforms should be acquired via the hardwired bedside monitor.
- The ambient conditions specified in the technical specifications of the service manual must be ensured at all times.
- Connect the power cord supplied with the monitor. Use only the original cord or an equivalent one.
- For measurements in or near the heart, GE recommends connecting the monitor to the equipotential stud. Use the green and yellow potential equalization cable and connect it to the equipotential stud on the back of the monitor.
- Contact customer service engineers to connect monitors to a central station.
- Monitors may be shipped with protective covers to protect unused parameter connector inputs from dust and liquids. Do not remove the protective covers; the parameter connectors will not function without them.

Equipment Symbols

NOTE
Some symbols may not appear on all equipment.

⚠	ATTENTION: Consult accompanying documents.
⚡	CAUTION: To reduce the risk of electric shock, do NOT remove cover. Refer servicing to qualified service personnel.
♥	TYPE CF APPLIED PART: Isolated (floating) applied part suitable for intentional external and internal application to the patient including direct cardiac application. "Paddles" outside the box indicate the applied part is defibrillator proof. [Medical Standard Definition:] F-type applied part (floating/isolated) complying with the specified requirements of EN 60601-1/UL 60601-1/CSA 601.1 Medical Standards to provide a higher degree of protection against electric shock than that provided by type BF applied parts.
⍟	TYPE BF APPLIED PART: Isolated (floating) applied part suitable for intentional external and internal application to the patient excluding direct cardiac application. "Paddles" outside the box indicate the applied part is defibrillator proof. [Medical Standard Definition:] F-type applied part (floating/isolated) complying with the specified requirements of EN 60601-1/UL 60601-1/CSA 601.1 Medical Standards to provide a higher degree of protection against electric shock than that provided by type B applied parts. **NOTE** The rating of protection against electric shock (indicated by symbol for CF or BF) is achieved only when used with patient applied parts recommended by GE.
人	TYPE B APPLIED PART: Non-isolated applied part suitable for intentional external and internal application to the patient excluding direct cardiac application. [Medical Standard Definition:] Applied part complying with the specified requirements of EN 60601-1/UL 60601-1/CSA 601.1 Medical Standards to provide protection against electric shock, particularly regarding allowable leakage current.

⊏══⊐	Fuse
↓▽	Equipotential Stud: A ground wire from another device can be tied here to ensure the devices share a common reference point.
∿	Alternating current (AC)
[I | O]	Power
👆	Indicates where to press to open the writer door.
🗑✕	This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.

Equipment Compliance Information

EN 60601-1 Component Classification

The following components meet EN 60601-1 classification standards.

	Type of protection against electrical shock[1]	Degree of protection against electrical shock[2]	Degree of protection against harmful ingress of water[3]	Degree of safety of application in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide[4]	Method of sterilization/ disinfection recommended by the manufacturer	Mode of Operation
Monitor	I	BF (NBP, SpO$_2$, CO$_2$) CF (ECG, Resp, IP, Temp/CO)	Ordinary	Not Suitable	N/A	Continuous
ICG Module	N/A	BF				
SAM Module		B				
PRN-50 Writer	I	Not Marked				
Remote Control	N/A					
TRAM-RAC 2A (powered)	I					

[1]The class of equipment — I or N/A (not applicable).

[2]The type of applied part — B, BF, CF, Not Marked or none (no applied parts).

[3]Ordinary equipment (enclosed equipment without protection against the ingress of water).

[4]Equipment not suitable for use in the presence of a flammable anesthetic mixture with air, oxygen or nitrous oxide.

Underwriters Laboratories, Inc. Classification

Medical Equipment
With respect to electric shock, fire and mechanical hazards only in accordance with UL 60601-1 and CAN/CSA C22.2 NO.601.1.

AAMI EMI Environment Recommendations

Review the AAMI EMC Committee technical information report (TIR-18) titled Guidance of electromagnetic compatibility of medical devices for clinical/ biomedical engineers - Part 1: Radiated radio-frequency electromagnetic energy. This TIR provides a means to evaluate and manage the EMI environment in the hospital.

The following actions can be taken.

- Managing (increasing) distance between sources of EMI and susceptible devices.
- Managing (removing) devices that are highly susceptible to EMI.
- Lower power from internal EMI sources under hospital control (such as, paging systems).
- Labeling devices susceptible to EMI.
- Educating staff (nurses and doctors) to be aware of, and to recognize, potential EMI related problems.

FCC Compliance Information Statement

This device complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada.

Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference 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.

Manual Information

Purpose

This manual contains instructions necessary to operate the monitor safely and in accordance with its functions and intended use.

Intended Audience

This manual is intended for clinical professionals. Clinical professionals are expected to have a working knowledge of medical procedures, practices and terminology, as required for monitoring of critically ill patients.

This manual must be used in conjunction with the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide." This document provides clinical reference information, such as ECG electrode placement, for GE patient monitors.

Conventions

Equipment

This manual uses the following terms to simplify common equipment names.

Term	Equipment Name
acquisition device	■ SAM module ■ ICG module ■ Non-GE interfaced devices
central station	■ CIC Pro Clinical Information Center ■ Centralscope central station
docking station	Dash Port docking station
monitor	Dash 3000/4000/5000 Patient Monitor
printer	■ Direct digital writer (DDW) ■ Laser printer
writer	PRN 50-M digital writer

User Interface

This manual uses the following terms to identify common monitor user interface controls.

Term	Definition
key	A labeled key found on the keypad or remote.
keypad	A pad containing multiple buttons.
main display	The main monitoring display that includes the parameter windows, patient data and access to menus.
menu	A menu is composed of a set of menu options.

Term	Definition
menu option	A choice found in a menu that performs one or more of the following functions: ■ Views another window. ■ Completes an action. ■ Views a report.
window	A window contains one or more of the following items: ■ Patient waveform and parameter data. ■ Parameter-specific controls. ■ List of menu options. ■ Data entry fields.
screen text	Any text that appears on the display screen.

Text

This manual uses the following text styles to identify hardware terms, software terms and the correct way to enter data.

Style	Definition
bold	Indicates hardware items, such as keys, labels or connectors.
italic	Indicates software items, such as menus, menu options or screen text.
>	Indicates menu options or control settings to select consecutively.

Illustrations and Names

In this manual, all illustrations are provided as examples only. They may not necessarily reflect your monitoring setup or data viewed on your monitor.

All names appearing in examples and illustrations are fictitious. The use of any real person's name is purely coincidental.

Ordering Manuals

A paper copy of this manual will be provided upon request. Contact your local GE representative and request the part number on the first page of the manual.

Revision History

Each page of this document has the document part number and revision letter at the bottom of the page. The revision letter changes whenever the document is updated.

Revision	Comments
A	Release of software version 6.

2 Equipment Overview

Hardware Overview

Front
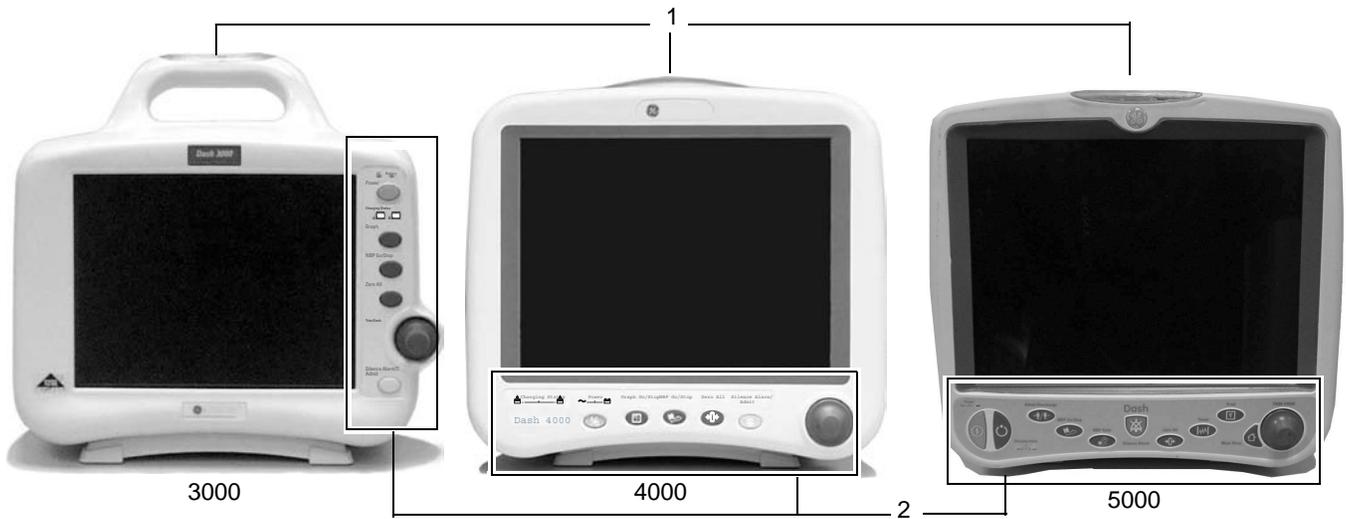
1	Alarm light indicator	Provides a visual alarm for patient status alarms.
2	Control panel	Provides quick function keys and the **Trim Knob** control to navigate menus and select options.

Right

4000
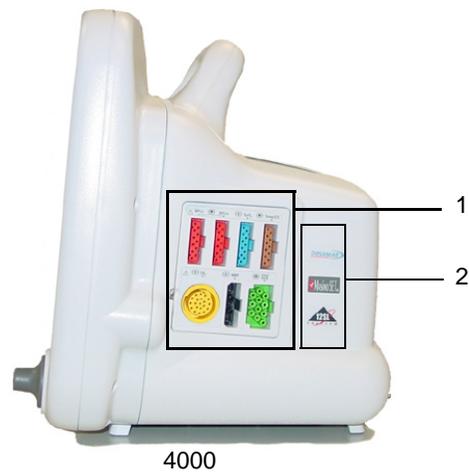
1	Patient connectors	Allows patient cables to connect to the monitor.
2	Enabled option labels	Identifies the options enabled on the monitor.

NOTE

All patient connectors with the applied part symbol (⊦ 🧍 ⊦) are high-insulation ports and defibrillator proof to ensure patient safety and protect the device during defibrillation and electrosurgery

Left

4000
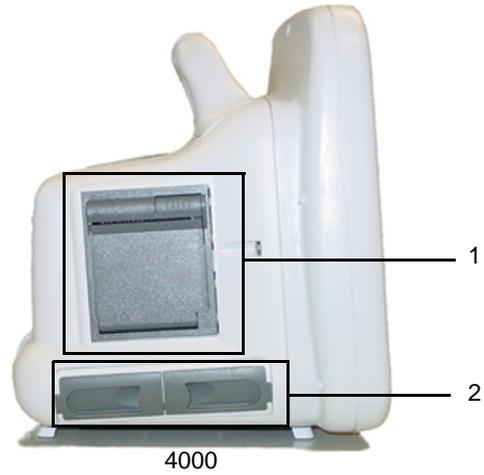
1	Built-in writer	Prints on two inch wide paper.
2	Battery doors	Holds up to two batteries to provide power during patient transport or whenever AC power is interrupted. For more information, refer to "Batteries" on page A-6.

Back

1	Line voltage selector	Matches the line voltage and frequency rating for your country.
2	Product code label	Identifies the product code for this monitor for identification and service needs.
3	Equipotential stud	Provides a common reference to an auxiliary device via a ground wire attached to the stud.
4	DC power connector	Provides connection for DC power cable. The internal power supply converts the AC current to DC power. The monitor is preset at the factory for a specific AC voltage. Refer to the label on the back of the unit for the voltage and current requirements. Before applying power, verify the power requirements match your power supply.
5	Wireless transmitter label	Identifies monitors that contain an internal wireless transmitter for network communication.
6	**Ethernet** connector	Provides network connections to other monitors and devices used in the patient monitoring network.

7	**Aux** connector	Provides serial connection to compatible auxiliary devices, including: ■ Remote control ■ TRAM-RAC housing ■ Remote display ■ Nellcor® 395 pulse oximeter ■ Aspect® BISx module
8	**Defib Sync** connector	Provides analog output signals to other equipment. For more information, refer to "Analog Output" on page 8-7.
9	Voltage and current requirements	Identifies the voltage and electrical current requirements for proper and safe operation of this monitor.
10	Speaker	Provides an audible announcement of patient and system status alarms. For more information, refer to Chapter 4.

Control Panel

3000, 4000 and 5000

The following keys are on the monitor's control panel.

⏻	**Power**	Press once to turn the monitor on and off. For more information, refer to "Operating Modes" on page 2-14.
⌇	**Graph Go/Stop** (3000/4000) **Print** (5000)	Press once to print patient data or an information window. Press again to stop the print job. For more information, refer to Chapter 6.
	NBP Go/Stop	Press once to start one noninvasive blood pressure measurement. Press again to stop the measurement. For more information, refer to "Monitoring NBP" on page 10-1.

→0←	Zero All	Press once to zero all invasive pressures lines which are open to the atmosphere. For more information, refer to "Monitoring Invasive Pressures" on page 9-1.
⚕	Silence Alarm/ Admit (4000/ 5000)	Press Silence Alarm/Admit to quickly admit a patient to the monitor when the monitor is in the discharged state.
	Silence Alarm (3000)	Press Silence Alarm to control audible alarms as configured in the monitor defaults. For more information, refer to "Alarms" on page 4-1.

5000

⏻	Standby	Press once to enter the standby mode. Press again to return to normal mode. For more information, refer to "Getting Started" on page 3-2.
⌂	Main Display	Press once to close all open menus and information windows and return to the main display. For more information, refer to "User Interface Overview" on page 2-16.
⋀⋁	Trend	Press once to display patient trends. The type of trend displayed depends on the factory or custom default setting. For more information, refer to "Customizing the Trends Key" on page 7-10.
🕐	NBP Auto	Press once to view the *NBP AUTO* menu. Select one of the 13 pre-defined time intervals or select *CUSTOM* to create a new automatic measurement interval cycle for the patient or begin a predefined custom interval cycle.
→👤/👤→	Admit/ Discharge	Press once to admit the patient. Press again to access the *DISCHARGE PATIENT* option and discharge an admitted patient. For more information, refer to "Automatic Admit" on page 5-3 or "Discharge" on page 5-5.

Trim Knob Control

Use the **Trim Knob** control to select menus and options.

Selecting Menus or Parameter Window Labels

1. Rotate the **Trim Knob** control in either direction to highlight a parameter window label or menu.

2. Press the **Trim Knob** control to make your selection.

Selecting Options from Lists

1. Rotate the **Trim Knob** control to scroll the pointer (>) up and down the list.

2. When the pointer is in front of the desired option, press the **Trim Knob** control to select the option.

3. If there are multiple options, turn the **Trim Knob** control until the desired option is highlighted.

4. Press the **Trim Knob** control again to make your selection.

5. To exit the menu, position the pointer in front *RETURN* and press the **Trim Knob** control.

Selecting High/Low Values from Lists

1. Rotate the **Trim Knob** control to scroll the pointer up and down the list.

2. When the pointer is in front of the desired option, press the **Trim Knob** control to highlight the parameter.

3. Turn the **Trim Knob** control to highlight the low or high limit.

4. Press the **Trim Knob** control and rotate to change the value.

5. Press the **Trim Knob** control to select the value.

6. Press the **Trim Knob** control to move to the next parameter.

7. Rotate the **Trim Knob** control to highlight the parameter.

8. To exit the menu, position the pointer in front *RETURN* and press the **Trim Knob** control.

Indicators

Alarm Light

Indicates an alarm condition. An optional alarm light indicator is built into the handle or the display bezel.

- Flashing red — *CRISIS* patient status alarms.
- Flashing yellow — *WARNING* patient status and system status alarms.

Power

Indicates the monitor's power source.

820A

Power Indicator

- AC illuminated — The monitor is running on AC power.
- Battery illuminated — The monitor is running on battery power.

Charging Status

Indicates the battery charging status of the internal batteries. One indicator for each battery (**A** and **B**).
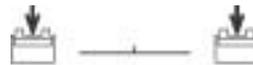
821A

Charging Status Indicator

- Yellow — The battery is charging.
- Green — The battery is fully charged.
- No light — The battery is not installed, not charging or "asleep". Or the monitor is using this battery for power.

Battery Status

Indicates the power status of the internal batteries. One inside each battery door.

- Green — The monitor is using this battery for power.
- No light — The monitor is not using this battery for power.

Optional Components

TRAM-RAC 2A Module Housing

The TRAM-RAC 2A module housing supports one single-parameter module. It has an optional internal power supply that runs the module housing and supports the needed voltages.

Single-Parameter Modules

Use the following single-parameter modules in the TRAM-RAC 2A module housing to acquire the patient's physiological data and view it on the monitor.

SAM Module

The Smart Anesthesia Multi-gas (SAM) module is an infrared based, multi-gas analyzer module that measures inspired and expired values for patient gases and calculates respiratory rate. For more information, refer to Chapter 16.

Solar ICG Module

The Solar ICG (impedance cardiography) module uses thoracic bioimpedance technology (TEB) to provide non-invasive, continuous hemodynamic data. For more information, refer to Chapter 17.

Nellcor® 395 Pulse Oximeter

The Nellcor 395 pulse oximeter is an external pulse oximeter that sends SpO_2 parameter data, including saturation and rate, to the monitor for review and print. You can connect this device to the monitor, the docking station or both. For more information, refer to "Nellcor 395 Pulse Oximeter" on page 11-13.

Unity Network

The Unity Network is a purchased software option that must be enabled in order use a central station, remote display, wireless LAN system or any other networked device.

Centralscope Central Station

The Centralscope central station accepts patient data from monitors and allows bed-to-bed communication via a network connection. The central station may have a built-in, two-inch writer or a laser printer. For more information, refer to the Centralscope central station operator's manual.

CIC Pro Clinical Information Center

The CIC Pro central station accepts patient data from monitors and allows bed-to-bed communication via a network connection. For more information, refer to the CIC Pro clinical information center operator's manual.

Wireless LAN System

CAUTION
DATA LOSS — Operation of an access point or wireless LAN device in close proximity to microwave ovens may cause gaps in waveforms, loss of waveforms or "*NO COMM*" at the central station due to radio-frequency (RF) interference. Isolate the monitor from the interfering source or device or remove the interfering source or device.

NOTE
Wireless monitors moved from room to room must be configured as *ROVER* or *ROVER/COMBO*.

The wireless LAN system allows monitors to roam (within the access point coverage area) and maintain a strong, seamless connection to the network. Access points connect wireless monitors to the wired network infrastructure within the building. The areas covered by each access point overlaps to ensure continuous coverage. Wireless monitors perform the same as monitors directly connected to the network.

Hardwired (directly connected to the network with a cable) or wireless network communication is transparent to the user. It is not indicated on the screen.

Wireless communication automatically occurs when the network cable is disconnected from a wireless monitor. Hardwired communication automatically occurs when the network cable is connected to the wireless monitor and the network. Each mode of network communication is established within three seconds of connection or disconnection from the wired network.

The hardwired network connection has priority when a monitor is wireless configured, but hardwired to the network.

If you experience any network communication issues, try the following:

- Make sure the monitor is in the wireless network coverage area.
- Try moving the monitor to a different access point location in the wireless network.
- Isolate the monitor from the interfering source or device or remove the interfering source or device.

Laser Printer

WARNING

SHOCK HAZARD — Laser printers are UL 60950/IEC 60950 certified equipment, which may not meet the leakage current requirements of patient care equipment. This equipment must not be located in the patient vicinity unless the medical system standard EN 60601-1-1 is followed.

Do not connect a laser printer to a multiple portable socket outlet (MPSO) supplying patient care equipment. The use of MPSO for a system will result in an enclosure leakage current equal to the sum of all the individual earth leakage currents of the system if there is an interruption of the MPSO protective earth conductor.

A laser printer can be accessed through a central station. For more information, refer to Chapter 6.

PRN 50-M Digital Writer

The built-in, four channel writer prints on two-inch wide paper.

Remote Control

The hand-held remote control operates the monitor. It connects to the monitor via a communications cable with a DIDCA connector plugged into the **Aux** port on the monitor or the docking station.

The remote control is available in three versions:

- Adult
- Neonatal
- Operating Room

Each version offers a unique set of buttons and a **Trim Knob** control.

Button	Version	Function
12-Lead	Adult	Opens the *12 LEAD ECG ANALYSIS* menu.
Admit/Discharge	Adult and Neonatal	Opens a menu to admit or discharge a patient.
Airway Gases: CO2	Operating Room	Opens the *CO$_2$* menu.
Airway Gases: Gas	Operating Room	Opens the *GAS* menu.
Alarm Volume	Neonatal	Opens the *ALARM VOL* menu.
All Limits	Adult and Neonatal	Opens the *ALL LIMITS* menu.
Cardiac Calcs	Adult and Operating Room	Opens the *CARDIAC CALCS* menu.
Cardiac Output	Adult and Operating Room	Opens the *CARDIAC OUTPUT* menu.
CRG Events	Neonatal	Opens the *DOCUMENT CRG EVENTS* window.
CRG Print	Neonatal	Prints the CRG waveforms.
CRG Recall	Neonatal	Opens the *CRG TRENDS* menu at the most recent CRG event.
Defaults	Adult, Neonatal and Operating Room	Opens the *MONITOR DEFAULTS* menu.
Display On/Off	Adult, Neonatal and Operating Room	Turns the display, alarms and NBP off, but remaining on AC or battery power and active at the central station.
Dose Calcs	Neonatal	Opens the *DOSE CALCS* menu.
Graph Go/Stop Print	Adult, Neonatal and Operating Room	Prints the current patient data. Press again to stop.
Graphic Trends	Adult and Operating Room	Opens the *GRAPHICS TRENDS* menu.
Main Menu	Adult, Neonatal and Operating Room	Returns to the main display.
NBP Auto	Adult and Operating Room	Opens the *NBP AUTO* menu.
NBP Go/Stop	Adult, Neonatal and Operating Room	Begins an NBP measurement. Press again to stop.
NBP Stat	Adult and Operating Room	Starts five minutes of continuous, sequential NBP measurements.
New Case	Operating Room	Discharges and admits a patient.
PA Wedge	Adult and Operating Room	Opens the *PA WEDGE* menu.
QRS Volume	Neonatal	Opens a menu to adjust the QRS volume tone.
Resp Relearn	Neonatal	Relearns the patient's respiration.

Button	Version	Function
Silence Alarm	Adult, Neonatal and Operating Room	Silences sounding alarms.
SpO2	Operating Room	Opens the *SPO$_2$* menu.
View Other	Adult and Neonatal	Opens the *VIEW OTHER PATIENTS* menu.
Vital Signs	Adult and Neonatal	Opens the *VITAL SIGNS* menu.
Zero All	Adult, Neonatal and Operating Room	Zeroes all invasive pressure lines open to the atmosphere.

Dash Port

The Dash Port is a docking station for a monitor. It gives the monitor easy connect/disconnect access to AC power, the network, remote display and auxiliary devices. For more information, refer to the docking station operating instructions.

Remote Display

The remote display provides a larger display or display in a separate room. The remote display must be located within 150 feet of the patient monitor. It also requires a docking station, a monitor running software version 5 or later and a network connection.

Cadex® SMart Two+ Charger

GE recommends using the Cadex SMart Two+ Charger (software version 1.1 or later) to care for all batteries used in this monitor. For more information, refer to "Batteries" on page A-6.

Operating Modes

Normal

Press the **Power** key to begin the normal operating mode. Normal mode provides all functional capabilities of the monitor, including vital signs monitoring, network communication and battery charging. During the power-up sequence, a splash screen displays and the control panel and alarm light indicators illuminate. After approximately 20 seconds, the *Main Menu* displays.

Before admitting a patient to the monitor, complete each of the following tasks to verify that the monitor is ready for use.

1. Verify the power, network and patient cables are connected to the monitor.

2. Press the **Power** key to turn the monitor on.

3. Verify the wireless network communication is functional, if applicable. Approximately one minute after power-up, perform one of the following actions to verify network communication:

   - From the wireless monitor's main display, select *MORE MENUS > VIEW OTHER PATIENTS > SELECT A BED TO VIEW*. Select a bed from the network.
   - View the wireless monitor from a central station on the network.
   - Perform a LIST NETWORK from a central station on the network and verify the wireless monitor appears in the list. For more information, refer to the central station's operator's manual.

4. Verify monitor is functioning correctly.

   After power-up and during operation, the monitor automatically self-tests. When a malfunction is detected, the monitor displays a message and a prompt asking whether the user wishes to continue operation.

   WARNING
   — Before using the monitor for the first time, please read the "Safety Statements" on page 1-2.

Off/Charging

When the monitor is in normal operating mode, press the **Standby** key to switch to the off/charging operating mode. All alarms are disabled and the Standby screen displays until you press the **Trim Knob** control, **Standby** or **Admit/Discharge** key. Off/charging mode operation only provides one function: charging batteries.

Off

Press the **Power** key and disconnect the monitor from AC power to turn the monitor off. When turned off, the monitor does not perform any operations.

NOTE
You cannot turn the monitor off when in *COMBO* or *ROVER COMBO* monitoring modes. If you disconnect from AC power and press the **Power** key, you are prompted to discharge the patient. The monitor receives power from the batteries until the patient is discharged.

User Interface Overview

Main Display

The main display is the primary display. It includes all monitored parameter windows and waveforms. It also includes monitor information and access to all other monitor and parameter functions and menus. The monitor automatically returns to the main display when any other menu is idle for more than five minutes.
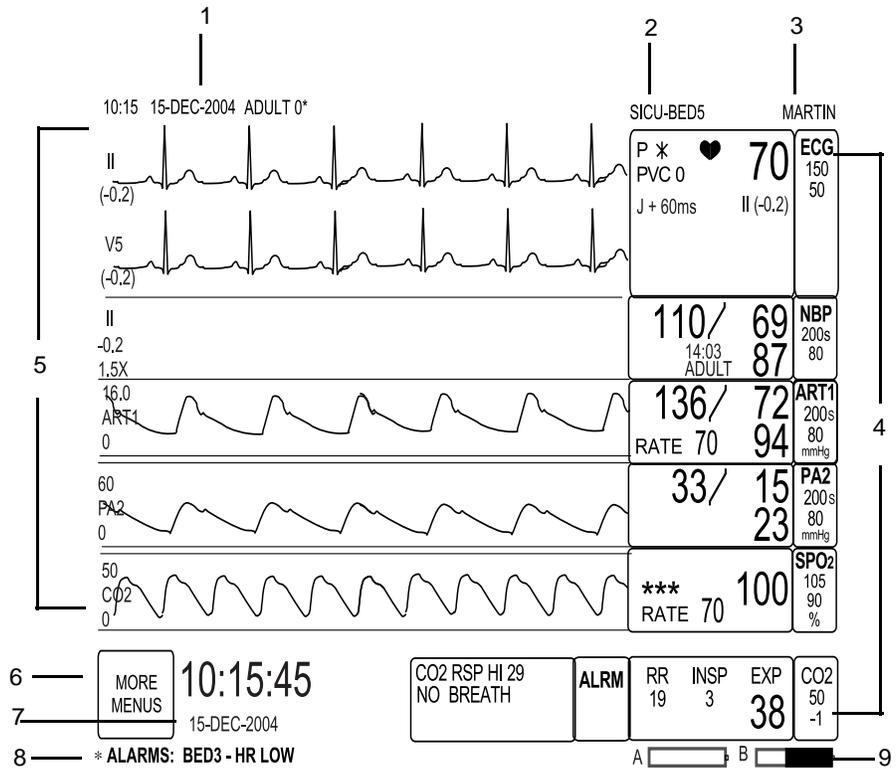
Main Display

1	Time, date and factory or custom default name
2	Care unit and bed name
3	Patient name
4	Parameter windows

5	Parameter waveforms
6	*MORE MENUS*
7	Large Clock/Date
8	Message line
9	Battery gauge

Menus

There are three types of menus.

■ Popup menus — A small menu that displays over the original menu. All popup menus require some action by the user. There are three types of action:

◆ Scrolling — Use the **Trim Knob** control to scroll and select an option from a list.

◆ Pointer — Use the **Trim Knob** control to move a pointer (>) and select an option from a list.

◆ Numeric — Use the **Trim Knob** control to scroll though a range of numbers and make a selection.

■ Subordinate menus — A complete set of menu options.

■ Direct action menus — A menu that allows you to select a status (for example, *ON* or *OFF*) or start a process (for example, *RELEARN*).

Windows

There are two types of window: parameter and information.

A parameter window for every monitored parameter displays on the right side and bottom of the screen. Where and how each parameter window displays depends on the priority set in *MONITOR DEFAULTS*. For more information, refer to "Defining Parameter Window Priority" on page 3-12.
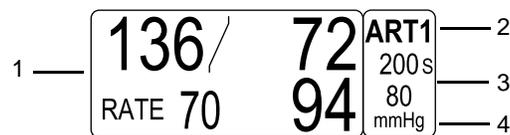
Parameter Window

518A

1	Digital values
2	Parameter window label
3	Alarm limits
4	Units of measurement

An information window is a large popup window that displays over most of the screen. It contains help and other non-real-time information. Up to six parameter windows and the last two seconds of real-time waveforms remain visible.
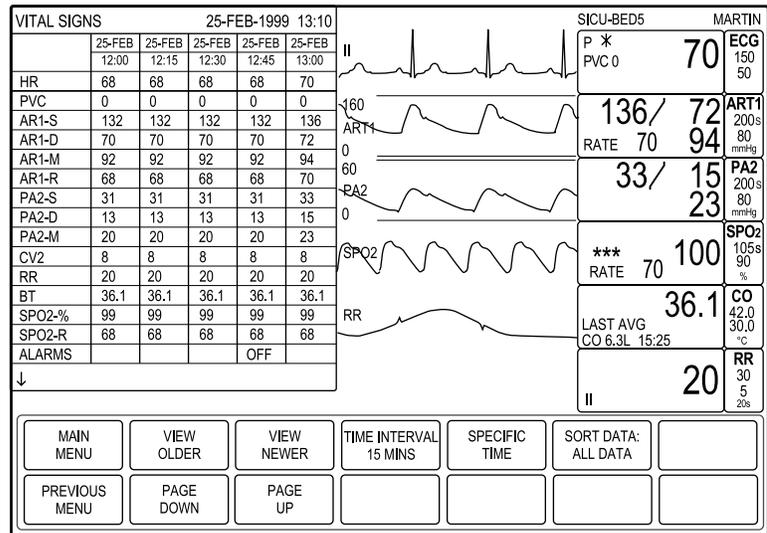
522D

Information Window

3   Monitor Setup

Getting Started

The main display has one menu option, *MORE MENUS*. The following menu options are starting points to access and adjust the monitor's settings.

Option	Function
ALARM CONTROL	View and modify alarm limits, change alarm levels and adjust alarm volume. For more information, refer to "Control Settings" on page 4-5.
VIEW OTHER PATIENTS	View other GE monitors on the network. For more information, refer to Chapter 5.
PATIENT DATA	View patient data and access the calculation programs. For more information, refer to Chapter 7.
MONITOR SETUP	Access menu options to customize the monitor to meet your needs. For more information, refer to "Customizing Monitor Setup" on page 3-6.
ADMIT MENU	Access the menu options to admit and discharge patients. For more information, refer to "Admit" on page 5-2. **NOTE** The menu name changes in *OPERATING ROOM* patient-monitor type to *NEW CASE SETUP*.
GO TO STANDBY	**NOTE** Only available in software version 6 or later. Select to temporarily suspend monitoring. All patient monitoring, alarms and trending stop, until the **Trim Knob** control, the **Standby** key or **Admit/Discharge** key is pressed or the monitor is rebooted.
BATTERY STATUS	Review battery information. For more information, refer to "Batteries" on page A-6.

Identifying Your Configuration

Software Packages

There are three software packages.

- BASIC — Includes standard-of-care parameters, lethal arrhythmia detection, dose calculations and other features required by clinicians caring for acutely ill patients.

- *CARDIAC* — Focuses on cardiac conductivity. Includes full arrhythmia analysis and storage, adjustable ST measurement point and ST segment trending, storage and templates.

- *CARDIO-PULMONARY* — Focuses on cardiac and pulmonary hemodynamics. Includes cardiac and pulmonary calculations, PA insert and wedge algorithms, intra-aortic balloon pump algorithm and a thermodilution cardiac output algorithm that includes predefined computation constants for major catheter manufacturers.

To determine the software running on a monitor, select *MORE MENUS > MONITOR SETUP > SOFTWARE CONFIGURATION*. The software package is listed under *ENABLED SOFTWARE OPTIONS*.

For more information on the features and functionality of each software package, refer to Appendix B.

Software Options

There are three software options. These options can be purchased separately and used with any software package or in combination with other software options.

- High Resolution Trends — Provides storage of up to 100 CRG events and up to 24 hours of CRG trend data.

- 12SL ECG — Provides an analysis program that includes the Gender Specific Criteria and the Acute Cardiac Ischemia-Time Insensitive Predictive Instrument (ACI-TIPI). It uses recorded ECG data to produce a numerical score which is the predicted probability of acute cardiac ischemia. In addition, the gender specific criteria improves the detection of acute myocardial infarctions (AMI) for adult women under the age of 60.

- Unity Network — Enables you to view other patients on the network, interface with a central station and other network devices and perform *COMBO* or *ROVER COMBO* monitoring.

To determine the software options running on a monitor, select *MORE MENUS > MONITOR SETUP > SOFTWARE CONFIGURATION*. The software options are listed under *ENABLED SOFTWARE OPTIONS*.

Monitoring/Admit Modes

There are four monitoring or admit modes. The mode determines how patients are admitted to the monitor and how the monitor functions within a network environment. It is defined during installation via the password protected *SERVICE MODE* menu.

- *STANDARD* — Permanently mount a monitor in a room. This mode does not accommodate telemetry and does not require a network connection unless central station communication is needed.

- *ROVER* — Move or "rove" the monitor to the patient, rather than moving the patient to a monitored room. This mode does not accommodate telemetry and does not require a network connection unless central station communication is needed.

- *COMBO* — Acquire ECG data from a monitor or a telemetry receiver cabinet and access all the available parameters from the monitor. A network connection is required.

- *ROVER COMBO* — Combines the mobility of *ROVER* mode and the telemetry compatibility of *COMBO* mode.

To determine the mode running on a monitor, select *MORE MENUS > MONITOR SETUP > SOFTWARE CONFIGURATION*. The monitoring mode is listed under *ADMIT MENU TYPE*.

Patient-Monitor Type

There are three patient-monitor types. The patient-monitor type controls the monitor defaults and monitor settings. It is defined during installation via the password protected *SERVICE MODE* menu.

- *ADULT-ICU*

- *NEONATAL-ICU*

- *OPERATING ROOM*

To determine the patient-monitor type running on a monitor, select *MORE MENUS > MONITOR SETUP > SOFTWARE CONFIGURATION*. The patient-monitor type is listed under *PATIENT MONITOR TYPE*.

For more information on the monitor default settings for each patient-monitor type, refer to "Factory Defaults" on page C-1.

Language

The monitor language is set to one of 14 options when installed. In most cases, the language does not affect the monitor functionality or usability. However, in a few languages, you may experience the following conditions:

- *HUNGARIAN*, *POLISH* and *RUSSIAN* — Special characters may appear as blanks, asterisks or square boxes due to the inability to display Cyrillic (Russian) characters, as well as certain Polish and Hungarian characters.

