Dräger medical
A Dräger and Siemens Company

Infinity Modular Monitoring Series

Infinity Vista XL Instructions for Use

WARNING: For a full understanding of the performance characteristics of this device, the user should carefully read this manual before use of the device.

Manufactured by:
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Infinity Vista XL Instructions for Use
Software VF7

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CE 0123 This device bears the CE label in accordance with the provisions of the Directive 93/42/EEC of 14 June 1993 concerning medical devices (this label is not applicable for US devices).

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All Dräger devices are intended for use by trained medical personnel only.

CAUTION: *In the United States, Federal Law restricts these devices to sale by, or on order of a physician.*

Before using any Dräger devices, carefully read all the manuals that are provided with your device. Patient monitoring equipment, however sophisticated, should never be used as a substitute for the human care, attention, and critical judgment that only trained health care professionals can provide.

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Overview

Intended Use

The Infinity Vista XL monitors are intended for multi-parameter patient monitoring. The devices will produce visual and audible alarms if any of the physiological parameters monitored vary beyond preset limits, and timed or alarm recordings will be produced. These devices will connect to R50 recorders either directly or via the Infinity network.

Indications For Use

The Infinity Vista XL monitors are capable of monitoring:

- Heart rate
- Respiration rate
- Invasive pressure
- Noninvasive pressure
- Arrhythmia
- Temperature
- Cardiac Output
- Arterial oxygen saturation
- Pulse rate
- Apnea
- ST Segment Analysis
- 12-Lead ST Segment Analysis
- FiO_2

The devices are intended for use in the environment where patient care is provided by Healthcare Professionals, i.e. Physicians, Nurses, and Technicians who will determine when use of the device is indicated, based upon their professional assessment of the patient's medical condition. The devices are intended to be used on Adult, Pediatric and Neonatal populations with the exception of the parameter cardiac output, ST-segment analysis, and arrhythmia which are intended for use in the adult and pediatric populations only.

The Infinity Modular Monitors are not compatible for use in a MRI magnetic field.

Documentation Features

Warnings, Cautions, Notes

WARNING! A warning statement provides important information about a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION! *A caution statement provides important information about a potentially hazardous situation which, if not avoided may result in minor or moderate injury to the user or patient, or in damage to the equipment or other property.*

NOTE: A note provides additional information intended to avoid inconvenience during operation.

Cross-references

Cross-references specify chapter and page (e.g., page 16-3 refers to Chapter 16, page 3). Chapter number and title are given when text refers to an entire chapter (e.g., *Chapter 1, Introduction*).

Quick Reference Tables

Wherever possible, a quick reference table is provided for easy access to information about monitor functions.

Footer

The current software version appears at the bottom of each page, together with the chapter and page number and the device name.

Applicability

All references to "the monitor" in this manual refer to the Vista XL patient monitor.

Safety Considerations

This Instructions for Use assumes a working knowledge of patient monitors. To support proper, safe and accurate operation of equipment, read all operating instructions carefully before you use the monitor. The monitor complies with IEC 60601-1 and applicable collateral and particular standards.

Site of Operation

WARNING:

- **Connect the AC Adapter to hospital grade electrical outlets with medical power cords.**
- **Monitor operation is not currently supported in the following environments: magnetic resonance imaging (MRI) environments, aircraft, ambulance, home or hyperbaric chamber environments.**
- **Do not operate the monitor or its remote displays in the presence of flammable gases.**
- **Do not use the monitor near devices with microwave or other high-frequency emissions. These emissions may interfere with the monitor's operation.**
- **Position the monitor and accessories with at least 2 in. (5 cm.) of space around all sides to prevent overheating.**
- **Do not allow fluids to come in contact with monitor or peripherals. If fluids are accidentally spilled on equipment, remove affected unit from service as soon as possible. Contact your biomed to ensure that there is no compromise in electrical safety.**

CAUTION:

- *The site of operation must meet the environmental requirements outlined in Appendix B, Technical Data.*
- *To avoid patient injury, ensure patient is disconnected from all sensors, etc. before moving patient.*

Inspection and Maintenance

Regular equipment inspection and maintenance is required. The user should verify that the monitor operates as described in this manual and that all safety labels are legible and should also maintain a record of these and other inspections. Safety checks, verification, calibration and maintenance should be performed *at least* every two years by trained personnel, as described in the Service Manual (see individual

parameter chapters for information about calibration and verification of parameter-specific functions and devices). All cables, alarm functions, accessories, and associated devices should be checked for damage, ground resistance, chassis and patient leakage currents on a yearly basis, or more frequently, based on usage.

WARNING:

- **Disposable accessories (such as disposable electrodes, transducers, etc.) are for single use only. Do not reuse disposable accessories.**
- **Do not use cables that appear cracked, worn, or damaged in any way. Such use may contribute to poor monitoring performance or the display of erroneous values.**
- **Moisture under the front panel can damage the electric circuits and compromise key function. Read carefully cleaning instructions on page 21-2.**
- **Because of the danger of electric shock, never remove the cover of any device while it is in operation or connected to a power outlet.**

NOTE:

- The monitor's Service Manual is available from your local Dräger Medical service representative.
- Dispose of all equipment in accordance with local regulations.

Dräger Medical recommends:

- Maintenance, modifications, and repairs are carried out by trained personnel.
- Components are replaced with Dräger Medical provided spare parts, otherwise the correct functioning of the device may be compromised.
- Devices are used in accordance with Dräger Medical operating instructions, as described in this Instructions for Use.

General Electrical Safety

CAUTION:

- *Ensure electrical shock classifications for all equipment connected to the patient are suitable for the intended application. Leakage current will increase when connecting multiple medical devices to a patient.*
- *It is the user's responsibility to verify that the overall system is connected in accordance with local regulations and your hospital's policies, and that it complies with EN 60601-1-1, "Collateral Standard: Safety Requirements for Medical Electrical Systems."*

Pacemakers

NOTE: See "Pacemakers" on page 8-3 for safety precautions when monitoring paced patients.

Peripheral Devices

CAUTION: *In the interest of patient safety and equipment performance, the connection of other manufacturers' equipment to the monitor is not authorized, unless the connection is explicitly approved by Dräger Medical. It is the user's responsibility to contact Dräger Medical to determine the compatibility and warranty status of any connection made to another manufacturer's equipment.*

Electrosurgery

WARNING:

- **Keep ECG, temperature, pressure, SpO_2 transducers, and intermediate cables off earth ground and away from ESU knife and return wires.**
- **Use only Dräger blue ECG lead wires or the ESU block with conventional leads (see page 8-7). They are designed to provide resistance to interference from the ESU and to protect the patient from burns caused by ESU-induced current flowing through the leads.**
- **Impedance respiration monitoring and pacemaker spike detection are inoperative when you are using the ESU Block.**

NOTE:

- Use SpO_2 or ART instead of the ECG parameter to determine heart rate.
- Use rectal temperature probe sheaths to cover internally placed temperature sensors.
- Always use accessories designed for ESU environments.

Electromagnetic Compatibility

The monitor has been designed and tested for compliance with current regulatory standards (EN55011 Class B and EN60601-1-2) regarding its capacity to reduce electromagnetic emissions (EMI) and to block EMI from external sources.

Dräger Medical recommends these procedures to reduce electromagnetic interference:

- Use only Dräger Medical provided accessories, otherwise the correct functioning of the device may be compromised (see Appendix C, Approved Options and Accessories for more information).
- Ensure that other products in patient-monitoring and/or life-support areas comply to accepted emissions standards (EN55011, Class B).
- Maximize distance between electromedical devices. High-power devices relating to electrocautery, electrosurgery, and radiation (X-ray), as well as electrical stimulators and evoked potential devices, may produce interference on the monitor.
- Strictly limit access to portable radio-frequency sources (e.g., cellular phones and radio transmitters). Portable phones may periodically transmit even when in standby mode.
- Maintain good cable management. Avoid routing cables over electrical equipment. Do not intertwine cables.
- Ensure electrical maintenance is done by qualified personnel.
- NBP circuits use motors that emit very low-level electromagnetic fields that may interfere with other sensitive medical devices.
- For more information on Electromagnetic Compatibility, see B-2

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Chapter 1 Introduction

Overview

The patient monitor is intended for adult, pediatric, and neonatal monitoring. It can be used as a standalone device or can be connected to the Infinity network. Monitor use is restricted to one patient at a time.

The following optional software features are available:

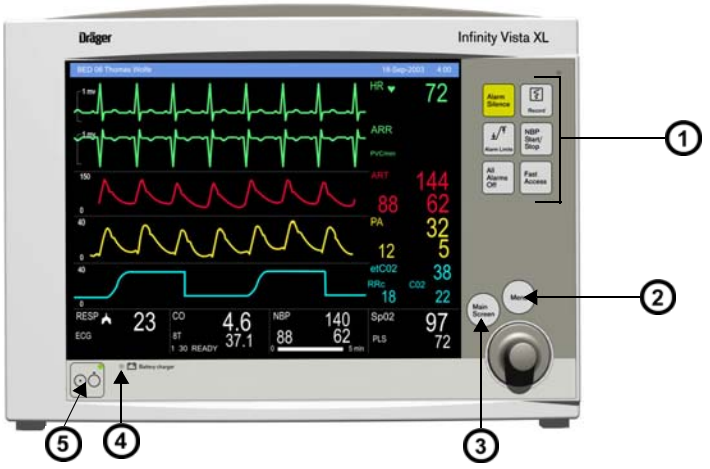
- ACE full arrhythmia (Arrhythmia II)
- HemoMed & oxygenation/ventilation calculations (physiological calculations)
- 3-lead ST segment analysis
- Waveform channel upgrades
- Aries (Advanced Review of Ischemia Event System)
- Wireless Networking
- OR mode

System Components

NOTE: Monitor configuration may vary. See your Biomed for more information.

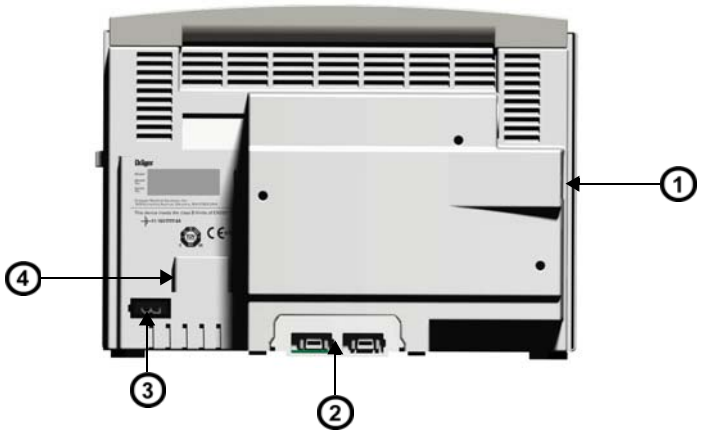
Base Unit

Monitor Front View--Vista XL



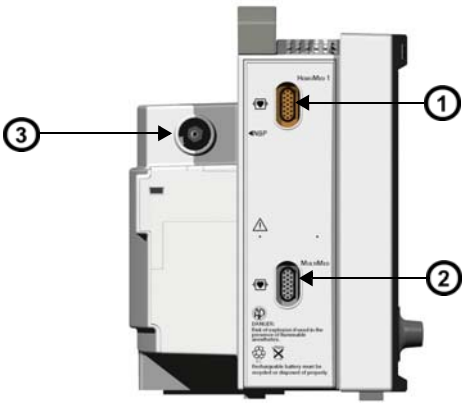
1	Fixed keys
2	**Main Menu** fixed key
3	Main Screen fixed key
4	Battery Charge indicator
5	**Power** switch

Monitor Rear View--Vista XL



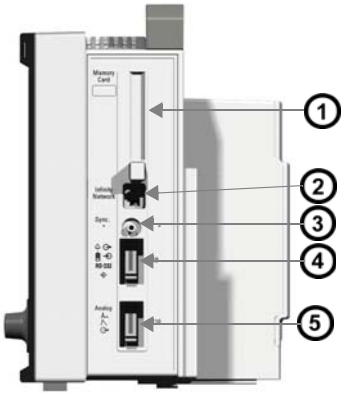
1	External (lead-acid) battery compartment
2	Remote Display (x5), R50 (x7)
3	Connector for AC adaptor
4	Slot for etCO_2 module

Monitor Left Side--Vista XL



1	HemoMed connector
2	MultiMed connector
3	NBP connector

Monitor Right Side--Vista XL



1	**PCMCIA** slot
2	**Network** connector
3	QRS Sync connector
4	**RS 232** connector **(X8)**
5	**Analog** connector **(X10)**

Device Markings

The following table describes the symbols on the monitor and its accessories:

	Monitor on/off		Remote keypad in
	Battery-operated equipment		RS 232
	Attention! Consult the accompanying document		Analog out
	Defibrillator-proof equipment, Type CF		Analog out

⎓	Direct current		Analog out
	Danger: Risk of explosion if used in presence of flammable anesthetics		Push battery all the way into compartment.
	Isolated patient connection, Type CF		Close battery compartment door.
CE 0123	Complies with the *European Medical Device Directive 93/42/EEC*		This end up
	Type BF, defibrillator protected		Artery symbol and arrow should be placed over brachial or femoral artery.
	Gas in		Contains no latex material
	Gas out		Manufacturer's lot number
	Dispose of properly		Certain cuff codes are ethylene oxide sterile.
	Manufacturing date	REF	Manufacturer's reorder code
	Alarm out		Does not provide isolation between connected devices
~	Monitor is receiving AC power		Potential equalization terminal
	Observe WEEE (Waste Electrical and Electronic Equipment) disposal requirements		

Modules

MultiMed and NeoMed Pods

The MultiMed houses connectors for ECG and impedance respiration leads, an SpO_2 sensor, and a temperature probe.

The optional NeoMed, specifically designed for neonates, has connectors for a 3-lead ECG cable set, an SpO_2 sensor, and two temperature probes. See page 8-2 for more information.

HemoMed Pod

The monitor acquires invasive blood pressure (IBP) signals from a HemoMed pod. For information, see Chapter 13, Invasive Blood Pressure. A HemoMed pod can also acquire injectate and blood temperature for cardiac output (20-4).

$etCO_2$ Module

The monitor processes $etCO_2$ signals through an $etCO_2$ module. For more information on these optional devices, see Chapter 16, etCO2 (End-Tidal CO2) Monitoring.

Auxiliary Display Components

The following devices enable remote viewing of patient data.

Remote Display -- Allows you to view but not control monitor functions away from the bedside. Dräger Medical strongly recommends that you use only approved video monitors, otherwise the function of the monitor may be compromised. For a complete list of approved video monitors, contact your Draeger Medical Systems, Inc. local representative to obtain a catalog. Any use of non-approved monitors may compromise the correct functioning of the device.

> ***CAUTION:*** *The Remote Display output on the IDS is not galvanically isolated. If you use a video monitor other than one specified by Dräger Medical, it must comply with IEC 60601-1. Upon installation, the installer must ensure that, in normal and single fault conditions, the entire system meets the requirements of IEC 60601-1 and IEC 60601-1-1 (Medical Electrical Systems Standards). Refer to the video monitor's operating instructions to ensure that the interconnection is within its intended use as specified by the manufacturer. Radiated and conducted emissions classification, suitability for flammable locations and water ingress protection must be considered based on the intended use of the system.*

Other Features and Components

- **Remote Keypad**--The optional Remote Keypad allows you to operate the monitor from a distance. A rotary knob and fixed keys duplicate those of the monitor, while a numeric keypad allows you to enter data. See page 1-15 for more information.
- **Export Protocol**--Allows you to share data with other Dräger Medical and third-party devices (e.g., Clinical Information and Anesthesia Record Systems and Data Loggers; see Dräger Medical publication *Infinity RS-232 Export Protocol Reference Booklet)*.
- **Arrhythmia Classification Expert (ACE)**--Detects cardiac events, reduces false alarms, and filters out misleading or erroneous arrhythmia data.
- **R50 Series Recorders**--Produce alarm, timed, continuous, and trend recordings. See Chapter 7, Recordings, for more information about R50 and R50-N recorders.
- **PCMCIA Card**--Allows you to transfer data, upgrade software, store setups, download setups, and store diagnostic logs.
- **QRS Sync. Output**--Allows you to synchronize defibrillators to the patient's heart beat during cardioversion.
- **Balloon Pump Interface**--Permits interaction with a balloon pump by providing two analog output signals (ECG and ART).

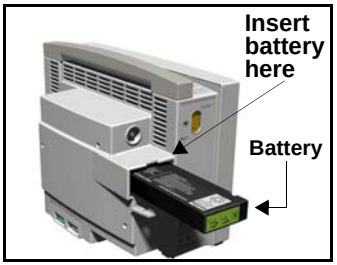
Power Sources

The Vista XL monitor can be powered by a hospital grade outlet with AC adapter, or battery. In case of a line outage or disconnected cable, the monitor automatically switches to battery power to ensure continued patient monitoring.

WARNING: Read "Safety Considerations" (page VII, in the Overview of this Instructions fo Use) before connecting the monitor to a power source.

CAUTION: *Make sure all power cords are properly connected, or batteries may be drained unintentionally.*

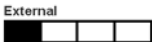
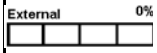
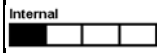
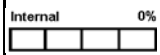
Battery Power



The Vista XL monitor operates on an external, sealed lead-acid battery and an internal lithium-ion battery. The external battery, which can easily be replaced when depleted, can power the monitor for 50 minutes. If it runs low or you remove it from a monitor that has been using battery power, the monitor automatically switches to an internal battery, which can power the monitor for 180 minutes (See "Electrical Specifications" on page B-7). When both batteries run low, the monitor sounds an alarm, and a status message appears in the network message area. *If both batteries are depleted, the monitor turns off automatically.*

The external battery fits into a compartment on the monitor's left side. When depleted or removed, replace it immediately or connect the monitor to a power supply. Whenever the monitor is connected to power, the battery is charged (as indicated by the battery charger LED on the front panel). The internal battery is charged first, then the external battery.The following table illustrates the function of the battery charge bar graph at the top of the screen:

NOTE: When AC power is disconnected, the battery charge display can take up to 15 seconds to reflect actual internal battery capacity and up to 60 seconds to reflect actual external battery capacity

Battery Charge Display		
Display	**Charge Left**	**Action**
	Battery in use is fully charged.	N/A
	Battery in use is half full.	Connect AC adapter.
	External battery is very low (< 25%).	Replace with fully charged external battery.
	External battery is depleted.[1]	Replace with fully charged external battery.
	Internal battery is very low (<25%).	Immediately connect monitor to AC adapter. Replace external battery.
	Internal battery is depleted; <5 minutes of power remaining.[2]	
[1]Monitor sounds single attention tone. [2]Monitor sounds attention tone every 5 seconds.		

WARNING: Actual time available on the internal battery can be significantly reduced with worn out or defective batteries. The 'Internal Battery Percentage' value on the Battery Status screen is accurate only if the batteries are in normal working condition.

CAUTION:

- *DO NOT use the monitor for transport if the internal battery charge is at 25% or less, unless you are using a fully charged external battery.*
- *High temperatures may adversely affect batteries. For optimal performance, charge and use the external batteries at temperatures below 35°C (95°F).*
- *Follow local regulations for safe disposal of batteries. To prevent fire or explosion, never dispose of batteries in fire.*
- *Use only batteries that are provided by Dräger Medical. The use of non-approved batteries may damage the device.*

NOTE:

- To retain charge during transport, leave the monitor connected until you are ready to move the patient. Reconnect the monitor immediately after transport. Dräger Medical recommends replacing lead-acid battery after 18 months of continued use.
- Dräger Medical recommends replacing the internal lithium ion battery after 24 months of use.
- To prevent premature depletion, recharge batteries immediately after discharging them. Lead-acid batteries degrade rapidly if left several days in an uncharged state.
- In storage, lead-acid batteries discharge slowly over time and may become depleted after several months. Batteries stored for use with the monitor should be recharged every six months.

Charging the Batteries

Before using the Vista XL monitor for the first time, charge the internal battery for a maximum of 4.5 hours and the external battery for 3.5 hours. When the monitor receives DC power, batteries recharge automatically.

The optional SLA Battery Charger can charge four fully depleted external batteries simultaneously in approximately 3.5 hours. To start a fast-charge, insert the batteries into the slots of the battery charger with the metal contacts facing down.

CAUTION: *This charger is intended for charging the monitor batteries only. Do not use other chargers or batteries.*

When the monitor receives DC power, batteries recharge automatically.

Getting Started

Turning the Monitor On and Off

To turn the monitor on:

- Press the power key (⊙Ⴗ), located on the bottom left of the Vista XL monitor's front panel . The monitor turns on the power indicator light, lights up the screen, performs a self-test, and displays the main screen.

To turn the monitor off:

- Press and hold the power key (⊙Ⴗ) for two seconds. The power indicator light turns dark, and the monitor emits a power-down tone.

Accessing the Main Screen

After you power up the monitor, the main screen appears. To return to the main screen from a menu or other display:

- Press the Main Screen fixed key, located just above the rotary knob on the front panel of the monitor. The main screen appears, as shown in the following illustration.

1	**Network** message
2	**Parameter** boxes
3	Waveforms
4	Local message

The standard monitor provides five waveform channels with adjacent parameter boxes. Channels can be added to display up to six waveforms. The bottom channel can be used to display additional parameter boxes (see “Bottom Channel” on page 2-7).

Parameter boxes show values, alarm limits, and special icons for selected parameters.

NOTE:

- You can access parameter setup menus by scrolling through the parameter boxes using the rotary knob and clicking on the parameter you wish to configure.
- See “Quick Reference -- Main Menu Setup” on page 2-3 to access parameter setup menus.

Parameters and their associated waveforms are color-coded for easy recognition.

NOTE:

- You can change the default color coding for each parameter by accessing the **Parameter Colors** menu. (See page 2-19)
- For a list of default parameter colors, see ***Quick Reference -- Parameter Colors Menu*** on page 2-20.

Messages appear along the top of the screen in either the **Local Message** (left) or **Network Message** (right) area. When there is no local message, the monitor displays the patient’s name and bed label. When there is no network message, the monitor displays the date and time.

Using the Rotary Knob

The rotary knob allows you to browse menus, choose settings, and execute menu functions. Scroll through menu items by turning the knob. Press the knob (or click) to confirm.

To set or execute menu items with the rotary knob:

1. Select the required function by dialing the knob.
2. Press the knob and click to confirm your selection. A list of choices appears *or* the field switches to its alternate value, e.g., **ON** to **OFF**.

You can also use the rotary knob to enter letters or numbers.

1. Click on a field (e.g., **Physician**). The monitor displays a data-entry screen similar to the following:

2. Use the rotary knob to select each character or number, then click to confirm. Use the control buttons at the bottom of the screen for editing.
3. Click on **Accept** to confirm the entire entry or on **Cancel** to exit the data entry screen.

Remote Keypad

The remote keypad has all of the fixed keys that are on the monitor and additional keys that perform the following:

Trends — Displays trend graphs

Freeze — Freezes waveform display

Calcs. — Activates Calculations menu

All ECG — Displays Show All Leads screen

Remote View — Displays Remote View menu

Recall Setup — Displays Restore Setups menu

View+ — Toggles from monitor to secondary (display) screen

To connect the remote keypad to the Vista XL monitor:

Plug one end of the keypad cable into the keypad and the other into the connector marked RS232 on the right side of the monitor.

Menu Access

There are two ways of accessing the menus. The Fast Access menu allows you to open commonly used menus quickly. The Main Menu lists the primary menus (Patient Setup, Monitor Setup, etc.), which allow you to access other menus.

Fast Access Menu

The Fast Access menu accesses the following submenus and screens directly:

Fast Access Item	See page	Fast Access Item	See page
Remote View	3-10	Calculations	14-1
OxyCRG (Neonatal only)	11-10	Show All Leads	8-15
Alarm History	5-15	OR	2-11
Trend Graphs	6-4	Reports	7-11
Trend Table	6-7	Split Screen	2-8
Event Recall	1-19		
Drug Dosage	14-7		

To open the Fast Access menu:

- Press the **Fast Access** fixed key on the front of the monitor.

You can access many of these menus by selecting **Review** on the Main Screen menu. See page 2-4 for more information.

Main Menu

The Main Menu allows you to execute certain functions and access others. Icons are used to identify menu items:

- Page icon (e.g., **Restore Setups**) -- Accesses submenu
- Arrow icon (e.g., **Review**) -- Displays another column
- No icon (e.g., **Standby**) -- Executes function

To display the Main Menu:

1. Press the **Menu** fixed key. The primary list of Main Menu options appears.
2. Click on a page icon next to a heading ( ) to open a Main Menu submenu *or* on an arrow icon ( ) to display another column of Main Menu options (see page 2-3 for detailed information on configuring the Main Menu).

Fixed Keys

Fixed keys on the monitor front panel allow you to perform commonly executed functions. .

CAUTION: *Moisture under the front panel can damage the electric circuits and compromise key function. For safe cleaning instructions, see page 21-1.*

Fixed Key	Description	Fixed Key	Description
Alarm Silence	Silences the active alarm tone for one minute	Main Screen	Activates the main screen
Alarm Limits	Opens a table from which you can set upper and lower alarm limits	Menu	Activates the Main Menu
All Alarms Off	Suspends all alarms for a pre-selected time or cancels the suspension	NBP Start Stop	Starts or stops non-invasive blood pressure (NBP) measurement
Fast Access	Displays the Fast Access Menu	Record	Toggles a timed recording on or off

Control Buttons

Control buttons are located along the bottom of the various screens, trend tables, graphs, loop displays, etc. They permit additional screen-specific settings.

Data Archive Applications

The monitor can store events, alarms and trends automatically or at the user's request, depending on the type of information you wish to store. Some events are automatically recorded and stored. The monitor automatically stores alarm conditions and arrhythmia events that you have configured for storage in the Alarm Limits table (see page 5-5) and in the Arrhythmia setup table (see page 9-6).

NOTE: You cannot disable event storage for asystole and ventricular fibrillation calls. The monitor stores these events automatically.

You can access archived information in one or more of the following databases:

- Trends

- Calculations
- Alarm History
- Event Recall.

Each database indicates the time of the data capture and parameter values and/or waveforms active at the time of capture. Trends, Calculations, and Alarm History are discussed in the following chapters (Event Recall and Storage is explained later in this section.):

- Trends -- See Chapter 6, Trends. Stored events are marked with the time and date of capture as follows:

  Trend Table -- An icon (◂) over the time line marks manually stored events only. (Automatically stored alarms and arrhythmia calls are not marked in the Trend Table.)

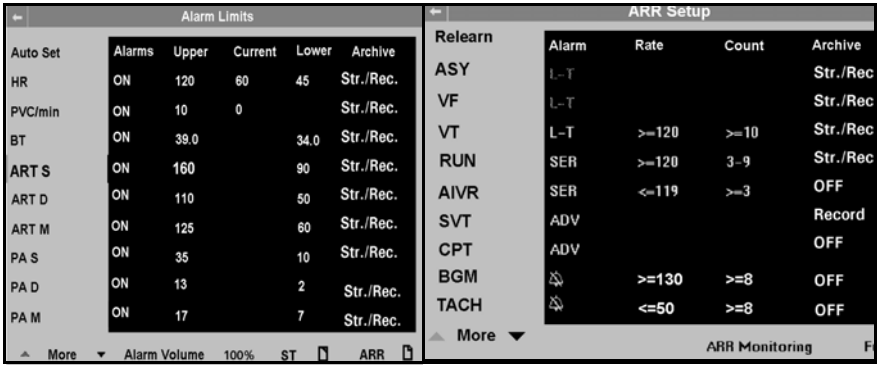
  Trend Graphs -- A small yellow vertical line at the top of the screen marks manually *and* automatically stored events.
- Calculations -- See Chapter 14, Calculations.
- Alarm History -- See Chapter 5, Alarms.

Storing Events

Automatic Storage

The monitor stores events automatically, if you have first correctly configured the Alarm Limits and Arrhythmia Setup tables.

You can enable individual parameter alarms in the **Alarms** column of the Alarm Limits and/or the ARR Setup screens. Configure event storage in the **Archive** column by selecting **Store** or **Str./Rec.**



Event Recall

The monitor stores monitoring data (waveforms and parameter values), alarm conditions, and arrhythmia events on the Event Recall screen. You can view up to 50 stored events, each containing 20 seconds of data, with associated date and time stamps.

Events are stored on a first-in, first-out basis. When event storage is full, the monitor deletes the oldest events to make room for new ones. All stored events are deleted whenever you discharge a patient, reset the monitor, or temporarily lose power.

To access the Event Recall screen:

1. Press the **Fast Access** fixed key.
2. Click on **Event Recall** to display the Event Recall screen.

1	Time of capture
2	Parameter values at time of capture
3	Print report
4	Requests recording
5	Saves/Deletes events
6	**View: All -** displays all stored events; **Manual -** displays manually stored events; **Alarm -** displays alarm events only; **BRDY -** displays bradycardia events only; **Desat -** (Neonatal only) displays desaturation events only
7	Parameter display: **Prev** displays previous set of (2) parameters. **Next** displays next set of (2) parameters
8	Parameter labels of displayed waveforms
9	Waveform delay and speed

Navigating the Event Recall Screen

To scroll forward and back through 20 seconds of waveform data, click on arrows at either side of scroll bar at the bottom of the screen.

To scroll through the list of parameter values at the time of data capture, click on the arrow keys above the list of parameters at the right of the screen:

To scroll through the waveforms displayed at the time of data capture, click on the **Prev** (Previous) and **Next** control buttons under waveform display.

Help Functions

You can display a short description of currently highlighted functions at the bottom of all active menus by enabling context-sensitive help:

1. Press the **Menu** fixed key to open the Main Menu.
2. Click on **Monitor Setup.** Another column of options appears.
3. Open the **Display Options** menu by clicking on that heading.
4. Select **Help Line Display** and click to choose **ON**.

Additional information about the monitor is available in the Main Help menu.

1. Press the **Menu** fixed key.
2. Click on **Help**. The Main Help Menu appears.

Click on the appropriate selection in the table below.

Menu Item	Description
Locked Options	Displays active software options currently installed on the monitor
Fixed Keys	**Describes functions of Fixed Keys**

Chapter 2 Monitor Setup

Overview

This chapter describes how to configure the monitor.

Configuring the Monitor

Main Menu Setup

The Main Menu allows you to access submenus, display screens, and execute certain monitor setup functions.

1. Press the **Menu** fixed key to display the Main Menu.
2. Click on a page icon ( ) to open a Main Menu submenu,
   or
   Click on arrow icon ( ) to display another column of submenu options.
3. Click on desired setting to execute functions or access further submenus.
4. Click on **Exit** at the bottom of a submenu list or on the white arrow in upper left corner of the screen to return to prior menu or screen.

Quick Reference -- Main Menu Setup

The Main Menu		
Menu Item	**Description**	**Available Settings**
Cursor Tool	Provides access to Cursor Tool submenu, which allows user to select three waveforms displayed with horizontal cursors and a vertical cursor.	• Setup • Horizontal Cursor • Stop • Hemo/Calcs • Vertical Cursor **Note:** See Cursor Tool Submenu, below.
The Cursor Tool Submenu This submenu allows you access to the following functions.		
Setup	Opens Cursor Tool Setup menu.	• Waveform *(Up to 3.)* **NOTE**: In 4 channel mode, maximum of 2 waveforms. • Sweep Speed • 6.25 mm/sec. • 12.5 mm/sec. • 25 mm/sec. *(Default)* • 50 mm/sec.
▲▼ Horizontal Cursor *(One for each waveform on display)*	Displays a horizontal cursor. User can scroll up and down each waveform. NOTES: • Cursor value is displayed[1]. • Cursor and value are on display until user exits window. • Buttons remain ghosted until user presses **Stop** key. To EXIT the Cursor tool: • Press/click the Rotary Knob to exit cursor control. or • Press the **Main Screen** fixed key.	N/A
[1] Cursor value is displayed only if a scale is associated with the waveform. Waveform scales are the same as parameter main display.		
Stop	Halts scrolling of all waveforms in cursor tool display and un-ghosts **Horizontal** and **Vertical Cursor** buttons.	N/A

The Main Menu		
Menu Item	**Description**	**Available Settings**
Hemo/Calcs	Opens the hemo/calcs screen. NOTES: • Button is ghosted unless a license is present. • Advanced calcs menu is available if option is installed.	N/A
◆▶ Vertical Cursor	Displays a vertical cursor. User can scroll forward and backward across all waveforms. NOTES: • Cursor has no value. • Cursor remains on display until user exits window. • Buttons remain ghosted until user presses **Stop** key. To EXIT the Cursor tool: • Press/click the Rotary Knob to exit cursor control. or • Press the **Menu, Main Screen, Alarm Limits,** or **Fast Access** fixed key.	N/A
Review	Provides access to submenus of the Main Menu display	• Click on **Review** to open the following submenus and displays: Alarm History, Trend Graphs, Trend Table, Event Recall, Calc. Results, OxyCRG (neonatal mode only), Show All Leads, and Reports. • Click on **Exit** to return to the first column of the Main Menu.

The Main Menu		
Menu Item	**Description**	**Available Settings**
The Patient Setup Submenu This submenu allows you to configure the following functions.		
Patient Category	Determines availability of monitoring features such as apnea detection (neonates only) and ventilation **Notes:** • When you click on a setting, a popup message warns you that algorithms and alarm settings are about to change. In the popup window, click again on the category of your choice. • If you change a patient's category, the weight selection is cleared and must be selected again.	• Adult • Pediatric • Neonatal
Pressure Labels	Assigns IBP pressure channel labels See Chapter 13, Invasive Blood Pressure, for detailed information.	ART, PA, CVP, LA, LV, RV, RA, ICP, GP1, GP2
Parameters	Accesses parameters' setup menus	• Click on one of the listed parameters to access its setup menu: (e.g., ECG, ARR, ST, ART, PA CVP, RA, SpO_2, NBP, RESP, $etCO_2$, C.O., TEMP, GP1, GP2, O2, fiO_2,). **Note:** There may be other possible selections depending on the monitor configuration and connected devices. • Click on **Exit** to return to the first column of the Main Menu.
Alarm Limits	Opens alarm limits table	N/A; see page 5-5.