- *CHINESE* and *JAPANESE* — All text for alarm broadcast sent over the network is in English. All text input (for example, unit name, bed name, patient information, etc.) is also in English.

NOTE

Special characters that are sent over the network in alarm broadcasts, patient status or system status messages, patient, bed or care unit names cannot be displayed by networked equipment that does not support these languages.

Locale

The monitor is set to one of two locale options when installed: *DEFAULT* or France. If the monitor is set to *FRANCE*, the following functionality varies from the standard, default monitor functions.

France

Alarms

- Alarm pause — Lasts no more than three minutes when in *ADULT-ICU* or *NEONATAL-ICU* patient-monitor types.
- Alarm volume — Alarms can not be turned off in *NEONATAL-ICU* patient-monitor type. The lowest possible setting is 10 percent.

  When turned off, the monitor alarms every three minutes to remind you alarms are silenced. The volume resets to the monitor default setting when a patient is admitted, alarm pause breakthrough occurs or the monitor is turned on.
- Discharge alarms — The monitor alarms every three minutes when a patient is discharged.
- Alarm levels — All parameter patient status message level alarms (except ECG) are automatically increased to a patient status advisory level alarm.

The following monitor default alarm limits are also unique:

- *NBP-S, NBP-D, NBP-M* (*ADULT-ICU* and *OPERATING ROOM*) — 350 to -25.
- *NBP-S, NBP-D, NBP-M* (*NEONATAL-ICU*) — 150 to -25.
- *ART* — 300 to 30.
- *HR* — 300 to 30.
- *SPO2* — 105 to 60.
- *SPO2-R* — 235 to 40.
- *TEMP* — 450 to 0.

Parameters

The following parameter values are unique:

- ECG gain — Derived by mV (.25 mV to 2 mV) and displayed on the primary ECG waveform.
- Units of measurement — Metric only.

- Arrhythmia level — The default arrhythmia alarm level for *ADULT-ICU* is *FULL*; *NEONATAL-ICU* and *OPERATING ROOM* are *OFF*.

- Heart rate — Values under 30 bpm are not displayed. The values displayed in the parameter window are replaced with "*X*".

- SpO$_2$ saturation — Values under 60 percent are not displayed. The values displayed in the parameter window are replaced with "*X*".

Customizing Monitor Setup

Monitor Defaults Overview

There are three types of monitor defaults:

- Factory defaults
- Custom defaults
- Control settings

Factory Defaults

Factory defaults control alarm levels, alarm limits, display setup and parameter priority settings. Each monitor is programmed with three sets of factory defaults (one for each patient-monitor type).

To review the factory defaults on a monitor, select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS*.

These are persistent settings; meaning they are recalled after a patient is discharged from the monitor.

You cannot change the factory defaults. If your care unit requires different settings, you can create custom defaults.

NOTE

If you are prompted for a password after selecting this option, access to monitor defaults was password protected during installation.

For a complete list of the factory defaults for each patient-monitor type, refer to "Factory Defaults" on page C-1.

Custom Defaults

Custom defaults are a set of modified factory defaults. You can create up to five custom default profiles for each patient-monitor type used in your care unit.

Custom defaults are retained when any of the following events occur:

- A parameter cable is disconnected from the patient.
- A parameter cable is disconnected from the monitor.
- A parameter cable is disconnected from a single-parameter module.
- A parameter was turned off, then turned on again.

> **CAUTION**
> — If a patient cable is disconnected from the monitor and the parameter window disappears from the display, alarm limits may revert to the factory defaults when the cable is reconnected.

These are persistent settings; meaning they are recalled when a patient is discharged from the monitor.

You cannot create or adjust custom defaults while a patient is admitted to the monitor.

If you change the patient-monitor type, all custom defaults are erased and the monitor returns to the factory default settings.

If you create custom defaults, record your changes in Appendix D.

Control Settings

Control settings are temporary adjustments you can make to parameter settings or basic monitor functions for the patient admitted to the monitor. These settings are erased when the patient is discharged from the monitor.

For more information on permanently changing monitor settings, refer to "Custom Defaults" on page 3-6.

Defining Custom Defaults

To define a new set of custom defaults, follow this procedure.

NOTE
All custom defaults are effective immediately, but you must admit the patient to the monitor for fully functional alarms.

NOTE
If you do not define a custom default name and make any changes to the monitor default settings, the custom default name displays with an asterisk. For example, ADULT 0*.

1. Discharge the patient from the monitor.

2. Select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS > CUSTOM DEFAULTS*.

3. To create a name for a custom default set, select *NAME DEFAULTS*.

4. Select the default name from the *CUSTOM DEFAULTS* window.

    There are five default names for each patient monitor-type:

    ■ *ADULT-ICU — ADULT 0* to *ADULT 4*.

    ■ *NEONATAL-ICU — NEO 0* to *NEO 4*.

    ■ *OPERATING ROOM — OR 0* to *OR 4*.

5. Use the **Trim Knob** control to define a unique name (up to 12 characters).

6. Select *NAME DEFAULTS* to save the new name.

7. Select *RETURN*.

8. Select *PREVIOUS MENU*.

9. Select any of the following menus and make the desired changes.

Option	Function
SETUP DEFAULTS ARRHYTHMIA ALARM LEVELS	Select the default alarm level for arrhythmias. The arrhythmias listed are determined by the software package, patient monitor type and whether arrhythmia is set for lethal or full. ■ BASIC software package — Only the V TACH alarm level can be changed. ■ *ADULT-ICU* patient-monitor type — The V FIB and V TAC alarm levels cannot be changed. ■ *NEONATAL-ICU* patient-monitor type — The V FIB and V TAC alarm levels cannot be changed.
SETUP DEFAULT PARAMETER ALARM LEVELS	Select the default alarm level for all monitored parameters.
SETUP DEFAULT LIMITS	Select the default high and low alarm limits for all monitored parameters.
SETUP DEFAULT DISPLAY	Select the display defaults for the current patient-monitor type and software package.

Option	Function
SETUP DEFAULT PARAMETER PRIORITY	Select how parameter windows are prioritized on the display. For more information, refer to "Defining Parameter Window Priority" on page 3-12.
RECALL DEFAULT	Select one of the factory or custom default names. Once selected, any changes you make to the settings are automatically saved.

Defining Control Settings

NOTE

All control settings are temporary and revert to the factory or custom defaults when the patient is discharged from the monitor. To permanently change these settings, refer to "Defining Custom Defaults" on page 3-7.

To define control settings for the patient admitted to the monitor, select *MORE MENUS > MONITOR SETUP*. Then select any of the following options and make the desired changes.

Option	Function
WAVEFORMS ON/OFF	Select the desired lead option for each waveform or select *OFF* to remove this waveform from the display. **NOTE** When the ECG parameter is turned off, the first waveform option displays the primary parameter monitoring the patient. The option cannot be changed until the ECG parameter is turned on.
DISPLAY	Select the number of waveforms on the display. ■ *INDV 6 WFS* — Display up to six waveforms with independent scales. The waveforms automatically align with their associated parameter window. ■ *INDV 3 WFS* — Display up to three waveforms with independent scales. The waveforms automatically align with their associated parameter window. ■ *FULL* — Display up to five waveforms. The first two waveforms are individual scales, the next two are full scale (common) and the final is an individual scale. ■ *FULL GRID* — Display the *FULL* mode waveforms with additional graticules. The graticules do not print.

Option	Function

COLOR	Select one of the display color options:
	
	■ *CLINICAL* — Group physiological functions by color.
	  ◆ Amber — ECG.
	  ◆ Green — Hemodynamics.
	  ◆ Blue — Cardiopulmonary, temperature and all other parameters.
	  ◆ Red — Alarms.
	  ◆ White — Gas.
	■ *TRANSDUCER* — Match transducers to a color.
	  ◆ Blue — CVP, RA and UVC.
	  ◆ Green — ECG, SP and all other parameters.
	  ◆ Red — Highest priority arterial line (ART, FEM or UAC), POC and alarms.
	  ◆ White — LA, ICP, non-highest priority arterial line (ART, FEM or UAC), CO, CO_2 and gas data.
	  ◆ Yellow — BIS and PA.
	■ *CRG PLUS*
	  ◆ Blue — SpO_2.
	  ◆ Green — ECG.
	  ◆ Red — Alarms, MAP and highest priority arterial line (ART, FEM or UAC).
	  ◆ White — All other pressures.
	  ◆ Yellow — BIS, CO_2 and RR.
	
	NOTE
	The *TRANSDUCER* and *CRG PLUS* pressure colors are based on the priority set as monitor defaults. The arterial line (ART, FEM and UAC) set at the highest priority is red, all others are white.

PARAMETERS ON/OFF	Select the parameters to display. When turned off, the parameter window and waveform does not display, alarms do not sound and data is not collected in trends.
PRINT SETUP	Select the print locations, content and timing. For more information, refer to Chapter 6.
MONITOR DEFAULTS	Select the custom defaults for any patient-monitor type.

Option	Function
CLOCK DISPLAY	Select the type of clock display. ■ OFF — Remove the clock display from the reduced parameter window location and display the smaller clock on the upper left of the screen. ■ ON W/SEC — Display the military time in hours, minutes and seconds. ■ ON W/OUT SEC — Display the military time in hours and minutes. **NOTE** This option uses the space of one parameter window. If the maximum number of parameter windows are needed for patient monitoring, turn this option off.
BRIGHTNESS	Select the screen brightness.
LEARN THE MONITOR	Select any of the MENTOR educational program options for basic monitor function instructions.
SOFTWARE CONFIGURATION	Select to view the monitor's software configuration, ADMIT menu type, PATIENT-MONITOR TYPE, enabled software options and NBP configuration.
REVISION AND ID	Select to view the monitor's software version and hardware configuration.
SERVICE MODE	Access password-protected monitor settings. These features are intended for qualified service personnel to set up, troubleshoot and repair the monitor. The following settings are controlled in this menu: ■ PATIENT-MONITOR TYPE ■ Application monitoring mode ■ MONITOR DEFAULTS password protection For more information, refer to the service manual.

NOTE

You can also change parameter settings from the main display by using the **Trim Knob** control to select the parameter window label. For more information on specific parameter control settings, refer to the appropriate parameter chapter in this manual.

Restoring Factory Defaults

To restore the factory default settings for the patient-monitor type, follow this procedure.

NOTE

Discharge patients from the monitor before restoring factory defaults.

1. Select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS*.

2. Select *CUSTOM DEFAULTS > RESTORE FACTORY DEFAULTS*.

3. Position the pointer in front of the desired custom name.

4. Press the **Trim Knob** control.

Defining Parameter Window Priority

The number of parameter windows that display on the screen depends on the display mode. No more than six full-sized parameter windows can display on the right side of the monitor. No more than 10 automatically sized parameter windows can display in total; six on the right side and four on the bottom of the screen.

NOTE

The large *CLOCK DISPLAY* option uses the space of one parameter window. If the maximum number of parameter windows are needed for patient monitoring, turn this option off.

You can define which parameters display as full-sized parameter windows in the *DEFAULT PARAMETER PRIORITY* window by selecting the parameters in priority order in the *PARAMETER 2* to *PARAMETER 6* fields.

```
            DEFAULT PARAMETER PRIORITY
  > RETURN
      PARAMETER 1          ECG
      PARAMETER 2          ECG
      PARAMETER 3          ART
      PARAMETER 4          PA
      PARAMETER 5          SPO2
      PARAMETER 6          CO2

    GAS        CVP*        CO*       BIS
    NBP        RA*         CCO
    ART        UVC*        RESP*
    FEM        LA*
    UAC        ICP*        TEMP*
    PA         SP*         TC
    CO2        SVO2*       UO*
    VENT*      SPO2*       ICG
                           ALARMS

    *MAY BE DISPLAYED AS REDUCED SIZE
```

579C

NOTE

PARAMETER 1 cannot be changed. It is always *ECG*. If *PARAMETER 2* is set for *ECG* or *ST*, the ECG parameter window will display the size of two parameter windows.

You can also define which parameters display on the bottom of the screen by selecting the parameters in the order that you want them to display from the list of parameters on the bottom half of the *DEFAULT PARAMETER PRIORITY* window. The parameters with an asterisk may be displayed in a reduced sized parameter window in order to accommodate 10 parameters.

The parameter priority also determines which parameters are displayed in *GRAPHIC TRENDS* and *ALL LIMITS* menus.

You cannot select more than 10 parameters. The monitored parameters vary by patient-monitor type. For a complete list of all parameter priority definitions by patient-monitor type, refer to "Factory Defaults" on page C-1.

NOTE

If you are not actively monitoring a parameter, the parameter window is not displayed. When you begin monitoring the parameter, the screen automatically reconfigures to display the parameter in the defined priority and screen position.

4   Alarms

Introduction

Overview

The monitor notifies you of patient or system status alarms by tone, light or on-screen messages. On-screen messages display in the following locations on the main display:

- Alarming parameter waveform area
- Alarming parameter window
- *ALRM* parameter window
- Message line

For more information on how and where you receive alarm notification, refer to
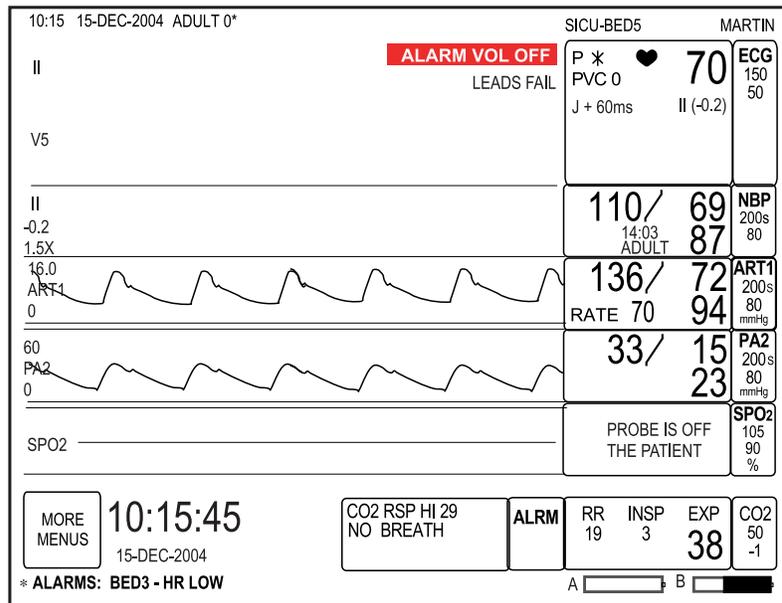
810A

For *ADULT-ICU* and *NEONATAL-ICU* patient-monitor types, the alarm parameter window automatically displays when a patient is admitted to the monitor. It records any patient status alarms set to *CRISIS*, *WARNING* and *ADVISORY*.

Active alarms display in red. Resolved alarms are the designated color for that parameter.

The four most recently resolved alarms are displayed in chronological order with the extreme parameter value and timestamp. The extreme numerical value for all active, displayed parameters is continuously updated.

To remove the alarm parameter window from the main display, select *MORE MENUS > MONITOR SETUP > PARAMETERS ON/OFF > ALRM > OFF*.

Alarm Types

Patient Status Alarms

Patient status alarms are the highest priority alarms. They are triggered by a patient condition which exceeds a parameter's alarm limits or by an arrhythmia condition.

There are four levels of patient status alarms.

- *CRISIS* — Life-threatening events. *CRISIS* alarms sound until silenced by the user.
- *WARNING* — Serious but non-life-threatening events. *WARNING* alarms sound until the condition is resolved.
- *ADVISORY* — Events that require monitoring, but are not serious or life threatening. *ADVISORY* alarms sound until the condition is resolved.
- *MESSAGE* — Additional information only; no alarms sound.

The monitor's response to patient status alarms is as follows.

Indicator	*CRISIS*	*WARNING*	*ADVISORY*	*MESSAGE*
Alarm tone	Three beeps	Two beeps	One beep	No
Alarm light	Red	Yellow	No	No
On-screen message	Yes	Yes	Yes	Yes
Automatic print[1]	Yes	Yes	No	No
ALARM HISTORY	Yes	Yes	Yes	No
Alarm broadcast	Yes	Yes	Yes	No
Remote alarm terminal	Yes	Yes	Yes	No

[1]The factory default for ADULT-ICU is ON; NEONATAL-ICU and OPERATING ROOM is OFF.

You can change patient status alarm levels and limits. For more information, refer to "Control Settings" on page 4-5.

System Status Alarms

System status alarms are triggered by mechanical or electrical problems. They are of lesser priority than patient status alarms.

There are three levels of system status alarms:

- *WARNING* — Serious mechanical or electrical problems.
- *ADVISORY* — Mechanical or electrical problems.
- *MESSAGE* — Additional information only.

The monitor's response to system status alarms is as follows.

Indicator	*WARNING*	*ADVISORY*	*MESSAGE*
Alarm tone	Repeating foghorn	Single foghorn	No
Alarm light	Yellow	No	No
On-screen message	Yes	Yes	Yes
Alarm broadcast	Yes	No	No
Remote alarm terminal	Yes	No	No

You cannot change system status alarm levels and limits.

Safety

WARNING
ALARM ACTIVATION —   No alarms sound or display on the monitor until a patient is admitted to the monitor. The monitor will NOT alarm if an unadmitted patient enters an alarm condition. You must admit the patient to activate alarms, automatic alarm printing and the *ALARM HISTORY*.

WARNING
 —   After an interruption of the electric power supply, verify the alarm processing is active and verify that no arrhythmia occurred.

CAUTION

— GE recommends that monitors without arrhythmia detection monitoring patients at risk of asystole should define the HR alarm as *CRISIS*. If the HR alarm is set to *WARNING*, the alarm clears after three minutes of continued asystole.

NOTE

Always remove all patient cables from the monitor prior to discharging a patient to clear all alarm data from the monitor.

Control Settings

To adjust the control settings for the patient admitted to the monitor, select *MORE MENUS > ALARM CONTROLS*. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to

Option	Function
ALL LIMITS	Select the high and low alarm limits for all monitored parameters.
ARRHYTHMIA ALARM LEVEL	Select the alarm level for arrhythmias.
PARAMETER ALARM LEVEL	Select the alarm level for all monitored parameters. **NOTE** In *NEONATAL-ICU*, the heart rate limit alarm level cannot be set to *MESSAGE*.
ALARM VOLUME	Select the alarm tone volume. **NOTE** In *NEONATAL-ICU*, the alarm volume cannot be turned off. The lowest alarm volume can be set to is 10 percent.
ALARM HELP	Select to learn about alarms levels and hear alarm tones.

Option	Function
DISPLAY OFF ALARM PAUSE	Select one of the following options to temporarily pause patient and system status alarms. ■ *MONITOR/CENTRAL PAUSE* — Preserve the collected patient data, turn off the display and alarm light and pause alarms at the central station. ■ *MONITOR PAUSE* — Turn off the display and alarm light, print local alarms and send patient data and alarms to the central station.
CLEAR ALARMS	Clear all alarm information displayed in the *ALARM WINDOW*.
ALARM HISTORY	**NOTE** *CARDIAC* software package only. View ST references, stored arrhythmia waveforms and ST alarm event for *CRISIS*, *WARNING* and *ADVISORY* alarms. For more information, refer to "Alarm History" on page 7-2.

Silencing Alarms

Temporarily

WARNING
  — Alarms do not sound, alarm histories are not stored, alarm graphs do not print and alarms are not sent to the central station during an alarm pause.

To silence alarms, press the **Silence Alarm** key. A "*SILENCED*" message displays and alarms will not sound. The length of time alarms are silenced depends on:

■ The patient-monitor type.

■ The number of times the **Silence Alarm** key is pressed.

■ Whether any alarms are active when the **Silence Alarm** key is pressed.

Alarms remained paused unless a *CRISIS* patient status alarm occurs. Alarm pause breakthrough allows any *CRISIS* patient status alarm to interrupt an alarm pause. Only *CRISIS* alarms breakthrough, other patient status alarms will not sound.

When the monitor is in alarm pause:

- Countdown timer — Displays time left in the alarm pause when in *ADULT-ICU* or *NEONATAL-ICU* patient-monitor types.
- NBP alarms — Silenced until the next measurement is taken.
- ECG or arrhythmia alarms — If a patient condition of equal or greater priority occurs, the alarm pause is cancelled and the alarm will "break through".
- When ECG is turned off, the "*ALARM PAUSE*" system status message does not display on the central station.
- *FRANCE* locale — Alarms are paused for no more than three minutes in *ADULT-ICU* and *NEONATAL-ICU* patient-monitor types.

Active Alarm

Key Pressed	*ADULT-ICU*	*NEONATAL-ICU*	*OPERATING ROOM*
One	60 seconds		
Two	5 minutes	3 minutes	5 minutes
Three	Pause cancelled		15 minutes
Four			Permanent pause
Five			Pause cancelled

NOTE

You can also select *Silence Only* from the monitor defaults. This disables the pause and a second push results in reactivation of alarm (versus an extended pause).

No Active Alarms

Key Pressed	*ADULT-ICU*	*NEONATAL-ICU*	*OPERATING ROOM*
One	5 minutes	3 minutes	5 minutes
Two	Pause cancelled		15 minutes
Three			Permanent pause
Four			Pause cancelled

Permanently

To permanently silence all audible alarms for the patient admitted to the monitor, select *MORE MENUS > ALARM CONTROL > ALARM VOLUME > OFF*.

NOTE

In *NEONATAL-ICU*, the alarm volume cannot be turned off. The lowest alarm volume can be set to is 10 percent.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

5 Managing Patients

Introduction

Managing patients includes the following tasks:

- Admitting patients to the monitor.
- Discharging patients from the monitor.
- Viewing other patients.

Admit

Overview

You can admit a patient to the monitor from the bedside or a central station. There are three ways to admit a patient to the monitor from the bedside.

Standard Admit

The information required to admit patients to the monitor varies by the monitoring mode and patient-monitor type.

To manually admit a patient to the monitor, follow this procedure:

1. Select *MORE MENUS* > *ADMIT MENU*.

2. Use the **Trim Knob** control to select the following patient information:

LAST NAME	Select the patient's last name (up to 16 characters).
FIRST NAME	Select the patient's first name (up to 10 characters).
PATIENT ID	Select a patient identification number (up to 13 characters) for a MUSE or a Lab Access Server. The default is 9999999999999.
SEX	Select male or female.
BIRTH DATE	Select the patient's birth date to automatically calculate the age from today's date and year. If a birth date is not entered, the default is 1948.
AGE	Age is calculated in years for adults; months, weeks and days for neonates.
HEIGHT	Select the patient's height.

WEIGHT	Select the patient's weight.
RACE	Select the appropriate race.
SECONDARY ID	Select a secondary identification number (up to 13 characters).
REF PHYSICIAN	Select the patient's referring physician's name or telephone number (up to 16 characters).

3. When finished, select *SAVE*.

4. To admit a patient to the monitor with a custom default, follow this procedure.

    a. Select *RECALL DEFAULT*.

    b. Select the desired custom default name from the *RECALL DEFAULT* window.

5. Select *ADMIT PATIENT*.

Quick Admit

To quickly admit a patient to the monitor, select *MORE MENUS > ADMIT MENU > ADMIT PATIENT* or *NEW CASE* without entering any patient information.

When time permits, add the patient's information by selecting *MORE MENUS > ADMIT MENU >CHANGE ADMIT INFO*.

Automatic Admit

NOTE

Only available in software version 6 or later. Not available in the *OPERATING ROOM* patient-monitor type.

To automatically admit a patient to the monitor, press the **Silence Alarm/Admit** or **Admit/Discharge** key.

When time permits, add the patient's information by selecting *MORE MENUS > ADMIT MENU >CHANGE ADMIT INFO*.

Control Settings

To adjust the control settings for the patient admitted to the monitor, select *MORE MENUS > ADMIT MENU*. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

Option	Monitoring Mode	Patient-Monitor Type	Function
CHANGE ADMIT INFO	All[1]	All[2]	Select the patient information. **NOTE** When monitoring ECG, entering the sex and age of the patient provides information needed for the 12SL with Gender-Specific Analysis or ACI-TIPI algorithms. **NOTE** If you change any patient information requested from a Lab Access Server, notify the appropriate hospital personnel.
REQUEST ADMIT INFO	All	All	Request patient information from a Lab Access Server with an interface to hospital information. **NOTE** Use the *VIEW MANUAL ADMIT INFO* menu option to review the manually entered information separately from the automatically populated information.
RECALL DEFAULT	All	All	Recall factory defaults.
ADMIT HELP	All	*ADULT-ICU* and *NEONATAL-ICU*	Review the patient information required to admit a patient for the current monitoring mode.
ADMIT PATIENT	All	*ADULT-ICU* and *NEONATAL-ICU*	Admit a patient to the monitor with the information entered on the *MANUAL ADMIT INFORMATION* information window.
NEW CASE	All	*OPERATING ROOM*	Discharge the existing patient data and ready the monitor for the next patient admission.
UNITS OF MEASURE	All	All	Select the units of measure for the patient's age, height and weight.
SET UNIT NAME	*ROVER* and *ROVER COMBO*	All	Select the unit name for network identification.
SET BED NUMBER	*ROVER* and *ROVER COMBO*	All	Select the bed number for network identification.

Option	Monitoring Mode	Patient-Monitor Type	Function
PRINT LOCATION	*ROVER* and *ROVER COMBO*	All	Select writers from the network.
SET LOCATION ID	*ROVER* and *ROVER COMBO*	All	Select the MUSE Cardiology Information System for network identification.
ECG SOURCE	*COMBO* and *ROVER COMBO*	All	Select the monitor or telemetry transmitter to receive ECG data. If you select telemetry you must also select the transmitter number before you can admit a patient to the monitor.

[1]All includes all four monitoring modes; STANDARD, ROVER, COMBO and ROVER COMBO.

[2]All includes all three patient-monitor types; ADULT-ICU, NEONATAL-ICU and OPERATING ROOM.

Discharge

Discharging a patient from a monitor clears all patient information while retaining the unit name, bed number and factory or custom defaults.

> **WARNING**
> DISCHARGE TO CLEAR PATIENT DATA — When admitting a new patient to the monitor, you must clear all previous patient data from the monitor. To accomplish this, disconnect all patient cables and discharge the patient from the monitor.

To manually discharge a patient from the monitor, follow this procedure:

1. Disconnect all patient cables.

2. Select *MORE MENUS > ADMIT MENU > DISCHARGE PATIENT* or *NEW CASE*.

3. If in *COMBO* or *ROVER COMBO* monitoring modes, select on of the following to terminate telemetry monitoring:

   - *MONITOR* — Discharge from monitor only. If ECG was acquired from telemetry, telemetry will be monitored by the central station.
   - *TELEMETRY* — Discharge from telemetry only. ECG monitoring automatically switches to the monitor.
   - *BOTH* — Discharge from monitor and telemetry.

4. If the monitor is setup to view other monitors, the following events occur when the host monitor is discharged:

- When running the VOA or AVOA software option, the viewed bed is removed from the display and the monitor reverts to the factory or custom defaults.

- When running the AutoView XM software option, the viewed bed is removed from the display, the monitor reverts to the factory or custom defaults. All monitors from other care units are removed from the list of watched monitors. All monitors in the same care unit are retained and monitored according to the *VIEW ON ALARM* control settings.

NOTE
To automatically discharge a patient from the monitor in *ADULT-ICU* or *NEONATAL-ICU*, press the **Silence Alarm/Admit** or **Admit/Discharge** key.

View Other Patients

There are three ways to view patients admitted to other monitors on the network:

- Select another monitor on the network.
- Select an alarming monitor on the network.
- Automatically view an alarming monitor on the network.

How and when monitors display on a host monitor varies by software option. There are three software options that control how you can select and view other monitors on the network.

- View On Alarm (VOA)
- Auto View On Alarm (AVOA)
- AutoView XM

Software Option Comparison

NOTE
GE recommends using ONE software option per care unit. All monitors outside the care unit have all automatic view on alarm functionality disabled.

	View On Alarm (VOA)	Auto View On Alarm (AVOA)	AutoView XM
Host monitor software version	Dash 3000/4000/5000 Patient Monitor (V1 or later)		Dash 3000/4000/5000 (V5 or later)
Monitor (source of alarm) software version	Solar 8000M Patient Monitor (V4 or later)		
	Solar 9500 Information Monitor		

	View On Alarm (VOA)	Auto View On Alarm (AVOA)	AutoView XM
Number of monitors viewable on a host monitor[1]	40 or 10	100	40 or 10
Unity Network Information Server V1 or greater	Not required	Required	Not required
Network connection	Continuous		
Automatic split-screen display	No	Yes	Yes
Monitors you can view	All monitors in the care unit.	All monitors in the care unit with *SEND AUTO VIEW* turned on.	All monitors on the network from the host monitor and have *SEND AUTO VIEW* turned on.
View on alarm functionality	Manually select the alarming monitor. Up to four alarming monitors are available.	Automatically displays the most recent, highest priority alarming monitor in the care unit.	Automatically displays the oldest, highest priority alarming monitor.

[1]Monitors without an installed wireless card and software version 5 or greater can send data to up to 40 other monitors or network devices.

Limitations

CAUTION
ALARM NOTIFICATION — A maximum of four monitors can be displayed in the message line at one time, even if more than four monitors are alarming. Because of this limitation, automatic view on alarm should not be used in place of a central station.

The following conditions prevent an alarming monitor from automatically displaying on another monitor:

- If any of the following menus are active:
  - ◆ *CHANGE ADMIT INFO* or *UNITS OF MEASURE*.
  - ◆ Any automatic view on alarm configuration.
- If any of the following information windows are open:
  - ◆ Any *LEARN THE MONITOR*.
  - ◆ *ECG SOURCE* (*COMBO*).
  - ◆ *UNIT NAME*, *BED NUMBER* and *CONFIRM BED NUMBER* (*ROVER*).
  - ◆ *ALL LIMITS*, *ARRHYTHMIA ALARM LEVEL*, *PARAMETER ALARM LEVEL* or any parameter alarm limit.

- ◆ *SELECT A BED TO VIEW*, *SELECT A BED TO AUTOVIEW*, *SELECT A CARE UNIT*.
- ■ If any of the following functions are being performed or updated:
  - ◆ *PA WEDGE*, *PA INSERT/WEDGE*.
  - ◆ *CARDIAC OUTPUT*.
  - ◆ *CARDIAC CALCS*.
  - ◆ *PULMONARY CALCS*.
  - ◆ *DOSE CALCS*.

NOTE

If an alarming monitor is blocked, text alarm messages are still available and you can manually access the alarm event.

Custom Defaults

All monitors in a care unit have the same factory or custom defaults. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

The following options control how and when other monitors are viewed on a host monitor. Some settings are only available for a specific software option.

Option	Software Option	Function
VIEW ON ALARM	All[1]	Select one of the following options: ■ *OFF* — Do not allow this monitor to view other monitors. ■ *ON* — Display alarm messages from alarming monitors in the care unit. If running AutoView XM, the alarm levels that trigger an automatic display on a host monitor are defined in the *AVOA ALARM LEVEL* setting. ■ *AUTO* — When running AutoView XM, select this option to display alarm messages and enable an automatic split-screen view on alarm on a host monitor.
VOA BROADCAST	All	Select one of the following options: ■ *OFF* — Do not send any alarms from this monitor to other monitors on the network. ■ *ON* — Send all *ADVISORY*, *WARNING* and *CRISIS* alarms to other monitors on the network. Only monitors that have this monitor selected to automatically view on alarm receive the alarms. **WARNING** ALARM NOTIFICATION LIMITATION — If a viewing bed is configured to auto view a bed that has *SEND AUTO VIEWS* turned *OFF*, the viewing bed will only receive the alarm line message, NOT the split-screen view of the accompanying audible alarm. To avoid this limitation, verify that all viewing beds in the watch list have *SEND AUTO VIEWS* turned *ON*.
VOA ALERT TONE	All	Select one of the following options: ■ *OFF* — No tone sounds at host monitor. ■ *ON* — Tone sounds once at host monitor. ■ *REPEAT* — Tone sounds at the host monitor until the condition is resolved.

Option	Software Option	Function
AVOA ALARM LEVEL	AutoView XM	Select the lowest alarm level to automatically view on the host monitor. All alarm levels of higher priority will also display. **NOTE** If the monitor is not running AutoView XM, all patient status warnings, system warnings and *CRISIS* alarms in the care unit display in the alarm message window.
REMOTE SILENCE	All	Select the highest alarm level that can be silenced at the host monitor. All alarm levels of lesser priority can also be silenced. Alarms cannot be silenced in *OPERATING ROOM*.
AVOA SILENCE	AutoView XM	Select when the split view of the alarming monitor is removed after an alarm is silenced at the host monitor. ■ *SILENCED* — Split view of silenced monitor displays until *RETURN* or *MAIN MENU* is selected, even if another monitor is alarming. ■ *NEW ALARM* — Split view of silenced monitor replaced when another monitor alarms.

[1]All software options include View On Alarm (VOA), Auto View On Alarm (AVOA) and AutoView XM.

Control Settings

To adjust the control settings for the patient admitted to the monitor, select *MORE MENUS > VIEW OTHER PATIENTS*. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

Option	Function
VIEW ALARM	Select the alarming monitor to display or print patient data or silence alarms.
VIEW ON ALARM OPTIONS	Select how this monitor receives automatic alarm displays. ■ *VIEW OTHER BEDS ON ALARM* — Select *ON, OFF* or *AUTO.* ■ *SEND AUTO VIEWS* — Select *ON* or *OFF.* ■ *ALERT TONE* — Select *ON, OFF* or *REPEAT.* ■ *CONFIGURE AUTO VIEW ON ALARM* — (AutoView XM only) Select a care unit to automatically display on alarm. ■ *CURRENT CONFIGURATION* — (AutoView XM only) View the current alarm configuration for a care unit.
SELECT A BED TO VIEW	Select the automatic view on alarm level for any monitor on the network. Select *ALLBEDS* to apply to selected beds.
SELECT ANOTHER CARE UNIT	Select any care unit from the network.
PRINT VIEWED BED	Print 20 seconds of the viewed patient data.
VIEWED PATIENT DATA	Display the patient's last event, *TABULAR TRENDS* or *GRAPHIC TRENDS.*

Viewing Other Monitors

Selecting a Monitor

If more than one monitor is alarming, the bed with the most recent and highest priority alarm is displayed first. Up to three other alarming monitors display in order of decreasing priority.

WARNING

— Due to space limitations in the alarm message line, it is possible that the alarm line will only display the beds that are in alarm, but not the alarm reason. Or the alarm reason may be abbreviated to the point where the reason is not immediately obvious to the user. To view alarm reason, select *VIEW ALARM* for the bed you wish to view.

To select an alarming monitor, follow this procedure.

1. Select *MORE MENUS > VIEW OTHER PATIENT*.

2. Select the alarming monitor from the associated *VIEW ALARM* menu.

3. Select one or more of the following functions:

    ■ *GRAPH/ PRINT*
    ■ *SILENCE* (60 seconds)
    ■ *LAST EVENT*
    ■ *VITAL SIGNS*
    ■ *GRAPHIC TRENDS*

4. Select *RETURN*, *PREVIOUS MENU* or *MAIN MENU* to exit.

Understanding the Split-View Display

When viewing another monitor, the split view divides the display in half, Each side displays one monitor's patient information.

■ Right — Host monitor patient information.
■ Left — Viewed monitor patient information, including the first six parameter windows and up to four waveforms. The "*VIEWED PATIENT*" message displays on the bottom of the split-view.

9-FEB-1999 10:00   SICU-BED2   HAYES   SICU-BED5   MARTIN
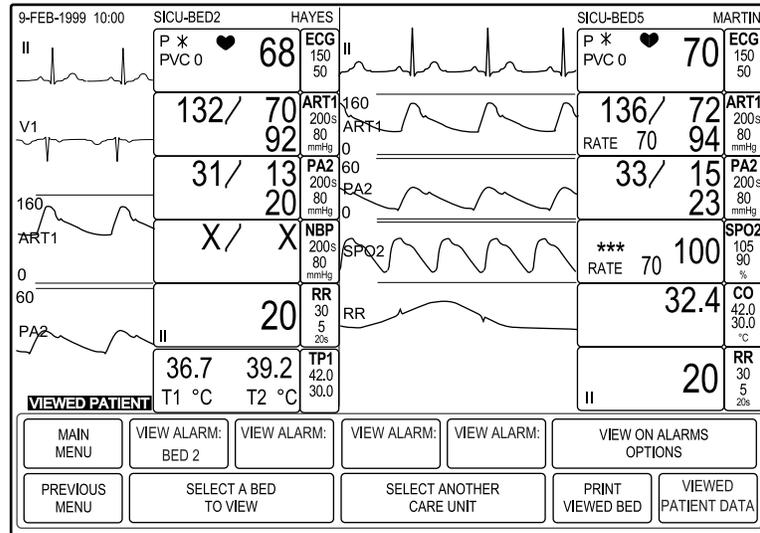
592B

The viewed monitor displays until you select *MAIN MENU* or view another monitor.

The host monitor is completely functional and two seconds of waveforms data continue to display. The menus still control the host monitor and any changes you make do not affect the function of the viewed monitor. Information windows will also display over the viewed monitor.

Keep in mind the following guidelines when viewing a split view:

■   Admit a patient to view. If the monitor is discharged, the parameter windows display (no waveforms) with a "*DISCHARGED*" message.

■   To maintain CO_2 monitoring on the host monitor while viewing another monitor, change the position of CO_2 to the sixth position. The slower CO_2 sweep speed will block all other waveforms adjacent or below the CO_2 position.

■ CO_2 waveform and parameter windows are not sent to the host monitor.

■   ST trends and complexes are not sent to the host monitor.

■   CRG+ display is not sent to the host monitor.

Removing a Viewed Monitor Display

To remove an alarming monitor display from the host monitor:

■   VOA — Select *MAIN MENU* or *RETURN*.

■   AVOA — Perform any one of the following actions:

◆   Select *MAIN MENU* or *RETURN*.

◆   Silence the alarming monitor at the host monitor or central station.

◆ Resolve the alarm condition at the alarming monitor (all alarm levels except *CRISIS*).

◆ Silence the remote alarm. This also prevents new alarms from sounding, even if a new alarm is of higher priority.

■ AutoView XM — Perform any one of the following actions:

◆ Select *MAIN MENU* or *RETURN*.

◆ Silence the alarming monitor at the host monitor or central station.

◆ Resolve the alarm condition at the alarming monitor (all alarm levels except *CRISIS*).

◆ Silence the remote alarm when the host monitor's *AVOA SILENCE* setting is set to *SILENCED*. This also prevents new alarms from sounding, even if a new alarm is of higher priority.

◆ A more recent, higher priority alarm is received at the host monitor when the host monitor's *AVOA SILENCE* setting is set to *NEW ALARM*.

NOTE

To remove a non-alarming monitor display from the host monitor, select *MORE MENUS > VIEW OTHER PATIENTS > SELECT A BED TO VIEW*. The viewed bed is indicated with the word "*VIEW*". Selecting that bed again will remove from the host monitor.

6   Printing

Introduction

Overview

You can print patient waveforms and most information windows. There are three possible printing devices:

■   Built-in writer

■   Writer on the network (another monitor or central station)

■   Laser printer on the network

Options

There are two printing options:

■   On demand — Press the **Graph Go/Stop** or **Print** key on the monitor to print the data displayed on the monitor. The real-time print opportunities depend on the monitored parameters and the data, tasks or windows displayed.

■   Scheduled, automatic — Automatically print patient data when a *CRISIS* or *WARNING* patient status alarm sounds.

Once a print job is started, press the **Graph Go/Stop** or **Print** key on the print source (monitor or central station) to cancel the print job.

Control Settings

To adjust the control settings for the patient admitted to the monitor, select *MORE MENUS* > *MONITOR SETUP* > *GRAPH SETUP* or *PRINT SETUP*. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

Option	Function
WAVEFORM *ECG 1*	Select a lead and its associated waveform to print first.
WAVEFORM 2	Select a lead and its associated waveform to print second.

Option	Function
WAVEFORM 3	Select a lead and its associated waveform to print third.
WAVEFORM 4	Select a lead and its associated waveform to print fourth.
GRAPH LOCATION *PRINT LOCATION*	Select the writer or printer for the following: ■ Manual printing. ■ Automatic printing on alarm. ■ Specific patient date, parameter or calculation information printing.
ALARM GRAPH *PRINT ON ALARM*	Select whether alarms print automatically.
SPEED	Select the print speed. The slower the speed, the more condensed the data. **NOTE** Alarms print at 25 mm/sec. Laser printers do not support 0.1 mm/sec print speed.
TIMED GRAPH *TIMED PRINT*	Select the amount of time to print for each manual print job. **NOTE** Arrhythmia alarms run until a normal sinus rhythm is detected or the print job is manually stopped. All other alarms run for 20 seconds or until the print job is manually stopped.
GRAPH BP INVASIVE *PRINT BP INVASIVE*	Select the blood pressure waveforms. When selected, BP waveforms are the only parameters that can be printed. They print on one scale on the full grid space. **NOTE** You cannot switch BP selections while a print job is in progress. To select a different BP, you must stop the current job. If a different parameter is printing, the BP print job is ignored.

Printed Output

All waveforms begin with 10 seconds of delayed data. The header information printed with the waveforms is real time data. Print output contains the following basic information in the header.

- Type (alarm, manual or saved)
- Alarm violation (if any)
- Unit name, bed number and patient name
- Date and time
- Patient-monitor type
- Alarm volume
- Speed
- Lead failed (if any)
- Heart rate
- Arrhythmia call (if any)
- Pace mode (if on)
- Arrhythmia mode (full, lethal, off)
- PVC count (if arrhythmia mode is on)
- ST value for top displayed lead (if on)
- ECG filter (Hz range)
- Monitored parameter values

Guidelines

Keep in mind the following printing guidelines:

- When printing to a laser printer, there may be a slight (one minute) delay to print the first page of data when any speed slower than 25 mm/sec is selected. Each page contains 20 seconds of waveforms per page in a cascade format.

- If the selected printer is removed from use, you must update the location to an available printer. All failed print jobs are saved until a printer is available. They print as soon as a functioning printer is selected.

- A one millivolt ECG signal at normal (1X) size equals 10 millimeters on the graph paper.

- To convert an arrhythmia alarm to a manual print, stop the print job by pressing the **Graph Go/Stop** or **Print** key and immediately restart by pressing the **Graph Go/Stop or Print** key again.

- Invasive pressure scales print on individual and full scales as follows:

Displayed Scale	Printed Scale
30	0-30 (PA, CVP, LA, RA, ICP)
40	0-45
60	0-60

Displayed Scale	Printed Scale
100	0-90
160	0-150
200, 300	0-300
Auto	0-150 (ART, FEM, UAC, SP) 0-45 (PA, CVP, UVC, LA, RA, ICP)

7   Patient Data

Introduction

Working with patient data includes the following tasks:

- Reviewing *ALARM HISTORY*.
- Reviewing *VITAL SIGNS*.
- Reviewing *GRAPHIC TRENDS*.
- Reviewing *CRG TRENDS*.
- Customizing the **Trend** key.
- Reviewing lab data.
- Managing cardiac calculations.
- Managing pulmonary calculations.
- Managing dose calculations.

Reviewing Patient Data

Alarm History

When running the *CARDIAC* software package, the *ALARM HISTORY* information window displays *CRISIS*, *WARNING* and *ADVISORY* alarm level arrhythmia and ST events in chronological order beginning with the most recent event. No parameter information is stored in *ALARM HISTORY*.

NOTE

In *ADULT-ICU* and *NEONATAL-ICU* patient-monitor types, events are not stored during an alarm pause or when the patient is discharged.

To review *ALARM HISTORY*, select *MORE MENUS > PATIENT DATA > ALARM HISTORY*.

```
                    ALARM HISTORY
          ALARM                 TIME
          RETURN
     >    BRADY           16-FEB     13:58:49
          BRADY                      13:30:07
          VFIB/VTAC                  13:17:12
          BRADY                      12:54:31
          ST LIMIT ALARM             10:15:00
          VFIB/VTAC                  10:09:55
          ST REFERENCE               09:01:56
```

MAIN MENU	SELECT ALARM		GRAPHIC TRENDS	CARDIAC CALCS	PULMONARY CALCS	DOSE CALCS
PREVIOUS MENU	↑ ↓					
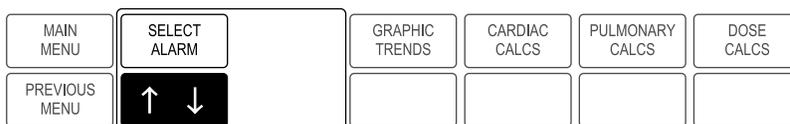
604A

Up to 36 arrhythmia events and 10 ST events (including alarms and references) are stored. Up to 15 events are displayed in the *ALARM HISTORY* information window at one time. When monitoring from telemetry, the event is stored at the tower and the last 36 events are viewable from the monitor.

The *ALARM HISTORY* contains 10 seconds of the arrhythmia event in a compressed format. Due to the display size, only eight seconds of waveform data is shown. For asystole, the first eight seconds of an event is displayed. All other arrhythmia events display the last eight seconds of the event.

WARNING

MEASURING DATA STORED IN ALARM HISTORY — Waveform data stored in *ALARM HISTORY* uses compression technology that may not allow perfect reconstruction of the waveform data when subsequently viewed. Although differences occur relatively frequently, they are usually very minor. Users are urged to verify diagnostic waveform measurements with the waveform data from real-time graph strips.

Three leads of ECG are displayed for arrhythmia events. If an ART line was monitored at the time of the event, two leads of ECG and the ART waveform are displayed with the associated numerics.

To select an alarm or event, position the pointer in front of the option and press the **Trim Knob** control. Selecting an arrhythmia event displays the applicable waveform and new menu options.

When viewing an ST alarm or reference, a QRS complex of all available leads (except AVR) is displayed. If viewing an ST alarm, an asterisk is displayed next to each lead in violation of ST limits.

Use the following options to review the *ALARM HISTORY*.

Option	Function
VIEW OLDER ALARM	View the previous event.
VIEW NEWER ALARM	View the next event.
DELETE ALARM	Delete the selected event.

Vital Signs

VITAL SIGNS displays the patient's monitored parameter values for the last 24 hours, including the last 20 cardiac calculations and the last 10 pulmonary calculations.

NOTE

If alarms were paused or the monitor was discharged, the word *OFF* displays in the *ALARMS* field of the *VITAL SIGNS* information window during the time either of these events occurred.

To review vital signs, select *MORE MENUS > PATIENT DATA > VITAL SIGNS*.

VITAL SIGNS	25-FEB 12:00	25-FEB 12:15	25-FEB 12:30	25-FEB 12:45	25-FEB 13:00
HR	68	68	68	68	70
PVC	0	0	0	0	0
AR1-S	132	132	132	132	132
AR1-D	70	70	70	70	71
AR1-M	92	92	92	92	91
AR1-R	68	68	68	68	70
PA2-S	31	31	31	31	30
PA2-D	13	13	13	13	13
PA2-M	20	20	20	20	19
RR					
SPO2%					
SPO2-R					
TP1-1					
TP1-2					
ALARMS				OFF	
↓ TMP (°C)					

25-FEB-1999 13:10

MAIN MENU	VIEW OLDER	VIEW NEWER	TIME INTERVAL 15 MINS	SPECIFIC TIME	SORT DATA: ALL DATA	
PREVIOUS MENU	PAGE DOWN	PAGE UP				

607C

Use the following options to review *VITAL SIGNS*.

Option	Function
VIEW OLDER	View the previous event.
VIEW NEWER	View the next event.
TIME INTERVAL	Select the desired time interval for the patient data display.
SPECIFIC TIME	Select a specific time period of collected patient data to display in the information window.
SORT DATA	Select one of the following episodic parameters to sort the collected patient data. The data prints in the same order displayed. ■ NBP ■ Cardiac calculations ■ Pulmonary calculations
PAGE DOWN	View the next page.
PAGE UP	View the previous page.

Graphic Trends

GRAPHIC TRENDS allows you to create a graphic representation of a parameter over a specified period of time. It uses median values from the collected patient data to create a one minute resolution trends.

Episodic parameters are stored every time an event occurs. Non-episodic parameters are sampled 30 times a minute.

To display *GRAPHIC TRENDS*, select *MORE MENUS > PATIENT DATA > GRAPHIC TRENDS*.

GRAPHIC TRENDS   25-FEB-1999 14:38

150

HR

50

13:08   13:38   14:08   h:min
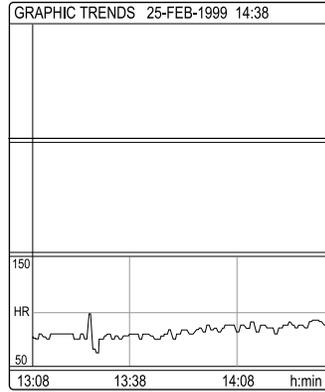
| MAIN MENU | PRESET TRENDS | VIEW OLDER | VIEW NEWER | TIME PERIOD 90 MINS | SELECT PARAMETERS | |
| PREVIOUS MENU | | | | | | |

611A

Use the following options to review *GRAPHIC TRENDS*.

Option	Function
PRESET TRENDS	Select one of the preset parameter groups to trend.
VIEW OLDER	View the previous trend.
VIEW NEWER	View the next trend.

Option	Function
TIME PERIOD	Select one of the following time periods to for the trends. Displayed trends automatically update while displayed in the *GRAPHIC TRENDS* information window according to the following cycle for each time period. ■ 24 hours — Updates every six minutes. ■ 12 hours — Updates every four minutes. ■ Eight hours — Updates every two minutes. ■ Four hours — Updates every minute. ■ Two hours — Updates every minute. ■ One hour — Updates every minute. ■ 30 minutes — Updates every minute. ■ 15 minutes — Updates every minute. ■ Six minutes — Updates every 10 seconds.
SELECT PARAMETERS	Select up to three parameters to trend. HR is the default parameter. **NOTE** NBP and invasive pressure (with the associated systolic, diastolic and mean values) are considered one selection and will generate one trend. If you do not want all three pressure parameters included in the trend, unmark the parameters you do not want. This is also true for inspired and expired CO_2.

NOTE

You cannot view older or newer trends when viewing a six minute time period.

CRG Trends

CRG TRENDS allows you to create high resolution trends for up to three CRG parameters (including HR, SpO_2, MAP, RESP and CO_2).

To view *CRG TRENDS*, select *MORE MENUS > PATIENT DATA > CRG TRENDS*.

NOTE

The primary ECG lead and parameters windows remain displayed.
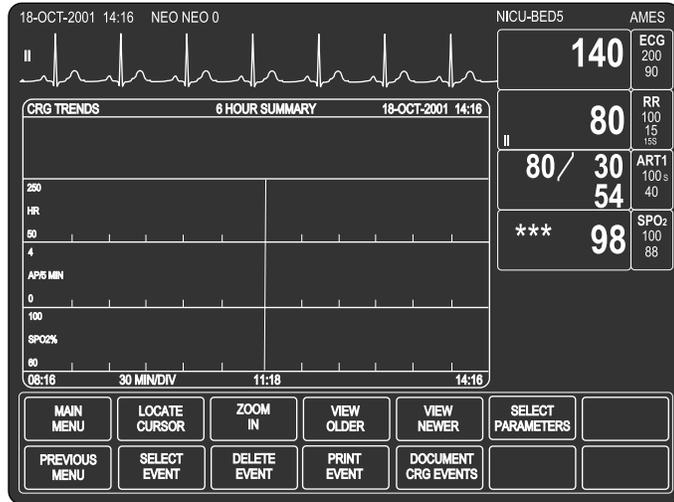
806C

The *CRG TRENDS* information window displays a directory of up to six stored CRG events. Each event has an associated number, a minimum and maximum alarm value and an event start time. An asterisk indicates that you cannot access the trend trace data for this event, usually because the event just occurred and the data is not available yet.

The directory holds up to 100 of the most recent events. Only resolved alarms with an alarm level above *MESSAGE* are stored. The directory automatically updates when a valid alarm is resolved.

When the directory is full, the oldest event in the directory is removed to make room for a new event. Trend traces are stored for 24 hours. It is possible that trends may not be available for events that occurred more than 24 hours ago.

There may be a two minute delay before data can be displayed when the system is first connected or when admitting a patient. Data is displayed on an even minute boundary in either two minute or six hour segments. The display automatically updates every two minutes when the most recent data segment is displayed

NOTE

When the monitor is set for the *NEONATAL-ICU* patient-monitor type and an apnea, brady or desaturation alarm occurs within 30 seconds of the first alarm, the monitor groups the alarms in one text line in the event directory.

When more than one alarm is grouped in a text line, each alarm counts as a single event. Each event can be viewed separately, and three separate events are recorded in the event directory.

The respiration trend data for the two minute display is the respiration waveform.

The respiration trend data for the six hour summary varies by patient-monitor type:

- *NEONATAL-ICU* — Apnea per five minutes; printing as apnea per minute.
- *ADULT-ICU* and *OPERATING ROOM* — Respiration rate.

Use the following options to review *CRG TRENDS*.

Option	Function
LOCATE CURSOR	Select a specific time on the display and display the associated parameter values.
ZOOM IN	Select a specific two minute trend from a six hour summary and display the associated trace.
ZOOM OUT	Display the six hour summary.
VIEW OLDER	View the previous event.
VIEW NEWER	View the next event.
SELECT PARAMETERS	Select the parameters to display as trends.
SELECT EVENT	Select and view a single two minute trend event from the six hour summary.
DELETE EVENT	Select and delete individual events (and associated traces) more than 24 hours old or all events more than 24 hours old.
PRINT EVENT	Print all events in the event directory.
DOCUMENT CRG EVENTS	When in the *NEONATAL-ICU* patient-monitor type you can review, edit and save CRG events associated with the patient's condition.

NOTE

The display and menu do not time out. To exit the display, select *MAIN MENU*.

Lab Data

If your monitoring system includes a Lab Access Server and an interface to a lab information system (LIS), you can access the patient's laboratory data at a monitor.

While monitoring, you may also receive an alert when new lab data is available for the patient. The alert is displayed at the top of the screen as the lab data icon ( ).

To review lab data information, select *MORE MENUS > PATIENT DATA > LAB DATA*.

The *LAB DATA* information window displays all the available lab data for the patient in the LIS database. How information is display in the window varies by report type.

Use the following options to review *LAB DATA* reports.

Option	Function
VIEW OLDER	View the previous report
VIEW NEWER	View the next report.
PAGE DOWN	View the previous page of reports.
PAGE UP	View the next page of reports.
VIEW RANGES AND UNITS OF MEASURE	View the high and low ranges and the units of measure used in the selected report.

Customizing the Trends Key

NOTE
Only available in software version 6 or later.

To select the default trend type, select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS > SETUP DEFAULT DISPLAY > TRENDS HARDKEY* and select one of the following options:

- *TABULAR ALL* — Displays the *VITAL SIGNS* information window sorted by parameter priority. This is the factory default setting.
- *TABULAR NBP* — Displays the *VITAL SIGNS* window sorted by NBP.
- *GRAPHIC* — Displays the *GRAPHIC TRENDS* information window.
- *CRG* — Displays the *CRG TRENDS* information window.

Calculations

Cardiac Calculations

NOTE
Only available in the *CARDIO-PULMONARY* software package.

The cardiac calculations program displays monitored and calculated hemodynamic parameter values that are used in cardiac output measurement.

The calculated parameter values are computed with input values. The input values are obtained from available monitored patient data. The patient's height and weight are required to compute cardiac calculations.

For more information on calculation parameters and formulas, refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide".

To adjust the control settings for the patient admitted to the monitor, select *MORE MENUS > PATIENT DATA > CARDIAC CALCS*. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

Option	Function
CHANGE VALUE	Select a new value for any monitored value. **NOTE** When a change is made, the date on the information window changes to the current date and any applicable calculated values display.
SAVE CALC	Select to save the displayed data.
REVIEW CALC	Select to review the saved calculation.
WEIGHT	Select the units of measurement for the patient's weight.
HEIGHT	Select the units of measurement for the patient's height.

Dosage Calculations

The dosage calculations program is used to determine appropriate doses and flow rates of intravenous medications.

NOTE

If you are using a drug that is not in the list, select one of the generic drug names (*DRUG A*, *B*, *C* or *D*). Make a note of the drug assigned to each generic drug name.

For more information on dosage calculations, refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide".

To adjust the dosage calculations for the patient admitted to the monitor, select *MORE MENUS > PATIENT DATA > DOSE CALCS*. Then select any of the following options and make the desired changes.

Option	Function
CHANGE VALUE	Select a drug name and values for the patient monitoring situation and drug use indications. ■ *WEIGHT* ■ *SOL VOLUME* (solution volume) ■ *DRUG QTY* (drug quantity) — Calculated the dose based on concentration from solution volume, dose and rate. If entered in milligrams the *DOSE/KG/MIN* is in micrograms. ■ *DOSE/MIN, DOSE /HR OR DOSE/KG/MIN* — Calculated from volume, quantity and rate. ■ *INF RATE* (Infusion rate) — How long the bag takes to infuse (cc/hr). ■ *DRIP RATE* — When administrating medication with a pump that counts drops and the pump's drop size is NOT 60 gtt/cc. ■ *DROP SIZE* ■ *INF TIME* (infusion time) — Calculated from volume, quantity and rate.
SAVE CALC	Save all complete calculations displayed on the screen. You can save up to four calculations. You cannot save incomplete calculations. If you modify an existing calculation for a specific drug name, the new calculation over writes the old calculation.
RECALL SAVED CALC	Display all saved calculations by drug name.
DELETE CALC	Delete the selected calculation.
TITRATION TABLE	Display the titration table for the selected calculation.
WEIGHT	Select the correct patient weight.
DRUG UNITS	Select the correct dosage unit for each of the generic drug.
DRUG QTY RANGE	Select the correct dosage quantity range for each of the generic drug names you are using.
RESUSCITATION MEDICATIONS	When in the *NEONATAL-ICU* patient-monitor type, select the concentration and dose for resuscitation medications.

Pulmonary Calculations

All aspects of oxygen uptake, transport and delivery are necessary in the assessment of critically ill patients. These parameters cannot be directly measured, but are derived from monitored cardiopulmonary variables.

The input values are obtained from available monitored patient data. The patient's height and weight are required for these calculations. The calculated parameter values are figured using the input values.

For more information on pulmonary calculation parameters and formulas, refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide".

To adjust the pulmonary calculations for the patient admitted to the monitor, select *MORE MENUS > PATIENT DATA > PULMONARY CALCS*. Then select any of the following options and make the desired changes.

Option	Function
CHANGE VALUE	Select a new value for any monitored value. **NOTE** When a change is made, the date on the information window changes to the current date and any applicable calculated values display.
SAVE CALC	Select to save the displayed data.
REVIEW CALC	Select to review the saved calculation.
WEIGHT	Select the units of measurement for the patient's weight.
HEIGHT	Select the units of measurement for the patient's height.
CALCULATED	Select *O2CI* (requires O_2CI value) or *FICK CO* (requires CO value).

Dash® 3000/4000/5000

8   Monitoring ECG

Introduction

Overview

ECG is the primary patient monitoring parameter. It measures heart rate, analyzes arrhythmia, detects pacemaker function and detects myocardial ischemia.

A parameter window and waveform display when a patient cable is connected to the monitor. The display updates every two seconds. The The parameter window varies by software package and the control settings.
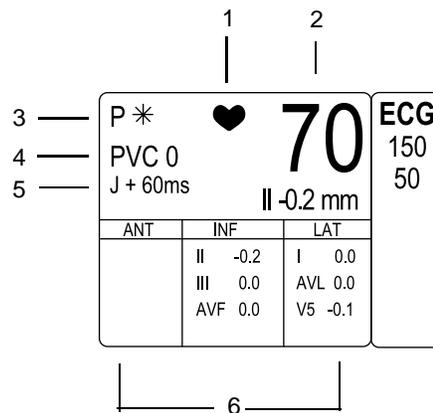
655A

1	QRS indicator
2	Heart rate
3	Paced beat detection indicator (Pacemaker detection enabled)
4	PVC count (full arrhythmia only)
5	ST measurement point
6	ST analysis data (ST analysis only)

When the quality of an electrode signal degrades to an inadequate monitoring level, a lead failure message displays and monitoring automatically switches to another lead, as described in the following table.

Message	New Lead Monitored
RA FAIL	Lead III
LL FAIL	Lead I
LA FAIL	Lead II
V FAIL	Lead II
LEADS FAILED	No waveforms displayed when RL or all leads fail.

If more than one lead fails, a system alarm will sound. The alarm is *ADVISORY* in *OPERATING ROOM* patient-monitor type and a *WARNING* in *ADULT-ICU* and *NEONATAL-ICU* patient-monitor types. You can change the alarm levels. For more information, refer to "Alarms" on page 4-1.

Options

AFIB Arrhythmia Detection

NOTE

This option is only available in the *CARDIAC* software package in software versions 3B or later and for the *ADULT-ICU* and *OPERATING ROOM* patient-monitor types.

The AFIB (atrial fibrillation) identification option uses an algorithm to identify atrial fibrillation arrhythmias. AFIB arrhythmias are characterized by random, chaotic, low-amplitude deflections of the supraventricular component of the ECG waveform. This results in irregular timing of QRS complexes and the absence of uniform P waves preceding the QRS complex.

When an AFIB arrhythmia is detected, a patient status alarm is triggered. An "*ATRIAL FIB*" message displays in the message line on both the monitor and the central station. AFIB arrhythmia alarms can take up to 90 seconds to display while the algorithm verifies the event.

When set for an alarm level of *ADVISORY* or greater, all AFIB alarms are displayed on the monitor in the *ALARM* parameter window and recorded in the *ALARM HISTORY*, *VITAL SIGNS* and *GRAPHIC TRENDS* information windows.

To determine if AFIB is enabled on this monitor, select *MORE MENUS > MONITOR SETUP > SOFTWARE CONFIGURATION*. If it is enabled, *ATRIAL FIB* is listed under the *ENABLED SOFTWARE OPTIONS* list.

When a network device does not support AFIB arrhythmia identification, the following conditions apply.

■ The network device displays the "*ATRIAL FIB*" message in the message line.
■ The network device does not display the "*ATRIAL FIB*" message in the *ALARM HISTORY*, *GRAPHIC TRENDS* or *VITAL SIGNS* information windows.

Alarm levels display on network devices that do not support AFIB arrhythmia identification as follows.

Network Device	Actual Displayed Text
Central station	<14>
Dash 3000/4000 (version 3B or earlier)	No text is displayed.
Eagle 4000 patient monitor	
Split View	No text is displayed.
Solar 7000/8000 patient monitor	
Full View	?
Split View	No text is displayed.
Solar View	?
OctaView	?
Solar 8000M patient monitor	
Full View	?
Split View	No text is displayed.
Unity View	?
Solar 9500 information monitor	
View Other Patient	No text is displayed.
Tramscope patient monitor	
Full View	?
Split View	No text is displayed.
Unity Network IS Information Suite	
AVOA	?

Network Device	Actual Displayed Text
Unity Network IS Information Suite	
Impact Pager	?
MARS PC workstation	The AFIB arrhythmia alarm text does not appear in the MARS Event window.

IntelliRate

WARNING

PATIENT RISK HAZARD — The heart rate reported by the IntelliRate feature may reflect either the electrical or pulsatile heart rate. An electrical heart rate may be reported on some pulseless rhythms. A pulsatile heart rate may be reported by the IntelliRate feature during ASYSTOLE if the patient is on a cardiac assist device. In these situations, the monitor will not detect or call an ASYSTOLE patient alarm. The user may elect to turn the IntelliRate feature off for patients at risk of these events, otherwise patient treatment may be delayed. Such patients should always be kept under close observation.

The IntelliRate algorithm utilizes information contained in multiple physiologic signals (for example, ECG, arterial blood pressure and pulse oximetry) to improve the accuracy of the heart rate calculation.

After assessing the information extracted from each of the physiologic signals, the IntelliRate algorithm applies rule-based logic to determine which heart rate source has the highest likelihood of being accurate. By reporting the most accurate rate, the trended heart rate is more accurate, and occurrences of false heart rate limit violation alarms are greatly reduced.

The IntelliRate value replaces the standard heart rate value in the *ECG* parameter window. It also indicates the source of the heart rate (*SPO$_2$* or *ART*) when the heart rate source is not *ECG*.

To determine if IntelliRate is enabled on this monitor, select *MORE MENUS > MONITOR SETUP > SOFTWARE CONFIGURATION*. If it is enabled, *ECG INTELLIRATE* is listed under the *ENABLED SOFTWARE OPTIONS* list.

Combo and Rover Combo Monitoring Guidelines

The following are guidelines to remember when monitoring in *COMBO* or *ROVER COMBO* monitoring modes.

- When monitoring ECG from telemetry:
    - ECG limits and arrhythmia alarm levels are not your monitor defaults, but are the telemetry defaults from the central station. You can adjust these settings at the monitor.
    - The alarm pause feature (if available on your transmitter) is honored at the monitor.
    - You should not turn off the monitor until you have discharged the patient from the monitor.
    - Second V lead data is not sent to the monitor from the telemetry transmitter. If you wish to see telemetry second V lead data, you must view the telemetry patient.
- When switching ECG monitoring from the monitor to telemetry:
    - Arrhythmia alarm histories from the monitor are merged in the telemetry system. CD Telemetry-LAN software version 5 or later is required.
    - If you discharge the monitor, the telemetry arrhythmia alarm levels will be the same as the arrhythmia alarm levels supported by the monitor.

      Therefore, when the monitor uses the BASIC software package, only lethal arrhythmia alarm levels will be detected from telemetry. If the monitor has the *CARDIAC* software package, full arrhythmia alarm levels will be detected from telemetry.
- When switching ECG monitoring from telemetry to the monitor:
    - Telemetry is automatically discharged and the most recent 36 alarm histories are transferred to the monitor.
    - The ECG limits, arrhythmia alarm levels and display defaults are recalled from the monitor defaults.

NOTE

It is not likely that the *COMBO* or *ROVER COMBO* monitoring modes are used when the patient-monitor type is *OPERATING ROOM*.

NOTE

Users should be aware of a possible time discrepancy between the waveforms from the telemetry device and the waveforms from the monitor. Users should not consider these waveforms to be synchronous. If absolute synchronicity is desired, *COMBO* mode should be discontinued and the ECG waveforms should be acquired via the hard-wired monitor.

Analog Output

The ECG analog output includes the top trace position lead and augmented leads. It provides the following signals:

- A five-volt, two-millisecond artificial pacer spike to the analog output when pacemaker detection is on and detection occurs.
- A defibrillator synchronization marker to determine the peak of the R wave.

In the event of a lead failure, the following output occurs:

Lead Failed	ECG Analog Output[1]
Right arm	Lead III
Left arm	Lead II
Chest	Lead II
Right leg	buzz
Left leg	Lead I

[1]All ECG outputs are one volt per millivolt of input.

NOTE

In a single lead mode, if the lead is not available, a buzz signal occurs. The buzz signal can be either a zero volt flat-line or a 60 Hz sine wave. The buzz signal option is set in the *SERVICE MODE > CALIBRATE > CAL ECG ANALOG OUT*. For more information, refer to the service manual.

Additional Information

The GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide" provides the following information:

- Skin preparation.
- Electrode placement.
- Pacemaker detection.
- Arrhythmia detection and analysis.
- Clinical-level troubleshooting.

Safety

Pacemaker

The following safety statements apply when monitoring pacemaker patients.

> **WARNING**
> FALSE CALLS — False low heart rate indicators or false asystole calls may result with certain pacemakers because of electrical overshoots.

> **WARNING**
> MONITORING PACEMAKER PATIENTS — Monitoring of pacemaker patients can only occur with the pace program activated.

> **WARNING**
> PACEMAKER SPIKE — An artificial pacemaker spike is displayed in place of the actual pacemaker spike. All pacemaker spikes appear uniform. Do not diagnostically interpret pacemaker spike size and shape.

> **WARNING**
> PATIENT HAZARD — A pacemaker pulse can be counted as a QRS during asystole. Keep pacemaker patients under close observation.

> **WARNING**
> RATE METERS — Keep pacemaker patients under close observation. Rate meters may continue to count the pacemaker rate during cardiac arrest and some arrhythmias. Therefore, do not rely entirely on rate meter alarms.

WARNING

SURVEILLANCE —   Maintain close surveillance of pacemaker patients. Heart rate errors can occur.

CAUTION

FDA POSTMARKET SAFETY ALERT —   The United States FDA Center for Devices and Radiological Health issued a safety bulletin October 14, 1998. This bulletin states "that minute ventilation rate-adaptive implantable pacemakers can occasionally interact with certain cardiac monitoring and diagnostic equipment, causing the pacemakers to pace at their maximum programmed rate."

The FDA further recommends precautions to take into consideration for patients with these types of pacemakers. These precautions include disabling the rate responsive mode and enabling an alternate pace mode. For more information contact:

Office of Surveillance and Biometrics, CDRH, FDA

1350 Piccard Drive, Mail Stop HFZ-510

Rockville, MD 20850

U.S.A.

NOTE

ECG monitoring with patients on non-invasive transcutaneous pacemakers may not be possible due to large amounts of energy produced by these devices. Monitoring ECG with an external device (for example, a defibrillator) may be needed. Remember that there are no ECG alarms at the monitor if you are monitoring with an external devices.

Arrhythmia

The following safety statements apply when monitoring arrhythmia patients.

WARNING

VENTRICULAR ARRHYTHMIAS — Occasionally the arrhythmia analysis program may incorrectly identify the presence or absence of an arrhythmia. Therefore a physician must analyze the arrhythmia information in conjunction with other clinical findings.

WARNING

SUSPENDED ANALYSIS — Certain conditions suspend arrhythmia analysis. When suspended, arrhythmia conditions are not detected and alarms associated with arrhythmias do not occur. The messages which alert you to the conditions causing suspended arrhythmia analysis are: *Arr Off, Arrhy Suspend,* and *Leads Fail.*

NOTE

Arrhythmia processing is suspended during an "*Artifact*" condition. Should the artifact condition persist for 20 seconds out of 30 seconds, an audible system *WARNING* alarm will sound and the message "*Arrhy Suspend*" will be displayed in the top waveform window until the condition is resolved.

NOTE

The EK-Pro algorithm simultaneously uses leads I, II, III, and the V/VA lead for ECG and arrhythmia analysis.

Monitoring

To verify that you are ready to monitor ECG, follow this procedure.

1. Admit the patient to the monitor.

2. Position the electrodes on the patient.

3. Connect the patient cable to the electrodes.

    NOTE

    When using "snap" leadwires, attach leadwires to the electrodes first, then apply the electrodes to the patient.