The Main Menu		
Menu Item	**Description**	**Available Settings**
The Monitor Setup Submenu		
Main Screen This submenu allows you to lay out the main screen display by configuring the functions outlined below. To access second page of the Main Screen menu, click on the down arrow at the bottom of the screen. Click on the up arrow to return to the Main Screen menu first page.		
Parameter Priority	Allows you to modify the order of parameters displayed on the Main Screen **Notes**: • Parameters must be assigned a priority; whether they appear on the main screen depends on their priority and on the number of channels configured to display waveforms (see **Max. Channels**). • In Automatic display mode, connected parameters are displayed according to their priority in the **Parameter Priority** list. If all available channels are filled, a higher priority parameter will NOT "bump" lower priority parameter boxes off the Main Screen when the associated device is connected. In order to display the parameter, the user must double-click on the parameter in the **Parameter Priority** list. • In OR Mode, if all available channels are filled, a higher priority parameter will "bump" lower priority parameter boxes off the Main Screen when the associated device is connected.	To change the display order of a parameter whether or not the associated device is connected: 1) Scroll to **Display Mode.** 2) Select **Manual**. 3) Click on **Parameter Priority** to highlight the first listed parameter. **Note:** Parameters are numbered according to their priority. The display is color coded: A green parameter label indicates that the associated parameter device (e.g., an NBP hose/cuff) is connected to the monitor. A white label indicates that the device is not connected. 4) Scroll the list to the parameter you wish to move and click. 5) Move the parameter to its new place using the rotary knob. 6) Click to confirm the parameter's new position on the list. 7) Click again to return to **Parameter Priority**. 8) Scroll to the arrow at the upper left corner of the menu to exit, or continue to set up other Main Screen submenu functions.
Max. Channels	Determines number of waveform channels and parameters displayed	• Click on **4, 5, 6, 7,** or **8.** **Note:** The number of waveforms you can display depends on the software option you have installed.

The Main Menu		
Menu Item	**Description**	**Available Settings**
Bottom Channel	Configures bottom waveform channel to display waveform or parameter boxes	• Click on **Waveform** to display a waveform in the bottom channel. • Click on **Parameters** to display 3 parameter boxes instead of a waveform in the bottom channel.
ECG Channels	Determines the number and format of ECG waveforms displayed	Click on the following settings: • **ECG1** -- Displays the primary ECG signal • **ECG1 & 2** -- Displays 2 signals • **ECG1 & 2 & 3** -- Displays 3 signals • **Cascade** -- Cascades ECG1 data into second channel
ARR Monitoring	Selects the Arrhythmia mode (For detailed information, see page 9-1.)	• Click on OFF to disable arrhythmia monitoring. • Click on FULL to enable full arrhythmia monitoring. • Click on BASIC to enable basic arrhythmia monitoring.
ST Monitoring	Enables and disables ST Monitoring (For detailed information, refer to Chapter 10, ST Monitoring.)	• Select ON to enable ST monitoring. • Select OFF to disable ST monitoring.
RESP Monitoring	Enables and disables respiration monitoring (For detailed information, refer to Chapter 11, Respiration.)	• Select ON to enable respiration monitoring. • Select OFF to disable respiration monitoring.
Display Mode	Reduces Main Screen clutter by displaying only parameters associated with a connected device (see **Parameter Priority**, page 2-6)	• Click on **Manual** to display all parameters and assign them a priority on the Parameter Priority screen. • Click on **Automatic** to display active parameters only.

The Main Menu		
Menu Item	**Description**	**Available Settings**
Split Screen	Reserves a portion of the main screen for display of trend graphs	Click on one of the following: • OFF • 60 Min Trends • 10 Min Trends
Display Options This submenu allows you to access and modify waveforms and other display features by configuring the following functions.		
Monitoring Sweep Speed	Determines waveform speed Higher sweep speed “moves” waveform more quickly.	• Click on **6.25, 12.5, 25,** or **50 mm/s.**
Respiratory Sweep Speed	Allows you to set monitoring sweep speed for Respiration waveform independently	• Click on **6.25, 12.5, 25,** or **50 mm/s.**
Pressure Overlap	Displays up to 4 overlapping IBP waveforms in single oversized channel Overlapped waveforms share a common zero point, but each retains original scale configuration (see page 13-11).	• Select **ON** to display IBP waveforms in overlapping format. • Select **OFF** to cancel display of waveforms in overlapping format.
Pressure Common Scale	Displays pressure waveforms with a common scale, making it easier to compare them	• Click on **5, 10, 15, 20, 25, 30, 40, 50, 75, 100, 150, 200, 250, 300 mmHg,** or **OFF.**
Monitor Brightness	Sets brightness of monitor	• Click on **Auto** (ambient light), **20, 40, 60, 80,** or **100%.**
SC 9015 Brightness	Sets brightness of SC 9015	
Help Line Display	Shows contextual help line at bottom of menu	• Select ON to display help. • Select OFF to cancel display.
Parameter Units Display	Displays unit of measure in parameter boxes	• Select ON to display units. • Select OFF to cancel display.

The Main Menu		
Menu Item	**Description**	**Available Settings**
Monitor Options This submenu allows you to configure the following functions.		
Date & Time	Sets the date and time displayed in the lower right potion of the main screen **Notes**: • An internal battery powers the monitor's clock even when the monitor is turned off. • This option is not available when the monitor is connected to network, since network date and time are set at the central station. • Changing the time does not affect other time-related functions such as timers and time stamps.	To set the monitor date and time: 1) Click on **Date & Time**. 2) Click on **Current Date**. A data entry screen appears. 3) Click on **Day**, scroll to the correct date, and click. 4) Repeat Step 3 for **Month** and **Year**. 5) Click on **Accept** to confirm or on **Cancel** to return to submenu. 6) Click on **Current Time** to set the time, using the same method described in steps 3 and 5.
Speaker Volumes	Allows you to set the volume for alarms, pulse tones, and attention tones	• Click on **Alarm Volume** to set the volume of alarms (**10-100%** in increments of 10). • Click on Pulse Tone Volume to set the volume of the pulse tone (OFF-100% in increments of 10 after 5). • Click on Attention Tone Volume to set the volume of attention tones (OFF-100% in increments of 10 after 5).
Trend Setup	Allows you to configure trend display	• *Submenu;* see Chapter 6, Trends, for detailed information.
Recordings	Allows you to configure and assign recorders	• *Submenu;* see Chapter 7, Recordings, for information.
Biomed	Provides access to technical and clinical logs and service menus	• *Submenu;* see page 2-17.
Unit Manager	Allows the unit manager, physician or head nurse to configure monitoring functions for the clinical staff	• *Submenu;* see page 2-13.
OR	Configures monitor to meet the special needs of the operating room environment	• *Submenu;* see page 2-11.

Setups Management

You can save and restore the current patient and monitoring settings.

Setups Management		
Menu function/ item	**Description**	**Reference/Procedures**
Configuring Setups To save, or restore setups, configure them as shown in the referenced pages.		
Main screen display	Main Screen menu	Page 2-6
Parameters	Parameter Setup menu(s)	Page 2-5 **Note**: For more information, see parameter chapters.
Alarms	Alarm Limits Table	Page 5-5
Arrhythmia calls	Arrhythmia Setup Table	Page 9-6
Trends	Trend Setup Trend Graphs Trend Table	Page 6-2 Page 6-4 Page 6-7
Naming and Renaming Setups Follow these procedures to name or rename the setups you have configured.		
Accessing the Unit Manager Menu	Allows you to modify setups on the password-protected Unit Manager menu **Note**: For information on other Unit Manager functions, see page 2-13.	To enter the password: 1) Press the **Menu** fixed key to display the Main Menu. 2) Click on **Monitor Setup.** 3) Click on **Unit Manager.** A data entry box appears. 4) Click on each number of the appropriate password. If you make a mistake, click on **Backspace** and try again. 5) Click on **Accept** to open the Unit Manager menu.
Restoring Factory Defaults Consult your Biomed to restore settings shipped with the monitor to their original configuration. For detailed information on password-protected Biomed setup functions, please consult service and installation documentation.		

Specialty Menus

OR Mode

OR mode is designed specifically for the operating room environment, allowing you instant access to a particular set of parameters and functions. In addition, you can disable audible alarms without affecting visual alarms, even when the monitor is not connected to a network.

WARNING: Do not set monitor to OR mode outside operating room environment because OR alarms behave differently than regular alarms.

NOTE: Life Threatening and Serious alarms do not latch when OR mode is ON.

To access the OR menu:

1. Press the **Fast Access** fixed key.
2. Click on **OR** to display the OR menu.

Quick Reference Table -- OR Menu

OR Function	Description	Settings
The OR Menu		
OR	Activates OR menu functions **Note**: This function is a locked option. It is installed at the time of purchase from perioperative care unit or it can be installed locally by Dräger Service or local Biomed.	• **ON** -- OR functions are enabled. • **OFF** -- The monitor reverts to normal functions; **Cardiac Bypass**, and **NBP Chime** are ghosted.
Cardiac Bypass	Configures monitor for use during cardiac surgery	• **ON** -- Suspends all patient-monitoring alarms, NBP interval measurements, and arrhythmia detection. • **OFF** -- The monitor reverts to normal functions.

OR Function	Description	Settings
NBP Chime	Enables and disables attention tone for NBP measurements (For more information, see Chapter 12, Non-Invasive Blood Pressure.)	• **ON** -- Monitor sounds an attention tone when NBP measurement is complete. • **OFF** -- No tone sounds when you complete an NBP measurement.
Alarm Volume	Sets alarm volume **Note**: Minimum setting is **OFF** if OR is enabled or if monitor is connected to a central station. Minimum setting is **10%** if OR is disabled.	• **20 - 100%** in increments of 10 • **OFF** or **10%**
Large IBP-Mean Display	Determines the relative size of the mean pressure value in invasive pressure parameter boxes	• ON -- Enlarges mean IBP display • OFF -- Reduces mean IBP display to match systolic and diastolic display size
Attention Tone Volume	Sets attention tone volume **Notes**: • Minimum setting is **5%** if OR is enabled or if monitor is connected to a central station. Minimum setting is **10%** if OR is disabled.	• **20 - 100%** in increments of 10 • **OFF** or **5%**
HR Source	Derives heart rate from various sources **Note**: This function is useful during electrosurgery, when artifact makes ECG channel unavailable. See page 8-20 for more information.	Click on one of the following settings to determine the Heart Rate source: • ECG • ART • SpO_2 • AUTO
Filter	Determines sensitivity to noise, artifact, and other signal distortion **Note**: The **ESU** setting automatically disables pacer detection. See page 8-17 for detailed information on **Filter** and its settings.	• OFF • ESU • Monitor
ARR Monitoring	Determines number of arrhythmia events you can monitor **Note:** For detailed information, see page 9-1.	• OFF • Basic • Full
Pulse Tone Volume	Sets pulse tone volume (See page 2-9.)	• Off - 100%

Unit Manager

The Unit Manager menu lets supervisory personnel configure monitoring functions for the clinical staff. Access to this menu is restricted by a password. To open the Unit Manager menu:

1. Press the **Menu** fixed key to open the Main Menu.
2. Click on **Monitor Setup**.
3. Click on **Unit Manager**. A data entry box appears.
4. Scroll through the numbers and click successively on the single digits of the clinical password. If you make a mistake, click on **Backspace** and try again.
5. Click on **Accept** to open the Unit Manager menu. Available functions are described in the table that follows.

The Unit Manager Menu		
Menu Item	**Description**	**Available Settings**
The Alarm Control Submenu This menu allows the unit manager to configure alarm annunciation. Open the Unit Manager menu, click on **Alarm Control**, then follow the procedures outlined in this table to execute the indicated functions.		
All Alarms OFF Key	Determines whether clinical personnel can suspend alarms by using the **All Alarms Off** fixed key on the front of the monitor	• **ON** -- Pressing **All Alarms Off** fixed key suspends alarms. • **OFF** -- Pressing **All Alarms Off** fixed key triggers an error tone.
All Alarms OFF Time	Sets alarm suspension time **WARNING**: **Never leave a patient unattended during an indefinite alarm suspension (e.g., after selecting No Timeout). Always enable the alarms again as soon as possible.**	• **1, 2, 3, 4,** or **5 min** -- A timer at the top of the screen *indicates the amount of time remaining in All Alarms OFF Time.* • **No Timeout** -- Alarms suspended indefinitely; no timer appears.
Extend All Alarms OFF Note: This selection will only appear if monitor is configured to support this feature. Contact your biomed for more information.	Determines whether clinical personnel can use the **All Alarms Off** fixed key to extend the **All Alarms Off** time.	• Enabled • Disabled (default)

The Unit Manager Menu		
Menu Item	**Description**	**Available Settings**
Alarm Validation **Note:** When **Alarm Validation** is **ON**, the time to alarm from the onset of a limit violation will equal the time for detection + the designated Alarm Validation signal delay. For HR, this time may exceed AAMI EC13 requirement of a maximum of 10 seconds.	Validates alarm conditions to limit nuisance alarms due to artifact or motion/movement by delaying time to alarm. Alarm validation times are: Upper / Lower *HR* 6 sec. / 6 sec. *RESP* 14 sec. / 14 sec. *IBP* 4 sec. / 10 sec. *SpO_2* 6 sec. / 10 sec.[1] *PLS* 6 sec. / 10 sec.[1] *SpO_2** 4 sec. / 4 sec. *PLS** 4 sec. / immediately *All Other Parameters* immediately [1](See “SpO2 Alarm Delay”.)	• **ON** -- Enables Alarm Validation • **OFF** -- Disables Alarm Validation
SpO_2 Alarm Delay	Validates an SpO_2 alarm condition by requiring that violation persist for 10 seconds (lower limit) before sounding an alarm. **Note**: Alarm validation must be turned **ON**.	• **ON** -- SpO_2 or PLS lower limit alarm condition annunciated after it persists for a period of 10 seconds. • **OFF** -- SpO_2 or PLS lower limit alarm condition is not validated before annunciation.
ASY/VF Alarms	Allows user to prevent disabling of ASY and VFIB alarms.	• **Always ON** -- ASY and VFIB alarms are always active. • **Follow HR Alarms** (default) -- ASY and VFIB alarms follow HR alarm settings. **WARNING**: **When HR Alarm is “OFF” and ARR monitoring is “OFF”, ASY/VF alarms do not sound.**
NBP/SpO_2 Interlock	Allows user to render SpO_2 alarm inactive when NIBP measurement is in progress. **WARNING**: **Visually ensure that NIBP cuff is on the same arm as SPO_2 sensor. The monitor will not automatically detect that NIBP cuff and SPO_2 sensor are on the same arm.**	• **ON** -- SpO_2 alarm is inactive when NBP measurement is taken. • **OFF** (default) -- SpO_2 alarm is active when NBP measurement is taken.

The Unit Manager Menu		
Menu Item	**Description**	**Available Settings**
MIB Alarm Control	Allows user to activate/ deactivate MIB disconnect alarm.	• **ON** (default) -- MIB disconnect alarms are active. • **OFF** -- MIB disconnect alarms are inactive.
Remote View Display	Allows user to set **Remote View** behavior when **Remote View** is displaying telemetry ECG.	• **Always ON** -- Local bed alarm will not cause remote view feature to "pull down" remote bed display. • **Pull Down on Alarm** (default) -- Local bed alarm will cause remote view feature to "pull down" remote bed display.
Audio Alarm Reminder	Allows user to set a reminder when alarm volume is turned OFF.	• **ON** (default) -- When **Alarm Volume** is turned OFF, a reminder tone sounds every 30 sec. at 50% volume. **Note**: For **OR Mode:** at the end of the countdown period (alarm silence or alarm off), if the alarm condition is still active, the parameter box will flash and an appropriate SER, LT, or ADV reminder tone (at 50% volume) sounds every 30 sec. • **OFF** -- There is no reminder tone when **Alarm Volume** is turned OFF.
SpO_2 Alarm Delay	Validates an SpO_2 alarm condition by requiring that violation persist for 10 seconds (lower limit) before sounding an alarm. **Note**: Alarm validation must be turned **ON**.	• **ON** -- SpO_2 or PLS lower limit alarm condition annunciated after it persists for a period of 10 seconds. • **OFF** -- SpO_2 or PLS lower limit alarm condition is not validated before annunciation.
The Code Setup Submenu This menu allows the unit manager to configure the monitor for quick emergency response. Open the Unit Manager menu (page 2-13), click on **Code Setup**, then select and execute functions as described in this table. For more information, see page 5-4.		
Continuous Record	**Note**: If no recorder is available, the recording request remains pending for later printing. The default setting is **Yes**.	• **Yes** -- Allows continuous recording when you press the **Code** key on the remote keypad. • **No** -- No recording can be initiated when **Code** key is pressed.