4. If using a 5- or 10-leadwire patient cable, verify the V lead labels are correct.

5. Connect the patient cable to the **ECG** patient connector on the monitor.

6. Verify that patient data displays in the *ECG* parameter window.

7. Verify the ECG baseline is stable and the waveforms are noise-free.

---

8. Print a test graph strip.

9. Adjust the control settings as necessary.

Control Settings

To adjust the control settings for the patient admitted to the monitor, select the *ECG* parameter window label. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

Option	Function
DISPLAY	Select the primary (top trace) lead. The V lead choice is determined by the V lead identified in the *ST* menu.
ECG SIZE	Select the waveform size. ■ *1X* — Recommended for standard monitoring. ■ *2X*, *4X* — Recommended for low amplitude QRS waveforms. However, this lowers the QRS detection threshold and baseline artifact may be detected as a QRS.
DETECT PACE	Turn pacemaker detection on or off.
ECG LIMITS	Select the alarm limits for heart rate and PVCs. **NOTE** PVC Limit is available in the *CARDIAC* software package only.
VIEW ALL ECG	Displays all six leads of ECG.
RELEARN	Relearn the patient's ECG pattern to correct arrhythmia calls and heart rate value, restore ST measurements and enable more accurate monitoring.
ST ANALYSIS	Turn the ST analysis program on or off. For more information, refer to "Performing ST Analysis" on page 8-18.
12 LEAD ECG ANALYSIS	Displays 12 leads of ECG. For more information, refer to "Performing 12 Lead Analysis" on page 8-21.

Option	Function
ECG FILTER	Select a ECG waveform signal filter to improve the waveform display and graphs. (Does not affect ST and arrhythmia analysis.) ■ *DIAGNOSTIC* — Provides the maximum available ECG signal information. Recommended for high-fidelity recordings in low-noise environments. ■ *MONITORING* — Provides modest reduction of high frequency interference. Recommended for typical monitoring applications. ■ *MODERATE* — Provides significant reduction of high frequency interference. Recommended for high-noise environments (for example, electrosurgical units). ■ *MAXIMUM* — Provides significant reduction of high frequency interference plus maximum stabilization of the ECG baseline. This mode alters the displayed QRS morphology, but does not affect automated analysis. Do not rely upon the displayed QRS morphology for diagnostic purposes when this mode is selected. **WARNING** — The *MAXIMUM* filter alters displayed ECG morphology. Do not rely on ECG morphology for diagnostic purposes when this filter is selected. **NOTE** *MODERATE* and *MAXIMUM* filters are not recommended for pacemaker patients.

Option	Function
LD ANALYSIS	Select one of the following for ECG and arrhythmia processing: ■ *SINGLE LEAD* — Uses the top trace position lead. Recommended for adults using an external, temporary pacemaker with a Zoll interface cable or for troubleshooting pacemaker or arrhythmia detection. **NOTE** ECG is relearned when the lead changes. ■ *MULTI-LEAD* — Uses leads I, II, III and V lead to eliminate false alarms and improve the ability to: ◆ Detect beats which occur isoelectric to a single chest lead. ◆ Discriminate artifact that appears in one lead compared to the other lead vectors. ◆ Allow failed leads to automatically switch to another lead. ◆ Continue arrhythmia processing after a lead change.
ARRHYTHMIA	Select the level of EK-Pro arrhythmia detection and relearns the patient's ECG pattern. ■ *FULL* — *CARDIAC* software package only; detects and identifies all types of arrhythmia. ■ *LETHAL* — Detects and identifies only lethal arrhythmia. ■ *OFF* — Does not detect or identify arrhythmia. **NOTE** You cannot select an arrhythmia level lower than the *MIN ARRHYTH LEVEL* monitor default.
CLEAR V2 - V6 FAIL	Clear the "V2-V6 Fail" message.
More ECG	

Option	Function
MORE ECG > QRS VOLUME	Select the alarm tone for QRS complex annunciation. If turned on, SpO$_2$ Rate volume is turned off.
	In *NEONATAL-ICU, BRADY ALARM* option automatically starts a QRS alarm tone when the monitor alarms for bradycardia that is 20 percent louder than the set alarm volume.
	NOTE Not available from a telemetry transmitter when performing combination monitoring.
MORE ECG > QRS WIDTH	Select one of the following for use in ECG analysis algorithms:
	■ *NARROW* — Default for *NEONATAL-ICU.*
	■ *NORMAL* — Default for *ADULT-ICU* and *OPERATING ROOM.*
MORE ECG >INTELLIRATE	Turn IntelliRate on or off. For more information, refer to "IntelliRate" on page 8-5.
MORE ECG > BEAT PAUSE INTERVAL	Select the maximum pause between consecutive heart beats before an alarm sounds.
MORE ECG > SPEED	Select a sweep speed for the displayed waveform.

Custom Defaults

Turning Off ECG

Permanently

To permanently turn the ECG parameter off, follow this procedure.

1. Select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS > SETUP DEFAULT DISPLAY*.

2. Locate and select *ECG PARAMETER*.

3. Select *OFF*.

Constraints

When the ECG parameter is turned off, the following constraints apply.

- SpO_2 becomes the primary parameter for patient monitoring.

- The patient's heart rate is determined from pulse oximetry.

- The SpO_2 and SpO_2 Rate parameter alarm levels become *WARNING*.

- The SpO_2 pulse search and probe off system status alarm levels become *WARNING*.

- Connecting the ECG cable to the monitor will NOT automatically turn the ECG parameter on.

- When the monitor is connected to a Dash Responder defibrillator, the ECG parameter will either automatically turn on or remain turned on.

- When the monitor alarms are paused AND the ECG parameter is turned off, the following network devices will NOT display an "*ALARM PAUSE*" text message for that monitor.

    - ◆ CIC clinical information center using software version 3.0 or earlier.

    - ◆ Centralscope central station using any version of software.

ECG Setting Source

Selecting ECG Setting Source

When the monitor is in *COMBO* mode, you can select whether the monitor uses its own ECG settings or the telemetry ECG settings. The following ECG settings are affected when you select an ECG setting source:

- Arrhythmia alarm levels
- *HR*, *PVC* and *ST* parameter alarm levels
- *ECG SIZE*
- *DETECT PACE*
- *ARRHYTHMIA*
- *ST ANALYSIS*
- *LEAD ANALYSIS*
- *HR HIGH LIMIT* and *HR LOW LIMIT*
- *PVC LIMIT* and PVC state

To select the source of ECG settings, follow this procedure.

1. Select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS > SETUP DEFAULT DISPLAY*.

2. Locate and select *COMBO DEFAULT SOURCE*.

3. Select one of the following:

   ■ *TELE DEFINED* — Use the telemetry ECG settings. This is the factory default.

   ■ *USER DEFINED* — Use the monitor's ECG settings if telemetry is NOT admitted. Use the telemetry ECG settings if telemetry IS admitted.

ECG Setting Source When Entering COMBO Mode

The following tables indicate the source (monitor or telemetry) of ECG settings when entering *COMBO* mode.

Tele Defined			
Monitor	Telemetry	Entering *COMBO* Mode	ECG Setting Source
Not admitted	Not admitted	>	Telemetry
Admitted	Not admitted	>	
Not admitted	Admitted	>	

User Defined			
Monitor	Telemetry	Entering *COMBO* Mode	ECG Setting Source
Not admitted	Not admitted	>	Monitor
Admitted	Not admitted	>	
Not admitted	Admitted	>	Telemetry

Notice that selecting *Tele Defined* means the ECG setting source is always telemetry when entering *COMBO* mode, while the ECG setting source for *User Defined* depends on whether the patient is admitted to the monitor or telemetry when entering *COMBO* mode.

NOTE

It is possible (but not a normal operation), to admit a patient to both a telemetry bed and a hardwired bed before entering *COMBO* mode. For example, bed101* (telemetry) AND bed101 (monitor) are two separate beds for the same patient. When you enter *COMBO* mode in this situation, the ECG setting source is always telemetry.

ECG Setting Source When Exiting COMBO Mode

When discharging from telemetry, but remaining admitted to the monitor (exiting *COMBO* mode), the ECG setting source (monitor or telemetry) depends on the *COMBO DEFAULT SOURCE* selection.

- *TELE DEFINED* — When exiting *COMBO* mode, the ECG settings return to the monitor's ECG custom defaults.
- *USER DEFINED* — When exiting *COMBO* mode, the ECG settings for the current patient persist until the patient is discharged from the monitor.

For both the *TELE DEFINED* and USER DEFINED options, when discharging from the monitor (exiting *COMBO* mode), but remaining admitted to telemetry, the ECG settings for the current patient persist until the patient is discharged from telemetry.

ECG Rate Averaging

To select the number of heart beat intervals used to generate an average heart rate, follow this procedure. The factory default is eight beats.

1. Select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS > SETUP DEFAULT DISPLAY*.

2. Locate and select *ECG RATE AVERAGING*.

3. Select one of the following:

   - *8 BEATS* — Averages the eight most recent heart beat intervals. This is the default setting.
   - *4 BEATS* — Averages the four most recent heart beat intervals to get a faster response to the changes in a patient's heart rate.

IntelliRate

To turn IntelliRate on, follow this procedure. When this option is enabled, the factory default setting is on.

1. Select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS > SETUP DEFAULT DISPLAY*.

2. Locate and select *ECG INTELLIRATE*.

3. Select *ON* or *OFF*.

AFIB Alarm Level

To adjust the AFIB arrhythmia patient status alarm level, follow this procedure. When this option is enabled, the factory default alarm level setting is *MESSAGE*.

1. Select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS > SETUP DEFAULT ARRHYTHMIA ALARM LEVELS*.

2. Locate and select ATRIAL FIB.

3. Select the patient status alarm level.

Performing ST Analysis

Overview

ST analysis begins at the end of the QRS complex and ends with the onset of the T wave. The point at which the QRS complex meets the ST segment is referred to as the J point.

The ST numeric that displays in the *ECG* parameter window indicates the greatest positive or negative deviation from the isoelectric reference (I) point. Numerics update every two seconds.

If ST is the second priority parameter (ECG is the first) the ST values display in three groups:

- Anterior (*ANT*) — V1 to V4.
- Inferior (*INF*) — Lead II, III and AVF.
- Lateral (*LAT*) — Lead I, AVL, V5 and V6.

The default ST display shows three, 30-minute ST trends and three ECG complexes for leads I, II and V. To change the display default settings, refer to "Control Settings" on page 8-11.

- ST trends — Displays 30-minute real-time trends for each lead. When in *OPERATING ROOM* patient-monitor type, a summation scale also displays.
- ST complex — Displays current complex for each lead superimposed over the reference complex to show ST segment changes. Updates every 16 beats.

NOTE

Trends and complexes are not available from a telemetry transmitter when performing combination monitoring.

Control Settings

To adjust the control settings for the patient admitted to the monitor, select the *ECG* parameter window label then *ST ANALYSIS*. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

NOTE

ST analysis control settings are only available in the *CARDIAC* software package.

Option	Function
TURN ST OFF	Turn ST analysis program on or off.
PRINT ST	Print displayed ST trends and complexes. **NOTE** Trends with a scale of 2 or 4 mm print on a 3 mm scale; 6 or 8 mm print on a 6 mm scale.
STORE NEW REFERENCES	Select a new set of reference complexes.

Option	Function
ST LIMITS	Select the ST deviation limits. ■ *ADJUST INDIVIDUAL LIMITS* — Select the low and high limits for any of the available leads. ■ *ADJUST ALL LIMITS* — Select the range to trigger an alarm for all of the groups. ■ *ADJUST INF LIMITS* — Select the range to trigger an alarm for INF group only. ■ *ADJUST LAT LIMITS* — Select the range to trigger an alarm for LAT group only. ■ *ADJUST ANT LIMITS* — Select the range to trigger an alarm for ANT group only. When any monitored lead has a deviation greater or less than the defined limit, an alarm sounds and the ST event is stored in the *ALARM HISTORY*. Only the first lead in each group to exceed the alarm limit is stored in *ALARM HISTORY*. Subsequent alarms in the same group will not be stored until all leads in a group return to the normal range.
IDENTIFY V LEAD	Locate the V lead being used for ECG and ST analysis. For 5-Leadwire Cables — Verify the V Lead used in ST and arrhythmia analysis is selected. This V Lead is also used for ST trends and complex displays. For 10-Leadwire Cables — Since ST measurement is performed with a different V lead I than arrhythmia analysis, any changes made to this selection only apply to the V lead used for arrhythmia analysis. This V lead is not used for ST trend and complex displays. **NOTE** Changing the V lead changes the displayed waveform, analog output, network data, ST trend and template, graphing and histories.
TREND SCALE	Select a ST trend scale.
ST DISPLAY	Select up to three leads for trend or complex display.

Option	Function
INITIATE 12 LEAD ON ST HISTORY	Enable automatic initiation of 12 lead analysis when an ST event is stored in history.
ADJUST ST POINT	Change ST measurement point; *J + 0 MS* to *J + 80 MS.*

NOTE

Upon initialization of ST analysis, regardless of which *IDENTIFY V LEAD* option is selected, the V lead's ST alarm limits will always be the default limits set for V1.

When the identified V lead's position or label is changed, the previous identified V lead's ST alarm limits will be retained.

For example, if you change the V lead's ST alarm limits to +/- 3 and then change the identified V lead's position and label, the ST alarm limits will remain at +/- 3 regardless of the default ST alarm limits for the new identified V lead.

This functionality occurs in both hard-wired and *COMBO* mode during 5-lead ECG monitoring.

Performing 12 Lead Analysis

To analyze 12-lead ECG data, follow this procedure.

WARNING

— This device uses a computerized 12-lead ECG analysis program which can be used as a tool in ECG tracing interpretation. This computerized interpretation is only significant when used in conjunction with clinical findings. All computer-generated tracings should be overread by a qualified physician.

To ensure accuracy, use only computer-generated tracings and not the display for physician interpretation.

The intended use of this device is to record electrocardiograms and vectorcardiograms from surface ECG electrodes, not for positioning (floating) temporary pacemaker leadwires, performing pericardiocentesis, or other internal applications.

NOTE

When monitoring ECG, entering the sex and age of the patient will provide information needed for using the 12SL Algorithm with Gender-Specific Analysis or the ACI-TIPI algorithm. The 12SL Algorithm with Gender-Specific Analysis improves the detection of acute myocardial infarctions (AMI) for adult women under the age of 60.

If the date of birth is not entered, the system will set the date of birth to the current month and day, but the year will be set to 1948.

ACI-TIPI analysis cannot be performed on patients less than 16 years of age.

1. From the *ECG* menu, select *12 LEAD ECG ANALYSIS*. All 12 leads of ECG display.

2. Define the following information (if required). If ACI-TIPI is enabled, you may have to define additional information.

   - *TECHNICIAN ID* — Select up to four characters.
   - *OPTION FIELD* — Select up to two digits.
   - *ORDER NUMBER* — Select up to nine digits.

3. Select *12 LEAD ECG NOW*.

   The "*PERFORMING ANALYSIS, PLEASE WAIT*" message displays for approximately 30 seconds until the analysis report displays.

4. Select one of the following options:

   - *TRANSMIT-PRINT* — Send the report to MUSE system for storage and print to local printer.
   - *TRANSMIT* — Send the report to MUSE system for storage.
   - *PRINT* — Print analysis and waveforms to a laser printer or just the analysis to a writer.
   - *DELETE* — Erase the report.
   - *RETURN* — Close the report.

NOTE

You can schedule automatic 12-lead analysis (if you have a MUSE system) by selecting *12 LEAD AUTO* and a time option.

NOTE

You can generate ACI-TIPI analysis separately by selecting *ACI-TIPI ANALYSIS* and entering the required patient information.

Troubleshooting

For clinical-level troubleshooting, refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide".

| Problem	Cause	Solution
Transmitting a 12-lead report to a MUSE when the report has an invalid ID.	There are communication problems with the network, Aware Gateway or MUSE system.	Contact service.
ST numerics only display for the primary (top) lead.	If *SINGLE LEAD* is selected for *LD ANALYSIS*, only the primary lead is used for processing.	Change *LD ANALYSIS* selection to *MULTI-LEAD*.
Printing a 12-lead analysis report fails.	There is a printer error.	If you cannot resolve the printer error, contact service.
	There are communication problems with the network	Contact service.
ALARM PAUSE or permanently paused	Clinician paused the alarms.	Reactivate the alarms.
ALL ALARMS OFF	The monitor is in a discharged state.	Admit a patient to the monitor.
PERFORMING ANALYSIS, PLEASE WAIT	The monitor is analyzing the ECG data.	This is a normal procedure message.
LEADS FAIL	Poor electrode signal quality.	Reapply electrode using electrode manufacturer's application recommendations.
LA FAIL		
LL FAIL		
RA FAIL		
V FAIL		
ARR OFF	Arrhythmia detection is turned off.	This is a normal procedure message.
V2-V6 FAIL	Five of the 10 leadwires were removed.	Clear the message by selecting the *ECG* parameter label > *CLEAR V2-V6 FAIL*.
DISCHARGED	The monitor is in a discharged state.	Admit a patient to the monitor.
LEARNING	The monitor is learning a new ECG pattern.	This is a normal procedure message.

9 Monitoring Invasive Pressures

Introduction

Detailed operating procedures are given for the CVP pressure site. Other pressure sites function essentially the same, except for the PA pressure site which may include the optional PA Wedge feature.

Overview

Invasive blood pressure monitoring uses a transducer to convert the pressure variations into electrical signals. The electrical signals are amplified and displayed as numeric pressure values and waveforms.

A pressure parameter window and labeled waveform display when a patient cable is connected to the monitor. The display updates every two seconds.
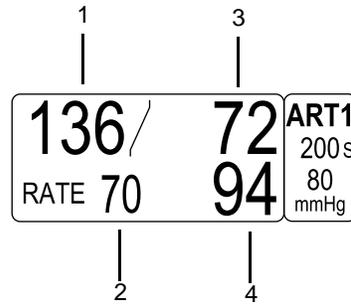
518A

1	Systolic value
2	Pulse rate value (ART, FEM, UAC)
3	Diastolic value
4	Mean value

There are two BP patient connectors on the monitor. Depending on your monitor's capabilities, you may be able to use a Y-adapter cable to monitor two sites per BP patient connector.

NOTE

When both ART and ICP pressure sites are monitored, a CPP values is calculated and displayed in the *ICP* pressure parameter window. The formula for CPP is the mean ART pressure value minus the ICP pressure value.

Pressure Site Names and Values

The following invasive pressure site names are supported. The monitor displays the following labels and pressure values.

arterial	*ART*	systolic, diastolic, mean and rate
femoral	*FEM*	systolic, diastolic, mean and rate
umbilical arterial	*UAC*	systolic, diastolic, mean and rate
pulmonary artery	*PA*	systolic, diastolic, and mean
intracranial	*ICP*	CPP and mean
umbilical venous	*UVC*	mean
central venous	*CVP*	mean
left atrial	*LA*	mean
right atrial	*RA*	mean
special	*SP*	mean

Default Site Labels

The BP patient connector default site labels are:

- **BP1** — *ART*
- **BP2** — *PA*
- **BP3** — *CVP*
- **BP4** — *LA*

NOTE
The default site labels in OPERATING ROOM are persistent, meaning they are retained after the patient is discharged from the monitor.

Analog Output

All pressure outputs are 10 mV/mmHg when zeroed.

NOTE
A buzz signal is sent to the analog output if the pressure is not zeroed.

- The pressure labeled *ART* is sent to the analog output.
- If both pressure sites are labeled *ART*, **BP1** is sent to the analog output.

■ If no pressure sites are labeled *ART*, **BP1** is sent to the analog output.

Additional Information

The GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide" provides the following information:

■ IABP feature.

■ Smart BP feature.

■ Clinical level troubleshooting.

Monitoring

To verify that you are ready to monitor pressure, follow this procedure.

1. Admit the patient to the monitor.

2. Connect a patient cable to the **BP** patient connector on the monitor.

3. Level transducers according to unit policy. GE recommends the LA/RA level.

4. Remove trapped air from the hydraulic system. For more information, refer to the manufacturer's instructions.

5. Zero transducers.

    a. Remove all excess tubing between the transducer and the patient.

        NOTE
        GE recommends zeroing invasive lines at the transducer stopcock only. Zeroing invasive pressures with excessive amounts of tubing between the transducer and the stopcock can cause error messages. This will cause a delay in obtaining invasive parameter information. For more information, refer to "Troubleshooting" on page 9-9.

    b. Place the transducer at the LA level (phlebostatic axis).

    c. Close the transducer stopcock(s) to the patient.

    d. Open the venting stopcock(s) to the air (atmosphere).

    e. Press the **Zero All** key.

    f. Verify that the zero reference is established.

    g. Close the venting stopcock(s) to the air (atmosphere).

    h. Open the transducer stopcock(s) to the patient.

6. Position the catheter in the patient.

7. Verify that patient data displays in the pressure parameter window.

8. Verify that a good quality waveform displays.

9. Adjust the control settings as necessary.

Control Settings

To adjust the control settings for the patient admitted to the monitor, select the pressure parameter window label. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

Option	Function
SCALES	Select the size of displayed waveforms. The higher the scale value, the smaller the waveform scale. ■ *AUTO* — Adjusts the scale to patient's ART pressure, Auto scaled waveforms print at a slightly different scale than the display scale. ■ *FULL* — Allows you to select the scale size and position on the display; right (*R*) or left (*L*).
CURSOR	Display a horizontal line with a numeric value over the waveform to indicate a pressure value at specific position on the waveform.
CLEAR CURSOR	Remove the cursor from the waveform.
LIMITS	Select the high and low alarm limits for heart rate, systolic, diastolic and mean pressures. An alarm sounds when a value occurs outside of these limits. **NOTE** Adjusting the HR limits affects the pressure tracing, not the primary ECG HR alarm level.
CHANGE NAME	Select the site name for the monitored pressure site for accurate waveform processing (for example, if monitoring the femoral pressure site, select *FEM*).

Option	Function
ZERO	Zero a single transducer. To zero all transducers, press the **Zero All** key.
BP FILTER	Select one of the following filter options: ■ *12 HZ* — Recommended for typical monitoring. ■ *40 HZ* — Recommended for higher frequency waveform component processing. May result is elevated pressure values.
CALIBRATE TRANSDUCER	Adjust the monitor to compensate for transducer errors. Measurement errors can be identified when pressure calibration is measured with other instruments (for example, a manometer). ■ *CAL# 100* — Select the percentage of error when the calibration error is known; (for example, 102 if the transducer measured two percent high). ■ *ADJUST TO MMHG* — Select the millimeters of mercury.
SPEED	Select a sweep speed for the displayed waveform. The smaller the speed value, the slower the speed (greater number of complexes).
IABP	**NOTE** Only available in the *CARDIAC* software package with ART and FEM parameter sites. **NOTE** Not available when in the *NEONATAL-ICU* patient-monitor type. **NOTE** The maximum ECG analog output delay specification with diagnostic ECG filter is less than 35 milliseconds. Turn the feature on or off. Measures the arterial (ART) pressure site and displays both pressure waveforms and numerical pressure values. It compensates for irregularities in the pressure waveforms caused by the use of an intra-aortic balloon pump.

Option	Function
SMART BP	**NOTE** Only available with ART and FEM parameter sites. **NOTE** Not available when in the *NEONATAL-ICU* patient-monitor type. Turn the feature on or off. This is an arterial (ART) artifact rejection program that substantially reduces alarms associated with zeroing the transducer, fast flushing the system and drawing blood.
DISCONNECT ALARM	**NOTE** Only available with ART and FEM parameter sites. Turn the feature on or off. This detects potential catheter disconnections. When on, if the mean pressure falls below 25 mmHg, a *Warning* patient status alarm sounds and the message "*DISCONNECT*" displays in the parameter window.
PULSE RATE	**NOTE** Only available with ART, FEM and UAC parameter sites. Turn the feature on or off to display pulse rate values in the parameter window.
PA WEDGE	**NOTE** Only available with PA parameter site and in the *CARDIO-PULMONARY* software package. Make a PA wedge measurement to emphasize the PA waveform. For more information, refer to "Performing PA Wedge Measurements" on page 9-7.

# Performing PA Wedge Measurements

Automatic

To perform an automatic PA wedge measurement, follow this procedure.

1. Select the *PA* parameter window label.

2. From the *PA* menu, select *PA WEDGE*. A single beep sounds and the message "*INFLATE BALLOON*" displays in the *PA* parameter window.

3. Inflate the balloon according to your unit's policy and procedure. The message "*WEDGE PROCESSING*" displays.

4. To add a cursor to the real-time wedged waveform, select *PA CURSOR*.

5. Deflate the balloon after three or four respiratory cycles (no more than 20 seconds).

   The *PA WEDGE REVIEW* information window displays 20 seconds of compressed waveform data with horizontal and vertical cursors identifying the end-exhalation point, PAW value and time of measurement.
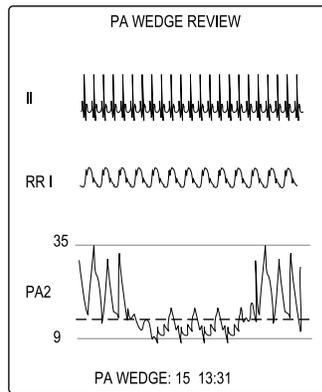
705B

6. To change the calculated PA wedge value, select *MOVE WEDGE CURSOR*. Adjust the value and select main display to save the new cursor value.

7. To save this PA wedge value in the cardiac calculations and *VITAL SIGNS*, select *CARDIAC OUTPUT*.

NOTE

To change the displayed waveform sweep speed, select *SPEED* and select an option.

Manual

To manually begin a PA wedge measurement when the balloon does not automatically inflate, follow this procedure.

The monitor cannot detect a PA wedge with certain patient conditions (for example, valvular disease, respiratory variation during an automatic PA wedge measurement).

1. Select the *PA* parameter window label.

2. From the *PA* menu, select *PA INSERT/WEDGE*. The message "*MANUAL WEDGE*" displays in the *PA* parameter window.

3. Inflate the balloon according to your unit's policy and procedure.

4. To add a cursor to the real-time wedged waveform, select *PA CURSOR*.

5. Deflate the balloon after three or four respiratory cycles (no more than 20 seconds).

6. Select *REVIEW WEDGE* to review the last 20 seconds of data.

7. To change the calculated PA wedge value, select *MOVE WEDGE CURSOR*. Adjust the value and select *MAIN MENU* to save the new cursor value.

8. To start a new PA wedge measurement, select *NEW WEDGE*.

NOTE

To change the scale of the displayed pressure waveform, select *FULL SCALE* and select a scale option.

To change the displayed waveform sweep speed, select *SWEEP SPEED* and select an option.

Troubleshooting

For clinical-level troubleshooting, refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide."

10   Monitoring NBP

Introduction

Overview

Automatic non-invasive blood pressure monitoring uses the oscillometric measurement method. The oscillometric method uses a sensitive transducer which measures cuff pressure and minute pressure oscillations within the cuff to determine the mean pressure and calculate the systolic and diastolic pressures.

A parameter window display updates every second. There is no waveform.
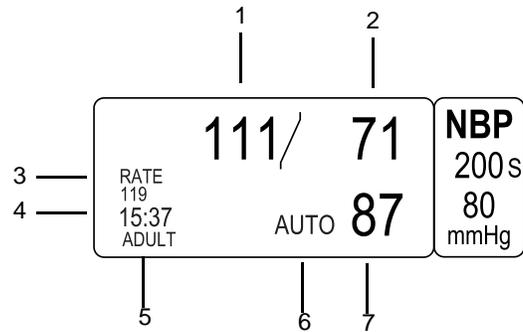
708B

1	Systolic value
2	Diastolic value
3	Pulse rate value
4	Time of last measurement (24 hour clock)
5	Cuff size
6	Automatic determination message
7	Mean value or cuff inflation pressure during a measurement

The reference blood pressure is the intra-arterial blood pressure for neonatal, pediatric and adult populations.

After inflating the cuff, the monitor begins to deflate and the oscillations in the cuff is measured. Finally, systolic, mean, and diastolic pressure are calculated and the display is updated.

The monitor deflates the cuff one step each time it detects two pulsations of relatively equal amplitude. The time between deflation steps depends on the

frequency of these matched pulses (pulse rate of the patient). However, if the monitor is unable to find any pulse within several seconds, it will deflate to the next step. The process of finding two matched pulses at each step provides artifact rejection due to patient movement and greatly enhances the accuracy. In stat mode, some steps only require one pulse.

NOTE
Values change to *X* when no monitoring has taken place for more than 15 minutes (*OPERATING ROOM*), two hours (*ADULT-ICU*) or 12 hours (*NEONATAL-ICU*).

Options

The monitor supports two blood pressure technologies. To determine the technology on this monitor, select *MORE MENUS > MONITOR SETUP > SOFTWARE CONFIGURATION*. The technology is listed under *NBP*.

DINAMAP Classic

The first determination initially pumps up to a target cuff pressure of about 160 mmHg for adult/pediatric patients or 110 mmHg for neonates depending on initial target pressure preset.

DINAMAP SuperSTAT

The first determination initially pumps up to a target cuff pressure of about 135 mmHg for adults or 110 mmHg for neonates, depending on initial target pressure preset. To allow for rapid setting of cuff pressure, the monitor will momentarily inflate to a higher pressure, then immediately deflate to the target pressure.

As a determination is taken, the monitor stores the pattern of the patient's oscillation size as a function of pressure. In any subsequent determination, as few as four pressure steps may be necessary to complete the process. When employing fewer pressure steps, the system uses the stored information from the previous blood pressure determination to decide the best pressure steps to take. The monitor measures the consistency of pulse size to tell if the oscillations taken at a step are good and if more steps are needed.

If the current blood pressure reading is similar to the previous reading, the monitor may use some information from the previous blood pressure in the current determination. The monitor constantly evaluates data during a measurement and tries to perform a blood pressure determination in the shortest possible time, providing greater comfort to the patient.

If it has been 16 minutes or less since the last determination and the current blood pressure is similar to the previous reading, the monitor will try to make an accelerated determination of blood pressure.

During irregular rhythms, only pulses from the current determination are used in calculating the blood pressure values. In order to ensure adequate artifact rejection capability and optimal SuperSTAT NBP performance, several criteria used to match and qualify the oscillometric pulses at each pressure step are relaxed while supplementing the criteria with additional information from ECG.

NOTE

(Adult/Pediatric only) When ECG is monitored, SuperSTAT NBP is able to determine blood pressure in the presence of irregular heart rhythms. At the beginning of a SuperSTAT NBP determination, the coefficient of variation from the previous 120 ECG R-R intervals is used to determine if an irregular rhythm is present.

Additional Information

The GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide" provides the following information:

- Oscillometric versus auscultation measurement methods.
- Patient preparation.
- NBP monitoring features.
- Clinical-level troubleshooting.

Safety

The following safety statements apply when monitoring NBP.

WARNING

— The NBP parameter will not measure blood pressure effectively on patients who are experiencing seizures or tremors.

WARNING

— Devices that exert pressure on tissue have been associated with purpura, skin avulsion, compartmental syndrome, ischemia, and/or neuropathy. To minimize these potential problems, especially when monitoring at frequent intervals or over extended periods of time, make sure the cuff is applied appropriately and examine the cuff site and the limb distal to the cuff regularly for signs of impeded blood flow.

WARNING

— The system is designed for use with dual-hose cuffs and tubing. The use of single-hose cuffs with dual-hose tubing can result in unreliable and inaccurate NBP data.

WARNING

— Do not place the cuff on a limb being used for A-V fistulas, intravenous infusion or on any area where circulation is compromised or has the potential to be compromised.

WARNING

— Do not apply external pressure against the cuff while monitoring. Doing so may cause inaccurate blood pressure values.

WARNING

— Use care when placing the cuff on an extremity used to monitor other patient parameters.

WARNING

— Arrhythmias will increase the time required by the NBP parameter to determine a blood pressure and may extend the time beyond the capabilities of the parameter.

WARNING

— For SuperSTAT NBP (Adult/Pediatric) Only. It takes one to three minutes for the NBP parameter to establish irregular rhythm after ECG is connected. (The NBP parameter will relearn the rhythm in the event of a lead fault, disconnect, or lead switch.) In patients with irregular rhythm, wait three minutes after ECG has been connected and ECG heart rate is present on the monitor screen before performing an NBP determination.

CAUTION

— Accuracy of NBP measurement depends on using a cuff of the proper size. It is essential to measure the circumference of the limb and select the proper size cuff.

CAUTION

— The pulse rate derived from an NBP determination (measurement) may differ from the heart rate derived from an ECG waveform because the NBP parameter measures actual peripheral pulses, not electrical signals or contraction from the heart. Differences may occur because electrical signals at the heart occasionally fail to produce a peripheral pulse or the patient may have poor peripheral perfusion. Also, if a patient's beat-to-beat pulse amplitude varies significantly (for example, because of pulsus alternans, atrial fibrillation, or the use of a rapid-cycling artificial ventilator), blood pressure and pulse rate readings can be erratic, and an alternate measuring method should be used for confirmation.

CAUTION

— For SuperSTAT NBP (Adult/Pediatric) Only — Simultaneously monitoring ECG will enhance SuperSTAT NBP performance in irregular rhythm.

NOTE

A patient's vital signs may vary dramatically during the use of cardiovascular agents such as those that raise or lower blood pressure or those that increase or decrease heart rate.

Monitoring

To verify that you are ready to monitor NBP, follow this procedure.

1. Admit the patient to the monitor.

2. Connect a patient cable to the **NBP** patient connector on the monitor.

3. Select a cuff appropriate for the limb size.

4. Position the cuff on the patient.

5. Verify the tubes between the cuff and the monitor are not kinked or blocked.

6. Verify the correct cuff size is selected in the *NBP* menu.

7. Start an NBP reading.

8. Verify that patient data displays in the *NBP* parameter window.

9. Adjust the control settings as necessary.

Control Settings

To adjust the control settings for the patient admitted to the monitor, select the *NBP* parameter window label. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

Option	Function
NBP AUTO	Turn automatic determination off or select the time interval to take automatic NBP measurements. The default setting is five minutes. A countdown timer displays in the NBP parameter window when the time interval is less than 60 minutes. To synchronize NBP measurements with actual clock times, change the *MONITOR DEFAULTS* > *SETUP DEFAULT DISPLAY* > *NBP CLOCK SYNC* option to *ON*. **WARNING** — Periodically check patient limb circulation distal to the cuff. Check frequently when using Auto NBP in one or two minute intervals. Intervals below 10 minutes are not recommended for extended periods of time.
NBP STAT	**NOTE** Not available when in the *NEONATAL-ICU* patient-monitor type. Start five minutes of automatic, continuous, sequential NBP measurements. When initiated, cuff inflation begins, a measurement is taken and the systolic, diastolic and mean pressure values are displayed. Thereafter, the systolic value displays after the measurement starts, but before the other pressure values are complete. The monitor beeps when all values are complete. Press the **NBP Go/Stop** key to stop the measurements.
REVIEW NBPS	Review the previous 96 NBP measurements less than 24 hours old in the *VITAL SIGNS* information window.
NBP LIMITS	Select the high and low alarm limits for systolic, diastolic and mean pressures. An alarm sounds when a value occurs outside of these limits.

Option	Function
CUFF SIZE	Select the type of NBP cuff used on the patient (*ADULT, PEDIATRIC* or *NEONATAL*). **WARNING** — The correct cuff size must be selected to obtain reliable NBP data and to prevent overpressure in neonatal or pediatric use. **NOTE** You must select *CLEAR NBP READINGS* after changing this setting for the target pressure to take affect.
CLEAR NBP READINGS	Remove all values from the *NBP* parameter window, remove NBP messages from the display and remove all NBP information from the *VITAL SIGNS* history.
SETUP CUSTOM AUTO	**CAUTION** — Changes made to these control settings are persistent. They are recalled when a patient is discharged from the monitor. **NOTE** Only available in software version 6 or later. Create a custom series of automatic NBP measurements, including the time interval between measurements and the number of measurements to perform. For more information, refer to "Setup Custom Automatic NBP Measurements" on page 10-10.

Option	Function
INITIAL INFLATION PRESSURE	Select the target inflation pressure for the first NBP measurement. The choices vary by cuff size.
	NOTE
	You must select *CLEAR NBP READINGS* after changing this setting for the target pressure to take affect.
	NOTE
	SuperSTAT NBP briefly over-inflates beyond the initial inflation pressure and then steps down to the correct pressure. To benefit patient comfort, lower the default initial inflation pressure.
PULSE RATE	**NOTE**
	Only available in software version 6 or later.
	Turn the feature on or off to display pulse rate values in the parameter window when the display setting is *INDV 3 WFS*.

Custom Defaults

Setup Custom Automatic NBP Measurements

To define up to four individual automatic NBP measurement series, follow this procedure.

CAUTION
 — Changes made to these control settings are persistent. They are recalled when a patient is discharged from the monitor.

NOTE
Only available in software version 6 or later.

1. Select the *NBP* parameter window label.

2. Select *Setup Custom Auto*.The *Setup Custom Auto* window displays. There are four *BP SERIES* sections

3. To define the first measurement series, follow this procedure.

    a. Select *1ST BP SERIES*.

b. Select the time interval between measurements from the available options (1 minute to 4 hours).

c. Select *REPEAT*.

d. Select the number of times to repeat the measurement (1to 25 times or continuously until manually stopped).

4. Repeat step 3 for each series (*2ND*, *3RD* and *4TH*).

5. To begin the automatic measurement cycle, select START CUSTOM AUTO. The measurement cycle begins with the first series, completes each measurement the defined number of times then proceeds to the second, third and fourth series. If any series is not defined or is turned off, it is skipped and the next series in the cycle is started.

6. To change a series while in progress, select the *NBP* parameter window label and select *SETUP SERIES*.

- To stop one of the defined series, select the *SERIES > OFF*.
- To stop measurements for one of the defined series, select *REPEAT > OFF*.

Auto NBP Cancellation Notification

NOTE
Only available in software version 6 or later.

If the monitor is set to acquire measurements automatically (*NBP AUTO*), and a time-out or no determination occurs, automatic measurement is cancelled, the message "*AUTO OFF*" displays in the *NBP* parameter window and a system status alarm will sound.

To set the system status alarm level, select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS > NBP NO DETERMINATION* and select *SYSTEM ADVISORY* or *SYSTEM WARNING*. This monitor default controls both no determination and pump timeout.

Extended NBP Alarm Silence

To extend the alarm silence, follow this procedure.

1. Discharge the patient.

2. Select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS > SETUP DEFAULT DISPLAY*.

3. From the *SETUP DISPLAY* information window, locate the *NBP SILENCE ALARM* option and *SELECT > 1 MINUTE*.

4. Press the **Silence Alarm/Admit** key.

    The NBP alarm is silenced until you change the *NBP SILENCE ALARM* setting to *NORMAL* or discharge the patient.

    All patient status alarms that occur while alarms are silenced are stored in *ALARM HISTORY* (as a patient status *MESSAGE*).

Troubleshooting

For clinical-level troubleshooting, refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide."

NOTE

The following messages display until the next measurement is initiated or manually cleared.

| Problem	Monitor Response	Solution
CUFF INFLATION OVER 5 MINS	Stops automatic NBP measurement after ONE message.	Make sure there is no air in the cuff and try a manual measurement.
DEFLATION FAIL, REMOVE CUFF		Remove cuff and contact service.
NBP HARDWARE MALFUNCTION		Contact service.
OVER PRESSURE		Remove cuff and contact service.
NO DETERMINATION	Stops automatic NBP measurement after TWO messages.	Verify cuff placement and try a manual measurement.
PUMP TIMEOUT (Inflation failure or pressure leak.)		Check connections between cuff and monitor, check for worn connector "O" rings and try a manual measurement.
TOTAL TIMEOUT (No measurement in over three minutes for adult and pediatrics or 90 seconds for neonatal patients.)		Verify patient is not moving excessively or experiencing an arrhythmia condition and try a manual measurement.

11 Monitoring SpO$_2$

Introduction

Overview

Non-invasive SpO_2 monitoring measures the amount of oxygenated hemoglobin and pulse rate by measuring the absorption of selected wavelengths of light. The light generated in the sensor passes through the tissue and is converted into an electrical signal by photodetectors in the sensor.

The monitor processes the electrical signal and displays digital values for SpO_2 and pulse rate. A parameter window displays when a patient cable is connected to the monitor. The display updates every two seconds.
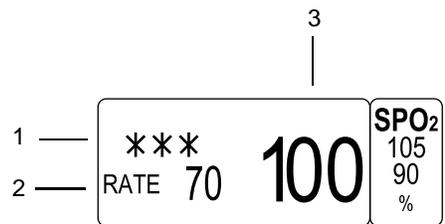
719A

1	Signal strength indicator
2	Derived pulse rate value
3	SpO_2 value

An *SpO_2* waveform is also displayed. The following examples show a good quality and bad quality waveform. Bad quality waveforms display motion artifact. The motion at the sensor site is indicated by noise spikes in the normal waveform.

687A

Good quality waveform

031A

Bad quality waveform

Primary Parameter Monitoring Considerations

When ECG is turned off, the SpO_2 parameter becomes the primary patient monitoring parameter. The following conditions apply when ECG is turned off:

- The SpO_2 and SpO_2 Rate parameter patient status alarm levels default to *WARNING*.

- The SpO_2 Pulse Search and Probe Off system status alarm levels default to *WARNING*.

- SpO_2 becomes the *WAVEFORM 1* selection for waveform display and graphing.

Configuration Options

To determine the option running on the monitor, look on the right side of the monitor next to the patient connectors. There will be a Masimo SET, Nellcor OxiMAX or an Ohmeda label. This label indicates the technology option installed on the monitor.

NOTE
The patient cable should easily plug into the patient connector. Do not use excessive force to connect the cable. If the patient cable does not easily fit into the patient connector, it is likely that you do not have the appropriate cable for the enabled configuration option.

Masimo

The following measurement guidelines apply to Masimo SET:

- The time period for acquiring a measurement average is adjustable.

- The default setting for all patient-monitor types is eight seconds.

- The pulse oximetry is calibrated to display functional saturation.

- The signal strength indicator denotes perfusion quality. Zero asterisks means no signal; three asterisks indicate high perfusion level.
- Only Masimo LNOP sensors are supported.
- Masimo LNOP sensors non-invasively measure pulse rate and the amount of oxygenated hemoglobin.
- Possession or purchase of this device does not convey any express or implied license to use the device with unauthorized replacement parts which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device.

NOTE

With motion, the plethysmographic waveform is often distorted and may be obscured by the artifact. With Masimo SET technology, the SpO_2 waveform is not an indication of signal quality or validity. Even with an SpO_2 waveform obscured by artifact, Masimo SET technology is able to read through the noise and locate the arterial pulsation.

Use the following guidelines when using Masimo LNOP sensors:

WARNING

MASIMO SET CABLES AND SENSORS — Do NOT immerse sensors or patient cables in water, solvents or cleaning solutions. Do NOT reuse sensors intended for single patient use. Do NOT sterilize sensors or patient cables by irradiation, steam, or ethylene oxide.

CAUTION

MASIMO SET CABLES AND SENSORS — Tissue damage can be caused by incorrect application or use of an LNOP sensor, for example by wrapping the sensor too tightly. Inspect the sensor site as directed in the sensor's directions for use to ensure skin integrity and correct positioning and adhesion of the sensor.

- Do not use damaged LNOP sensors.
- Do not use an LNOP sensor with exposed optical components.
- Do not immerse the sensor in water, solvents or ethylene oxide. Refer to the cleaning instructions in the directions for use for reusable Masimo LNOP sensors.

Nellcor

The following measurement guidelines apply to Nellcor:

- The time period for acquiring a measurement average is adjustable.
- The pulse oximetry is calibrated to display functional saturation.
- The signal strength indicator is not proportional to pulse amplitude. Zero asterisks means no signal; three asterisks means a strong signal.
- The *SpO₂* waveform corresponds to (but is not proportional to) the arterial pressure waveform.

Use the following guidelines when using OxiMAX SpO$_2$ accessories and sensors:

WARNING
— Intravascular dyes (such as indocyanine green, mythylene blue, etc.) and darkly pigmented skin can adversely affect SpO$_2$ readings.

WARNING
— Oximetry performance may be impaired when patient perfusion is low or signal attenuation is high.

NOTE
The Sat-Seconds feature has a "safety net" designed for patients whose saturation is frequently outside the limits but does not remain outside the limits long enough for the Sat-Seconds limit to be reached. When three or more limit violations occur within 60 seconds, an alarm sounds even if the Sat-Seconds limit has not been reached.

NOTE
Sat-Seconds is only available when the SpO$_2$ parameter block is full-sized.

- Periodically inspect extension cables and sensors for damage and discontinue use if damage is found.
- Do not immerse sensors.
- Do not use NBP or constricting instruments on the same appendage as the SpO$_2$ sensor.

Ohmeda

The following measurement guidelines apply to GE Ohmeda oximetry:

- Adult measurements are averaged over a six second time period.
- Neonate measurements are averaged over a 12 second time period. This longer averaging time decreases false alarms from patient motion artifact.
- The pulse oximetry is calibrated to display functional saturation.

- The signal strength indicator is not proportional to pulse amplitude. Zero asterisks means no signal; three asterisks means a strong signal.
- Ohmeda OxyTip+ sensors and Nellcor R-Cal technology compatible sensors are supported.

Use the following guidelines when using OxyTip+ sensors:

WARNING

PATIENT SAFETY — Patient conditions such as reddening, blistering, skin discoloration, ischemic skin necrosis and skin erosion may warrant changing the site frequently or using a different style of sensor.

Check the sensor site every four hours (more frequently of the perfusion is poor). Routinely check to ensure adequate circulation distal to the sensor site.

WARNING

DATA VALIDITY — Conditions that may cause inaccurate readings and impact alarms include interfering substances, excessive ambient light, electrical interference, excessive motion, low perfusion, low signal strength, incorrect sensor placement, poor sensor fit, and movement of the sensor on the patient

Do not use a blood pressure cuff or arterial blood pressure measurement device on the same limb as the sensor.

It is possible for any device to malfunction, therefore, always verify unusual data by performing a formal patient assessment.

Additional Information

The GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide" provides the following information:

- Factors contributing to inaccurate measurements.
- Patient preparation.
- Masimo SET information.
- Nellcor Sat-Seconds alarm management information.
- Clinical-level troubleshooting.

Safety

General

The following safety statements apply when monitoring SpO_2.

WARNING

DATA VALIDITY — Do not expose sensor detector to strong ambient light while monitoring a patient. A poor signal may result.

WARNING

DATA VALIDITY — Do not allow tape to block the sensor photodetectors.

WARNING

PATIENT SAFETY — Prolonged monitoring may require changing the sensor site periodically. Move the sensor if there is any sign of skin irritation or impaired circulation. Change the sensor site at least every four hours to prevent ischemic skin necrosis. Be particularly careful when monitoring neonates. If required, reduce the application periods to half the times recommended above. If a sensor is damaged in any way, discontinue use immediately.

WARNING

APNEA — A pulse oximeter should NOT be used as an apnea "no breath" monitor.

WARNING

CABLES — Route all cables away from the patient's throat to avoid possible strangulation.

WARNING

EARLY WARNING — A pulse oximeter should be considered an early warning device. As a trend toward patient deoxygenation is indicated, blood samples should be analyzed by a laboratory co-oximeter to completely understand the patient's condition.

WARNING

EXPLOSION HAZARD — Do not monitor SpO_2 in the presence of flammable anesthetics or other flammable substance in combination with air, oxygen-enriched environments, or nitrous oxide.

WARNING

INACCURATE MEASUREMENTS — Inaccurate measurements may be caused by various patient or mechanical conditions. These conditions include but are not limited to: venous pulsations; hypotension; severe vasoconstriction; severe anemia; hypothermia; shock; cardiac arrest; sensor tension; sensor placement on the same extremity as a blood pressure cuff, arterial catheter or intravascular line; or arterial occlusion proximal to the sensor.

WARNING

INTERFERING SUBSTANCES — Carboxyhemoglobin may erroneously increase SpO_2 readings. The level of increase is approximately equal to the amount of carboxyhemoglobin present. Dyes, or any substance containing dyes, that change usual arterial pigmentation may cause erroneous readings.

WARNING

MRI INTERFERENCE — Do not monitor SpO_2 or use SpO_2 probes during magnetic resonance imaging (MRI) scanning. Induced current could potentially cause burns. SpO_2 monitoring may affect the MRI image, and the MRI unit may affect the accuracy of the oximetry measurements.

NOTE

Read all literature accompanying sensors for specific safety information.

Neonates and Infants

The following precautions apply when monitoring neonate and infant patients.

> **WARNING**
> — The display of inaccurate pulse oximetry values has been linked to the presence of poor signal strength or artifact due to patient motion during signal analysis. This condition is most likely to be encountered when the monitor is used on neonates or infants. These same conditions in adults do not impact the values to the same extent.

Use the following criteria when measuring SpO_2 on neonates and infants.

- The peripheral pulse rate (PPR) as determined by the SpO_2 function must be within ten percent of the ECG heart rate.
- The SpO_2 signal strength indicator must have two or three asterisks displayed.

Monitoring

To verify that you are ready to monitor SpO_2, follow this procedure.

1. Admit the patient to the monitor.

2. Connect the patient cable to the **SpO₂** patient connector on the monitor.

3. Position the sensor on the patient. Refer to the manufacturer's instructions for placement information.

4. Verify that patient data displays in the *SpO₂* parameter window.

5. Verify the signal and data validity:

   a. The signal strength indicator displays a strong signal.

   b. Verify a good quality waveform displays.

6. Adjust the control settings as necessary.

NOTE
If the measurements do not seem reasonable, check the patient's vital signs by alternate means, then check the monitor for proper SpO_2 functioning.

Control Settings

To adjust the control settings for the patient admitted to the monitor, select the SpO_2 parameter window label. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

Ohmeda, Nellcor and Masimo

The following settings control pulse oximetry monitoring for all configuration options.

Option	Function
SIZE	Select the size of the displayed waveform. **NOTE** When using Nellcor Sat-Seconds, select *1X*.
RATE	Turn the feature on or off to display pulse rate values in the parameter window.
RATE VOL	Select the volume of the pulse rate tone to sound when an SpO_2 pulse is detected. This is a variable pitch tone. The tone pitch decreases as the patient's saturation level decreases. The lower the setting, the quieter the tone. **NOTE** Turning the pulse tone volume off also automatically turns off the ECG QRS volume.
SPO2 LIMITS	Select the high and low alarm limits for SpO_2 percentage and pulse rate (beats per minute). An alarm sounds when a value occurs outside of these limits.
SPEED	Select a sweep speed for the displayed waveform.

Ohmeda and Masimo

The following settings control pulse oximetry monitoring for the Ohmeda and Masimo configuration options.

Option	Function
PERSISTENT	Turn the feature on or off. When on, a "*PROBE IS OFF THE PATIENT*" system status *WARNING* displays in the SpO$_2$ parameter window when the patient cable is disconnected. The parameter window and waveform still display.

Nellcor

The following settings control pulse oximetry monitoring for the Nellcor configuration option.

Option	Function
SAT SECONDS	**NOTE** Only available in software version 6 or later. Select the amount of time that the saturation values can fall outside the saturation limits before an alarm sounds. ■ *OFF* — Any alarm limit violation instantly alarms. ■ *10 SECS* — Triggers an alarm when the saturation violates the limits for more than 10 seconds. ■ *25 SECS* — Triggers an alarm when the saturation violates the limits for more than 25 seconds. ■ *50 SECS* — Triggers an alarm when the saturation violates the limits for more than 50 seconds. ■ *100 SECS* — Triggers an alarm when the saturation violates the limits for more than 100 seconds. **NOTE** When Sat-Seconds is turned on, the signal strength indicator is not displayed. In this event, check the amplitude of the waveform to determine signal strength. Be sure the *SIZE* (waveform scale) setting is *1X*.
RESPONSE	**NOTE** Only available in software version 6 or later. Select the averaging time (speed of response) to changes in a patient's SpO$_2$ measurements. ■ *Normal* — Reports changes within four to six seconds under motion-free conditions. ■ *Fast* — Reports changes in less than four seconds under motion-free conditions.

Masimo

The following settings control pulse oximetry monitoring for the Masimo configuration option.

Option	Function
SENSITIVITY	Select the sensor sensitivity. ■ *NORMAL* — Select for normal patient monitoring. ■ *MAXIMUM* — Select for improved low perfusion performance and faster tracking of SpO_2 saturation changes. **CAUTION** — The *MAXIMUM* setting delays "*PROBE IS OFF THE PATIENT*" detection alarms.
AVERAGING	**CAUTION** — An increased averaging time may result in delayed startup, erroneous detection of minimum parameter values, missed alarms and desaturation and resaturation detection delays. Select the sensor averaging time. The higher the setting, the more stable the reading. The default setting is eight seconds. **NOTE** For the two and four second settings, the actual averaging time may range from two to four and four to six seconds.

Nellcor 395 Pulse Oximeter

Connecting

Use the following diagram to connect one pulse oximeter to the **AUX** port on the monitor.
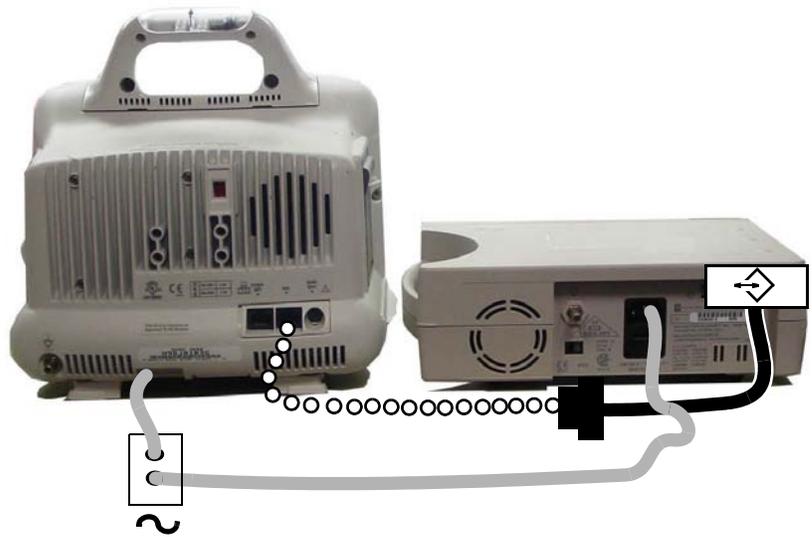
401A

▬▬	Power cable
oooo	Standard category 5 cable
▬	Nellcor 395 DIDCA cable kit
∼	AC power source

Use the following diagram to connect two pulse oximeters to the **AUX** ports on the monitor and docking station.
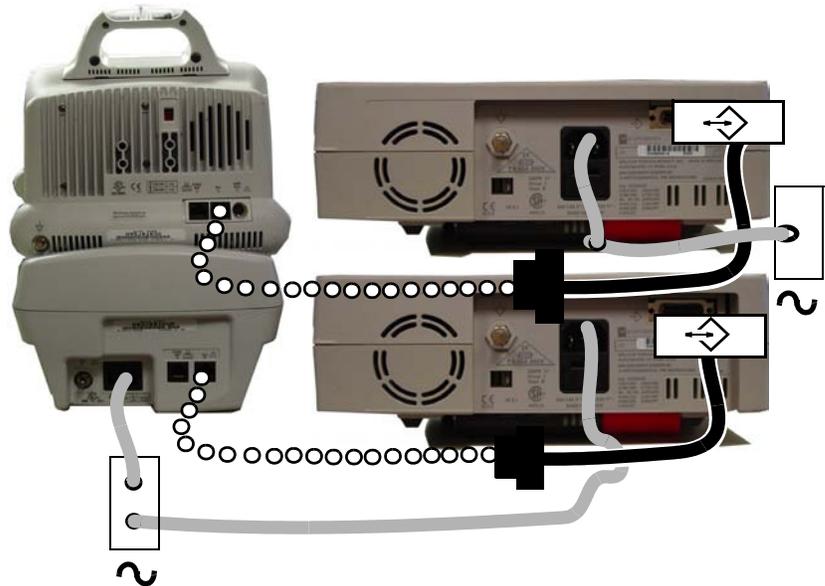
402A

Guidelines

When acquiring patient data from this external pulse oximeter, keep the following guidelines in mind.

- The monitor uses the SpO_2 rate and saturation alarm levels as defined in the *PARAMETER ALARM LEVELS* information window (*SETUP DEFAULT PARAMETER ALARM LEVELS* menu).
- The monitor sounds and display alarms for external alarm limit violations, probe off and pulse search. Any alarm settings for the monitor do not apply to the external device.
- The central station displays alarm messages and highlights the single-view and multi-view window displaying the alarm condition.
- SpO_2 data from the pulse oximeter can be viewed on alarm via the monitor.
- Nellcor Oxismart XL, GE Nellcor R-Cal compatible or other Nellcor R-Cal compatible sensors are supported.

The following table identifies what conditions apply to the monitor and to other network devices when SpO_2 data is acquired from an external oximeter.

	External Parameter Conditions
SpO$_2$ trend data	The monitor displays external SpO$_2$ rate and saturation trend data with the following labels to identify whether the information is from the first or second external oximeter. ■ *SPOX1-%* or *SPOX2-%* (saturation) ■ *SPOX1-R* or *SPOX2-R* (rate)
SpO$_2$ parameter block	The central station does not display the SpO$_2$ parameter block. The monitor displays the SpO$_2$ rate and the oxygen saturation level.
SpO$_2$ parameter menu	The monitor does not display a SpO$_2$ parameter menu or selectable menu options.
SpO$_2$ waveform display	The monitor does not display an external SpO$_2$ parameter waveform.
Secondary monitoring parameter	The monitor does not allow the external SpO$_2$ parameter to be the primary monitoring parameter.
Secondary parameter display priority	The monitor does not allow the external SpO$_2$ parameter to have a higher display priority than the internal SpO$_2$ parameter. As a result, the monitor displays the internal (primary) SpO$_2$ parameter before an external (secondary) SpO$_2$ parameter.

Troubleshooting

For clinical-level troubleshooting, refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide."

Message	Cause	Solution
SPO2 PULSE SEARCH	Searching for a valid pulse for the purpose of computing saturation, when a valid sensor is connected.	Check the patient and sensor.
PROBE IS OFF THE PATIENT	No data is displayed because the sensor is unplugged, invalid or no longer on the patient.	
LOW QUALITY SIGNAL	Data is displayed, but signal quality is questionable.	
POOR SIGNAL QUALITY DETECTED	No data displayed due to low patient pulse, patient motion or other interference.	
PROBE OR MODULE MALFUNCTION (Masimo SET only)	No data displayed due to hardware failure or unrecognized sensor.	Replace the cable and sensor.

12 Measuring Cardiac Output

Introduction

Overview

NOTE

This parameter is only available with the *CARDIO-PULMONARY* software package.

The cardiac output (CO) program allows measurement of cardiac output by use of a thermodilution catheter. A numeric value and a real-time cardiac output washout curve are displayed.

A parameter window displays when a patient cable is connected to the monitor. The display updates every two seconds. The waveform does not display unless you are performing an injection procedure.
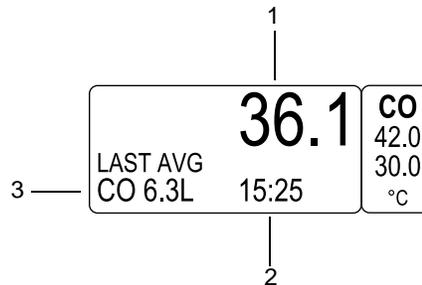
520A

1	Blood temperature value
2	Last saved calculation time stamp
3	Last saved calculation average

Performing a cardiac trial allows you to perform multiple measurements and to delete those not wanted. Up to four measurements are retained and included in the average value. The program automatically averages these and, when saved, enters the average value into cardiac calculations and *GRAPHIC TRENDS*. The monitor can save up to 20 calculations.

Additional Information

The GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide" provides the following information:

- Cardiac output washout curve information.
- Clinical techniques that can help obtain an accurate cardiac output.
- Patient preparation (bath probe setup and in-line setup).
- Cardiac calculations program information.
- Clinical-level troubleshooting.

Measuring

To verify that you are ready to measure CO, follow this procedure.

1. Admit the patient to the monitor.

2. Connect the patient cable to the **Temp/CO** patient connector on the monitor.

3. Position the patient.

4. Verify the in-line sensor is connected to the tubing or that the bath probe is correctly sensing injectate temperature.

5. Verify that patient data displays in the *CO* parameter window.

6. Verify the monitor is ready for cardiac output trials.

7. Verify that a good quality waveform displays.

8. Adjust the control settings as necessary.

9. Verify that the swan catheter vendor, size and constant are correct.

Control Settings

To adjust the control settings for the patient admitted to the monitor, select the *CO* parameter window label. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

NOTE

If you change the selections for *USE*, *CATHETER*, *INJECT TEMP*, *SIZE* or *INJECT VOL* during or after beginning a cardiac trial, the trials saved in the history are deleted. Saved calculations are not deleted or changed. All new trials and calculations use the new selected values.

| Option	Function
DELETE CO TRIALS	Select and delete trials not wanted. Up to four trials are saved; when a new trial is made, the oldest trial is deleted.
CARDIAC CALCS	Access the cardiac calculations program. For more information, refer to "Cardiac Calculations" on page 7-10.
CARDIAC OUTPUT NOW	Perform one manual cardiac output measurement when the "*INJECT NOW!*" message displays. Manual injections may be preferred for patients with extreme blood temperature fluctuations.
BT LIMITS	Select the blood temperature alarm limits and unit of measurement. An alarm sounds when a value occurs outside of these limits.
PRINT CO CURVE	Print the displayed real-time waveform. A "*PRINTING MANUAL*" message displays when the waveform is printing.
AUTO MODE	Turn automatic measurements on or off. The monitor searches for a stable baseline by averaging approximately 8.5 seconds of the patient's blood temperature and displays the message "*INJECT WHEN READY*" when a stable baseline is established.
USE	Before the injection procedure begins, select one of the blood pressure values to be factored in the cardiac calculation:
CATHETER	Before the injection procedure begins, select the correct catheter type. The monitor guides you through the *INJECT TEMP*, *SIZE* and *INJECT VOL* options to assure correct setup. If you select *OTHER*, you must select a value for *COMPUTATION CONSTANT*. Refer to the literature provided by the catheter manufacturer for the correct value.
INJECT TEMP	Select the injectate probe type.
SIZE	Select the catheter French size.
INJECT VOL	Select the injectate volume.

Option	Function
COMPUTATION CONSTANT	Select a computation constant for a catheter manufacturer.
	If you selected a specific manufacturer for the *CATHETER*, the correct value for the manufacturer is automatically selected for you.
	If you selected *OTHER* for the *CATHETER*, you must select a value or you will not be able to complete a trial. Refer to the literature provided by the catheter manufacturer for the correct value.
CARDIAC OUTPUT HELP	Display troubleshooting information.

Performing the CO Procedure

To perform a CO procedure, follow this procedure. Before you begin this procedure, verify you are ready by reviewing "Measuring" on page 12-3.

1. Select the *CO* parameter window label.

2. If the monitor is configured for automatic measurements, the "*INJECT WHEN READY*" message and *CARDIAC OUTPUT* information window displays.

3. Watch for the *"Inject Now"* message and select *CARDIAC OUTPUT NOW* to calculate the cardiac output.

   The information window displays the current cardiac trial information, a review CO curve, the derived CO value, the average CO value between stored trials, the patient's heart rate and other vital signs at the time of the trial. It also includes cardiac disturbances (*RHY*), the patient's height and weight and calculated parameters.

CARDIAC OUTPUT

SICU-BED5   MARTIN

INJECT WHEN READY
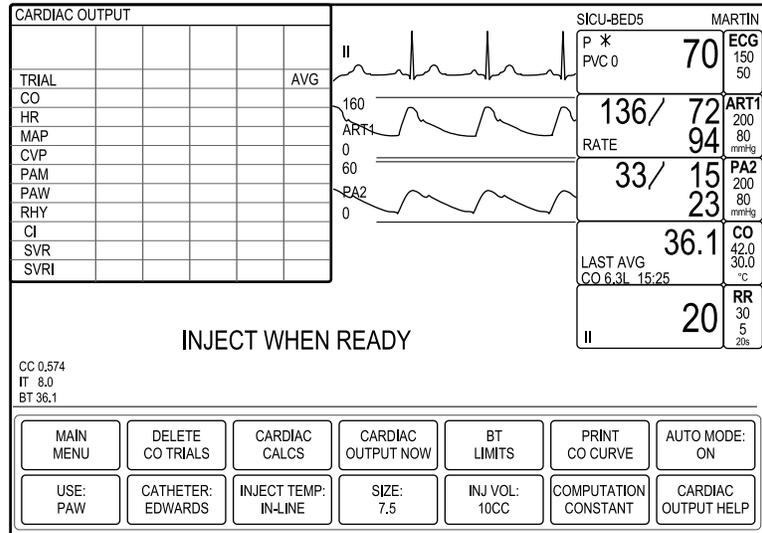
730B

If the monitor is configured for manual measurements, the "*PUSH CO NOW OR TURN AUTO ON*" message displays. If this message displays, select *CARDIAC OUTPUT NOW* and watch for the "*INJECT NOW!*" message.

If the message "*UNSTABLE BT DETECTED*" displays, refer to "Troubleshooting" on page 12-7.

4. Make sure the values for computation constant (*CC*), injectate temp (*IT*) and blood temperature (*BT*) in the lower left of the display are correct. If they are not, adjust the control settings before you perform the injection.

5. Perform the injection. The washout curve displays within a few seconds of the injection and the message "*COMPUTING CO*" displays.

6. When the message "*CO COMPLETE*" displays, the *CARDIAC OUTPUT* information window is populated with the relevant values for this trial and the values update in the *CO* parameter window.

7. Perform another injection when prompted (up to four). The average value displays in the information window and parameter window.

8. To print the displayed waveform and information window, select *PRINT CO CURVE*.

NOTE
    The washout curve cannot be printed during calculation. You can print the CO curve once when calculation is complete.

9. To save this trial average, select *CARDIAC CALCS*. The *CARDIAC CALCULATIONS* information window displays.

10. For information on adjusting the displayed calculation, refer to "Cardiac Calculations" on page 7-10.

11. Select *SAVE CALC*.

12. To view the saved calculation, select *REVIEW CALCS* to display the calculation in the *VITAL SIGNS* information window.

Troubleshooting

For clinical-level troubleshooting, refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide."

Message	Cause	Solution
CO COMPLETE	The numeric value of the cardiac output has been calculated and displayed on the screen.	This is a normal procedure message.
COMPUTING CO	The cardiac output waveform has been displayed and the monitor is preparing for numeric results.	
INJECT NOW!	A stable baseline temperature has been detected and the monitor is ready for the injectate.	
INJECT WHEN READY	A stable baseline temperature has been automatically detected and the monitor is ready for the injectate.	
PLEASE WAIT	The monitor is searching for a stable baseline temperature.	
PUSH CO NOW OR TURN AUTO ON	A stable baseline temperature has been automatically detected and the monitor is ready for the injectate.	

Message	Cause	Solution
CO IS TOO LOW (HIGH) TO DISPLAY	The calculated cardiac output value has exceeded the acceptable range (0.2L to 20L).	Check the patient and catheter. If any of these problems persist, contact service.
NO CO DUE TO BT SENSOR FAIL	A cable may be loose or there is equipment failure.	
NO CO DUE TO IT SENSOR FAIL		
UNSTABLE BT DETECTED	The monitor cannot detect a stable baseline temperature after over 12 seconds of attempts.	
BT TOO LOW (HIGH)	Blood temperature is too high or low to detect or there is an equipment failure.	
IT TOO LOW (HIGH)	Injectate temperature is too high or low to detect or there is an equipment failure.	

13 Monitoring Respiration

Introduction

Overview

Respiration rate is detected by measuring thoracic impedance changes through ECG lead I or lead II.

- Lead I provides good thoracic (upper chest) breath detection. However, lead I is more susceptible to cardiogenic artifact.

- Lead II provides good thoracic breath detection and abdominal (lower chest) breath detection. However, lead II is more susceptible to both cardiogenic artifact and motion (head, neck or arm) artifact.

To enable respiration monitoring, select *MORE MENUS > MONITOR SETUP > PARAMETERS ON/OFF > RR*.

A parameter window and waveform display when a patient cable is connected to the monitor and respiration monitoring is enabled. The display is updated every two seconds.
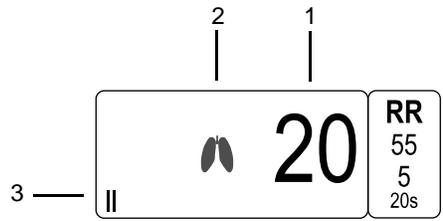
752A

1	Respiration rate
2	Breath indicator
3	Monitored lead

NOTE

Using an ESU ECG filter will not adversely affect respiration monitoring.

NOTE

When monitoring CO_2, a respiration rate is always measured and displayed in the CO_2 parameter window. Using the respiration rate measurement from CO_2 should be the preferred measurement method as an impedance respiration rate can be disrupted by many conditions.

Additional Information

The GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide" provides the following information:

- ECG skin preparation.
- Respiration lead placement.
- Clinical-level troubleshooting.

Safety

The following safety statements apply when monitoring respiration.

> **WARNING**
> ELECTRODE CONFIGURATION — Impedance respiration monitoring is not reliable when ECG electrodes are placed on the limbs.

> **WARNING**
> APNEA — The monitor may not detect all episodes of inadequate breathing, nor does it distinguish between central, obstructive and mixed no breath events.

Monitoring

To verify that you are ready to monitor respiration, follow this procedure.