The Unit Manager Menu		
Menu Item	**Description**	**Available Settings**
Continuous NBP	**Note**: You must attach the NBP cuff and display the NBP parameter box before requesting NBP measurements. The default setting is **No**.	• **Yes** -- Allows continuous NBP measurements when you press the **Code** key on the remote keypad. • **No** -- No NBP measurements can be initiated when **Code** key is pressed.
Alarm Volume OFF	The default setting is **No.**	• **Yes** -- Allows you to lower the alarm volume (to **10%** on non-networked monitors) or silence alarms completely (**OFF** on networked monitors) when you press the **Code** key on the remote keypad. • **No** -- Alarm volumes are not affected when the **Code** key on the remote keypad is pressed.
The Menu Setup Submenu		
Menu Setup	Determines amount of time menus and screens remain displayed **Note**: This setting determines menu display time in **Remote View** also.	1) Click on **Menu Setup.** 2) Click on **Menu Time Limit.** 3) Click on one of the following: • **ON** -- Active menus and screens display for a limited time only (approximately 5 minutes). • **OFF** -- Menus and screens remain displayed until you cancel them or select another display.
The Drug List Setup *Submenu* This menu allows the unit manager to store up to 44 types of drugs and their dosages for use during drug calculations. Open the Unit Manager menu (page 2-13), click on **Drug Setup**, then follow the procedures outlined on page 14-9.		

The Unit Manager Menu		
Menu Item	**Description**	**Available Settings**
The Change Password *Submenu* This feature allows you to change the password of the Unit Manager menu. Open the Unit Manager menu (page 2-13), click on **Change Password**, then follow the procedures outlined in this table. 1) Scroll through the numbers and click successively on the single digits of the clinical password. If you make a mistake, click on **Backspace** and try again. 2) Click on **Accept** to confirm the new password.		
The **Pacer Detection Mode** *Submenu* This feature allows you to set pacer detection function. Open the Unit Manager menu, click on **Pacer Detection Mode**, then follow the procedures outlined in this table.		
Basic (default)	Sets **Pacer Detection** selections in the **ECG options** submenu to **ON/OFF** only.	• N/A
Advanced	Sets **Pacer Detection** selections in the **ECG options** submenu to **ON/OFF/Fusion**.	• N/A

Biomed

The Biomed menu addresses technical aspects of the monitor. To open the Biomed menu:

1. Press the **Menu** fixed key to open the Main Menu.
2. Click on **Monitor Setup**.
3. Click on **Biomed**.

Quick Reference -- Biomed Menu

Menu Item	Description	Settings/Procedures
The Logs Submenu This menu displays clinical and technical diagnostic records. Open the Biomed menu and click on Logs, then follow the procedures described in this table.		

Menu Item	Description	Settings/Procedures
Component Log	The monitor maintains read-only logs for principal components or devices. These logs include a part and revision numbers, serial numbers, software version, and compatibility information.	1) Scroll to the component you wish to inspect and click on it. The log appears with the exit arrow already selected. 2) Return to the **Logs** submenu by clicking again.
Status Log	Displays information about your current software and hardware versions	Display is read-only.
Diagnostic Log	Captures data about hardware and software performance relating to the monitor's operation	Display is read-only. • Click on the down arrow at the bottom of screen to scroll through the display.
FE Diag. Log	Captures and displays data about front-end performance related to the monitor's operation	Display is read-only. • Click on the down arrow at the bottom of screen to scroll through the display.
Copy All Logs	Downloads status logs and diagnostic logs to a memory card	Click on **Copy All Logs**. A confirmation message appears in the message area to indicate the download is complete.
Print Log	Prints an expanded version of the Diagnostic Log to an INFINITY network laser printer	Click on **Print Log**.
The Service Submenu The Service menu is password-protected and intended for the hospital's biomedical or Dräger Medical service personnel only.		
Test Pulse		
Test Pulse	Tests ECG signal clarity and display	Clicking on **Test Pulse**: • Injects a 300 ms pulse into the ECG waveform (1 mV on leads I and III, 2 mV on lead II).

Parameter Colors

The Parameter Colors menu allows the user to assign a color to an individual parameter/waveform. To open the Parameter Colors menu:

1. Press the **Menu** fixed key to open the Main Menu.
2. Click on **Monitor Setup**.
3. Click on **Monitor Options**.
4. Click on **Parameter Colors**.
5. Enter clinical password.

NOTE: The clinical password menu will time-out after approximately 5 minutes . It will stay active that long unless the user clicks **Accept**.

6. Click on **Accept**.

7. Click on parameter and select color desired.
8. Click on desired color.

Parameter Colors functions are described in the following table:

Quick Reference -- Parameter Colors Menu

Parameter	Default Color	Possible Selections
NOTES: • The color change set in this menu changes all uses of the parameter (parameter-box, waveform, trends). • The parameter list is not limited to only parameters connected. • Agent parameters (HAL, ISO, ENF, SEV, DES) and O2/N2O cannot change color.		
ECG (inc. ST, ARR) Notes: • ECG lead label on Main Screen is same color as waveform. • ST complexes follow the color selected for ECG (Reference curves remain purple)	Green	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
ART	Red	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
PA	Yellow	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
CVP	Lt. Blue	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
RA	Orange	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
LA	Purple	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
LV	Yellow	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
ICP	Lt.Blue	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
RV	Orange	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
GP1 and/or GP2	Red	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange

Parameter	Default Color	Possible Selections
P1a and/or P1b and/or P1c and/or P1d	Red	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
P2a and/or P2b and/or P2c and/or P2d	Red	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
P3a and/or P3b and/or P3c and/or P3d	Red	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
TEMP	White	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
$EtCO_2$ (inc. iCO2, RRc) and/or $EtCO_2$* (inc. iCO2*, RRc*)	Yellow	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
SpO_2 (inc. PLS) and/or SpO_2* (no waveform, but inc. PLS*, ΔSpO_2%)	White	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
NBP Note: During NBP measurement, NBP p-box becomes white background with black letters/ numerics regardless of color selected in this menu.	White	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
RESP	Blue	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange
O2/N2O	White	None
FiO_2	White	Red, White, Yellow, Green, Lt. Blue, Blue, Purple, Orange

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Chapter 3 Network Applications

Overview

By connecting your bedside monitor to a network, you can access a patient's information from any other networked monitor or from a central workstation. Each of these devices can present Main Screen information for remote viewing.

The Infinity Network‘ links monitors and other devices to a central station and to each other, providing a wide range of monitoring functions. On the MultiView‘ you can display information from up to 16 networked monitors simultaneously. (For more information on the central station, see the Infinity CentralStation Instructions for Use.)

WARNING: Loss of communication between the Infinity CentralStation and the bedside monitor is possible. Dräger recommends using the bedside monitor for primary diagnosis and the Infinity CentralStation for patient viewing.

The DirectNet feature allows you to connect your monitor directly to the Infinity network (see page 3-3).

Your monitor's RemoteView‘ function allows you to display other networked monitor screens, print remote recordings, and silence remote alarms (see page 3-10). Via the Remote Control function on the MultiView, you can perform the following tasks at the central station for any bedside monitor:

- Initiate recordings
- Modify alarm limits
- Silence alarms
- Initiate an Arrhythmia or Respiration Relearn
- Print the current monitor screen on a network laser printer (via the optional Remote Keypad)

Enter, edit, and view patient data

WARNING: Never rely on the central station to evaluate a patient. Always check patient status at bedside.

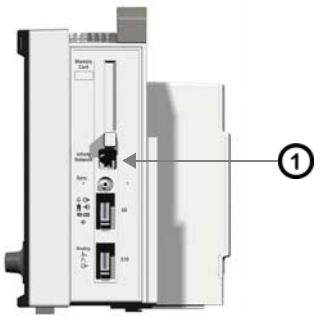
Connecting to the Network

Connecting the monitor to the network gives you access to the following:

- Infinity network
- Bedside recorder
- Nurse call alarm

Connecting the Vista XL to the Network

For the Vista XL, you can connect to the network via the network connector on the right side of the monitor.



1	**Network** connector

Network Message

Once the monitor is connnected to the Network, the following message may appear.

Message	Condition	Display Area
Not monitored by central	• Connected to network, but not assigned to an Infinity CentralStation	Network

Disconnecting the Vista XL from the Network

To disconnect the monitor from the network, remove the cable from the network connector in the right side of the monitor.

Wireless Network

The Vista XL can operate in a wireless network which allows the monitor to establish and maintain contact with the Infinity network and the central station without being connected by cable.

A wireless monitor transmits and receives data with the help of a wireless LAN PC card installed in the Memory Card slot on the monitor. The wireless card communicates with access points which are strategically placed within a monitoring unit in order to cover the desired transmission area.

NOTE: Wireless networking is a locked option. Contact your biomed for more information.

A wireless network offers the following:

- **Seamless Patient Relocation** — Patient and monitor can be moved to a different room or care unit, within the same monitoring unit, without ever losing contact with the Infinity network.
- **Simplified Network Setup** — Wireless monitors can be networked without the need of hard-wired hub connectors, which reduces the need for network cables within the hospital. (Note: Central station, access points, and recorders/printers *are* connected to the network by cable.)

WARNING: Before operating the monitor in a wireless network configuration, please read the Wireless Network Safety Considerations below.

Wireless Network Safety Considerations

When operating the monitor in a wireless network, please observe the following:

- Before using the wireless monitoring equipment, read the instructions and safety warnings supplied by the wireless equipment manufacturer.
- While the unit is transmitting or receiving signals, do not hold the transmitting/receiving unit close to exposed body parts, especially the face or eyes. The antenna/wireless card should be at least 2" (5 cm) away from the body.
- Operation of the wireless network relies on uninterrupted signal transmission between the transmitting and receiving components of the network. When using the wireless network, be aware that

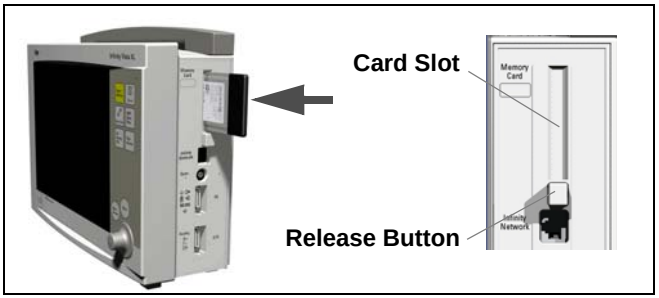
  certain structural limitations within the hospital building may interfere with signal transmission,

  other devices emitting radio frequencies, such as leaky microwave ovens or warmers, may interfere with signal transmission,

the frequencies emitted by the device may interfere with the operation of other medical equipment.

- The installation of wireless equipment must be performed by qualified Service technicians. This includes installation, placement, and configuration of WLAN access points. Any changes or modifications to the equipment not expressly approved by the equipment manufacturer may result in equipment malfunction or damage.
- Access points are not considered medical equipment and should be kept out of the patient's vicinity.
- Maximum number of beds per access point in wireless mode is eight.

Wireless Network Setup



Vista XL Memory Card Slot

STEPS: Installing the Wireless Card

1. Facing the monitor, turn the card so that the flat side (back label) faces you.
2. Press the card firmly into the Memory Card slot until the slot's release button protrudes.

Wireless Card Removal

To remove the card, press the release button and remove card from slot.

Wireless Mode

NOTE: Wireless networking is a locked option. Contact your biomed for more information.

To access wireless settings for the monitor:

1. Press the **Menu** fixed key.
2. Click on **Admit/Discharge**.
3. Click on **Wireless**.
4. Click on **Care Unit** to select from a list of available care units.
5. Click on **Exit** to return to the Wireless menu.
6. Click on **Bed Label** to select from a list of available beds.

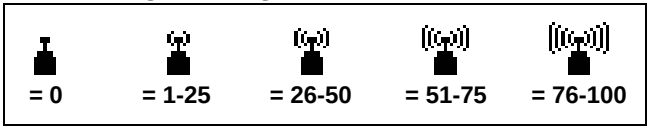
NOTE: **Bed Label** selection is ghosted until a valid care unit is selected.

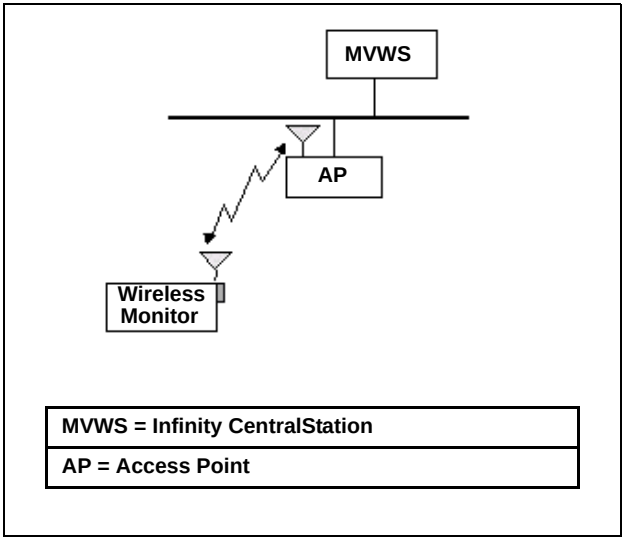
Wireless During DirectNet mode

To change the monitor to wireless mode, consult your Biomed or service and installation documentation.

When the wireless mode is active, an icon appears with the date/time icon to reflect signal strength. The icon and the date/time icon alternate with other secondary messages in the network messaging area.

There are five different signal strength icons:





If a wireless monitor loses contact with all access points and wireless transmission is interrupted (i.e. you remove the wireless card or the monitor is out of range), the network generates an offline message and the monitor operates as a standalone device.

If a wireless monitor regains contact with any access point (i.e. you insert the wireless card or the monitor is brought back into range) the normal monitoring state will be restored and the offline message cleared within 40 seconds.

CAUTION:

- *Software upgrades, saved setups, and card data transfers are not possible simultaneously with wireless monitoring.*
- *Software upgrades, saved setups, and card data transfers may take place while the monitor is in wireless mode, but the patient will not be monitored via wireless at the Infinity CentralStation at that time.*

Wireless Messages

In wireless mode, the messages in the following table may appear:.

Message	Condition	Display Area
Offline	• Monitor travels out of range of AP or • Wireless card removed	Network

Message	Condition	Display Area
Invalid memory card	Wireless card is defective	Local
Wireless option not enabled	• Wireless card inserted without wireless option enabled	Local
Not monitored by central	• Connected to network, but not assigned to a MVWS	Network

Network Transfer

Patient Data

You can transfer patient data (admission, trends, events, and Hemo/Oxy calculations) from one monitor to another. Procedures differ according to whether or not the source and destination monitors are connected to the Infinity network. To transfer information involving a non-networked monitor, you must use a PCMCIA memory card. To transfer information over the network, you can use menu options. See page 4-4 for more information.

Software Licenses

Optional software functions must be “unlocked” (activated) with the proper license before you can use them. Your Biomed can transfer licenses and optional software from the monitor to the network and vice-versa. Refer to your Service and Installation Manual for more information on transferring licenses.

Remote View

If the monitor is connected to the Infinity network, you can view other networked monitors, print their recordings, and silence their alarms from your monitor. Procedures to display the Remote View screen follow. To set menu display time, see Main Menu Setup on page 2-2.

Quick Reference -- Remote View Setup

Menu Item	Description	Settings
Select Remote Bed	Displays up to two waveforms and parameter boxes of a remote bed. If the remote bed is not in alarm, the top two waveforms are displayed on the local bed, otherwise the alarming waveform occupies the bottom channel. **Notes**: • The monitor continuously updates the remote bed label, patient name, and alarm or status messages. • The remote display appears on the bottom half of the screen so that you can continue to display the local monitor's top waveform(s), parameter box(es), and message area.	1) Press the **Fast Access** fixed key. 2) Click on **Remote View**. 3) **Select Remote Bed** to display a list of all beds in the monitoring unit. 4) Click on the label of the bed you wish to view. 5) Press the **Main Screen** fixed key to return to Main Screen, *or* click on **Select Remote Bed** to return to the Remote View menu. **Note**: To access Remote View functions, see the section "Remote View Screen" on page 3-11.
Alarm Group	Assigns the monitor an alarm group number (0 - 255), allowing you to restrict the number of messages received over the network from the central station or other bedsides	1) Press the **Fast Access** fixed key. 2) Click on **Remote View**. 3) Click on **Alarm Group**. 4) Click on the number of the desired alarm group.

Menu Item	Description	Settings
Auto Dual View	Configures the monitor to display any remote bed in alarm that is part of the local bed's alarm group	1) Press the **Fast Access** fixed key. 2) Click on **Remote View**. 3) Click on **Auto Dual View**. 4) Click to toggle **ON** or **OFF**. **Note**: Beds in the same alarm group continue to post messages in the alarm group's network message area when **Auto Dual View** is disabled. If you do not want to display messages at a particular bed, place the bed in its own alarm group by selecting an unassigned Alarm Group number.

Remote View Screen

The Remote View menu bar divides the screen horizontally, separating the remote display from the main screen. Follow the procedures outlined on page 3-10 (**Select Remote Bed**) to display the Remote View screen.