1. Admit the patient to the monitor.

2. Verify that respiration is enabled on the monitor.

3. Position electrodes on the patient.

4. Attach leadwires to the electrodes.

5. Connect the patient cable to the leadwires.

6. Connect the patient cable to the **ECG** patient connector on the monitor.

7. Verify that patient data displays in the *RR* parameter window.

8. Verify the respiration waveform is regular and even.

9. Adjust the control settings as necessary.

Control Settings

To adjust the control settings for the patient admitted to the monitor, select the *RR* parameter window label. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

Option	Function
LEAD	Select the lead to derive the respiration rate.
RELEARN RESPIRATION	Relearn the patient's respiration pattern over the next eight breaths. While in process, the message "*LEARNING*" displays. When complete, the respiration rate value displays at 40 percent sensitivity and the waveform is automatically sized.
SENSITIVITY	Select the detection sensitivity of the average amplitude. The lower the value, the greater the detection sensitivity.
RESPIRATION LIMITS	Select the high and low alarm levels for respiration rate and apnea. An alarm sounds when a value occurs outside of these limits.
AUTO SIZE	Select the size of the displayed waveform to fit as factory-intended on the display. The waveform size has no effect on detection.
MANUAL SIZE	Select the size of the displayed waveform. The waveform size has no effect on detection.
CARDIAC ARTIFACT ALARM	Turn this patient status *ADVISORY* alarm on or off. It alerts you when the respiration rate is within five percent of the heart rate over 30 consecutive breaths because the monitor may be counting heart beat artifact as respiration. It displays the message "*ARTIFACT*" in the *RR* parameter window and sounds a one beep tone.
SPEED	Select a sweep speed for the displayed waveform.

Troubleshooting

For clinical-level troubleshooting, refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide."

Message	Cause	Solution
LEARNING	The monitor is relearning the patient's respiration pattern.	This is a normal procedure message.
APNEA	No breath detected.	Check the patient and the sensor.
ARTIFACT	The monitor cannot determine respiration.	Check the patient and sensor.
LD I (II) FAIL	The monitor cannot detect patient data from the current lead.	Check the patient, and replace or switch the sensor.
LEADS FAIL	The monitor cannot detect patient data from any lead.	Check the patient, and replace or switch the sensor.

14 Monitoring Temperature

Overview

Because the temperature patient connector on the monitor is also used for cardiac output, you cannot monitor temperature and cardiac output at the same time.

A parameter window displays up to two temperature sites when a patient cable is connected to the monitor. The display is updated every two seconds. There is no waveform.
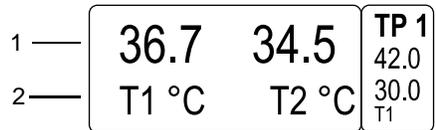
764A

1	Temperature value
2	Temperature site and unit of measurement

You can monitor temperature from both internal and external temperature sensors from the YSI series 400 and 700.

Monitoring

To verify that you are ready to monitor temperature, follow this procedure.

1. Admit the patient to the monitor.

2. Position the sensor on the patient.

3. If you are using a dual temperature cable, select **400** or **700** on the cable switch.
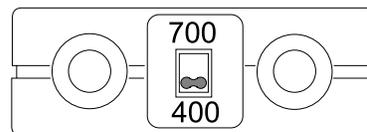
766A

4. Connect the patient cable to the **Temp/CO** patient connector on the monitor.

5. Verify that patient data displays in the *TP* parameter window.

6. Adjust the control settings as necessary.

Control Settings

To adjust the control settings for the patient admitted to the monitor, select the *TP* parameter window label. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

Option	Function
T1	Select the T1 temperature site to acquire patient data. When off, no patient data is acquired or displayed.
T2	Select the T2 temperature site to acquire patient data. When off, no patient data is acquired or displayed.
UNITS	Select the unit of measurement.
TEMPERATURE LIMITS	Select the high and low alarm limits for each temperature site. An alarm sounds when a value occurs outside of these limits.

Troubleshooting

Message	Cause	Solution
CAL CHECK	The monitor detects a 0.1°C deviation between the temperature value and the internal calibration.	Check the sensor.
CAL FAIL		
SENSOR	The monitor does not detect a sensor.	

15 Monitoring End-Tidal CO$_2$

Introduction

Overview

End-tidal CO_2 monitoring is a continuous, non-invasive technique that determines the concentration of carbon dioxide in respiratory gas by measuring the absorption of specific wavelengths of infrared light.

The light generated in the analyzer bench is passed through respiratory gas. The amount of absorption by CO_2 is measured and digitized by the photodectector. The monitor processed the electrical signal and displays a parameter window and a waveform.
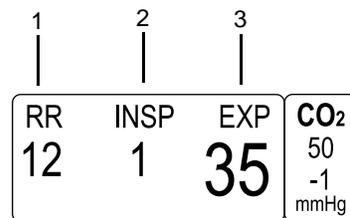
773A

1	Respiration rate value
2	Inspired CO_2 value
3	Expired CO_2 value

It may take up to two minutes after the sensor is connected to the monitor to display patient data and a waveform. The message "*WARMING UP*" displays in the *CO_2* parameter window and is replaced with patient data when available. The display updates every two seconds.

Compatible Devices/Sensors

Patients can be monitored whether intubated or non-intubated.

■ Intubated patients — Use the SAM module or a direct connection to the **CO_2** patient connector on the monitor.

■ Non-intubated patients — Use the CapnoFlex LF CO_2 module.

Additional Information

The GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide" provides the following information:

- Mainstream and sidestream setup.
- Clinical-level troubleshooting.

Safety

The following safety statements apply when monitoring CO_2.

WARNING

DEVICE PROXIMITY — Capnostat CO_2 sensors should not be used in close proximity to wireless networking equipment to strong electromagnetic fields (for example, radio station transmitters, citizen's band radios, cellular phones, etc.). Using these sensors under these conditions may cause on or all of the following to occur:

- Noise may be induced on the capnogram.
- The CO_2 parameter values may be replaced by *X*s.
- The message "*CHECK ADAPTER CAL*" may display.
- The message "*CALIBRATE SAMPLE LINE*" may display.

Normal operation will resume when the source of interference is removed.

CAUTION

CO_2 SOURCE — Do not attempt to use a combination of gas monitoring modules (for example, end-tidal CO_2 and SAM) at the same time. Only data from one acquisition source is displayed.

CAUTION

GAS EXHAUST LINE — Do not allow the gas exhaust line to become kinked or blocked. Back pressure may cause inaccurate gas readings. It may also cause serious damage to the module or monitor's internal components.

CAUTION

INFECTIOUS DISEASE — To avoid the spread of infectious disease, do not allow the exhaust to discharge in the direction on the patient or the user.

CAUTION

VACUUM SOURCE — Do not connect the exhaust to an unregulated high vacuum source. Pressures may cause inaccurate gas readings. It may also cause serious damage to the module or monitor's internal components.

Monitoring

To verify that you are ready to monitor CO_2, follow this procedure.

1. Admit the patient to the monitor.

2. Attach the sensor to the patient.

3. Attach the patient cable to the **CO_2** patient connector on the monitor.

4. Setup the monitoring method (sidestream or mainstream). For more information, refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide".

    NOTE

    Not required with CapnoFlex LF CO_2 module.

5. Select *MORE MENUS > MONITOR SETUP > PARAMETERS ON/OFF > CO2*.

6. Calibrate the sensor when using mainstream/sidestream or SAM modules. For more information, refer to "Sensors" on page 15-6.

7. If using a sidestream setup, calibrate the sample line. For more information, refer to "Sample Lines" on page 15-7.

    If using a mainstream setup, calibrate the airway adapter. For more information, refer to "Adapters" on page 15-7.

8. Verify that patient data displays in the *CO_2* parameter window.

9. Verify that a good quality waveform displays.

10. Adjust the control settings as necessary.

Control Settings

To adjust the control settings for the patient admitted to the monitor, select the CO_2 parameter window label. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

Option	Function
UNITS	Select the units of measure of inspired and expired CO_2. **NOTE** Respiration is measured in breaths per minute; no breath is measured in seconds.
CO2 SCALE	Select a scale for the displayed CO_2 capnogram. The larger the scale, the smaller the displayed waveform. A waveform scale that exceeds the defined display area is flattened on top.
CO2 LIMITS	Select high and low alarm limits for inspired/expired CO_2, respiration rate and apnea. An alarm sounds when a value occurs outside of these limits.
N20 COMPENSATION	**NOTE** Only available when in the *OPERATING ROOM* patient-monitor type. Select the percentage of N_2O concentration to compensate for N_2O-related elevation of the CO_2 value. Obtain the concentration from an analyzer or anesthesia machine.
O2 COMPENSATION	Select the percentage of O_2 concentration to compensate for O_2-related decrease of the CO_2 value. Obtain the concentration from an oxygen analyzer.
CO2 AVERAGING	Select a time interval for averaging CO_2.

Option	Function
CAL SENSOR TO ZERO CELL	**NOTE** Only available with a Mainstream setup. Zero the sensor each time a sensor is connected to the monitor.
CALIBRATE SAMPLE LINE	**NOTE** Only available with a Sidestream setup. Calibrate the module each time a module is connected to the monitor.
CALIBRATE ADAPTER	**NOTE** Only available with a Mainstream setup. Calibrate the airway adapter each time a adapter is connected to the monitor.
SPEED	Select the sweep speed for the displayed waveform.

Calibrating

Sensors

To calibrate a sensor, follow this procedure.

1. Remove the adapter from the sensor.

2. Verify the sensor cable is attached to the **CO$_2$** patient connector on the monitor.

3. Place the sensor on the cell marked "0".
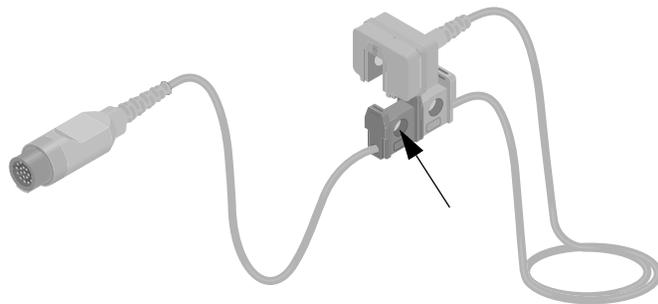
780A

4. Select the *CO$_2$* parameter window label.

5. From the CO_2 menu, select *CAL SENSOR TO ZERO CELL*.

6. Select *READY*. The message "*CALIBRATING*" displays in the CO_2 parameter window. When calibration is complete, the *EXP* value changes to 0.

7. Remove the sensor from the cell marked "0" and attach to the cell marked "REF".

8. The *EXP* value should update to 38mmHg (± 2). If the value is not within this range, the sensor is out of tolerance. Replace the sensor.

Adapters

To calibrate an airway adapter, follow this procedure.

1. Verify the sensor is connected to the adapter.

2. Verify the sensor cable is connected to the **CO_2** patient connector on the monitor.

3. Verify the airway adapter is clean and free of foreign matter.

4. Place the sensor and adapter away from all sources of CO_2, including the patient's exhaled breath, your exhaled breath and ventilator exhaust valves.

5. Select the CO_2 parameter window label.

6. From the CO_2 menu, select *CALIBRATE ADAPTER*.

7. Select *READY*. The message "*CALIBRATING*" displays in the CO_2 parameter window. When calibration is complete, the message clears.

Sample Lines

To calibrate sample lines, follow this procedure.

1. Connect the sample line to the Capnoflex module, but not to the patient.

   NOTE
   A "spike" may display when attaching the sample line. Wait for the spike to finish its cycle before continuing.

2. Select the CO_2 parameter window label.

3. From the CO_2 menu, select *CALIBRATE SAMPLE LINE*.

4. Select *READY*. The message "*CALIBRATING*" displays in the CO_2 parameter window. When calibration is complete, the message clears.

5. Connect the sample line to the patient.

Troubleshooting

For clinical-level troubleshooting, refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide."

NOTE
Sidestream setup messages only display on the monitor, not at the central station.

Message	Cause	Solution
CHECK SAMPLE LINE	The sample line is blocked, loose or not connected.	Connect or replace the sample line.
CALIBRATE SAMPLE LINE	The sample line is not calibrated.	Calibrate the sample line.
CAL SENSOR TO ZERO CELL	The sensor is not calibrated.	Calibrate the sensor.
CANNOT CALIBRATE	The calibration process failed.	Calibrate the sensor again.
CHECK ADAPTER ADAPTER CAL	The adapter is not calibrated.	Calibrate the adapter.
INCOMPATIBLE SENSOR	The sensor is not compatible with the monitor.	Replace the sensor.
NO BREATH DETECTED	The sensor is not connected to the patient.	Check the patient and sensor placement.
NOT CALIBRATED	The sensor signal is out of tolerance.	Calibrate or replace the sensor.
SERVICE CO2 MODULE	The CO_2 module failed.	Contact service.
SERVICE CO2 MODULE TMP	The CO_2 module is overheated.	Replace module or contact service.
SERVICE CO2 SENSOR	The CO_2 sensor failed.	Replace sensor.
SERVICE CO2 SENSOR - SENSOR TEMP	The CO_2 sensor is overheated.	Replace sensor or contact service.
WARMING UP	The sensor is warming up.	If the message displays for more than four minutes, replace sensor or contact service.

16 Monitoring Anesthesia Gases

Introduction

Overview

The monitor uses a SAM module to monitor anesthesia gases. The SAM module is an infrared based multi-gas analyzer. It measures inspired and expired values for patient gas and calculates respiratory rate.

When all connections are made and the module has warmed up, the CO_2 and *GAS* parameter windows display. The display updates every two seconds. There is no waveform.

002E

803B

The module detects the following gases:

- Oxygen (*O2*)
- Carbon dioxide (*CO2*)
- Nitrous oxide (*N2O*)
- Enflurane (*ENF*)
- Halothane (*HAL*)
- Isoflurane (*ISO*)
- Desflurane (*DES*)
- Sevoflurane (SEV)

The monitor can detect a mixture of anesthetic agents. A gas mixture is made up of two or more anesthetic agents, each greater than 0.30 percent in concentration. A third gas agent is displayed if its concentration is greater than 0.60 percent.

If two agents are detected, the primary and secondary agents are displayed with N_2O. The primary agent is always displayed on the left. The primary agent is defined as the agent with the greatest inspired value.

If a third agent is detected with a concentration greater than 0.60 percent, the N_2O values will be removed to make room for the third agent. You can adjust the control settings to display the N_2O values with the primary and secondary agents.

NOTE

Halothane and enflurane are identified and quantified in a mixture with desflurane if desflurane is less than seven percent.

Options

There are two models of the SAM module, one with an O_2 sensor and one without. The module without the O_2 sensor is identified by a SAM 80 label on the top of the module and the words "No O2 Sensor" on the front panel label. Operating instructions are similar for both modules.

Guidelines

Use the following guidelines when monitoring anesthesia gases with an external gas analyzer:

■ Configure alarm limits at the gas analyzer.

■ Configure and adjust alarm levels at the monitor.

■ Review or adjust control settings from the *CO₂* or *GAS* menus. The settings you may view or adjust are dependent upon the connected device and may vary between devices.

Additional Information

Refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide" for the following information:

■ Patient tube connections.

■ Patient gas exhaust.

Safety

The following safety statements apply when monitoring anesthesia gases with a SAM module.

WARNING

ISOFLURANE AND DESFLURANE — The SAM module cannot distinguish between isoflurane and desflurane. You must use tell the module which agent combination will be used.

If both are present (such as, when introducing one and discontinuing the other) inaccurate values are displayed for the selected agent (isoflurane or desflurane) until only the selected agent is present. If isoflurane is selected and concentration is greater than 5.0 percent, a "Desflurane?" prompt will be displayed, suggesting verification of correct selection.

CAUTION

AGENT EXPOSURE — Connect exhaust to a scavenging system to prevent exposure to exhaled agents.

CAUTION

ANESTHETIC AGENT VERIFICATION — When administering anesthetic agents, always verify your anesthetic vaporizer settings.

CAUTION

ETHANOL AND METHANE — The presence of ethanol or methane with halogenated agents causes inaccuracy in the agent values. Methane, even when no halogenated agent is present, will cause a halothane value to be displayed.

CAUTION

MULTIPLE CO2 MODULES — Do not attempt to use a combination of CO_2 or SAM modules at the same time. Only data from the first acquisition source to detect CO_2 will be displayed.

CAUTION

SAMPLE RATE — The SAM module continuously withdraws about 250 milliliters per minute (nominal) from the patient airway. The SAM 80 module has a withdrawal rate of about 150 milliliters per minute. Do not use the module on any patient who may be adversely affected by this sampling rate.

CAUTION

AQUA-KNOT WATER TRAP USE — An Aqua-Knot water trap must always be used when the unit is running. Failure to use the water trap can result in contamination of the internal gas measurement instruments and may cause subsequent inaccurate gas analysis data.

CAUTION

AQUA-KNOT WATER TRAP REPLACEMENT — Replace and dispose of the Aqua-Knot water trap weekly or when occluded, whichever occurs first. Do not reuse. Reusing the water trap may cause incorrect readings to be displayed and may damage the equipment.

CAUTION

CONTAMINANT PREVENTION — Always keep an Aqua-Knot water trap or filter on the gas sample inlet when not in use. This will prevent dust particles from being drawn into the system, which may damage the equipment.

NOTE

Always position the Luer-Lok connection and patient sample line in an upright position to avoid aspiration of fluids into the patient sample line, which will cause premature blockage of the Aqua-Knot water trap.

NOTE

Delivery of bronchodilators, mucolytics via aerosol, and meter dose inhalers will cause premature blockage of the Aqua-Knot water trap. Discontinue gas analysis prior to treatment by removing the airway adapter from the ventilator circuit, or by disconnecting the sample line from the Aqua-Knot water trap.

Monitoring

To verify that you are ready to monitor anesthetic gases, follow this procedure.

1. Install the SAM module into the TRAM-RAC 2A module housing. You will hear a click when the module is fully inserted.

2. Connect one end of the TRAM-NET communication cable into the **Auto** or **TRAM-NET** port on the back of the module housing.

3. Connect the other end of the communication cable into the **Aux** port on the back of the monitor.

4. Turn on the power switch on the back of the module housing.

5. Turn on the monitor.

6. Admit the patient to the monitor.

7. Position the sensor on the patient.

8. Verify that patient data displays in the *CO$_2$* and *GAS* parameter windows.

9. Adjust the control settings as necessary.

Control Settings

CO$_2$

To adjust the control settings for the patient admitted to the monitor, select the *CO$_2$* parameter window label. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

NOTE

The following options are additional *CO$_2$* control settings. These are only available when using a SAM module. The other *CO$_2$* control settings are defined in the *CO$_2$* chapter. For more information, refer to "Control Settings" on page 15-5.

Option	Function
O2 LIMITS	**NOTE** Only available with O_2 sensor. Select the high and low alarm limits for inspired/expired O_2, respiration rate and apnea. An alarm sounds when a value occurs outside of these limits.
O2 COMPENSATION	**NOTE** Only available with O_2 sensor. Select the percentage of O_2 concentration to compensate for O_2-related decrease of the CO_2 value. Obtain the concentration from an oxygen analyzer.
CLEAR MESSAGE	Clear hardware error messages after the condition is corrected.
MODE	Select one of the following: ■ *RUN* — The pump is on. ■ *STANDBY* — The pump is in a low flow state or off.
CO2 DISPLAY MODE	**NOTE** Only available with O_2 sensor. Select the value display size: ■ *INSP/EXP* — Displays both inspired and expired values at normal size. ■ *EXP ONLY* — Displays the expired value larger; no inspired value displayed. If an inspired alarm limit is exceeded, the display reverts to INSP/EXP. ■ *AUTO* — Displays the expired value larger and the inspired value when less than five mmHg.
CALIBRATE MODULE	**NOTE** Only perform when the patient is discharged. Calibrate the module with a special calibration gas cylinder.

Gas

To adjust the control settings for the patient admitted to the monitor, select the *GAS* parameter window label. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

Option	Function
UNITS	Select the units of measure for gas parameters.
VIEW OTHER GASES	Select one of the following to select the gases displayed: ■ *N2O* — Display just N_2O. ■ *MIX* — Displays the primary and secondary agents if a mix of three agents are detected
REVIEW GAS DATA	Review *GRAPHIC TRENDS* information.
MONITOR	Select one of the following to select the agent combination for analysis. ■ *ISO* — Isoflurane, halothane, enflurane and sevoflurane. ■ *DES* — Desflurane, halothane, enflurane and sevoflurane.
GAS LIMITS	Select the high and low alarm limits for gas parameters. An alarm sounds when a value occurs outside of these limits.
CP BYPASS	Select to deactivate alarms when the patient is on bypass. Alarms are automatically reactivated when three minutes of uninterrupted ventilation is detected.

Option	Function
CLEAR MESSAGE	Clear hardware error messages after the condition is corrected.
MAC VALUES	Display the MAC value until the patient is discharged. The MAC value is the minimum alveolar concentration of an agent needed to produce an anesthetizing effect in 50 percent of the population. **WARNING** — The MAC values correspond to healthy adults. Other factors, such as age and physical condition, need to be accounted for. **NOTE** The displayed value reflects the expired MAC value. **NOTE** If N_2O and two other agents are displayed, the MAC value does not display in the *GAS* parameter window.

Enabling HAL and ENF

When using a SAM module, you can enable the monitor to detect and display low values of halothane and enflurane (greater than one percent) due to non-analyzed gases in the circuit in the *GAS* parameter window.

To enable the HAL and ENF display, follow this procedure.

1. Select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS > SETUP DEFAULT DISPLAY*.

2. In *SETUP DISPLAY* locate *DISABLE SAM HAL* and *DISABLE SAM ENF* and select *ON*.

Troubleshooting

For clinical-level troubleshooting, refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide."

Message	Cause	Solution
BLOCKED LINE	The sample or exhaust line blocked.	Clean or replace sample or exhaust line.
CALIBRATE	The SAM module is not calibrated.	Calibrate the module.
MODULE CELL SERVICE CO2	The SAM module failed.	Contact service.
CP BYPASS	The alarms are deactivated for bypass.	This is a normal procedure message.
DESFLURANE?	Desulfurane is selected, but isoflurane is detected.	Change the gas agent selection.
ISOFLURANE?	Isoflurane is selected, but desoflurane is detected.	
CONNECT AQUA KNOT	The Aqua-Knot water trap is disconnected.	Connect or replace the Aqua-Knot water trap.
LOW TEMP	Gas cells are liquefied.	Apply power and wait for the module to warm up (30 minutes to one hour).
GAS LIQUEFIED/WARMING UP	Due to extreme temperature change, gas in one or more of the internal cells is liquefied.	
NO BREATH DETECTED	No breath detected or sample line disconnected.	Check the patient and the sensor.
AIR CAL IN PROGRESS	Room air calibration in progress.	This is a normal procedure message,
SERVICE...	Unknown hardware failure.	Contact service.
UNKNOWN ERROR		
WARMING UP	The SAM module is warming up.	If the message displays for more than four minutes, replace module or contact service.

17 Monitoring Impedance Cardiography (ICG)

Introduction

Overview

The monitor uses an ICG module to acquire impedance cardiography data. When the ICG module is installed into the TRAM-RAC 2A module housing, the *ICG* parameter window displays one primary ICG parameter and up to three secondary ICG parameters. The display updates every two seconds.

The ICG parameter also displays a waveform. The ICG waveform is not synchronized with any parameter. A message "*DELAYED*" displays with the waveform due to an approximately four-second patient data delay.

Monitored Parameters

The following measured parameters are available for display.

- Thoracic Fluid Content (*TFC*)
- Acceleration Index (*ACI*)
- Velocity Index (*VI*)
- Heart Rate (*HR*)

The following calculated parameters are available for display.

- Cardiac Output (*CO*)
- Cardiac Index (*CI*)
- Stroke Volume (*SV*)
- Stroke Index (*SI*)
- Systemic Vascular Resistance (*SVR*)
- Systemic Vascular Resistance Index (*SVRI*)
- Left Ventricular Stroke Work Index (*LVSWI*)
- Left Cardiac Work Index (*LCWI*)
- Systolic Time Ratio (*STR*)
- Estimated Delivered Oxygen Index (*eDO2I*)
- Pre Ejection Period (*PEP*)
- Left Ventricular Ejection Time (*LVET*)

Additional Information

Refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide" for the following information:

- ICG formulas.
- Patient preparation.
- Sensor and cable placement.
- ICG reference literature.
- Clinical-level troubleshooting.

Safety

For important information about monitoring pacemaker patients, refer to "Pacemaker" on page 8-8 and the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide".

WARNING
— The ICG module is designed for use on adult patients in the resting position meeting the following height and weight criteria:

- Patient heights between 120–230 cm (48–90 in).
- Patient weights between 30–155 kg (67–341 lbs).

WARNING
— The ICG module and its components are not designed, sold or intended for use except as described in this document.

WARNING
— Use only GE approved ICG module accessories.

WARNING
— ICG sensors are intended for skin application only and are not for direct cardiac application.

WARNING
— The conductive gel of the ICG sensors should not contact any other conductive materials during patient monitoring.

WARNING

— ICG sensors are specified for single patient use.

WARNING

— The patient cables specified and included with the ICG module are specifically designed for protection against the effects of cardiac defibrillators and radio-surgery equipment.

CAUTION

— Impedance cardiography is a theoretical model of blood flow and is subject to inaccuracies in cases where the model does not fit an individual patient's clinical profile. Conditions which may impede the accuracy of the ICG data are as follows:

- Septic shock.
- Aortic valve regurgitation.
- Severe hypertension (MAP >130 mmHg).
- Patient heights < 120 cm (48 in) or > 230 cm (90 in).
- Patient weights < 30 kg (67 lbs) or > 155 kg (341 lbs).
- Aortic balloon pump insertion.
- Patient movement, including shivering.
- Signal interference caused by cable and/or power cord.
- Open chest surgery in which the normal patterns of blood flow or electrical current flow of the thorax are altered.

CAUTION

— Hemodynamic parameter calculations are dependent on accurate patient height, weight, sex and age values. Ensure that these values have been properly entered.

Monitoring

To verify that you are ready to monitor ICG, follow this procedure.

1. Install the ICG module into the TRAM-RAC 2A module housing. You will hear a click when the module is fully inserted.

2. Connect one end of the TRAM-NET communication cable into the **Auto** or **TRAM-NET** port on the back of the module housing.

3. Connect the other end of the communication cable into the **Aux** port on the back of the monitor.

4. Turn on the power switch on the back of the module housing.

5. Turn on the monitor.

6. Verify the status light on the front of the module illuminates green.

7. Position the sensors on the patient.

8. Connect the ICG cable to the sensors.

9. Connect the ICG cable to the module.

10. Admit the patient to the monitor.

11. Enter the required patient information.

12. Verify that patient data displays in the *ICG* parameter window.

13. Verify that a good quality waveform displays.

14. Adjust the control settings as necessary.

Control Settings

To adjust the control settings for the patient admitted to the monitor, select the *ICG* parameter window label. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

Option	Function
ICG PATIENT INFORMATION	Select the required patient information. When monitoring the following parameters additional information is required: ■ *MAP* — Select *NBP* or *Arterial Line*. ■ *CVP* — Select invasive CVP or enter a specific value for SVR and SVRI calculations. ■ *PAW* — Select invasive PAW or enter a specific value for LVSWI and LCWI calculations. ■ *HB* — Enter a specific value for eDO_2I monitoring. This value is retained for 12 hours and may be used in other calculations (for example, pulmonary calculations).
FAST LOOK	Select one of the following options for viewing and printing parameter data: ■ *NORMAL RANGES* — Display data with normal parameter ranges. A plus (+) or minus (-) indicates values outside the normal range. ■ *UNITS OF MEASURE* — Displays data with units of measurement.
SECONDARY PARAMETERS	Select three parameters from the available parameters to display in the parameter window. The default selections are CO, SVR and TFC.
LIMITS	Select the high and low parameter alarm limits. An alarm sounds when a value occurs outside of these limits.
TRENDS	Display the *GRAPHIC TRENDS* information window. All ICG parameters display with an "i" preceding the parameter label (for example, iHR, iMAP, iCO2, etc.).
HELP	Display the *HELP* information window for help with patient preparation, proper sensor placement and troubleshooting issues.
WAVEFORMS	Select one of the following options for waveform display: ■ *ICG* — Reflects beat-to-beat changes in the impedance consistent with events of the cardiac cycle. ■ *DZ/DT* — Reflects the rate of change at the first derivative of the waveform.

Option	Function
SPEED	Select a sweep speed for the displayed waveform.
SIGNAL QUALITY	Select one of the following options for signal quality. This overrides the automatic signal selection made by the module for data acquisition and processing. ■ *AUTO SEARCH* — Search all leads for optimum signal. Displays the message "Signal Search" in the parameter window. ■ *SIGNAL 1* to *SIGNAL 4* — Select to switch the vector designation to a specific lead.
BEAT AVERAGE	Select the number of heart beats that are averaged. When monitoring begins, beat averaging begins at 10, 20, 30 and 60 beats. The averaging remains at 60 beats unless a new value is selected. The smaller the number selected, the more likely the data will be affected by artifact. The higher the number selected, the more the beat average will be smoothed out with minimum fluctuation.
CHANGE NORMALS	Select the normal range for the parameters.
CHECK LEADS	Check for lead failures.

Troubleshooting

For clinical-level troubleshooting, refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide."

Message	Cause	Solution
ENTER REQUIRED ICG PATIENT INFO	Required patient information missing or incorrect.	Enter the required patient information.
ENTER PATIENT WEIGHT		
ENTER PATIENT HEIGHT		
ENTER PATIENT AGE		
ENTER PATIENT SEX		
PATIENT WEIGHT OUT OF RANGE		
PATIENT HEIGHT OUT OF RANGE		
PATIENT AGE OUT OF RANGE		
SERVICE MODULE	Hardware failure.	Contact service.
RIGHT THORACIC LEAD FAIL	Lead failure.	Check patient and sensor.
LEFT THORACIC LEAD FAIL		
RIGHT NECK LEAD FAIL		
LEFT NECK LEAD FAIL		
CABLE DISCONNECTED	Hardware or lead failure.	
SIGNAL SEARCH		

18   Monitoring Bispectral Index (BIS)

Introduction

Overview

NOTE

Only available in software version 6 or later.

NOTE

Although the external Aspect® BISx can monitor EEG, the monitor does not support EEG monitoring.

The external BISx uses an internal digital signal converter (DSC). The DSC uses EEG amplifiers and analog filters, and digitizes the resulting waveforms for transmission and processing by the monitor. It also amplifies and digitizes the EEG signal close to the patient, to limit the effect of ambient noise sources.

When connected to the monitor, BISx computes the BIS value and other processed EEG parameters in real-time using three steps:

■ The raw EEG signal is broken down second by second and the segments that have artifact are identified and removed.

■ BISx calculates the BIS value by combining EEG features associated with the anesthetic effect.

■ The index is modified to reflect the amount of suppressed EEG signal in the raw waveform.

The monitor displays the digital values in a parameter window. The display is updated every two seconds.
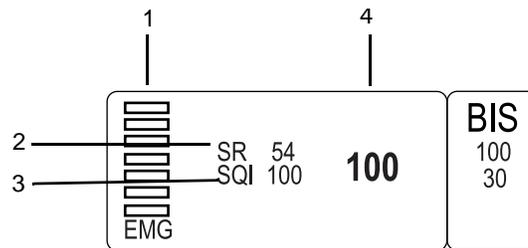
900A

1	Electromyograph (EMG) value
2	Suppression ratio value
3	Signal quality index value
4	Bispectral index value

The monitor also displays a single raw EEG waveform.

Additional Information

Refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide" for the following information:

- BIS sensor placement.
- Patient preparation.
- BIS reference literature.
- Clinical-level troubleshooting.

NOTE

You can also refer to the sensor packaging for instructions on patient preparation and sensor placement.

Safety

Considerations

- Clinical judgement should always be used when interpreting BIS in conjunction with other available clinical signs. Reliance on BIS alone for intraoperative anesthetic management is NOT recommended.
- As with any monitored parameter, artifacts and poor signal quality may lead to inappropriate BIS values. Potential artifacts may be caused by poor skin contact (high impedance), muscle activity or rigidity, head and body motion, sustained eye movements, improper sensor placement and unusual or excessive electrical interference.
- Due to limited experience in the following applications, BIS values should be interpreted cautiously in patients with known neurological disorders, those taking psychoactive medications and in children below the age of one.

General

The following safety statements apply when monitoring BIS.

WARNING

INTENDED USE — BISx is intended for use under the direct supervision of a licensed health care practitioner or by personnel trained in its proper use. It is intended for use on adult and pediatric patients within a hospital or medical facility providing patient care to monitor the state of the brain by data acquisition of EEG signals.

The BISx may be used as an aid in the monitoring of certain anesthetic agents. Use of BIS monitoring to help guide anesthetic administration may be associated with the reduction of the incidence of awareness with recall in adults during general anesthesia and sedation.

WARNING

CABLES — Route all cables away from the patient's throat to avoid possible strangulation.

WARNING

 — The BISx may remain connected to a patient during defibrillation as long as the sensor is not located between the defibrillator pads.

CAUTION

 — Due to elevated surface temperature, do not place in prolonged direct contact with the patient.

CAUTION

 — Continuous impedance checking may need to be disabled if the impedance check signal interferes with other equipment.

Monitoring

To verify that you are ready to monitor BIS, follow this procedure.

1. Verify BISx is securely mounted to an IV pole, bedrail or clipped to a bedsheet.

2. Connect the BISx communication cable in the **AUX** connector on the back of the monitor.

3. Connect BISx to an AC power source.

4. Position the sensor on the patient. For more information, refer to the sensor packaging or the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide".

5. Insert the BIS sensor paddle into the patient interface cable.

6. Admit the patient to the monitor.

7. Verify that patient data displays in the *BIS* parameter window.

8. Verify that the SQI value indicates a strong signal.

9. Verify that a good quality waveform displays.

10. Adjust the control settings as necessary.

Control Settings

To adjust the control settings for the patient admitted to the monitor, select the *BIS* parameter window label. Then select any of the following options and make the desired changes.

NOTE

All changes are temporary and revert to the factory or custom defaults when the patient is discharged. To permanently change the these settings, refer to "Defining Custom Defaults" on page 3-7.

Option	Function
SMOOTHING	Select the averaging time used to calculate BIS: The factory default setting is 15 seconds. ■ *15 SEC* — Select for operating room or sedation patient monitoring to increase the responsiveness to changes in the patient's state. ■ *30 SEC* — Select for intensive care patient monitoring to provide a smoother BIS trend with less variability and sensitivity to artifact.
BIS LIMITS	Select the high and low alarm limits for BIS parameter. An alarm sounds when a value occurs outside of these limits.

Option	Function
SENSOR CHECK	Select to automatically detect sensors and display the impedance value and status of each lead. This data is updated every two seconds. ■ *PASS* — This lead passed the sensor check. ■ *LD OFF* — No impedance value; check the lead. ■ *NOISE* — No impedance value; check the lead. ■ *HIGH* — Re-prep the sensor.
BIS SETUP	Provides access to the following controls: ■ *LEAD DETECT* — For more information, refer to "Disabling Continuous Lead Detection" on page 18-6. ■ *EEG FILTER* — For more information, refer to "Disabling the Waveform Filter" on page 18-7. ■ *BIS TEST* — For more information, refer to "Testing the BIS" on page 18-7.
RESUME BIS	Select to initiate a sensor check when the "*EXPIRED SENSOR*" message displays.
EEG WAVEFORM	Select *ON* to display EEG waveform data.
EEG SCALE	Select the scale of the displayed waveform. The larger the scale, the smaller the waveform. The factory default setting is *25 µV/DIV*.
BIS RANGES	Displays a description of the factory default BIS ranges.
BIS TRENDS	Display the trended BIS values in the *VITAL SIGNS* information window.
SPEED	Select a sweep speed for the displayed waveform.

Disabling Continuous Lead Detection

By default, the BISx continuously checks electrode impedances. This 1 nA 128 Hz impedance check signal may interfere with other equipment, such as evoked potential. To temporarily stop the continuous lead detect signal, select the *BIS* parameter window label > *BIS SETUP* > *LEAD DETECT* > *OFF*.

Disabling the Waveform Filter

The monitor uses an EEG filter to modify the raw EEG waveform with a combination of low pass, high pass and notch filters. This produces waveform data display between 2 and 70 Hz. To temporarily remove filters and display only the raw waveform for troubleshooting purposes, select the *BIS* parameter window label > *BIS SETUP > EEG FILTER > OFF*. When the filter is removed, the waveform data between 0.25 and 100 Hz displays.

Testing the BIS

BISx uses an internal DSC to filter and transmit data to the monitor. To test the function of the DSC, select the *BIS* parameter window label > *BIS SETUP > BIS TEST > ON*. The message "*BIS TEST IN PROGRESS*" displays until the evaluation is complete.

A "*PASS*" message displays if BISx is functioning within normal operating parameters.

A "*FAIL*" message displays if BISx did not meet the noise, gain, high and low pass normal values. If BISx fails, contact service.

Understanding Displayed Values

BIS

BIS is a processed EEG parameter which corresponds to the patient's level of consciousness. The resulting BIS values range from 100 (patient is wide awake) to 0. Since BIS is an absolute value, baseline information about the patient is not required for monitoring patients.

BIS Value	Patient State
100	Patient is awake; responds to normal voice.
80	Patient is moderately sedated; responds to loud commands or mild prodding/shaking.
60	Patient is in deep sedation; low probability of explicit recall and unresponsive to verbal stimulus.

BIS Value	Patient State
20	Patient is in deep sedation; burst suppression.
0	No brain activity detected.

SR

The suppression ratio value identifies the percentage of epochs in the last 63 seconds in which the EEG signal is considered suppressed, or the percentage of time the EEG waveform is flat-line over the previous minute. The range is zero to 100 percent.

SQI

The signal quality index value identifies the percentage of good epochs (episodes) in the last 60 seconds that could be used to calculate the bispectral index. The optimum SQI is 100.

SEF

The spectral edge frequency is the frequency between zero and 30 Hz at which 95 percent of the total power is a lower frequency and five percent exceeds the spectral edge frequency.

EMG

The electromyograph value measures the absolute power in the 70 to 110 Hz range. The power value is in dB (decibels). This is the measurement of the facial muscle activity or other artifact in the EEG signal within this frequency range.

The indicator displays up to seven bars; the more bars the greater the EMG activity. No bars display when EMG values are less than 30 dB. Seven bars display when the EMG values are 55 dB.

Troubleshooting

For clinical-level troubleshooting, refer to the GE "Critical Care Monitoring Clinical Reference and Troubleshooting Guide."

Message	Cause	Solution
CHECK SENSOR - RESET BIS	Sensor failure.	Reposition or replace the sensor, PIC cable or BISx.
CHECK BIS - RESET BIS	Hardware failure.	Reconnect BISx.
COMM ERROR	Communication failure.	Reinstall BISx.
CONNECT SENSOR	Connection or communication failure.	Reposition or replace the sensor, PIC cable or BISx.
BIS FAILURE	Over-current electrical condition.	Contact service.
BIS TEST IN PROGRESS	A self test is in progress.	This is a normal procedure message.
EXPIRED SENSOR	The current time and date exceeds the recommended usage date of the sensor.	Select *Resume BIS* to initiate a sensor check. If the sensor check passes, BIS monitoring will begin. Then Re-prep or replace the sensor, PIC cable or BISx.
INCOMPATIBLE SENSOR	The sensor is not compatible.	Reconnect or replace the sensor, PIC cable or BISx.
BIS ERROR	Hardware failure.	Contact service.
PATIENT ISOELECTRIC	No EEG activity detected for several minutes.	Check the patient and sensor
REPREP SENSOR	Sensor impedance/status failure.	Press firmly on each sensor electrode for five seconds. If the impedance check fails, reposition or replace the sensor, PIC cable or BISx.
SENSOR CHECK IN PROGRESS	A self test is in progress.	This is a normal procedure message.
SENSOR ERROR	Sensor failure.	Replace the sensor.
SERVICE BIS	Hardware failure.	Contact service.
SIM CONNECTED	A BIS demonstration device is connected to the patient interface cable.	This is a normal procedure message.
SQI BELOW 50%	The signal quality is low.	The system is unable to attain high quality EEG signal. Run sensor self-test to confirm sensor impedances are in range. If not, re-prep or replace the sensor or the PIC cable.
SQI TOO LOW	The signal quality is low.	

A   Maintenance

Overview

Biocompatibility

When used as intended, the parts of the product described in this operator's manual, including accessories that come in contact with the patient during the intended use, fulfill the biocompatibility requirements of the applicable standards. If you have questions about this matter, please contact GE or its representatives.

Inspection

An effective maintenance schedule should be established for your monitoring equipment and reusable supplies. This should include inspection as well as general cleaning on a regular basis. The maintenance schedule must comply with the policies of your institution's infection control unit and/or biomedical department.

WARNING
— Failure on the part of responsible hospital or institution employing the use of this monitoring equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.

Check with your biomedical department to be sure preventive maintenance and calibration is complete. Refer to the service manual for detailed maintenance and repair information.

Follow these guidelines when inspecting the equipment:

- Locate obvious physical damage; replace all damaged items.
- Inspect cords and plugs for any damage; schedule repair or replacement with qualified service personnel.

Disposal

WARNING
PACKAGING DISPOSAL — Dispose of all packaging material, observing all applicable waste control regulations and keeping out of children's reach.

WARNING

DISPOSAL — At the end of its service life, the product described in this manual, as well as its accessories, must be disposed of in compliance with the guidelines regulating the disposal of each product. If you have any questions concerning disposal of a product, please contact GE or its representatives.

Cleaning

Exterior Surface

WARNING

— Disconnect the monitor from AC power before cleaning or disinfecting its surface.

CAUTION

— Failure to follow these rules may melt, distort or dull the exterior surface finish, blur lettering on labels or cause equipment failure.

Clean the exterior surface on a regular basis in compliance with your institution's infection control and/or biomedical department. Use any of the following approved solutions to dampen a clean, lint-free cloth:

■ Diluted ammonia.

■ Cidex®.

■ Diluted sodium hypochlorite bleach.

■ Diluted mild soap.

NOTE

Always dilute solutions according to the manufacturer's suggestions and wipe all the cleaning solution from the exterior surface with a dry cloth.

NOTE

Always avoid the following:

- Cleaning solutions containing wax.
- Pouring or spraying water or cleaning solution directly on the exterior surface, connectors or ventilation openings.
- Abrasive cleansers or solvents.
- Acetone, ketone or alcohol-based cleansers.
- Betadine®.

Display

Dampen a soft, clean, lint-free cloth with a glass cleaner.

NOTE

Do not spray cleaner directly on the screen. Do not use alcohol-based cleansers or hospital disinfectants like Cidex or Betadine.

Applied Parts

Cables and Leadwires

CAUTION

— Do not use acetone or ketone solvents, an autoclave or steam cleaner to clean cables and leadwires.

CAUTION

— The decision to sterilize must be made per your institution's requirements with an awareness of the effect on the integrity of the cables or leadwires.

Use a warm, damp cloth and mild soap to clean cables and leadwires. For more intensive disinfecting (near sterile) you can use Ethylene Oxide (ETO); however, this method will reduce the useful lifetime of the cable or leadwire.

Capnostat Sensor and Adapter

To clean the sensor, use a damp cloth to wipe clean and dry (including the sensor windows). Do not immerse or sterilize the sensor.

To clean the reusable adapters, rinse in warm, soapy solution then soak in a liquid disinfectant (pasteurized or cold sterilized) such as glutaraldehyde. Rinse and dry well with sterile water.

To clean adult and low volume dead space adapters, sterilize with the ETO gas method or a steam autoclave. Using the steam autoclave may reduce the useful lifetime of the adapter.

Before reusing any adapter, make sure the sensor windows are dry and residue-free. Also ensure the adapter was not damaged during handling, cleaning or sterilization.

NBP Cuff and Hose

To clean an NBP cuff, consult the manufacturer for the correct cleaning information. Make sure cleaning fluid used does not enter the valves. Fluid trapped in the valves can enter the monitor and may result in damage to the monitor.

Other

For other applied parts, such as temperature sensors, catheters, pulse oximetry probes and NBP cuffs, consult the manufacturer for cleaning, sterilization or disinfecting methods.

Printer/Writer(s)

Changing Writer Paper

1. Press the button on the top of the writer to open the writer door.
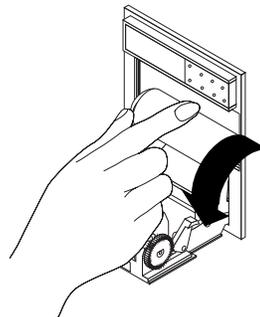
638A

2. Remove the old spool and install a new paper roll. Install the paper so it unrolls from the bottom.
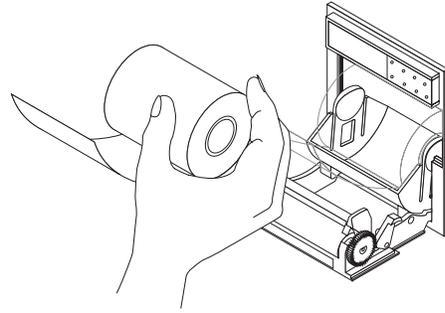
639A

3. Close the door. Make sure the paper protrudes from the opening.
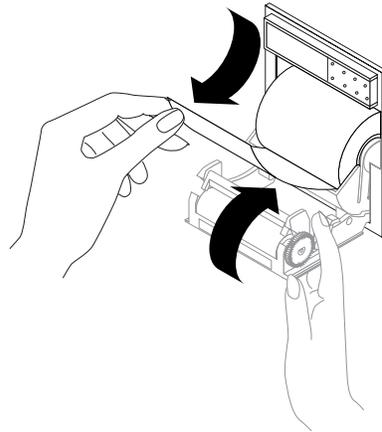
640A

4. Test the writer by initiating a graph strip.

5. Remove the test graph by tearing downward.

Batteries

Overview

General

A complete battery management system provides maximum battery performance.

Depending on usage, the run time per battery for new, fully-charged batteries is up to 3.5 hours. Monitoring NBP, CO_2 and SpO_2 drains battery power faster than other

parameters. The display brightness, graphing, and connection to a wireless network can also alter battery run times.

Audible and visual alarms alert you when loss of power is imminent and on-screen capacity gauges indicate battery charge condition and capacity. A "*BATTERY LOW*" message at the top of the screen warns you prior to complete loss of battery power. You should replace the battery or connect the monitor to an AC power source when the message is displayed.

Lithium-Ion Technology

The batteries used in this monitor are rechargeable batteries containing lithium-ion cells. Each battery contains an integrated electronic fuel gauge and a safety protection circuit. The following are the key points you should know about lithium-ion battery technology:

- The battery will discharge on its own, even when it is not installed in a monitor. This discharge is the result of the lithium-ion cells and the bias current required for the integrated electronics.
- By the nature of lithium-ion cells, the battery will self-discharge. The self-discharge rate doubles for every 10°C (18°F) rise in temperature.
- The capacity loss of the battery degrades significantly at higher temperatures.
- As the battery ages, the full charge capacity of the battery will degrade and be permanently lost. As a result, the amount of charge that is stored and available for use is reduced.

Cadex SMart Two+ Battery Charger

NOTE

To extend the life of batteries, GE recommends using the external Cadex SMart Two+ battery charger to perform all battery care functions.

To use the external battery charger, the monitor must be running software version 2A or later and the charger must be running software version 1.1 or later.

The following LEDs appear on the battery charger. The combination of LEDs and their meaning change by illumination type (solid or flashing).

LED	Illuminated	Flashing
RUN	Charging in progress.	Initializing the battery.
RUN and CONDITION	Conditioning in progress.	
READY	Charging is complete.	

LED	Illuminated	Flashing
READY and CONDITION	Conditioning is complete (pass target).	Conditioning is required.
FAIL	Battery fault.	Charger fault.
FAIL and CONDITION	Conditioning is complete (fail target).	

Safety

WARNING

PHYSICAL INJURY — Do NOT install the monitor above a patient. Make sure the batteries are completely inserted and battery doors are completely closed. Falling batteries could seriously or fatally injure neonatal or other vulnerable patients.

WARNING

EXPLOSION OR FIRE — Using non-recommended batteries could result is injury/burns to the patients or users. Only use batteries recommended or manufactured by GE. The warranty can be voided if non-recommended batteries are used.

WARNING

PHYSICAL INJURY — Do NOT install the monitor above a patient. The potential exists for a battery to leak a chemical on the patient if the monitor is mounted above the patient.

Leaks from battery cells can occur under extreme conditions. The liquid is caustic to eyes and skin. If the liquid comes in contact with eyes or skin, flush with clean water and seek medical attention.

NOTE

For optimal performance and safety, use only batteries supplied by GE.

Identifying Capacity

One new, fully charged battery lasts about 3.5 hours. Two new, fully charged batteries last about 5 hours.

The following terms are used to define the battery capacity:

- Design capacity — The theoretical capacity of the battery cells when the battery is new.
- Full charge capacity — The actual amount of charge the battery can store and deliver to the monitor.
- Remaining charge capacity — The amount of full charge capacity currently remaining in the battery. This is a percent of the full charge capacity.

Battery Gauges

The battery gauge for each battery displays on the screen when installed in the monitor. The example shows a battery that has lost about 20 percent of its design capacity and has about 50 percent remaining charge capacity (approximately 1.4 hours).

859B

1	Filled (white) area — Remaining charge capacity.
2	Empty (black) area — Full charge capacity.
3	Dotted outline area — Design capacity.

If the message *"ERROR"* displays in the battery gauge, refer to "Battery Status Menu" on page A-10.

Battery Charger

When you select the **Target Capacity** switch on the charger, the charger compares the battery's performance to a 60, 70, or 80 percent target capacity set on the battery charger. If the battery fails to meet the target performance, the battery charger will prompt you to condition the battery. If after the condition cycle has been completed, the battery does NOT meet the target performance, then the battery charger will illuminate a "fail" light.

Battery Status Menu

To display the *BATTERY STATUS* menu, select *MORE MENUS > BATTERY STATUS*.

```
                    BATTERY STATUS

                        BATTERY A       BATTERY B
    SLOT STATUS         IDLE            IN USE
    CHARGE LEVEL (%)    100             65
    TIME TO EMPTY (H:M) 01:55           01:12
    TIME TO FULL (H:M)  n/a             n/a


    FAULT STATUS:
    DURING USE          OK              OK
    DURING CHARGE       OK              OK
    TEMPERATURE         OK              OK
    BATTERY QUALITY     OK              CONDITION
```

```
    MAIN      BATTERY
    MENU       HELP
    PREVIOUS
    MENU
```

637B

Select *BATTERY HELP* for more information on batteries.

■ *SLOT STATUS* — Definitions of the information presented in the *BATTERY STATUS* information window.

■ *TIMES* — Definitions of the information presented in the *BATTERY STATUS* information window.

■ *FUEL GAUGES* — Explains the battery capacity gauges.

■ *ALARMS* — Lists the battery messages and solutions.

Installation Guidelines

Position the monitor in a location that does not artificially increase the operating temperature of the battery.

■ To optimize battery life and performance, select a location that does NOT artificially increase the ambient temperature surrounding the monitor.

■ Do not place the monitor near a heat vent or near heat-generating equipment, such as computer monitors.

■ Avoid placing the monitor in corners where the airflow may be restricted.

Battery Care

Charging

Charging a battery takes approximately 9 hours for both the external and the internal charging method.

External Charger Method (Preferred)

The Cadex SMart Two+ charger maintains a lower battery cell temperature during the charge cycle than the monitor. This reduction in temperature will extend the life of the battery.

To charge a battery, use the following procedure.

1. Insert the battery into the battery charger. The RUN LED illuminates.

2. Leave the battery in the charger until the READY LED illuminates.

3. If the FAIL LED illuminates, remove and reinsert the battery. This will correct any battery charger time out errors.

Internal Method

To charge a battery, use the following procedure.

1. Insert battery into the monitor. The battery *CHARGING STATUS* indicator illuminates yellow.

2. When the battery *CHARGING STATUS* indicator illuminates green, the battery is fully charged.

Conditioning

Condition the battery every six months or whenever the *BATTERY STATUS* information window displays *CONDITION* in the *BATTERY QUALITY* field.

External Charger Method (Preferred)

Remove the battery from the monitor every six months and condition it using the SMart Two+ charger. This condition cycle recalibrates the electronic fuel gauge.

To condition a battery, use the following procedure.

1. Insert the battery into the battery charger.

2. Press the CONDITION button when one of the following conditions occur:

- When the RUN LED light is flashing.
- When the CONDITION LED is flashing.

3. Remove the battery when the READY LED illuminates.

Internal Method

WARNING

PATIENT RISK — Never condition a battery while the monitor is connected to a patient. Serious injury or death could result.

To condition a battery, use the following procedure.

1. Remove all batteries from the monitor.

2. Insert one battery in slot **A**.

3. Disconnect the monitor from AC power.

4. Select *MORE MENUS > BATTERY STATUS*.

5. Allow battery to discharge to less than 90 percent (*CHARGE LEVEL*).

6. Connect the monitor to AC power and fully charge the battery.

7. Disconnect the monitor from AC power again.

8. Allow the monitor to run on battery power until the "*BATTERY LOW*" message displays or until the monitor shuts down.

9. Connect the monitor to AC power again and allow the battery to fully charge.

Storing

Store the battery outside of the monitor at a temperature between 20°C and 25°C (68°F to 77°F).

- When the battery is stored inside a monitor that is powered by an AC power source, the battery cell temperature increases by 15°C to 20°C (27°F to 36°F) above the room's ambient temperature. This reduces the life of the battery.

- When the battery is stored inside a monitor that is continuously powered by an AC power source and is not powered by battery on a regular basis, the life of the battery may be less than 12 months. GE recommends that you remove the battery and store it near the monitor until it is needed for transport.

When the battery is stored for a long period of time without being charged, it will eventually lose all of its charge and "fall asleep." When the battery is "asleep," none of the LEDs on the battery will illuminate when the battery's Test button is pressed. You must "wake up" the battery before you can use it again.

Waking Up

The procedure for waking up a battery inside the monitor should only be performed by qualified service personnel. For more information, refer to the service manual.

To wake up a battery with the external charger (preferred method), use the following procedure.

NOTE

A deeply discharged battery will require you to repeat the following steps more than once before the battery will "wake up".

1. Insert the battery into the battery charger and wait for the RUN LED light to illuminate (approximately three minutes).

2. If the RUN LED light does NOT illuminate, complete the following steps:

    a. Remove the battery from the battery charger.

    b. Insert the battery into the battery charger and let the battery trickle charge for two to three minutes while the FAIL LED flashes. If the RUN LED light illuminates, ignore it.

    c. Watch the battery charger LEDs and immediately remove the battery from the battery charger when the FAIL LED stops flashing AND remains illuminated, OR when both the RUN and CONDITION LEDs flash.

    d. Wait for one to two seconds, then reinsert the battery into the battery charger. The RUN and CONDITION LEDs will flash for five to ten seconds while the charger initializes the battery. If the FAIL LED illuminates, remove the battery and reinsert it into the battery charger.

    e. Watch the battery charger LEDs. The RUN LED should stop flashing and remain illuminated for approximately one minute, then the CONDITION LED should stop flashing. At this time, the battery is awake and being charged.

Recycling

WARNING
EXPLOSION HAZARD —   DO NOT incinerate the battery or store at high temperatures. Serious injury or death could result.

When the battery no longer holds a charge, it should be replaced. The battery is recycleable. Remove the old battery from the monitor and follow your local recycling guidelines.

In the United States and Canada, the Rechargeable Battery Recycling Corporation (RBRC) can help you locate your nearest rechargeable battery collection site. You can contact RBRC by telephone (1-800-8-BATTERY) or by accessing their internet web site (www.rbrc.org).

Troubleshooting

There are three conditions that activate battery alarms:

- Low battery
- Battery failure
- Charger failure

Refer to the following table for solutions to alarm messages that display in the ECG waveform area.

Message	Solution
BATTERY LOW	When this system *WARNING* sounds and displays, only 10 minutes of battery run time is remaining. Replace the battery or connect the monitor to AC power.
POWERING DOWN!	When this system *WARNING* sounds and displays, there is no battery run time left. The monitor will power off unless connected to AC power.
CHECK BATT STATUS	When this system message displays, the battery is not functioning. Remove and insert or replace the battery.
BATTERY ERROR	When this system *WARNING* sounds and displays, the battery cannot be charged in the monitor. Attempt charging in the external battery charger or replace the battery.
CHECK BATT STATUS	When this system message displays, the external charger failed to charge the battery. Attempt charging the battery again or replace the battery.

Technical Maintenance

Diagrams, technical specifications and other relevant technical information can be found in the service manual supplied with this equipment. Comply with the policies of your institution's biomedical department and the preventive maintenance recommendations in the service manual.

Safety Tests

General

> **WARNING**
> — Failure on the part of all responsible individuals, hospitals or institutions employing the use of this device to implement the recommended maintenance schedule may cause equipment failure and possible health hazards. The manufacturer does not in any manner assume the responsibility for performing the recommended maintenance schedule, unless an Equipment Maintenance Agreement exists. The sole responsibility rests with the individuals, hospitals or institutions utilizing the device.

- General safety tests should be performed every 12 months. NBP and temperature measuring devices should be tested every two years.
- Safety tests may only be performed by qualified personnel not subject to directives with respect to these tests.
- If a service contract exists, safety tests may be performed by GE service personnel.
- Detailed information about safety tests can be found in the service manual.
- Once the safety tests have been performed, no additional regular maintenance is required.
- Only use standards that guarantee sufficient accuracy. All such standards must be based upon national or European standards.

Temperature Testing

To test temperature, use the following procedure and a MARQIII patient simulator.

1. Connect the simulator to the **Temp/CO** patient connector.
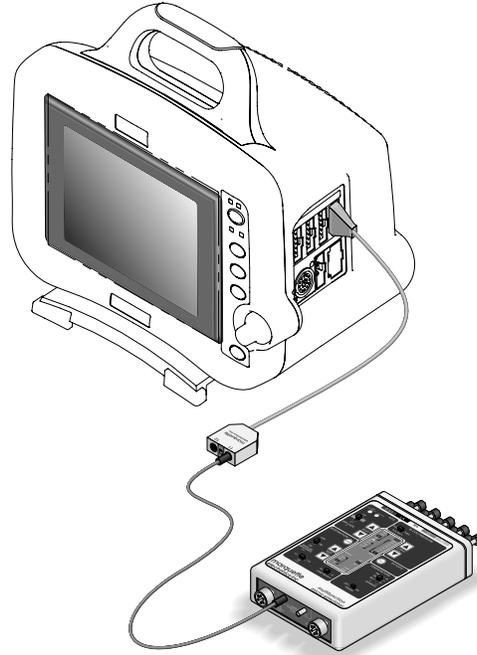
017C

2. Turn on the simulator, set the adapter to 400 and set the temperature output to 37°C.

3. Check the temperature values in the *TEMP* parameter window. The displayed value must be within ± 0.4°Cof the simulator setting.

   If the readings fail, re-calibrate the **Temp/CO** circuit. For more information, refer to the service manual

4. Repeat the procedure with the simulator adapter set to 700.

NBP Testing

To test NBP, use the following procedure and a digital pressure or calibrated mercury manometer (for example, Sensym PDM200M or Diptron Plus 3).

WARNING
— When the NBP cuff is used in this procedure, it must be tightly wrapped around a rigid cylinder or pipe. Do not place the NBP cuff around a human limb during this procedure due to the potential for injury.

1. Connect the manometer to the NBP cuff.

2. Connect the manometer to the **BP 1/3** patient connector.

3. Press the **Power** key to turn the monitor on.

4. Verify the parameter window, waveform label and other parameter information display.

5. Turn the manometer on and set range switch to 1000 mmHg.

6. Wrap the NBP cuff around rigid cylinder or pipe (at least six inches in diameter).
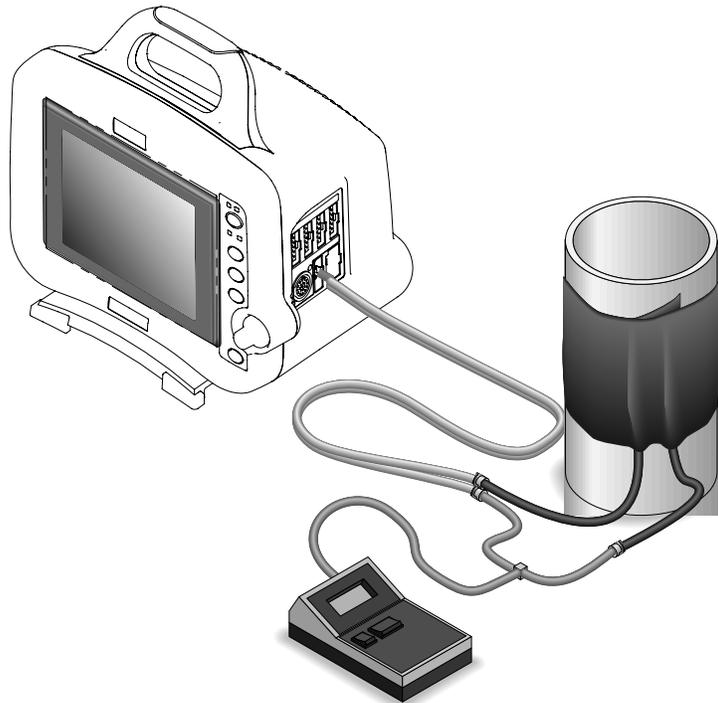
021B

7. Verify the calibration:

    a. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE*.

    b. Select *CALIBRATE > CALIBRATE NBP > CHECK CALC OFF > START*.

    c. Verify the readings in the *NBP* parameter window and the readings on the manometer are within ±1 mmHg for at least one full minute.

       If the readings fail, re-calibrate the NBP circuit. For more information, refer to the service manual.

       d.   Select *CHECK CALC IN PROGRESS > STOP* to deflate the NBP cuff.

8. Repeat procedure for the **BP 2/4** patient connector.

Alarm Verification

To verify the system alarm functions, use the following procedure.

1. Raise the heart rate limit until it is higher that the patient's current heart rate.

2. Verify the following:

   - The audible alarm sounds the correct tone.
   - The heart rate in the *ECG* parameter window flashes in the correct color.
   - The alarm light flashes the correct color.
   - An alarm graph printed.

3. Silence the alarms and verify they react correctly.

4. Return the heart rate alarm settings to the original monitoring levels.

NOTE
For more information on alarms, refer to Chapter 4.

B   Software Packages

Feature Comparison by Software Package

Capability or Feature	Basic	Cardiac	Cardio-pulmonary	High Resolution CRG Trends	Gender Specific 12SL & ACI-TIPI
6-trace color display	X				
On-screen invasive BP site labels	X				
Common scale and individual scale BP displays	X				
Persistent SPO$_2$ parameter window display	X				
Right-left overlapping BP scale display	X				
Waveform and numeric alignment	X				
MENTOR on-screen operational support	X				
Adult, neonate, and operating room customization	X				
User-programmable, monitor default/monitor setup	X				
Storage of up to 100 CRG events				X	
Storage of up to 24 hours of CRG trend data				X	
Simultaneous, multi-lead ECG acquisition	X				
3-lead or 5-lead ECG cable compatibility	X				
Selectable beat pause interval		X			
Selectable heart rate averaging	X				
Pacemaker detection/rejection	X				
Smart-lead fail	X				
All ECG display format	X				
Lethal arrhythmia detection package (Asystole, VTach, and VFib alarms)	X				
Full arrhythmia package w/alarm level adjust		X			
Multi-lead arrhythmia storage and recall		X			

Capability or Feature	Basic	Cardiac	Cardio-pulmonary	High Resolution CRG Trends	Gender Specific 12SL & ACI-TIPI
Multi-lead ST segment measurement—7 leads		X			
12-lead ST segment monitoring—12 leads		X			X
Multi-lead ST segment template and trending		X			
Multi-lead ST segment history storage		X			
Selectable ST points		X			
12SL ECG Analysis					X
Automatic 12 lead on ST alarm		X			X
Respiration monitoring and apnea detection	X				
Invasive BP measurement cursor	X				
Arterial disconnect alarm	X				
Arterial Smart BP function	X				
Intra-aortic balloon pump BP algorithm			X		
PA wedge measurement program			X		
PA insert wedge measurement program			X		
Non-invasive BP (NBP) measurement	X				
NBP clock sync	X				
NBP cuffs/measurement for adult, pediatric, neonate	X				
NBP manual, automatic, and stat measurement modes	X				
Pulse oximetry monitoring	X				
Pulse oximetry desaturation tones	X				
Pulse oximetry — Masimo probe compatibility	X				
Pulse oximetry — Nellcor probe compatibility	X				
Pulse oximetry — factory probe compatibility	X				
Temperature monitoring support	X				

Capability or Feature	Basic	Cardiac	Cardio-pulmonary	High Resolution CRG Trends	Gender Specific 12SL & ACI-TIPI
Thermodilution cardiac output support			X		
Cardiac computation constants stored for major manufacturers			X		
Cardiac calculations			X		
CapnoFlex LF Sidestream CO_2	X				
SAM (Smart Anesthesia Multi-gas module) interface	X				
Vital Signs—24 hr	X				
Graphic trending—24 hr	X				
Pulmonary calculations w/fick CO calculation			X		
Dose calculations—adult/neonate	X				
High/low alarms, all parameters	X				
Alarm window	X				
Multi-level, user-programmable, "graded" alarms package	X				
Laser printer support	X				
Two or four inch direct digital writer (DDW) support	X				
View other patient (float)	X				
View on alarm	X				
Auto view on alarm (requires Prism Information Server)	X				
LAN *COMBO* (telemetry/hardwire) monitoring	X				

C   Factory Defaults

Arrhythmia Alarm Levels

The following are the arrhythmia alarm level factory defaults. To access these options, select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS > SETUP DEFAULT ARRHYTHMIA ALARM LEVELS*.

	ADULT-ICU	*NEONATAL-ICU*	*OPERATING ROOM*
ASYSTOLE	*CRISIS*	*CRISIS*	*ADVISORY*
VFIB/VTAC			
V TACH			
VT > 2			
V BRADY			
COUPLET	*MESSAGE*	*—*	*—*
BIGEMINY			
ACC VENT			
PAUSE			
TRIGEMINY			
R ON T			
PVC			
TACHY			
BRADY		*CRISIS*	
IRREGULAR/ ATRIAL FIB		*—*	

Parameter Alarm Levels

The following are the parameter alarm level factory defaults. To access these options, select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS > SETUP DEFAULT PARAMETER ALARM LEVELS*.

	ADULT-ICU	*NEONATAL-ICU*	*OPERATING ROOM*
HR	*WARNING*	*WARNING*	*ADVISORY*
CO2 NO BREATH			
VENT	—		—
PVC/MIN	*ADVISORY*	*ADVISORY*	*ADVISORY*
ST			
ART			
PA			
CO2			
NBP			
FEM			
UAC			
GAS			
CVP			
RA			
UVC			
LA			
ICP			
SP			
SVO2			
TC			
SPO2[1]			

	ADULT-ICU	NEONATAL-ICU	OPERATING ROOM
ART RATE		MESSAGE	
BT			
ICG			
RR			
RESP APNEA	MESSAGE	CRISIS	MESSAGE
FEM RATE			
UAC RATE			
CCO		MESSAGE	
SPO2 RATE			
TMP			
ICG			

[1]When ECG is turned off, SpO2 alarm levels are elevated from advisory to warning.

Parameter Limits

The following are the parameter alarm limit factory defaults. To access these options, select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS > SETUP DEFAULT LIMITS*.