1	Displays **Remote View** menu	**8**	**Screen label** (Display only)
2	Local bed display	**9**	Local bed message
3	Remote View menu bar	**10**	**Remote bed** label
4	**Remote bed** display **(Remote View)**	**11**	**Exit arrow** (Restores local bed display)
5	Remote bed alarm message area	**12**	**Local bed** label
6	Silences Remote bed alarm for 60 seconds	**13**	Initiate **Rremote bed** recording (see note below)
7	Patient name		

NOTE:

- Recordings print on the recorder assigned to the local monitor and show local settings for recording delay, duration, and speed. The remote patient's name and bed label are printed on the recording strip. (For more on timed and continuous recordings, see Chapter 7, Recordings).
- You cannot select waveforms for remote recordings. Waveforms are printed according to the remote bed's recording setup. If the remote bed is configured for manual waveform selection (see page 7-8), the recording's waveforms may differ from those displayed on the Remote View menu.
- If the *local* bed alarms while Remote View is displayed, the monitor behavior depends upon the Remote View Display selection in the Unit Manager menu.
- If the *remote* bed alarms, the top waveform and the alarming waveform channel are displayed. In the presence of multiple alarms, the one with the highest alarm grade is displayed.
- For information about the Alarm Silence feature, see page 5-4.

Privacy

When operating in Privacy mode, the monitor blanks the screen and silences audible alarms at the bedside. This feature is helpful when such displays and alarms are distracting to patients and visitors. All audible alarms are suppressed, and the screen is blank except for a banner reading

Privacy: Press Main Screen to resume monitoring

All other monitoring functions remain active, and you can continue to monitor the patient at the central station.

NOTE:

- Privacy mode available only on bedsides connected to a central station. The monitor exits Privacy Mode any time it is disconnected from the network or the Infinity CentralStation.
- Nurse Call option is still supported in privacy mode.

To activate Privacy mode:

1. Press the **Menu** fixed key.
2. Click on **Privacy**.
3. Press the **Main Screen** fixed key to return to the Main Screen.

WARNING: No audible alarms sound at the bedside, when the monitor is in Privacy mode. Alarms sound only at the Infinity CentralStation.

Chapter 4 Admission, Transfer, and Discharge

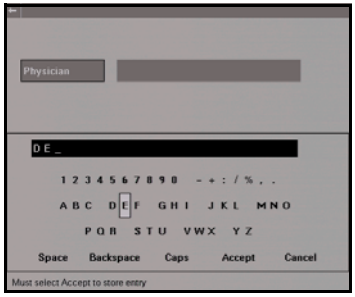
Overview

The Patient Admit screen allows you to enter and edit a patient's personal data (name, ID, birth date, height, weight, admit date, and physician). You can admit patients at the bedside monitor or at the central station, provided your monitor is networked. You can also transfer a patient's data, trends, and calculations from one monitor to another. Transfer procedures differ according to whether or not the source and destination monitors are connected to the Infinity network. Discharging a patient deletes all related data, both on the monitor and at the central station. Monitor and patient settings return to their local default settings and all recordings are cancelled.

Admitting a Patient

To admit a patient at the bedside monitor:

1. Press the **Menu** fixed key.
2. Click on **Admit/Discharge**.
3. Click on **Admit** to display the **Patient Admit** menu.
4. Click on a field (in the example below, **Physician**). A data-entry screen appears.



5. Click successively on the letters of the word you would like to enter. If you make a mistake, click on **Backspace** and try again.
6. Click on **Accept** to confirm your entry.
7. Click on the next field, and repeat steps 5 and 6.

NOTE:

- To change the patient's category (Adult, Pediatric, or Neonatal), you must access the Patient Setup menu. (see pag 2-5).
- If you change a patient's category, the weight selection is cleared and must be selected again.
- In Neonatal mode additional selections (Gestational Age, Birth Weight, Day of Life, and Corrected GA) are available.
- Entries and changes regarding a patient's height and weight affect all other monitor menus and displays that use this information.
- If the monitor is connected to the Infinity Network, you can enter additional patient data such as sex, religion, blood type, and telephone number when you admit the patient at the central station. You cannot, however, view this additional data at the monitor. For information on admission at the central station, see the Instructions For Use for the MultiView WorkStation.

Transferring Patient Data

You can transfer patient data, including trends, calculations, and event recall data, to or from another monitor. To transfer information involving a non-networked monitor, you must use a PCMCIA memory card. To transfer information over the network, you can use either the **Copy Patient Data** (PCMCIA card required) or **Transfer** options of the menu system (see pages 4-4 and 4-6). Certain conditions restrict the transfer of patient data:

- Both source and destination monitors must have the same software level (consult your Biomed for more information).
- You can only transfer calculations if the destination bed supports the Calculations option (see Chapter 14, Calculations).

CAUTION: *When you begin a transfer, the destination monitor discharges the current patient. All patient data currently stored in the destination monitor is overwritten.*

Data Transfer Using the Memory Card

Transferring data from one monitor to another with the PCMCIA memory card is a two-step process: you copy data from the source monitor to the card and then from the card to the destination monitor. After the data has been copied to the monitor, it is no longer available on the card.

The monitor displays the current patient's name and ID number at the beginning of a data transfer. Because the data on the card overwrites data on the destination monitor, you can overwrite one patient's data with another's, effectively discharging the former and admitting the latter. Make sure you copy information to the destination monitor *before* you perform significant monitoring functions.

Memory Card Transfer

WARNING:

- **Use electrostatic discharge (ESD) prevention practices when inserting the PCMCIA card into the monitor. In some environmental conditions, insertion of the memory card could cause the monitor to reset as the result of an ESD event.**
- **The patient's stored event and trend information will be lost after the monitor resets.**
- **Monitoring does not occur during data transfer.**

CAUTION: *Do not remove the memory card while a copy is in process. If the transfer fails, repeat procedure using a new card.*

1. Insert the card in the memory card slot.
2. Press the **Menu** fixed key on the source monitor.
3. Click on **Admit/Discharge**.
4. Click on **Copy Patient Data**.
5. Highlight **Copy To Card** and click**.** On the right side of the screen, a large arrow shows the direction of the data flow.
6. Go to step 7 if the patient's name and ID appear in both the upper and lower windows

or

   — Click on **Patient Admit** and follow standard data entry procedures (page 4-3) if the upper window instructs you to enter a patient's name or ID.

   — A banner informs you that the copy is in process. A message appears when the copy is successfully completed.

7. Remove the memory card from the source monitor.
8. Take the memory card to the destination monitor.
9. Press the **Menu** fixed key on the destination monitor.
10. Click on **Admit/Discharge**.
11. Click on **Copy Patient Data**. The large arrow now indicates that the direction of the data flow is from monitor to card.
12. Click on **Move To Monitor**. If the date and time are correct on both monitors, the following message appears:

    Current data will be replaced. Copy data to Monitor?

    If the date and time are not correct, the following messages may appear to indicate synchronization of monitors is needed:

    Some data on the card is ahead of the monitor's time. That data cannot be copied to the monitor.

    Some data on the card is older than the monitor can accept. That data cannot be copied to the monitor.

13. Click on **Yes** to initiate the transfer, or on **No** to cancel the transfer and return to the Copy Patient Data menu.

Synchronizing the Monitors

To ensure the complete and successful transfer of information, you must check that the date and time of the source and destination monitors are identical. Trend data that is copied from the source monitor 24 hours before or five minutes after the destination monitor time is transferred without interruption. If you attempt to transfer data that falls outside this window of time, a banner appears requesting you to confirm the transfer.

Network Data Transfer

To transfer data over the network, you must interrupt patient monitoring temporarily by putting the source monitor in standby mode. The monitor saves both patient and monitor settings until you exit standby and resume monitoring the same patient. To transfer data over the network:

1. Press the fixed key **Menu**. The Main Menu appears.
2. Scroll to **Standby** and click. The Main Screen goes blank except for the following message:

   Standby: Press Main Screen to resume monitoring.
3. Go to the destination monitor and press the **Menu** fixed key.
4. Click on **Admit/Discharge**.
5. Click on **Transfer** to display the Transfer Patient Data menu. If you are transferring data from outside the destination care unit, go to Step 6. Otherwise go to Step 8.
6. Click on **Select Care Unit to transfer from**. A list of care units appears. (If you are monitoring only one care unit, this item is ghosted.)
7. Click on the care unit *from* which you are transferring data. The selected unit appears next to **Care Unit**.
8. Click on **Select Bed to transfer from** to display beds currently in standby.
9. Click on the source bed to display it on the menu.
10. Click on **Start Transfer to this bed**. The following warning screen appears:
11. Click on **Transfer to this bed** to transfer patient data and display the banner, Transfer In Progress, *or* on **Cancel** to return to the previous menu.
12. Press the **Main Screen** fixed key on the source monitor to exit Standby mode.

Discharging a Patient

You must discharge one patient before admitting another. The monitor otherwise appends existing data to the subsequently admitted patient. You can discharge a patient *only* at the bedside monitor. You cannot discharge a patient at the central station.

To discharge a patient via the **Main Menu**:

1. Press the **Menu** fixed key.
2. Click on **Admit/Discharge**.
3. Click on **Discharge**.

The monitor displays the message:

Discharge will delete patient data.

4. Click on **Discharge** again.

The monitor displays the message, Discharge In Progress... When the patient has been successfully discharged, a discharge banner appears with the message:

Press main screen to resume monitoring.

or

Use the trim knob to click on **Cancel** to return to the Main Menu *without* discharging the patient.

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Chapter 5 Alarms

Overview

You can configure the monitor to display alarm limits--parameter thresholds--which, if violated, trigger an alarm. Limits are displayed both on the alarm limits table and in parameter boxes, where visual or audible alarms alert you to limit violations. Depending on the alarm condition, the monitor announces alarms using one or more of the following indicators:

- Audible tones that reflect the severity of the alarm
- Color changes in the parameter box of the alarm parameter
- Alarm messages in the local message area
- External alarm devices such as a nurse call system
- Activation of an alarm recording

The monitor issues alarms for parameters turned ON in the Alarm Limits table (see page 5-5). It is not a prerequisite for the parameter to be on display or connected for a parameter to alarm.

The monitor does not alarm for Injectate Temperature (IT), Paced beats (% Paced) or Cerebral Perfusion Pressure (CPP)or N2O.

Networked Alarms

The network can broadcast alarm messages to any monitor or central station within the network. In the Infinity network, you can also group monitors into separate alarm groups to limit the number of messages posted at a given device (see page 3-10).

Monitors connected to the network automatically relay alarms to the central station. If the central station cannot acknowledge an alarm within 10 seconds (because of a network interruption, for instance), the monitor displays the message, Network Alarm Error, and sounds a tone at maximum volume (100%). The alarm volume remains set at 100% until you change it on the Alarm Limits menu (page 5-5).

Alarm Grades

The monitor has three alarm levels: life-threatening, serious, and advisory. Each alarm grade has its own distinctive alarm tone and alarm color. If more than one alarm occurs simultaneously, the parameter boxes continue to blink, but the monitor sounds only the highest grade alarm. The cause of an alarm is displayed in the local message area at the top left of the screen. If life-threatening and serious alarms occur simultaneously, the monitor displays the associated alarm messages in sequence. All alarm grades activate any external alarm system which is connected to the monitor.

You can define alarm grades for arrhythmia and ST parameters only, using the arrhythmia setup table (see page 9-6) or the ST alarms table (see page 10-7).

Some alarms are *latched*: they continue to annunciate visually and audibly until you acknowledge them manually, even if the condition that caused the alarm no longer exists. Other alarms may be latched only partially, as indicated in the following table. To acknowledge (or silence) a latched alarm, press the **Alarm Silence** or the **All Alarms Off**.

Alarm Grade	Latching and Recording Behavior	Visual	Audio
L-T (Life-Threatening)	Life-threatening alarms are latched and initiate an alarm recording if the recording function is enabled in the alarm limits table. **Note**: Life Threatening and Serious alarms do not latch in OR mode; see page 2-11 for more information.	Flashing red	Continuous two-tone sequence
SER (Serious) (e.g., neonatal apnea, patient safety conditions during NBP measurements) **Note**: Life Threatening and Serious alarms do not latch in OR mode.	Only the alarm *message* is latched; it continues to display when the alarm condition ceases, while the parameter box stops flashing and the alarm tone ceases. Serious alarms initiate an alarm recording if the recording function is enabled in the alarm limits table.	Flashing yellow	Two tones, then pause
ADV (Advisory) (technical conditions, e.g., misapplied transducer or disconnected lead)	Alarms cease as soon as the cause of the alarm disappears or you acknowledge the alarm. Advisory alarms initiate an alarm recording for events whose recording function is enabled in the arrhythmia or ST table. **Note**: Some advisory alarms will cease during an **All Alarms Off** alarm timeout but will return after the timeout if the condition persists.	Flashing white	Low tone, once every ten seconds.

Alarm Management

Suspending Alarms

You can suspend alarms using the fixed keys on the front of the monitor.

- **All Alarms OFF** -- Press to suspend visual and audible alarms for a user-determined period of time. A banner appears at the top of the screen with the message, *All Alarms Off*. Alarms remain suspended until you press the **All Alarms Off** key again or the timeout period expires.

WARNING: Never leave a patient unattended during an indefinite alarm suspension (e.g., after selecting No Time out). Always enable the alarms again as soon as possible. If you select No Timeout on the Unit Manager menu (see page 2-13), alarms are suspended indefinitely and no timer appears.

NOTE: Monitor may be configured to support a feature that allows the **All Alarms Off fixed** key to be used to extend the **All Alarms Off** time (via incremental presses of the **All Alarms Off fixed** key).

- **Alarm Silence** -- Press to silence an alarm for 60 seconds. Visual alarm indications remain on the screen. The alarm tone resumes if a new alarm occurs during an alarm silence period, or if a life-threatening or serious alarm condition persists past the one minute silence period.
- **Code key** on the remote keypad -- Press once to silence alarm tone (in network mode) or reduce volume to 10% (in standalone mode) and activate and display an event timer. Press again to deactivate all active Code functions. Press a third time to deactivate the event timer. See page 2-16 for more information.

Alarm Control

Many alarm functions, including alarm suspension, validation, and the display of alarm limits, can be configured only on the Alarm Control menu, which in turn is accessible only via the password-protected Unit Manager menu.

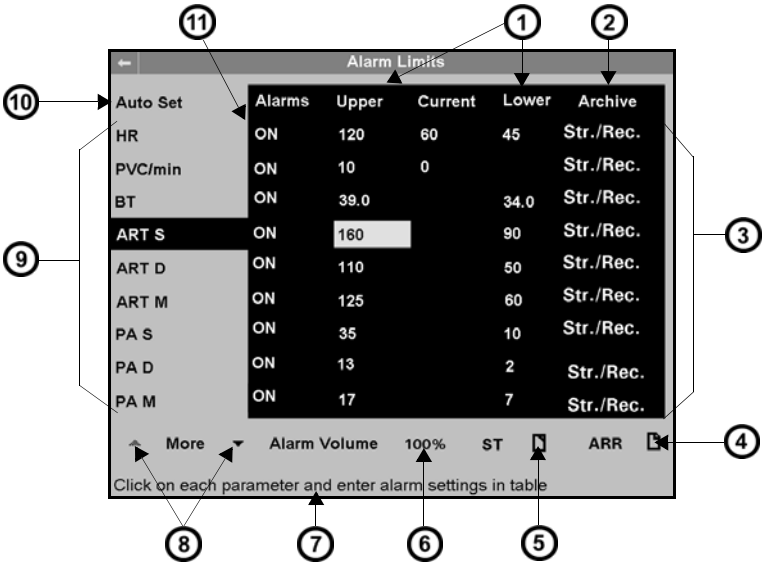
For a description of available functions on the Alarm Control menu, see page 2-10.

Alarm Setup (Alarm Limits Table)

The alarm limits table allows you to modify the alarm limits of multiple parameters in a single location.

The Alarm Limits Table displays values only if the associated parameter has been prioritized (see page 2-6) or the associated monitoring device (e.g., the NBP cuff) is connected.

- Press the **Alarm Limits** fixed key. The Alarm Limits table appears:



1	Set alarm limits
2	**Store** and/or **record** alarms
3	Storage/recording options
4	Access **Arrhythmia setup**
5	Access **ST alarm limits**
6	Alarm volume
7	**On-line help** message
8	Click on arrows to **scroll up** or **down**
9	List of **parameters**
10	Auto set
11	Enable alarms

Upper and Lower Alarm Limits

Alarm limits should be set according to your patient's prevailing condition within the predefined ranges.

of the monitor listed in the following table.

Parameter	Predefined Alarm Range	Default State	Default Alarm Setting
ARR	See "Arrhythmia Setup Table" on page 9-6.		
ART S/M/D	-5 to 300 mmHg (-0.6 to 40 kPa)	Off	**S: (Adult)** *Low* 90mmHg(12 kPa) *High* 160 mmHg (21 kPa) **M: (Adult)** *Low* 60 mmHg (08 kPa) *High* 125 mmHg(17 kPa) **D: (Adult)** *Low* 50 mmHg(07 kPa) *High* 110 mmHg(15 kPa)
			S: (Pediatric) *Low* 50mmHg(07 kPa) *High* 120 mmHg (16 kPa) **M: (Pediatric)** *Low* 50 mmHg (07 kPa) *High* 80 mmHg(11 kPa) **D: (Pediatric)** *Low* 30 mmHg(04 kPa) *High* 80 mmHg(11 kPa)
			S: (Neonatal) *Low* 50mmHg(07 kPa) *High* 120 mmHg (16 kPa) **M: (Neonatal)** *Low* 40 mmHg (05 kPa) *High* 85 mmHg(11.3kPa) **D: (Neonatal)** *Low* 35 mmHg(4.6 kPa) *High* 80 mmHg(11 kPa)

Parameter	Predefined Alarm Range	Default State	Default Alarm Setting
BT	25 to 43 ^{O}C (77 to 109 ^{O}F)	Off	*Low* 34^{O}C (93.2 ^{O}F) *High* 39^{O}C (102.2 ^{O}F)
CPP	-25 to 300 mmHg (-3 to 40 kPa)	Off	*Low* 70 mmHg (09 kPa) *High* 100mmHg (13 kPa)
CVP	-5 to 300 mmHg (-0.6 to 40 kPa)	Off	*Low* 00 mmHg (00 kPa) *High* 20 mmHg (03 kPa)
$etCO_2$	5 to 95 mmHg (0.7 to 12.6 kPa)	Off	*Low* 30 mmHg(04 kPa) *High* 50 mmHg(07 kPa)
FiO_2	18 to 100 %	On	*Low* 18% *High* 100%
GP1/GP2 S/M/D	-5 to 300 mmHg (-0.6 to 40 kPa)	Off	**S: (Adult/Pediatric)** *Low* 90mmHg(12 kPa) *High* 160 mmHg (21 kPa) **M: (Adult/Pediatric)** *Low* 60 mmHg (08 kPa) *High* 125 mmHg (17 kPa) **D: (Adult/Pediatric)** *Low* 50 mmHg (07 kPa) *High* 110 mmHg (15kPa)
			S: (Neonatal) *Low* 50mmHg(07 kPa) *High* 120 mmHg (16 kPa) **M: (Neonatal)** *Low* 40 mmHg (05 kPa) *High* 85 mmHg(11.3kPa) **D: (Neonatal)** *Low* 35 mmHg (4.6 kPa) *High* 80 mmHg (11 kPa)

Parameter	Predefined Alarm Range	Default State	Default Alarm Setting
HR	20 to 300 beats per minute	On	**Adult**: *Low* 45 bpm *High* 120 bpm **Pediatric**: *Low* 50 bpm *High* 150 bpm **Neonatal**: *Low* 80 bpm *High* 170 bpm
iCO_2	2 to 10 mmHg (0.3 to 1.3 kPa) (upper limit only)	Off	*High*: 4 mmHg (0.5 kPa) (upper limit only)
ICP	-25 to 300 mmHg (-3 to 40 kPa)	Off	*Low* 02mmHg (0.26 kPa) *High* 20 mmHg(03 kPa)
LA	-5 to 300 mmHg (-0.6 to 40 kPa)	Off	*Low* 00 mmHg(00 kPa) *High* 20 mmHg(03 kPa)
LV S/M/D	-5 to 300 mmHg (-0.6 to 40 kPa)	Off	**S:** *Low* 75 mmHg (10 kPa) *High* 160 mmHg (21 kPa) **M:** *Low* 40 mmHg (05 kPa) *High* 80 mmHg (11 kPa) **D:** *Low* 02 mmHg (0.26kPa) *High* 25 mmHg (03 kPa)

Parameter	Predefined Alarm Range	Default State	Default Alarm Setting
NBP S/M/D	Adult: 10 to 250 mmHg (1.5 to 33.3 kPa) Pediatric: 10 to 170 mmHg (1.5 to 23 kPa) Neonatal: 10 to 130 mmHg (1.5 to 17 kPa)	Off	**S: (Adult)** *Low* 90mmHg(12 kPa) *High* 160 mmHg (21 kPa) **M: (Adult)** *Low* 60 mmHg (08 kPa) *High* 125 mmHg (17 kPa) **D: (Adult)** *Low* 50 mmHg (07 kPa) *High* 110 mmHg (15 kPa)
			S: (Pediatric) *Low* 50mmHg(07 kPa) *High* 120 mmHg (16 kPa) **M: (Pediatric)** *Low* 40 mmHg (05 kPa) *High* 85 mmHg (11.3kPa) **D: (Pediatric)** *Low* 35 mmHg (4.6 kPa) *High* 80 mmHg (11 kPa)
			S: (Neonatal) *Low* 50mmHg(07 kPa) *High* 80 mmHg (11 kPa) **M: (Neonatal)** *Low* 40 mmHg (05 kPa) *High* 70 mmHg (9.3kPa) **D: (Neonatal)** *Low* 25 mmHg (3.6 kPa) *High* 60 mmHg (08 kPa)

Parameter	Predefined Alarm Range	Default State	Default Alarm Setting
PA S/M/D	-5 to 300 mmHg (-0.6 to 40 kPa)	Off	**S:** *Low* 10mmHg(01 kPa) *High* 35 mmHg (05 kPa) **M:** *Low* 07 mmHg (0.9 kPa) *High* 17 mmHg (02 kPa) **D:** *Low* 02 mmHg (0.26kPa) *High* 13 mmHg (1.7 kPa)
PLS/PLS*	30 to 300 beats per minute	Off	**Adult**: *Low* 45 bpm *High* 120 bpm **Pediatric**: *Low* 50 bpm *High* 150 bpm **Neonatal**: *Low* 80 bpm *High* 180 bpm
PVC/min	Adult and Pediatric: 1 to 50 PVC per minute (upper limit only)	On	High: 10 PVC per minute (upper limit only)
RA	-5 to 300 mmHg (-0.6 to 40 kPa)	Off	*Low* 02mmHg (0.26 kPa) *High* 12 mmHg (1.6 kPa)
RESP	Adult: 5 to 100 breaths per minute Pediatric and Neonatal: 5 to 145 breaths per minute	Off	**Adult**: Low 05 bpm High 30 bpm **Pediatric/Neonatal**: Low 20 bpm High 80 bpm
RRc	5 to 145 breaths per minute	**Adult**: Off **Ped/ Neo**: On	**Adult**: Low 05 bpm High 30 bpm **Pediatric/Neonatal**: Low 20 bpm High 60 bpm

Parameter	Predefined Alarm Range	Default State	Default Alarm Setting
RV S/M/D	-5 to 300 mmHg (-0.6 to 40 kPa)	Off	**S:** *Low* 10mmHg(01 kPa) *High* 35 mmHg (05 kPa) **M:** *Low* 07 mmHg (0.9 kPa) *High* 17 mmHg (02 kPa) **D:** *Low* 02 mmHg (0.26kPa) *High* 13 mmHg (1.7 kPa)
SpO_2/SpO_2*	20 to 100 %	**Adult**: Off **Ped/ Neo**: On	**Adult/Pediatric:** Low 90% High 100% **Neonatal**: Low 85% High 95%
ΔSpO_2%	1 to 100 %	Off	**Adult/Pediatric:** High 20% (upper limit only) **Neonatal**: High 10% (upper limit only)
ST Alarms	Adult and Pediatric: -15.0 to +15.0mm (-1.5 to +1.5 mV) **Note**: For all except **STVM** and **STVCM**	See "ST Alarms Table" on page 10-7.	
Temperature (Ta/b)	-5 to 50 ^{o}C (25 to 120 ^{o}F)	Off	Low 34^{o}C (93.2 ^{o}F) High 39^{o}C (102.2 ^{o}F)
ST Leads (when TruST is **ON**):	Adult and Pediatric: -15.0 to +15.0mm (-1.5 to +1.5 mV)	See "ST Alarms Table on 10-7.	--
Δ**T**	-32 to 35^{o}C (0 to 95^{o}F)	Off	Low 00^{o}C (32 ^{o}F) High 02^{o}C (35.6 ^{o}F)

Modifying Alarm Functions

1. Access the **Alarm Limits** table (see page 5-5).
2. Scroll to the parameter whose alarm functions you wish to configure and click.
3. Scroll to the alarm function you wish to modify (the first column, *Alarms*, is highlighted when you first click on the parameter).

NOTE:

- Turning an alarm **ON** allows those parameters to alarm, whether the parameters are displayed or not. It is not a prerequisite for the parameter to be on display or connected for a parameter to alarm.
- Turning an alarm **OFF** prevents those parameters from alarming.

4. Choose the new setting, and click to confirm your selection.
5. Repeat steps 2 - 4 for each change.

Quick Reference -- Alarm Limits Table Setup

<table>
<tr><th colspan="3">Alarm Limits Table</th></tr>
<tr><th>Function</th><th>Description</th><th>Available Settings</th></tr>
<tr><td>Auto Set</td><td>Sets alarm limits based on current values

<table><tr><th>Parameters</th><th>Upper Limit</th><th>Lower Limit</th></tr><tr><td>Ta, T1a-b</td><td>≤ 107% of current value</td><td>≤ 93% of current value</td></tr><tr><td>ΔT1</td><td>No change</td><td>No change</td></tr><tr><td>SpO_2/ SpO_2*</td><td>Adults 100
Neonates 98</td><td>Current value - (value x 5%)</td></tr><tr><td>ΔSpO_2%</td><td>Current value + 20%</td><td>None</td></tr><tr><td>ST</td><td>Current value + 2.0 mm</td><td>Current value -2.0 mm</td></tr><tr><td>MultiGas O2</td><td>100%</td><td>21%</td></tr><tr><td>All Others</td><td>≤ 120% of current value</td><td>≤ 80% of current value</td></tr></table></td><td>N/A

Notes:

• The monitor recalculates the upper and lower alarm limits based on the parameter values in the Current column.
• Auto Set applies to all displayed parameters and ST parameters only.
• If a calculated limit value falls outside the range for that parameter, the parameter's alarm limits will remain unchanged.</td></tr>
<tr><td>Alarms</td><td>Enables or disables the alarm function for the selected parameter</td><td>• ON
• (Alarm off icon)</td></tr>
<tr><td>Upper</td><td>Determines upper alarm limit</td><td>Settings are parameter-specific</td></tr>
<tr><td>Current</td><td>Read-only; cannot be modified</td><td>N/A</td></tr>
<tr><td>Lower</td><td>Determines lower alarm limit</td><td>Settings are parameter-specific</td></tr>
<tr><td>Archive</td><td>Allows you to store and/or record automatically an alarm event for the selected parameter. You can later review stored alarms on the Event Recall screen.
Note: You cannot turn the Archive option off for asystole and ventricular fibrillation.</td><td>• Store
• Record,
• Str./Rec.
• OFF</td></tr>
</table>

Alarm Limits Shortcut

Each parameter setup menu has an **Alarm** menu selection which opens the **Alarm Limits** table, targeting associated parameters on the **Alarm Limits** table. Exiting the **Alarm Limits** table returns you to the parameter setup screen.

ST and Arrhythmia Alarms

ST and arrhythmia parameters have their own alarm limits configuration screens, which you can access by selecting the ST or ARR control button at the bottom of the alarm limits table (see page 5-5).

Refer to Chapter 10, ST Monitoring, and Chapter 9, Arrhythmia Monitoring, for more information about ST and arrhythmia tables.

Alarm History Table

The monitor stores up to 50 physiological alarm events for each patient. Events are erased when the patient is discharged. Data is stored in the monitor. Data also survives power shutdowns. The Alarm History table records all life-threatening and serious alarms, every activation and deactivation of cardiac bypass mode, every change of patient category, and records each activation of **All Alarms Off** or **Alarm Silence**.

To access the Alarm History table:

1. Press the **Fast Access** key.
2. Click on **Alarm History** to display the Alarm History table.

Anesthesia Alarms

Monitoring may be interrupted or discontinued more frequently during anesthesia than in the course of critical care. For this reason, some alarms behave differently when the monitor operates in OR mode. As shown in the following table, certain alarms stop annunciating when the condition ceases (*one-shot* alarms), while others emit a single attention tone. For more information on OR mode, see page 2-11..

NOTE: You cannot set **Attention Tone Volume** to **OFF** for anesthesia alarms.

Message	Condition	Grade	Annunciation
SpO_2 Transparent	Nothing detected between the sensor's light source and the detector	ADV	One-shot
SpO_2 Light Blocked	Insufficient light for valid measurement	ADV	One-shot
ECG Leads Invalid	• QRS processing leads invalid for > 10 seconds • Faulty electrode contact or lead set • Unplugged lead set • Wrong Cable Type selected on ECG Lead Setup menu (see page 8-15)	ADV	One-shot
Apnea	Breath has not been detected for Apnea Time (**A_T**) **seconds**	No alarm	Single attention tone
	Breath has not been detected for A_T x 2 seconds	No alarm	Single attention tone
	Breath has not been detected for **A_T** x **3 seconds**	SER	One-shot
	Breath has not been detected for **A_T** x **6 seconds**	L-T	One-shot

Notes:

- The information in this table applies to apnea detected by $etCO_2$ monitoring from any source). You can set RRc Apnea Time (A_T) to OFF, 10, 15, 20, 25 or 30 seconds on setup menus for $etCO_2$ or $etCO_2$*.
- If you press the **Alarm Silence** key any time after the monitor's first indication of an apnea condition (A_T), subsequent alarms for that apnea condition do not annunciate.

Chapter 6 Trends

Overview

The monitor stores trend data for all connected signals except automatic pressures (P1a-d, P2a-d, P3a-d).

You can request a trend recording or report and execute a print screen of displayed trends. The monitor deletes all trend data once the patient is discharged.

Automatically stored events are identified on an event summary bar at the top of the trend display as outlined below:

- *Trend Table* -- An icon (|◂) over time line marks manually stored events only; alarms and arrhythmia calls are not marked (see illustration on page 6-7)
- *Trend Graphs* -- A small yellow vertical line marks manually and automatically stored events (see illustration on page 6-4).

For information on marking or storing events (including use of the Event Recall screen), see page 1-17.

Trend Setup

The Trend Setup menu allows you to customize trend functions. To open the Trend Setup menu:

1. Click on the **Menu** key on the front of the monitor.
2. Click on **Monitor Setup**.
3. Click on Trend Setup to display the Trend Setup menu.

Display Mode

There are two modes for determining the order of parameters in Trend Graphs: *Automatic* mode, which displays parameters in the order in which they appear on the Main Screen, and *Manual* mode, which allows you to determine the order of parameters in the trend display.

To determine trend display mode:

1. Access the Trend Setup menu (see page 6-2).
2. Select **Display Mode** and click the rotary knob to switch between **Automatic** and **Manual** modes.

Channel Assignment

You display a parameter trend by assigning parameters to one of twelve display channels. To display parameter trends:

1. Access the Trend Setup menu (see page 6-2).
2. Select **Display Mode** and click the rotary knob to switch between **Automatic** and **Manual** modes**.**
3. Click the knob to select **Manual** mode.
4. Scroll to the channel you want to format and click on it. A list of available parameters appears.
5. Click on the parameter whose trended values you wish to view in Trend Graphs.

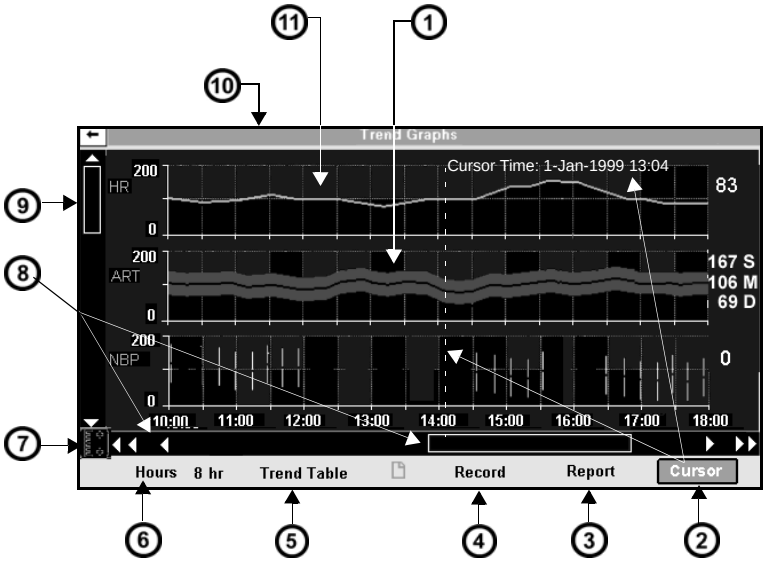
Trend Graphs

Trend graphs display stored trend data in the form of individual graphs for each parameter. These graphs show the behavior of the displayed parameters over a significant time period, three channels at a time. The parameter label in its identifying color and a scale bar appear to the left of the associated trend channel. Vertical lines in each graph mark time divisions. Trends are updated automatically, with the most recent data entering continuously on the right side.

To display Trend Graphs:

1. Click on the **Fast Access** key to display the Fast Access menu.
2. Click on **Trend Graphs** to display the Trend Graphs screen.

Several features are available to help you navigate the Trend Graphs screen. Using the rotary knob, scroll to the desired function and click.



1	**Multiple-value parameter display** – set of variable values (e.g., ART, plotted as a multi-layered band below) (here, top layer = systolic pressure; bottom layer = diastolic pressure; blank "layer" in the middle = mean pressure	**7**	Change scale
2	Activate/cancel cursor	**8**	Scroll intervals
3	Print **Report**	**9**	Scroll trends
4	Request trend recording	**10**	**Vertical marker** showing time of alarm, arrhythmia, or manually marked event
5	Access **Trend Table**	**11**	**Single-value parameter display** -- Single variable value (e.g., HR) plotted as a single continuous line
6	Set intervals		

Changing the Size of Trend Graphs

You can change the scale of an individual trend graph for easier or more detailed viewing.