	ADULT-ICU		NEONATAL-ICU		OPERATING ROOM	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
HR	50	150	90	200	−1	150
PVC/MIN	—	6	—	6	—	6

	ADULT-ICU		NEONATAL-ICU		OPERATING ROOM	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
ST-I						
ST-II						
ST-III						
ST-V1						
ST-AVL						
ST-AVF	−2.0	2.0	−2.0	2.0	−2.0	2.0
ST-AVR						
ST-V2						
ST-V3						
ST-V4						
ST-V5						
ST-V6						
NBP-S	80	200	40	100	40	200
NBP-D	20	120	20	60	20	120
NBP-M	40	140	30	70	40	140
ART-S	80	200	40	100	40	200
ART-D	20	120	20	60	20	120
ART-M	40	140	30	70	40	140
ART-R	50	150	90	200	−1	150
FEM-S	80	200	40	100	40	200
FEM-D	20	120	20	60	20	120
FEM-M	40	140	30	70	40	140
FEM-R	50	150	90	200	−1	150
UAC-S	80	200	40	100	40	200

	ADULT-ICU		NEONATAL-ICU		OPERATING ROOM	
	LOW	*HIGH*	*LOW*	*HIGH*	*LOW*	*HIGH*
UAC-D	*20*	*120*	*20*	*60*	*20*	*120*
UAC-M	*40*	*140*	*30*	*70*	*40*	*140*
UAC-R	*50*	*150*	*90*	*200*	*−1*	*150*
PA-S	*−99*	*350*	*−99*	*350*	*−99*	*350*
PA-D						
PA-M						
CVP						
RA						
UVC						
LA						
ICP						
SP						
CO2-EXP	*−1*	*50*	*−1*	*50*	*−1*	*50*
CO2-INSP	*—*	*5*	*—*	*5*	*—*	*5*
CO2-RESP	*5*	*30*	*15*	*100*	*1*	*200*
NO BREATH	*—*	*20*	*—*	*15*	*—*	*30*
SPO2	*90*	*105*	*88*	*100*	*90*	*105*
SPO2-R	*50*	*150*	*90*	*200*	*−1*	*150*
BT	*30.0° C/ 86.0° F*	*42.0° C/ 107.6° F*	*30.0° C/ 86.0° F*	*42.0° C/ 107.6° F*	*0.0° C/ 32.0° F*	*42.0° C/ 107.6° F*
SVO2	60	80	60	80	60	80
RR	5	30	15	100	*1*	*200*
RR-APNEA	*—*	*20*	*—*	*15*	*—*	*20*
TEMP 1	*30.0° C/ 86.0° F*	*42.0° C/ 107.6° F*	*30.0° C/ 86.0° F*	*42.0° C/ 107.6° F*	*0.0° C/ 32.0° F*	*42.0° C/ 107.6° F*

	ADULT-ICU		NEONATAL-ICU		OPERATING ROOM	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
TEMP 2	30.0° C/ 86.0° F	42.0° C/ 107.6° F	30.0° C/ 86.0° F	42.0° C/ 107.6° F	0.0° C/ 32.0° F	42.0° C/ 107.6° F
O2-INSP	18	102	18	102	18	102
O2-EXP	−1	102	−1	102	−1	102
N2O-INSP		80.0		80.0		80.0
N2O-EXP		80.0		80.0		80.0
N2-INSP		85.0		85.0		85.0
N2-EXP		85.0		85.0		85.0
SEV-INSP		7.0		7.0		7.0
SEV-EXP		7.0		7.0		7.0
DES-INSP		12.0		12.0		12.0
DES-EXP		12.0		12.0		12.0
ENF-INSP	−1.0		−1.0		−1.0	
ENF-EXP						
HAL-INSP						
HAL-EXP						
HE-INSP		7.0		7.0		7.0
HE-EXP						
ISO-INSP						
ISO-EXP						
AR-INP						
AR-EXP						
CI	1.5	5.0	1.5	5.0	1.5	5.0
TFC	10	60	10	60	10	60
BIS	-1	100				

Display Defaults

The following are the display factory defaults. To access these options, select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS > SETUP DEFAULT DISPLAY.*

	ADULT-ICU	*NEONATAL-ICU*	*OPERATING ROOM*
PATIENT AGE	*ADULT*	*0-2*	*ADULT*
DISPLAY MODE	*INDV 6 WFS*		
COLOR FORMAT	*TRANSDUCER*		
PRIMARY ECG	*II*		
ECG WAVEFORM 2	*V1*	*OFF*	*ST*
MIN ARRHYTH LEVEL	*OFF*		
ARRHYTHMIA	*FULL*	*LETHAL*	*OFF*
DETECT PACE	*OFF*		
ARTERIAL RATE	*ON*		
LEAD ANALYSIS	*MULTI-LEAD*		
ST ANALYSIS	*OFF*	*OFF*	*ON*
ST TEMPLATES	*OFF*	*OFF*	*TRENDS*
ST V LEAD	*V5*		
ST TEMPLATE 1	*II*		
ST TEMPLATE 2	*V5*		
ST TEMPLATE 3	*I*		
ADJUST ST POINT	*J + 60 MS*	*J + 30 MS*	*J + 60 MS*
12 LD ON ST HISTORY	*OFF*		
ECG WF SPEED	*25*		

	ADULT-ICU	NEONATAL-ICU	OPERATING ROOM
PRINT WAVEFORM 2	ART		
PRINT WAVEFORM 3	OFF	RR	OFF
PRINT WAVEFORM 4	OFF		
PRINT ON ALARM	ON	OFF	OFF
TIMED PRINT	CONTINUOUS	CONTINUOUS	20 SECONDS
ART DISCONNECT	ON	—	OFF
SMART BP	ON	—	ON
ARTERIAL SCALE	160	100	160
PA SCALE	60		
CVP-RA-UVC SCALE	30		
LA SCALE			
ICP SCALE			
SP SCALE	160		
BP WF SPEED	25		
CO2 SCALE	50		
CO2 WF SPEED	6.25		
NBP AUTO	OFF		
ADULT CUFF PRESSURE	160 MMHG		
PED CUFF PRESSURE	140 MMHG		
NEO CUFF PRESSURE	110 MMHG		
CO CATHETER	BAXTER/EDWARDS		

	ADULT-ICU	*NEONATAL-ICU*	*OPERATING ROOM*
CO INJ TEMP	*IN-LINE*		
CO SIZE	*7.5*		
CO INJ VOL	*10 CC*		
CO AUTO MODE	*ON*	*ON*	*OFF*
N2O COMPENSATION	—	—	*0-40% N2O*
O2 COMPENSATION	*0-60% O2*		
RR PARAMETER	*OFF*	*ON*	*OFF*
RR LEAD	*II*		
RR WF SPEED	*25*		
SPO2 WF SPEED			
VIEW ON ALARM	*OFF*		
VOA BROADCAST			
VOA ALERT TONE			
REMOTE ALARM LEVEL	*CRISIS*		
ALARM VOLUME OFF	ENABLE	DISABLE	ENABLE
MIN ALARM VOLUME	10%		
ALARM VOLUME	*70%*	*70%*	*40%*
SILENCE ALARM	*NORMAL*		
QRS VOLUME	*OFF*		
RATE VOLUME	*OFF*	*OFF*	*40%*
ECG LEADS FAIL	*SYSTEM WARNING*	*SYSTEM WARNING*	*SYSTEM ADVISORY*
SPO2 PROBE OFF	*SYSTEM WARNING*		

	ADULT-ICU	*NEONATAL-ICU*	*OPERATING ROOM*
SPO2 PULSE SEARCH	*SYSTEM ADVISORY*		
MONITOR ISO/ DES	*ISOFLURANE*		
DISPLAY LIMITS	*ON*	*ON*	*OFF*
DISPLAY UNITS	*OFF*		
UNITS FOR HEIGHT	*CM*		
UNITS FOR WEIGHT	*KG*		
TEMPERATURE UNITS	*C DEG*		
CO2 UNITS	*MMHG*		
O2 UNITS	*%*		
GAS UNITS			
NBP LIMITS TYPE	*SYSTOLIC*		
ARTERIAL LIMITS TYPE			
PA LIMITS TYPE	*DIASTOLIC*		
MENU TIMEOUT	*5 MINUTES*		
ECG FILTER	*MONITORING*	*MONITORING*	*MODERATE*
BP FILTER	*12 HZ*		
QRS WIDTH	*NORMAL*	*NARROW*	*NORMAL*
CO2 DISPLAY MODE	*AUTO*		
DISCHARGE ALERT	*OFF*		
VENT WF SPEED	6.25		

	ADULT-ICU	NEONATAL-ICU	OPERATING ROOM
DISPLAY MAC VALUE	OFF		
DISABLE SAM HAL			
DISABLE SAM ENF			
TECH ID FIELD			
ICG PRIMARY PAR	CI		
ICG SECONDARY PAR1	CO		
ICG SECONDARY PAR2	SVR		
ICG SECONDARY PAR3	TFC		
NBP SILENCE ALARM	NORMAL		
PAUSE BREAKTHRU	CRISIS		
MASIMO AVERAGING	8 SECS		
SAT-SECONDS	OFF		
SPO2 RESPONSE MODE	NORMAL		
ECG INTELLIRATE	ON		
ECG PARAMETER			
DISCONNECT OPTION	TO DEFAULT		
NBP CLOCK SYNC	OFF		
AVOA ALARM LEVEL	WARNING		

	ADULT-ICU	*NEONATAL-ICU*	*OPERATING ROOM*
REMOTE SILENCE	*CRISIS*		
AVOA SILENCE	*SILENCED*		
PERSISTENT SPO2	*OFF*		
ECG RATE AVERAGING	*8 BEATS*		
BEAT PAUSE INTERVAL	*3 SEC*		
UNIT ROVING	*ON*		
DOSE CALCS WT XFER	*OFF*	*ON*	*ON*
NBP PULSE RATE	*OFF*		
NBP NO DETERMINATION	*SYS ADVISORY*		
TRENDS HARDKEY	*TABULAR ALL*		
COMBO DEFAULT SOURCE	*TELE DEFINED*		
CLOCK DISPLAY	*ON W/SEC*		
BIS SMOOTH RATE	*15 SEC*		
EEG WF SCALE	*25*		
EEG WF SPEED	*25*		

Default Parameter Priority

The following are the parameter priority factory defaults. To access these options, select *MORE MENUS > MONITOR SETUP > MONITOR DEFAULTS > SETUP DEFAULT PARAMETER PRIORITY*.

The following parameters, when monitored, always appear in the parameter window.

	ADULT-ICU	*NEONATAL-ICU*	*OPERATING ROOM*
PARAMETER 1[1]	*ECG*	*ECG*	*ECG*
PARAMETER 2	*ECG*	*UAC*	*NBP*
PARAMETER 3	*ART*	*UVC*	*ART*
PARAMETER 4	*PA*	*RR*	*PA*
PARAMETER 5	*SPO2*	*SPO2*	*SPO2*
PARAMETER 6	*CO2*	*NBP*	*CO2*

[1]When ECG is turned on, it is first and cannot be changed. If turned off, SPO2 is first and cannot be changed.

The following highlighted parameters' parameter windows may display on the bottom of the screen when there is no room on the right side of the screen. The parameters preceded with an asterisk (*) may display in reduced size.

Adult-ICU

GAS	*CVP**	*CO**	*BIS*
NBP	*RA**	*CCO*	
ART	*UVC**	*RESP*	
FEM	*LA**	*TEMP**	
UAC	*ICP**	*TC*	
PA	*SP**	*UO**	
CO2	*SVO2*	*ICG*	
*VENT**	*SPO2*	*ALARMS*	

Neonatal-ICU

VENT*	NBP	SVO2*	BIS
ART	CVP*	TC	
FEM	RA*	TEMP*	
UAC	UVC*	CO*	
PA	LA*	CCO	
CO2	ICP*	UO*	
GAS	SP*	ICG	
RESP*	SPO2*	ALARMS	

Operating Room

CO2	FEM	ICP*	BIS
GAS	UAC	SP*	
SPO2*	PA	SVO2*	
CO*	VENT*	RESP*	
CCO	CVP*	TC	
TEMP*	RA*	UO*	
NBP	UVC*	ICG	
ART	LA*	ALARMS	

Dash® 3000/4000/5000

D   Custom Defaults

Overview

Use this worksheet to record the custom defaults used in your care unit. Keep it in a prominent place. You may want to make additional copies of the worksheet for future use before filling it out.

General Information

Custom Default Name: _____

Unit Name: _____

Patient-monitor type: _____

Arrhythmia Alarm Levels

	Crisis	*Warning*	*Advisory*	*Message*
ASYSTOLE				
VFIB/VTAC				
V TACH				
VT > 2				
V BRADY				
COUPLET				
BIGEMINY				
ACC VENT				
PAUSE				
TRIGEMINY				
R ON T				
PVC				
TACHY				
BRADY				
IRREGULAR/ATRIAL FIB				

Parameter Alarm Levels

	Crisis	Warning	Advisory	Message
HR				
CO2 NO BREATH				
PVC/MIN				
ST				
ART				
PA				
CO2				
NBP				
FEM				
UAC				
GAS				
CVP				
RA				
UVC				
LA				
ICP				
SP				
SVO2				
TC				
SPO2				
ART RATE				
BT				
ICG				
RR				
RESP APNEA				

FEM RATE				
UAC RATE				
SPO2 RATE				
TMP				

Parameter Limits

	LOW	*HIGH*
HR		
PVC/MIN		
ST-I		
ST-II		
ST-III		
ST-V1		
ST-AVL		
ST-AVF		
ST-AVR		
ST-V2		
ST-V3		
ST-V4		
ST-V5		
ST-V6		
NBP-S		
NBP-D		
NBP-M		
ART-S		
ART-D		
ART-M		

	LOW	*HIGH*
ART-R		
FEM-S		
FEM-D		
FEM-M		
FEM-R		
UAC-S		
UAC-D		
UAC-M		
UAC-R		
PA-S		
PA-D		
PA-M		
CVP		
RA		
UVC		
LA		
ICP		
SP		
CO2-EXP		
CO2-INSP		
CO2-RESP		
NO BREATH		
SPO2		
SPO2-R		
BT		
RR		

	LOW	HIGH
SVO2		
RR-APNEA		
TEMP 1		
TEMP 2		
O2-INSP		
O2-EXP		
N2O-INSP		
N2O-EXP		
N2-INSP		
N2-EXP		
SEV-INSP		
SEV-EXP		
DES-INSP		
DES-EXP		
ENF-INSP		
ENF-EXP		
HAL-INSP		
HAL-EXP		
ISO-INSP		
ISO-EXP		
HE-INPS		
HE-EXP		
AR-INP		
AR-EXP		
CI		

	LOW	HIGH
TFC		
BIS		

Display Defaults

PATIENT AGE	
DISPLAY MODE	
COLOR FORMAT	
PRIMARY ECG	
ECG WAVEFORM 2	
ARRHYTHMIA	
DETECT PACE	
ARTERIAL RATE	
LEAD ANALYSIS	
ST ANALYSIS	
ST TEMPLATES	
ST V LEAD	
ST TEMPLATE 1	
ST TEMPLATE 2	
ST TEMPLATE 3	
ADJUST ST POINT	
12 LD ON ST HISTORY	
ECG WF SPEED	
PRINT WAVEFORM 2	
PRINT WAVEFORM 3	
PRINT WAVEFORM 4	

PRINT ON ALARM	
TIMED GRAPH	
ART DISCONNECT	
SMART BP	
ARTERIAL SCALE	
PA SCALE	
CVP-RA-UVC SCALE	
LA SCALE	
ICP SCALE	
SP SCALE	
BP WF SPEED	
CO2 SCALE	
CO2 WF SPEED	
NBP AUTO	
ADULT CUFF PRESSURE	
PED CUFF PRESSURE	
NEO CUFF PRESSURE	
CO CATHETER	
CO INJ TEMP	
CO SIZE	
CO INJ VOL	
CO AUTO MODE	
N2O COMPENSATION (OR ONLY)	
O2 COMPENSATION	
RR PARAMETER	
RR LEAD	
RR WF SPEED	

SPO2 WF SPEED	
VIEW ON ALARM	
VOA BROADCAST	
VOA ALERT TONE	
REMOTE ALARM LEVEL	
ALARM VOLUME	
ALARM VOLUME OFF	
MIN ALARM VOLUME	
SILENCE ALARM	
QRS VOLUME	
RATE VOLUME	
ECG LEADS FAIL	
SPO2 PROBE OFF	
SPO2 PULSE SEARCH	
MONITOR ISO/DES	
DISPLAY LIMITS	
DISPLAY UNITS	
UNITS FOR HEIGHT	
UNITS FOR WEIGHT	
TEMPERATURE UNITS	
CO2 UNITS	
O2 UNITS	
GAS UNITS	
NBP LIMITS TYPE	
ARTERIAL LIMITS TYPE	
PA LIMITS TYPE	
MENU TIMEOUT	

ECG FILTER	
BP FILTER	
QRS WIDTH	
CO2 DISPLAY MODE	
DISCHARGE ALERT	
VENT WF SPEED	
DISPLAY MAC VALUE	
DISABLE SAM HAL	
DISABLE SAM ENF	
TECH ID FIELD	
ICG PRIMARY PAR	
ICG SECONDARY PAR1	
ICG SECONDARY PAR2	
ICG SECONDARY PAR3	
NBP SILENCE ALARM	
PAUSE BREAKTHRU	
MASIMO AVERAGING	
ECG INTELLIRATE	
ECG PARAMETER	
DISCONNECTION OPTION	
NBP CLOCK SYNC	
AVOA ALARM LEVEL	
REMOTE SILENCE	
AVOA SILENCE	
PERSISTENT CO2	
ECG RATE AVERAGING	
BEAT PAUSE INTERVAL	

UNIT ROVING	
DOSE CALCS WT XFER	
NBP PULSE RATE	
NBP NO DETERMINATION	
TRENDS HARDKEY	
COMBO DEFAULT SOURCE	
CLOCK DISPLAY	
BIS SMOOTH RATE	
EEG WF SCALE	
EEG WF SPEED	

Parameter Priority Defaults

Indicate which parameters you want to have priority in the first six positions on the display.

PARAMETER 1	*ECG*
PARAMETER 2	
PARAMETER 3	
PARAMETER 4	
PARAMETER 5	
PARAMETER 6	

Circle the other parameters you want to have priority after position 6. Size of the parameter window determines how many selections you can make (three full size, five reduced size, or combination thereof). The software prevents you from selecting more parameters than allowable.

GAS	*RA**	*TEMP**
NBP	*UVC**	*ALARMS*
ART	*LA**	
FEM	*ICP**	

UAC	*SP**	
PA	*SPO2**	
CO2	*CO**	
*CVP**	*RESP**	
* May be displayed as reduced size (determined by software).		

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E   Interfacing with Non-GE Devices

Introduction

General

When connected to a Unity Network Interface Device (ID) connectivity device, the monitor can interface with up to seven non-GE peripheral bedside devices at the same time. The connectivity device is intended for use on one patient at a time.

For more information on the Unity Network ID connectivity device, refer to the operator and service manuals.

Safety

The following safety statements apply when interfacing with non-GE devices.

WARNING
ACCURACY —   Patient information transferred by the connectivity device must be qualified by medical personnel before permanent storage in a database.

WARNING
ALARMS —   The peripheral device's alarms must not be turned off or the volume reduced in any way to diminish the importance of the peripheral device as the primary alarm source for parameters monitored by the peripheral device.

WARNING
CORRECT INTERFACE ADAPTER —   Use of the wrong interface adapter may cause improper operation of the supported peripheral device. Verify that the correct interface adapter on the peripheral device is operational before the device is used on a patient.

WARNING
INSTALLATION — Qualified technical personnel must connect the interface adapter to the peripheral device and make any necessary adjustments to the peripheral device (baud rate, parity, etc.) as described in the specific installation instructions for the interface adapter.

Insert cabling from the Unity Network ID connectivity device only into specified interface adapters and specified peripheral devices.

To avoid inadvertent disconnection, route all cables in a way to prevent a stumbling hazard. Wrap and secure excess cabling to reduce risk of entanglement by patients and personnel. Do not install in a location where the device may drop on a person.

WARNING
SINGLE PATIENT USE — All eight serial ports on the connectivity device must only be used by ONE patient.

CAUTION
INSTALLATION — To avoid accidental ingress of liquids, always mount the connectivity device in a vertical position with the connectors at the bottom.

CAUTION
TREATMENT — Do not treat a patient based solely on the alarm messages and/or numerics presented via the connectivity device to the monitor. You must verify the accuracy of the alarm message and/or numerics at the peripheral device itself before initiating treatment. Treatment should be based on the information presented at the peripheral device.

Non-GE Device Information

Displayed Data

The peripheral device data that displays on the monitor varies by device, as shown in the following table.

Device	Waveform	Parameter Window	Trends	Alarm Broadcast	Graphing
Anesthesia machines	Yes	Yes	Yes	Yes	Yes
Continuous cardiac output	No	Yes	Yes	Yes	Yes
Gas analyzers	Yes	Yes	Yes	Yes	Yes
IV pumps	No	No	No	Yes	No
Pulse oximeters	No	Yes	Yes	Yes	Yes
Transcutaneous monitors	No	Yes	Yes	Yes	Yes
Urometers	No	Yes	Yes	No	Yes
Ventilators	Yes	Yes	Yes	Yes	Yes

The monitor only displays the information the peripheral device sends to the connectivity device. The parameters sent vary with each external device and are subject to change without notice by the manufacturer.

If the peripheral device manufacturer changes any parameters or information sent, the connectivity device will not send any of the new parameter information over the network.

Compatible Devices

The following peripheral devices are compatible with the monitor at the time this document was published.

NOTE

These devices are compatible with Dash 3000/4000/5000 software version 3 or later and Unity Network Interface Device software version 1 or later.

Device Type	Manufacturer and Model	Parameters	Alarms
Anesthesia machine	Dräger® Julian	VNT, CO_2, GAS	Yes
	Dräger Cato, PM8050	VNT, CO_2, GAS	Yes
	Dräger Cicero EM	VNT, CO_2, GAS	Yes
	Dräger PM8060	VNT, CO_2, GAS	Yes
	Dräger Primus (Not for sale in the United States)	VNT, CO_2, GAS	Yes
	North American Dräger Narkomed 2B, 2C, GS: Vent only 3, 4, 6000: Vent, Gas, CO_2	All versions: VNT 3, 4, 6000: VNT, CO_2, GAS	Yes
	Ohmeda® 7800, 7810	VNT	Yes
	Ohmeda 7900	VNT	Yes
	Ohmeda Aestiva 3000	VNT	Yes
	Ohmeda Engstrom	VNT	Yes
	Ohmeda Aisys	VNT	Yes
	Ohmeda Avance	VNT	Yes
Continuous cardiac output	Abbott Q-Vue	CCO	Status messages only
	Pulsion Picco, Picco Plus	CCO	Status messages only
Continuous cardiac output with SVO2	Abbott Q-2	CCO, SVO2	Status messages only
	Baxter Edwards® Vigilance	CCO, SVO2	Yes
Gas analyzer	Datex Capnomac Ultima	GAS, CO_2	Yes
	Ohmeda 5250 RGM	GAS, CO_2	Yes
	Ohmeda Rascal II	GAS, CO_2	No

Device Type	Manufacturer and Model	Parameters	Alarms
IV pump	Abbott LifeCare 5000	NA	Status messages
	Alaris® Medical Systems 560M, 570	NA	Status messages
	Alaris Medical Systems Gemini PC-1, PC-2, PC-2TX, PC-4	NA	Status messages
	Alaris Medical IVAC Signature 7130, 7230	IV	Status messages
	Baxter Edwards Flowgard 6201, 6301	NA	Status messages
Multi-parameter monitor	Hellige SMU EVO	GAS, CO_2, SpO_2, TCO_2	No
	Siemens® SC9000	SpO_2, CO_2	No
Pulse oximeter	Nellcor Puritan Bennett® N-200	SpO_2	Yes
	Nellcor Puritan Bennett N-395	SpO_2	Yes
	Nellcor Puritan-Bennett N1000	SpO_2, CO_2, GAS	Yes
Pulse oximeter/gas analyzer	Nellcor Puritan-Bennett N2500	SpO_2, CO_2, GAS	Yes
Transcutaneous monitor	Novametrix 840 PtcO2/PtcCO2, TCO2M	TCO_2	Status messages
	Radiometer TINA (TCM3)	TCO_2	Yes
	Linde MicroGas 7650 (Not for sale in the United States)	TCO_2	Yes
Urometer	Bard CritiCore	UO	Status messages

Device Type	Manufacturer and Model	Parameters	Alarms
Ventilator	Bear 1000	VNT	Yes
	Bird 6400ST, 8400ST	VNT	Yes
	Dräger Evita	VNT	Yes
	Dräger Evita XL	VNT, CO_2	Yes
	Dräger Fabius GS	VNT	Yes
	Dräger Savina	VNT	Yes
	Hamilton Amadeus, Veolar	VNT	Yes
	Hamilton Galileo	VNT	Yes
	Nellcor Puritan Bennett Adult Star, Adult Star 1500, 2000	VNT	Yes
	Nellcor Puritan Bennett 7200SPE, AE, E	VNT	Yes
	Puritan-Bennett 840	VNT	Yes, with the following exceptions: $\dot{V}_{E\ TOT}$ $V_{TE\ MAND}$ $V_{TE\ SPONT}$ $V_{TI\ SPONT}$
	Respironics Espirit	VNT	Yes
	Stephan Christina, Stephanie (Not for sale in the United States)	VNT	Yes
	Siemens Servo-i	VNT	Yes
	Siemens SV900C, 900D, 900E	VNT	No
Ventilator (adult/neonatal)	Siemens SV300	VNT	Yes
Ventilator (neonatal)	Nellcor Puritan Bennett Infant Star, Infant Star 500, 950	VNT	Yes
	Bird VIP	VNT	Yes
	Dräger Babylog 8000	VNT	No

Limitations

Duplicate Devices

The connectivity device can support a pre-defined number of each device type and up to eight total devices, including the monitor. When the maximum number is exceeded on any device type, the connectivity device ignores all data from the duplicate device.

- One ventilator, anesthesia machine or gas analyzer.
- Seven IV pumps.
- One transcutaneous monitor.
- One urometer.
- One continuous cardiac output monitor.
- One multi-parameter monitor.
- Two pulse oximeters.
- One auto-association device (GE monitor).

Duplicate Parameters

The connectivity device can support a pre-defined number of parameters. When the maximum number is exceeded, the connectivity device ignores all data from the duplicate parameter.

- Two SpO_2 parameters.
- Four temperature parameters.
- Eight BP parameters.
- Eight IV parameters.
- One CO_2 or Gas parameter.
- One each of all other parameters

CO_2 and Gas Parameter Handling

The connectivity device requires that CO_2 and Gas parameters originate from the same peripheral device. If a device only provides one of the parameters, the connectivity device does not recognize the other parameter from any other peripheral device.

However, when the connectivity device is connected to a Dash 3000/4000 monitor, the monitor controls which source of CO_2 and Gas parameter data is used. The monitor does NOT require that CO_2 and Gas parameters originate from the same peripheral device.

Refer to the following table for more information CO_2 and Gas parameter data.

SAM Module	Monitor CO_2 Option	Unity Network ID	CO_2 Data Source	Gas Data Source
Yes	No	No	SAM module	SAM module
Yes	Yes	No	SAM module	SAM module
Yes	No	Yes	SAM module	SAM module
Yes	Yes	Yes	SAM module	SAM module
No	Yes	No	Monitor	None
No	Yes	Yes	Monitor	Unity Network ID
No	No	Yes	Unity Network ID	Unity Network ID

Setup

Connecting the Monitor

The monitor and the connectivity device much be connected to the same network. To connect a monitor to a connectivity device, follow this procedure.

1. Turn off the monitor and connectivity device.

2. Connect one end of the purple interconnect cable to the **AUX** connector on the monitor or docking station.

3. Connect the other end of the purple interconnect cable to the serial port labeled **1** on the connectivity device.
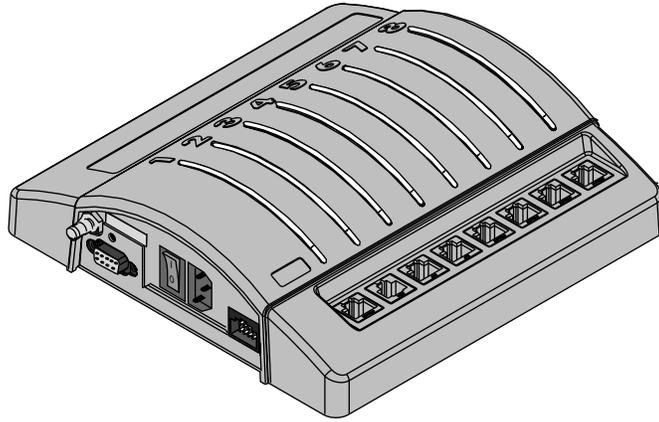
4. Connect one end of the network cable to the **Ethernet** connector on the connectivity device.

5. Connect the other end of the network cable to the **Ethernet** connector on the monitor or docking station.

6. Turn on the monitor and connectivity device.

Connecting Peripheral Devices

A unique, factory-programmed interface adapter is required for each peripheral device. Refer to the instructions provided with the interface adapter for setup and installation instructions.

To assure proper operation, GE recommends permanently connecting interface adapters to peripheral device cables.

To connect peripheral devices to the connectivity device, follow this procedure.

1. Connect the interface adapter to the peripheral device cable.
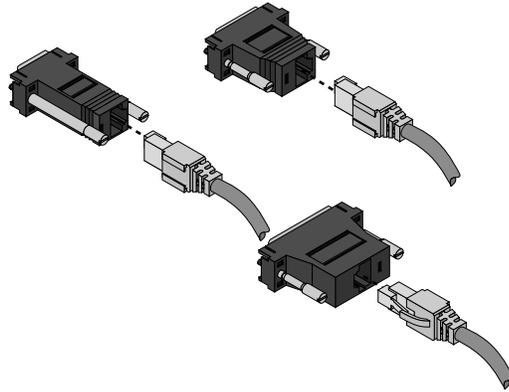
2. Connect the interface adapter in any of the remaining serial ports labeled **2**-**8**. Serial port **1** is reserved for the monitor.

3. Turn on the connectivity device and peripheral devices.

Establishing Communication

When properly connected, the monitor and the connectivity device automatically identify each other and the connected peripheral device. You can determine the connection status for each serial port with the following connectivity device status indicators:

Green Indicator	Yellow Indicator	Serial Port Status	Description
off	off	No connection	Nothing is connected to this serial port or the interface connector is not operational.
	on	Pending communication	The cable and interface adapter are connected, but communication with the peripheral device is not established yet.
	slow flash	Communication error	The peripheral device is connected, but there is a communication error.
	fast flash	Other errors	Use the following guidelines to identify the error: ■ Too many devices of one type are connected. ■ Device software is not compatible with monitor software. ■ Interface adapter is not supported by the monitor software.
on		Communicating	Communication with the device is working.

Customizing Data Display

Default Parameter Alarm Levels

Configure all alarm levels on the monitor. When connected to a monitor, the connectivity device follows the alarm levels defined in the *MONITOR DEFAULTS* menu. The peripheral device does not determine the alarm level displayed or broadcast by the monitor.

Refer to the following table for the monitor's factory default parameter alarm levels.

	CRISIS	*WARNING*	*ADVISORY*	*MESSAGE*
VENT		X		
SVO2			X	
TC			X	

	CRISIS	WARNING	ADVISORY	MESSAGE
CCO				X
ICG				X

Alarm Limits

You must configure all alarm limits on the monitor. The monitor only displays and enunciates the alarm limit violations defined on the peripheral device.

Parameter Windows and Menus

The parameters displayed by the monitor from a peripheral device vary from device to device. Anesthesia machines, parameter modules, gas analyzers and ventilators are capable of sending parameters to the monitor. In some cases, not all parameters can be displayed at one time.

To add parameters to the display, use the following procedure.

1. Select *MONITOR SETUP*.

2. Select *PARAMETERS ON/OFF*. All parameters sent to the monitor display in the *AVAILABLE PARAMETERS* information window.

3. Select the parameters you want to display.

4. Select *RETURN* to close the window.

Peripheral Device Monitoring Guidelines

Anesthesia Interface

When an anesthesia interface is connected, the following applies:

- The monitor can display up to three parameters: *CO$_2$*, *GAS* and *Vent*.
- The information displayed varies by device.
- For more information, refer to Chapter 15 and Chapter 16.

Gas Interface

When a gas interface is connected, the following applies:

- The monitor displays *CO$_2$* and *GAS* parameter windows.

- The information displayed varies by device.
- For more information, refer to Chapter 15.

Pulse Oximeter Interface

When a pulse oximeter interface is connected, the following applies:

- The monitor displays an *SpO$_2$* parameter window.
- The information displayed varies by device.
- For more information, refer to Chapter 11.

Transcutaneous pO$_2$/pCO$_2$ Interface

When a transcutaneous pO$_2$/pCO$_2$ interface is connected, the following applies:

- The monitor displays a *TC* parameter window.
- The information displayed varies by device.

Ventilator Interface

When a ventilator interface is connected, the following applies:

- The monitor displays a *VENT* parameter window.
- The monitor displays up to four ventilator parameters.
- The information displayed varies by device.
- The control settings vary by device.

Continuous Cardiac Output

When a cardiac output interface is connected, the following applies:

- The monitor displays a *CCO* parameter window.
- The monitor may display an additional *SvO$_2$* parameter window.
- The information displayed varies by device.
- For more information, refer to Chapter 12.

IV Pump

When an IV pump interface is connected, the following applies:

- The monitor does not display a parameter window for IV pumps.

- The monitor does not broadcast alarms.
- The information displayed varies by device.

Urometers

When a urometer interface is connected, the following applies:

- The monitor displays a *UO* parameter window.
- The information displayed varies by device.
- The temperature is displayed and trended as an indicator of core temperature.

Additional Information

For more information on the intended use, safety and setup information for any interface with the Unity Network ID connectivity device, refer to the Unity Network ID connectivity device operator's manual.

F   Abbreviations and Symbols

Abbreviations

The following abbreviations and symbols that you may encounter while reading this manual are listed below with their meanings.

12SL	12-lead ECG analysis

A

AC	alternating current
Acc	accelerated
ACI	acceleration index
AD	adult
AFIB	atrial fibrillation
ALRM	alarm
AMI	acute myocardial infarctions
ANT	anterior
Arr, Arrhy	arrhythmia
ART	arterial
Auto	automatic
Aux	auxiliary
A-V	arterial venous
AVG	average
AVOA	automatic view on alarm

B

BIS	bispectral index
BP	blood pressure
Brady	bradycardia
BT	blood temperature

C

C	celsius

Cal	calibrate
Calc, calcs	calculation(s)
cc	cubic centimeter
CC	computation constant
CCO	continuous cardiac output
CD	compact disc
CI	cardiac index
CIC	Clinical Information Center
cm	centimeter
CO	cardiac output
CO	carbon monoxide
CO_2	carbon dioxide
comm	communication
CP	cardiopulmonary
CPP	cerebral perfusion pressure
CRG	cardiorespirogram
CSA	Canadian Standards Association
CVP	central venous pressure

<p align="center">D</p>

D	diastolic
DDW	direct digital writer
DES	desflurane
DIDCA	direct interface device connection adapter
DSC	digital signal converter

<p align="center">E</p>

E	expired
e.g.	for example

ECG	electrocardiograph
eDO2I	estimated delivered oxygen index
EEG	electroencephalograph
EMC	electromagnetic compatibility
EMI	electromagnetic interference
ENF	enflurane
ESU	electrosurgical cautery unit
et al	and others
ET CO$_2$	end-tidal carbon dioxide
etc.	etcetera
ETO	ethylene oxide
EXP	expired

F

F	Fahrenheit
FEM	femoral

G

G	gram
gHz	gigahertz
gtt	drops

H

HAL	halothane
Hb	hemoglobin
HR	heart rate
Hz	hertz

I

I	inspired
IABP	intra-aortic balloon pump

ICG	impedance cardiography
ICP	intracranial pressure
ICU	intensive care unit
ID	identification
in	inches
INDV	individual
INF	infusion, inferior
Inject	injectate
INSP	inspired
INT	interior
INF	inferior
ISO	isoflurane
IT	injectate temperature
IV	intravenous

J

J	ST measurement point

K

kg	kilogram

L

L	lead
L	left
L	liter
LA	left arm
LA	left atrial
LAN	local area network
LAT	lateral
LBS	pounds

LCWI	left cardiac work index
LD	lead
LED	light emitting diode
LIS	lab information system
LL	left leg
LVET	left ventricular ejection time
LVSWI	left ventricular stroke work index

M

M	mean
MAC	minimum alveolar concentration
MAP	mean arterial pressure
Min	minimum
mm	millimeters
mmHg	millimeters of mercury
MPSO	multiple portable socket outlet
MRI	magnetic resonance image
ms	milliseconds
mV	millivolt

N

N/A	not applicable
N_2O	nitrous oxide
NBP, NIBP	non-invasive blood pressure
Neo	neonatal

O

O_2	oxygen
O_2CI	oxygen consumption index
OR	operating room

P

P	pace
PA	pulmonary artery
PAD	pulmonary artery diastolic
Par	parameter
PAW	pulmonary artery wedge
PC	personal computer
pCO_2, pO_2	partial pressure of arterial carbon dioxide
PED	pediatric
PEP	pre-ejection period
PVC	premature ventricular contractions

Q

QRS	interval of ventricular depolarization
Qty	quantity

R

R	right
R	rate
RA	right arm
RA	right atrial
REF	reference
Reprep	re-prepare
RES	resistance
Resp	respiration
RF	radio-frequency
RHY	rhythm
RL	right leg
RR	respiration rate

S

S	systolic
sec	second
SEV	sevoflurane
SIM	simulator
Sol	solution
SP	special
SpO$_2$	arterial oxygen saturation (pulse oximetry)
SQI	signal quality index
ST	interval of ventricular repolarization
Stat	right away
STR	systolic time ratio
SV	stroke volume
SvO2	mixed venous oxygen saturation
SVR	systemic vascular resistance
SVRI	systemic vascular resistance index
Sync	synchronized

T

T1, T2	temperature site
Tachy	tachycardia
TC	transcutaneous
Tech	technical
Temp, TMP, TP	temperature
TFC	thoracic fluid content
TIR	technical information report

U

UAC	umbilical artery catheter

UO	urometer
UVC	umbilical venous catheter

V

V	volt
V	version
V	ventrical lead
Vent	ventilator
VFib	ventricular fibrillation
VI	velocity index
VOA	view on alarm
Vol	volume
VTach	ventricular tachycardia

W

WF, WFS	waveform(s)

X

X	multiplier (2X)
X	invalid data

Symbols

&	and
°	degree(s)
>	greater than
<	less than
-	minus
#	number
%	percent

±   plus or minus

"   inches

μ   micro

Index

Dash® 3000/4000/5000

CE 0459

GE Medical Systems

Information Technologies