1. Highlight the scale icon (). Scale values are simultaneously highlighted.
2. Using the rotary knob to scroll through the trend scales, click on the value you wish to change.
3. Dial to the desired value.
4. Click to confirm your choice.

Reviewing Graphs in Time

To review a specific point on the trend graphs.

- Select the vertical bar at the left of the screen and click the rotary knob. Scroll through the trended parameters and click to select the graphs to be viewed.
- Click repeatedly on either pair of arrows below the trend graphs *or* click on the horizontal bar at the bottom of the screen and dial to the desired time.
- Click on **Hours**, dial to the desired trend duration (**1**, **2**, **4**, **8**, **12**, or **24 hr**), and click again to confirm your choice. This function also affects scrolling intervals when you use the horizontal bar or arrows as described above.

NOTE: The monitor's clock controls the time scale. When you adjust the clock, a vertical yellow marker appears at the base of the trend graph. If you adjust the clock more than once in a 24-hour period, only the most recent change is marked.

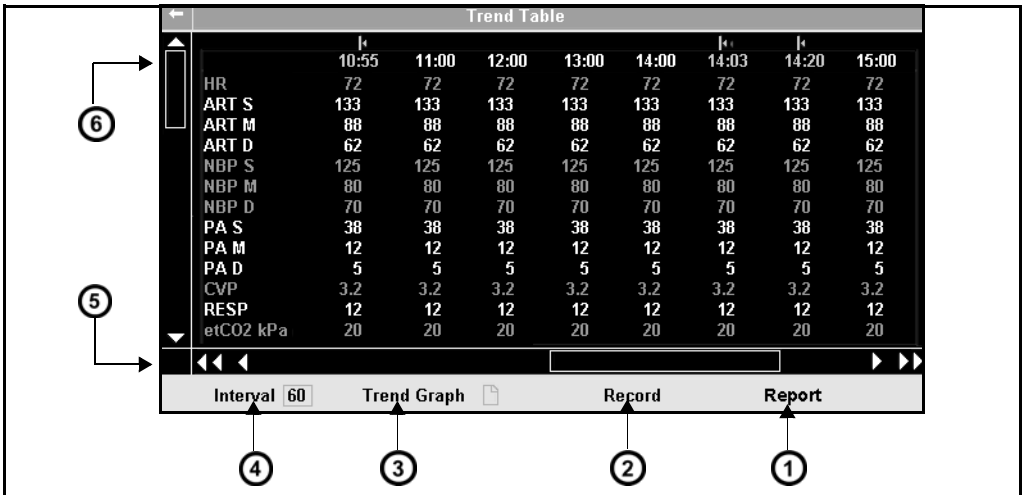
- Click on **Cursor** to display a vertical white line, a corresponding date and time stamp and cursor-time parameter values at the right of the screen. Use the rotary knob to move the cursor to the time you wish to delineate. If no data is stored for that point in time, no value is displayed.

Trend Table

The Trend Table arranges stored trend data in an easy-to-read tabular format. Up to eight columns are displayed and updated every 60 seconds. A time stamp above each column marks the interval during which that column of data was trended. The value displayed is the last acquired during that interval, with the rightmost column reserved for most recent data. To view the Trend Table:

1. Click on the **Fast Access** key on the front of the monitor.
2. Click on **Trend Table**.

NOTE: The time stamp indicates the *end* of the interval. If the Interval option is set to 15 minutes, then the time stamp 11:15 marks a column of data trended between 11:00:00 and 11:14:59.



1	Request trend report
2	Request trend recording
3	Access trend graphs
4	Set intervals
5	Scroll intervals
6	Scroll trends

The Interval key at the bottom left of the Trend Table display functions similarly to the Hours feature in Trend Graphs (see page 6-5).

Settings are **1**, **5**, **15**, **30**, or **60 min**.

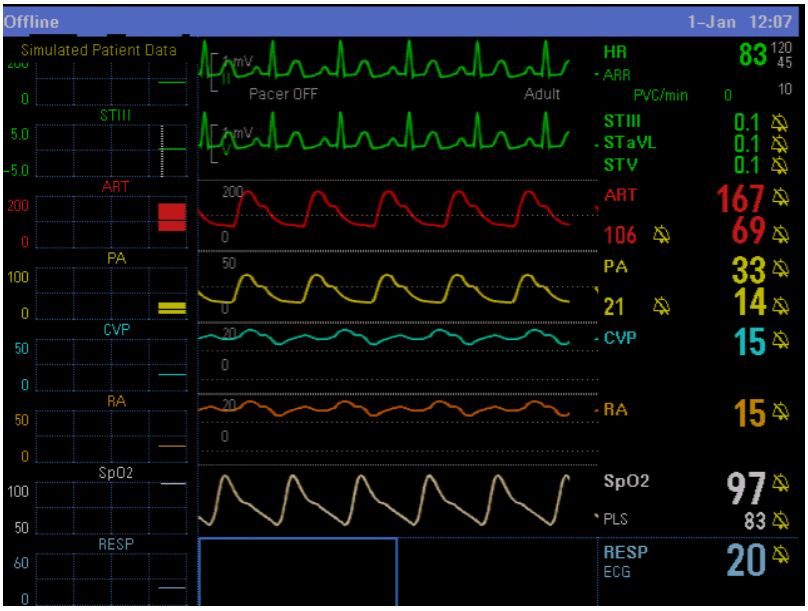
NOTE: The monitor always marks an NBP measurement and a C.O. average with a time-stamp in the trend table.

Mini-Trends

You can display up to one hour of trend data for as many as eight parameters while continuing to monitor Main Screen waveforms and parameter boxes. Mini-trend graphs follow the color coding and display order of the parameters they represent and are updated with new trend data every 60 seconds.

To display Mini-Trends:

1. Press the **Fast Access** fixed key.
2. Click on **Split Screen**.
3. Click on **10 Min Trends**, **60 Min Trends**, or **Off**.
4. Press the Main Screen fixed key to exit the menu.



Mini-trend display **MAIN SCREEN**

NOTE: If a parameter box contains more than one parameter label, you can select the individual parameter setup menu for the trend data you want to see.

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Chapter 7 Recordings

Overview

The monitor can print out a real-time record of its monitoring results on a bedside recorder or on a centrally located recorder within the monitoring network. You can request a recording at the local monitor, a remote monitor in the network (via Remote View screen), or the network's central station.

Recordings are printed on an R50 series recorder, which can be connected to the bedside monitor as well as the Infinity network. The R50 and R50-N are two-channel recorders. .

Recordings are either continuous or timed, and they can be triggered manually or automatically., depending on their origin. The monitor can also print recordings of trends, events, and OCRG waveforms. Alarm recordings may be automatically triggered, depending on how they are configured or on the associated condition (see Chapter 5, Alarms, for more information)

All recordings are identified by the patient name and ID, the bed number, and the date and time of the recording.

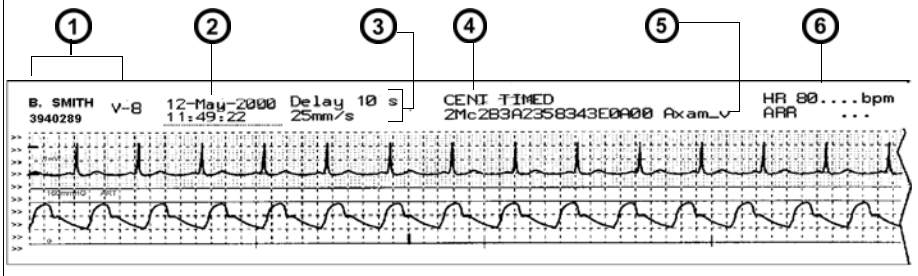
Recordings

Layout

Recordings contain one, two, or three waveforms on 50 mm strips. To print a waveform, you must first display it on the screen. Pressure waveforms are recorded in either standard or overlapped mode, depending on your prior configuration of Pressure Overlap display on the Monitor Setup menu (see page 2-6). A header displays information about the patient, monitor and recorder settings, and currently monitored parameters.

Header Information

The header shows parameter values, patient name, ID #, date and time, and other pertinent information. The following illustration shows a typical timed recording strip. Continuous recording headers do not show a delay time but are otherwise identical to timed recording headers.



1	Patient name, ID, and bed label	4	Origin and type of request
2	Date and time of recording request	5	Diagnostic code
3	Recording delay and recording speed	6	Events and alarm conditions

NOTE: Values and alarm OFF indicators (🔔) active at the time of the recording request are printed after the recording header for each parameter (if appropriate).

Diagnostic Code

The following table explains the characters which make up the diagnostic code in the header of a strip recording. The first column shows each character's position in the string (left to right).

Position	Description	Values	Definition
1	Lead Processed for VF and Pacer Pulse Rejection	X 1 2 3 S T U V + a b c d e f g h i A B C D E F G H I j k l m n o p q r J K L M N O P Q R	None I II III aVR aVL aVF V V+ V1 V2 V3 V4 V5 V6 V7 V8 V9 dV1 dV2 dV3 dV4 dV5 dV6 dV7 dV8 dV9 V1R V2R V3R V4R V5R V6R V7R V8R V9R dV1R dV2R dV3R dV4R dV5R dV6R dV7R dV8R dV9R

Position	Description	Values	Definition
2	ECG Filter	M D E	Monitor Off ESU
3	Pacemaker Detection	C c	On - Artifact Rejection<Medium> Off - Artifact Rejection<Medium>
4	QRS/ARR processing	2 1	ECG1 + ECG2 ECG1
5	Patient Category/QRS Classification	<Space> 1 2 B n	Adult, Neither lead completed learn Adult, ECG1 lead completed learn Adult, ECG2 lead completed learn Adult, ECG1 & ECG2 leads completed learn Neonate
6	Leads available for processing	0 1 2 3	No valid lead to process ECG1 lead valid to process ECG2 lead valid to process ECG1 & ECG2 lead valid to process
7	VT Count	5-F	Value = VT Count (where A-F corresponds to 10-15)
8	VT Rate	0-A	Value = (VT Rate - 100)/10 (where A corresponds to 10)
9	SVT Count	3-A	Value = SVT Count (where A corresponds to 10)
10	SVT Rate	0-A	Value = (SVT Rate - 100)/10 (where A corresponds to 10)
11	TACH Count	5-F	Value = TACH Count (where A-F corresponds to 10-15)
12	TACH Rate	0-A	Value = (TACH Rate - 100)/10 (where A corresponds to 10)
13	BRDY Rate	0-F	Value = (BRDY Rate - 30)/5 (where A-F corresponds to 10-15)
14	PAUS Rate	0-5	Value = (PAUS Rate - 1.0)/0.5 (where A-F corresponds to 10-15)
15	HR Source	E P S	ECG is HR Source IBP(AP) is HR Source SpO_2 is HR Source

Position	Description	Values	Definition
16	RESP Mode	O M A	Resp Monitoring Off Manual Automatic
17	RESP Size	1-K	Value = (RESP Size)/5 (where A-K corresponds to 10-20)
18-19	minutes since breath detector initialization	00-99	Number of minutes that have elapsed since the breath detector was initialized (where 99 corresponds to >= 99 minutes)
20	Not Used	<Space>	N/A
21	Monitor Model	B T	Vista XL Infinity Telemetry
22-26	Software Version	XXXX (ASCII)	First 5 characters of base software (i.e. “VA1.1”)

Timed

Timed recordings are strip recordings of a specified duration (from 6 to 20 seconds). They contain *delay* data that originated *before* the recording was initiated and *real-time* data that was acquired *after* the recording started.

Alarm limit violations and arrhythmia events trigger a timed recording automatically, if the recording and/or alarm function has been enabled on the Alarm Limits table, the ST Alarms menu, or the Arrhythmia Setup menu (see Chapter 5, Alarms).

To request a timed recording:

- Press the **Record** fixed key on the front of the monitor.

To cancel a timed recording:

- Press the **Record** fixed key again *or* the recorder’s **Stop** fixed key.

Continuous

Unlike timed recordings, which run only for a specified time, continuous recordings run until you stop them manually.

To request a continuous recording:

1. Press the Menu fixed key to open the Main Menu.
2. Click on **Cont. Record**.

To stop the recording:

- Click on **Cont. Record** again *or* press the recorder's **Stop** fixed key.

Events and Trends

The monitor can store waveforms and parameter values for up to 50 events (parameter alarms, arrhythmia events, marked events). These are displayed on the Event Recall screen (see page 1-19).

You can print a recording of stored events as well as trends as follows:

1. Press the **Fast Access** fixed key.
2. Click on **Trend Graphs**, **Trend Table,** or **Event Recall**.
3. Click on **Record** at the bottom of the displayed screen.

Pending Recordings

Recorders connected to the monitor may be temporarily unavailable to print (for example, during a paper change). If another recorder is available, the recording is rerouted to that recorder and printed there in its entirety. If no recorder is available, the data becomes a *pending* recording and is printed as soon as a recorder is available. The monitor can store up to six timed recordings and one request for a continuous recording. Print order is determined by the type of recording. Continuous recordings have the highest priority, followed by timed, and then alarm recordings.

NOTE: When the monitor stores a timed recording, it saves the actual monitoring data at the time of the recording request. For continuous recordings, however, the monitor saves only the recording request, and not the actual data.

Recorder Setup

The monitor prints recordings on a bedside R50 recorder or on a networked R50-N recorder. The figure at right shows an R50 recorder. The R50-N recorder, used for printing recordings over the network, looks similar but is slightly larger. The **mm/s** fixed key on the recorder's front panel (**Alternate Speed** on older recorders) allows you to change the recording speed while a recording is in progress. The recorder stops briefly and then restarts automatically at the new recording speed. The **Stop** fixed key, also on the recorder's front panel, stops a recording in progress.

NOTE: The **mm/s** or **Alternate Speed** key only functions while a recording is in progress.

The monitor prints recordings on a bedside R50 recorder or on a networked R50-N recorder. On the R50 Setup menu, you can customize a variety of recorder functions.

To access the R50 series Setup menu:

1. Press the **Menu** fixed key to display the Main Menu.
2. Click on **Monitor Setup.**
3. Click on **Recordings.**
4. Click on **R50 Setup** to display the Setup menu.

Quick Reference: R50 Series Setup Menu

The functions listed on the R50 Setup menu are described below.

Menu Selection	Description	Available Settings
Delay	Determines the amount of pre-event data included in the timed recording You cannot enter a **Delay** value which exceeds the selected **Duration** time.	• 6, 10, 15 s
Duration	Determines the length of a timed recording You cannot enter a **Duration** value less than the selected **Delay** time.	• 6, 10, 15, 20 s
Speed	Determines the recording speed	• 1, 6.25, 12.5, 25, 50 mm/s
Alternate Speed	Determines the recording speed when you press the **Alternate Speed** (**mm/s**) key on R50 Series recorder	• 1, 6.25, 12.5, 25, 50 mm/s
Waveform Selection	Determines whether waveforms to be printed are selected automatically or manually	• **Auto** - The topmost displayed waveforms are automatically selected for recordings. • **Manual** - The waveforms that you have selected (see **Waveform 1** and **Waveform 2**) are printed.

Menu Selection	Description	Available Settings
Waveform 1	Assigns the top waveform for R50 recordings, provided **Waveform Selection** is set to **Manual**	• ECG1, ECG2, RESP, ART, PA, RV, LV, RA, LA, CVP, ICP, GP1, GP2, SpO_2, $etCO_2$
Waveform 2	Assigns the waveform for channel 2 on R50 recordings, provided **Waveform Selection** is set to **Manual**	
Recording mode	Displays current recorder This setting is read-only and cannot be modified.	N/A
Alarm Waveform	Gives priority to an alarmed parameter, which (if **Alarm Waveform** is enabled) appears in the second recording channel regardless of previous waveform assignments **Note**: If the alarmed parameter does not have a waveform (e.g., NBP, TEMP), the recorder prints the assigned waveform to the second recording channel.	• ON -- Places waveform associated with alarming condition in lower recording channel Waveforms are printed according to how you have configured Waveform Selection (Auto or Manual). • OFF

Primary and Secondary Recorders

You can designate a primary and a secondary recorder or a backup recorder on the Infinity Network. The monitor prints to the designated recorder on the network *or* to the local or bedside recorder according to the following criteria:

- The primary recorder prints the recording if no local R50 recorder is connected to the monitor. The secondary recorder prints the recording if the primary recorder is not available.
- The local recorder, if connected, prints the requested recording. If a local recorder is connected but is not available, the secondary recorder executes the print request.

To designate recorders:

1. Press the **Menu** fixed key to display the Main Menu.
2. Click on **Monitor Setup.**
3. Click on **Recordings**.
4. Click on **R50 Assign**. A data entry box appears.
5. Scroll through the numbers and click successively on the single digits of the clinical password. If you make a mistake, click on **Backspace** and try again.

6. Click on **Accept** to open the R50 Assign menu.
7. Click on **Primary Recorder** to display available recorders.
8. Click on the desired recorder.
9. Click on **Secondary Recorder**.
10. Click on the desired recorder.

NOTE:

- **Recording Mode** is a read-only setting; you cannot modify it manually.
- Recorder names are assigned by service personnel when the Infinity Network is configured.
- If your monitor and recorders are not networked, **R50 Assign** is ghosted. To connect the R50-N recorder to the network and to a secondary recorder, see the R50-N Installation Instructions.

Replacing Recorder Paper

When the recorder is about to run out of paper, a red line appears on the recording strip. Replace the paper as soon as possible to ensure continued operation.

To replace the recorder paper:

1. Open the paper door.
2. Pull out the paper roll from the spool holder.
3. Remove any paper remaining in the printing mechanism.
4. Place the new paper roll into the spool holder. Unroll a few inches of paper from the bottom. The printed side should be facing up.
5. Align the paper roll with paper guides. If not aligned, paper could jam.
6. Close the paper door.
7. To verify positive results, generate a timed recording (see page 7-6).

Reports

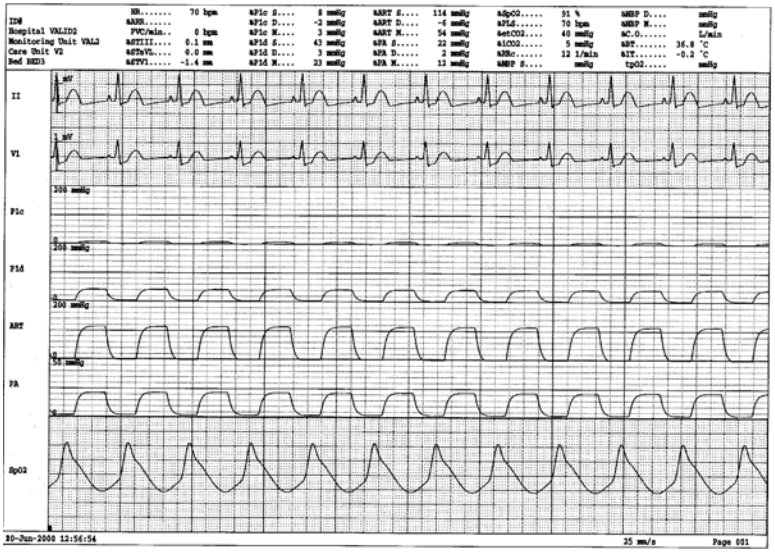
If the monitor is connected to an Infinity network, you can generate reports on a laser printer. In addition to trends, ECG, and standard waveforms, you can also print reports of events and conditions stored in the Event Recall database. For more information, see page 1-19.

To open the Reports setup menu:

1. Press the **Fast Access** fixed key to display the Fast Access menu.
2. Click on **Reports** to display the Reports menu:

Available functions on the Reports setup menu are described in the table “Quick Reference: Reports Setup” on page 7-12.

A typical monitor ECG report follows:



Quick Reference: Reports Setup

Menu Item	Description	Available settings
ECG Report	Prints ECG report Notes: • The Vista XL with TruST can print 12 lead reports that are not diagostic quality.	• Click on printer icon to request report.
Timed Waveforms	Prints timed recording report See page 7-6.	
Continuous Waveforms	Prints continuous recording report See page 7-6.	• Click on icon to request report. • Click again to stop printing.
Waveform Delay	Determines the amount of pre-event data included in the timed recording	• 6, 10, 15 s
Waveform Duration	Determines length of timed report	• 10, 20 s
Trend Graph	Prints graphical trend report See Chapter 6, Trends, for more information.	• Click on printer icon to request report.
Trend Table	Prints tabular trend report See Chapter 6, Trends, for more information.	

Menu Item	Description	Available settings
Trend Duration	Determines length of graphical trend report This item corresponds to the **Hours** setting at bottom of Trend Graphs display. See Chapter 6, Trends, for more information.	• 1, 2, 4, 8, 12, 24 hr
Table Interval	Determines time interval for tabular trend report This item corresponds to the **Interval** setting at the bottom of the Trend Table display. See Chapter 6, Trends, for more information.	• 1, 5, 15, 30, 60 min

Status Messages

Message	Possible Cause	Suggested Action
Check Printer	Printer is not connected.	Check the printer connection.
[Primary/Secondary] Recorder not connected	Recorder is disconnected or the connection is poor.	Connect a recorder and verify that it is appropriately assigned. Inspect cable, replace if necessary.
[Primary/Secondary] Recorder not assigned	You have not specified a recorder.	Specify a recorder from the **R50 Assign** menu.
[Primary/Secondary] Recorder door open	The paper door is open.	Securely close the door to the recorder paper compartment.
Timed recording started	Recorder is currently printing.	Let recorder finish printing.
Recording not accepted	Recorder does not understand print request.	Try again; call Biomed.

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Chapter 8 ECG and Heart Rate

Overview

The monitor can calculate heart rate, detect arrhythmia conditions, and display ECG data. Lead wires are connected to the monitor via special pods designed to facilitate cable management. The MultiMed Pod™ accommodates either standard (3-lead or 5-lead) or optional (6-lead) cable sets.The optional NeoMed Pod™ is designed for 3-lead monitoring. The MultiMed and NeoMed pods also have connectors for an SpO_2 sensor and up to two temperature probes. A connector for an FiO_2 sensor is available only on the NeoMed pod. Before you begin ECG and heart rate monitoring, proceed as follows:

1. Connect the appropriate MultiMed or NeoMed pod to the side of the monitor.

1	**MultiMed 5 pod** with accessories. (NeoMed and MultiMed 3 and 6 pods look identical.)

2. Plug leads and accessories into designated connectors.

NOTE: The MultiMed 6 pod does not support 3 lead monitoring

3. Attach the lead wires to the electrodes on the patient.

ECG Precautions

This section discusses ECG monitoring precautions. See your institution's clinical guidelines for more information.

WARNING:

- **Do not allow conductive parts of electrodes and associated connectors (including neutral electrode) to contact other conductive parts, including earth.**
- **Before attempting cardioversion, always verify the timing of the SYNC pulse (see page 8-18).**
- **Never place defibrillator paddles over ECG electrodes or cables. The discharge can interfere with defibrillation and cause injury to both patient and clinician.**
- **Evoked potential devices may produce interference in ECG monitoring.**

Pacemakers

Difficulties inherent in ECG monitoring require special attention for patients with pacemakers. The monitor errs on the side of caution in cases of uncertain pacemaker performance and may not count QRS complexes in paced patients. False "low rate" alarms may therefore result under the following circumstances:

- Fused beats and asynchronous pacers when coupling intervals are +10 to -90ms
- 700mV pacer pulses followed by QRS complexes smaller than 0.5mV
- Asynchronous pacer pulses with overshoot

The monitor has been successfully tested for pacer pulse rejection. It is not possible, however, to anticipate every clinically possible waveform characteristic.

Consequently, for some paced patients, the monitor may not count heart rates accurately and may misinterpret rate-dependent arrhythmias.

WARNING:

- **Make sure pacer detection is OFF for patients without pacemakers, ON for patients with pacemakers.**
- **Rate meters may continue to count pacemaker rate during cardiac arrest or some arrhythmias. Do not rely entirely upon rate meter alarms. Keep pacemaker patients under close surveillance. See page 8-4 for pacemaker pulse rejection capability.**
- **Do not rely entirely on the displayed heart rate and respiration rate to assess a paced patient's condition. Always observe these patients closely and monitor their vital signs carefully.**
- **Some pacemakers (especially external pacemakers with body surface electrodes) emit pulses with amplitudes far exceeding the 700mV maximum amplitude specified for the monitor. The monitor may, therefore, misinterpret the pulses of such large-amplitude pacers as valid QRS complexes *and may fail to detect cardiac arrest*.**
- **Take extra precautions with patients who have rate-adaptive implantable pacemakers. Patient monitors may cause interference with some rate-adaptive implantable pacemakers. This could cause unnecessarily high paced rates.**

Pacer Detection

When Pacer Detection is enabled, the monitor identifies as a pacer pulse any pulse that meets the following specifications:

Amplitude -- ±2 to ±700 mV
Width (d_p) -- 0.2 to 2.0 ms
Rise/Fall times (min.) -- 0.1 d_p, 100 ms
Overshoot (min.) -- 0.025 a_p, 2 mV
Recharge time constant -- 4 to 100 ms

The monitor identifies detected pacer pulse by a blue mark on the patient's ECG in channel ECG1. If a QRS complex occurs within 250 ms of a pacemaker pulse, that QRS complex is identified as a paced beat. In the HR parameter box, paced beats are identified by the icon **P♥**. Regular beats continue to be identified by the flashing heart symbol (♥).

When Pacer Detection is **OFF**, the message, *Pacer Off,* appears in the ECG1 channel. Configuring the monitor for neonatal monitoring (see page 2-5) or for protection from electrosurgery (see page 8-7) automatically disables Pacemaker Detection.

To activate Pacer Detection:

1. Click on the **HR** parameter box.
2. Click on **ECG Options**.
3. Click on **Filter.**
4. Scroll to *OFF* and click.
5. Scroll to **Pacer Detection** and click to toggle it **ON**.

Using a five-lead or six-lead cable set to maximize your range of signal choices, you can further optimize ECG signal acquisition and processing for paced patients as follows:

1. Activate Pacer Detection as described above.
2. Select the lead with the least interference and highest R-wave for display in channel ECG1.
3. Scroll again to **Filter** on the ECG menu.
4. Toggle between *Monitor* and *OFF* until you determine which setting gives you the clearest signal.

Impedance-Derived Rate Response Pacemakers

Pacemakers with impedance-derived rate response emit pulses which can adjust the pacer rate to the respiration rate. The monitor may interpret the emitted pulses as pacer pulses, superimposing a blue pacemaker spike on the ECG waveform. For impedance-derived rate response pacemakers, modify electrode placement until blue spikes on the waveform disappear.

Electrosurgery

Observe the following precautions during electrosurgery to minimize ESU interference and maximize user and patient safety (see “Safety Considerations” on page VII of this Instructions for Use for general safety precautions during electrosurgical procedures).

WARNING:

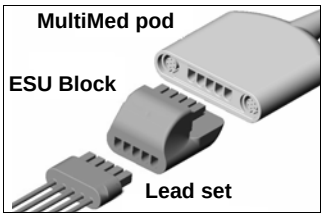
- **Keep ECG, temperature, pressure, SpO_2 transducers, and intermediate cables off earth ground and away from ESU knife and return wires.**
- **Use only Dräger Medical blue ECG lead wires or the ESU block with conventional leads (see page 8-7). They are designed to provide resistance to interference from the ESU and to protect the patient from burns caused by ESU-induced current flowing through the leads. No other lead wires have been tested for this resistance to interference from ESU.**
- **Impedance respiration monitoring and pacemaker spike detection are inoperative when you are using the ESU Block or shielded cables and set the filter to ESU.**

NOTE:

- Place the electrodes as far from the surgical incision as possible while maintaining a clinically useful configuration.
- Place the cable and lead wires as far from the ESU as possible and perpendicular to the ESU cables.
- Use ESU-return electrode with largest possible contact area.
- Whenever possible, place the ESU-return electrode directly under the surgical site, avoiding bony protrusions.
- Replace ECG electrodes regularly.
- Read the operating instructions that came with the ESU for additional information.
- Always use accessories designed for ESU environments.
- Use SpO_2 instead of ECG parameter to determine heart rate.
- Use rectal temperature probe sheaths to cover internally placed temperature sensors.

The monitor’s ECG function is protected against high-frequency interference from defibrillators and electrosurgical units.

To minimize interference from the electrosurgical unit:



1. Click on the **HR** parameter box on the main screen.
2. Click on **ECG Options**.
3. Click on **Filter**.
4. Scroll to **ESU** and click.

ESU Block

The ESU Block enhances monitor performance during electrosurgery. Compatible with 3- and 5-wire ECG lead sets, it reduces noise on ECG waveforms and protects the patient from burns. See Chapter 21, Cleaning and Disinfecting, for information on cleaning the device.

To use the ESU Block:

1. Click on the **HR** parameter box on the main screen.
2. Click on **ECG Options**.
3. Click on **Filter**.
4. Scroll to **ESU** and click.
5. Plug a standard white ECG lead set into the ESU Block as shown. Do not use the shielded blue leads; use only standard white ECG lead sets with the ESU Block.

NOTE: Do not use the ESU Block except during electrosurgery.

Infusion or Roller Bypass Pumps

Infusion or roller bypass pumps may cause artifact in the monitor's ECG signals. Such interference may cause the monitor to display pacemaker spikes even though the ECG waveform appears normal. To determine if the pump is the source of the electrical disturbance, turn it off, if possible. If the artifact disappears, the pump is the probable cause. To minimize such artifact, choose the lead with the best signal for monitoring or replace the electrodes. Rerouting invasive pressure tubing away from the infusion pump tubing may also improve the signals.

Line Isolation Devices

To reduce the effect of line isolation devices, which may cause temporary disturbances (transients) in the ECG signal, take the following precautions:

- Choose the lead with the best signal for monitoring.
- Check the electrodes, and replace them if necessary.

Transcutaneous Electrical Nerve Stimulators

Signals from transcutaneous electrical nerve stimulators (TENS) often resemble pacemaker signals and may be labeled as such by the monitor. The monitor may reject valid QRS complexes which follow misinterpreted TENS signals. To avoid resulting false asystole or “low rate” alarms, follow the steps outlined for assuring signal clarity (see “Pacer Detection” on page 8-4). If TENS signals continue to register as pacer spikes, you may wish to disable pacemaker detection.

Patient Preparation

Careful skin preparation and proper electrode placement support strong signals with minimal artifact. In case of a technical alarm (e.g., a detached lead), re-prep the patient according to the following recommendations.

Follow the clinical techniques approved at your hospital for preparing the patient's skin. For a good quality signal, change electrodes every 24 to 48 hours. Electrodes may have to be changed more frequently under the following conditions:

- ECG signal degradation
- Excessive patient perspiration
- Patient skin irritation

A wide selection of reusable and disposable electrodes is available. Select the best electrode for the monitoring situation. Dräger Medical recommends Ag/AgCl disposable electrodes. If you are using pre-gelled electrodes, verify that there is enough gel in the electrode gel-filled area. Never use disposable electrodes after their expiration date or when the gel has dried out.

Choose electrode sites in the configuration that will provide the best ECG. (P- and T-wave amplitudes should be no more than one third of the QRS amplitude.) Select flat, non-muscular sites to maximize electrode contact and minimize muscle artifact. Avoid joints or bony protrusions. Consider the following special conditions when selecting sites for electrode placement:

Surgery — Keep the electrodes as far from the surgical site as possible.

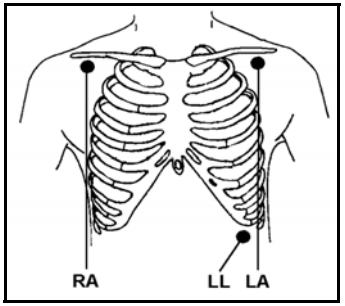
Burn Patients — Use sterile electrodes. Clean the equipment thoroughly. Follow hospital infection control procedures.

Use a piece of waterproof tape (≈ 2 inches wide) or steri-drape to secure electrodes and protect them from fluids. Form a small loop with the lead wire directly beneath connection and secure with tape.

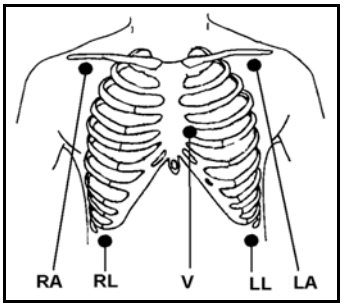
Three-, Five-, and Six-Lead TruST Configurations

The following illustrations show typical ECG lead configurations and color codes designated by the IEC and the AHA/US:

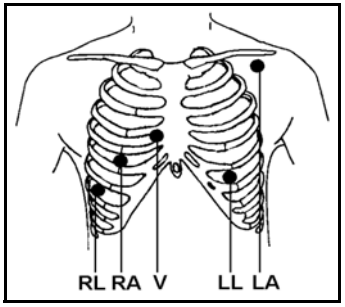
Three-Lead Standard



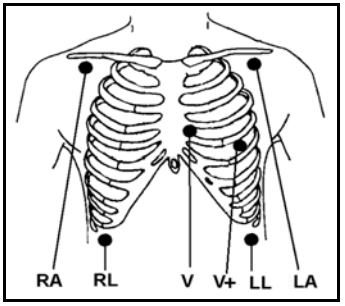
Five-Lead Standard



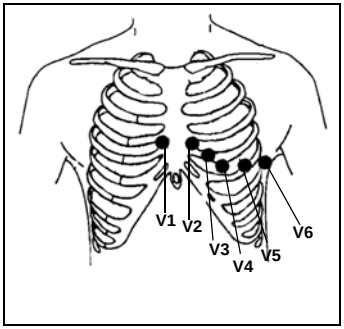
Five-Lead (Paced Patients)



Six-Lead Standard Infinity TruST



Chest Lead Standard



NOTE: For Infinity TruST 12-Lead Monitoring, recommended lead placements for **V** and **V+** are V2 and V5 (Chest Lead).

:

Lead color-coding for 3-, 5-, 6-lead monitoring		
ECG Lead	**AHA/US**	**IEC**
LA	Black	Yellow
LL	Red	Green
RA	White	Red
RL	Green	Black
V	Brown	White
V+	Gray and Brown	Gray and White

Derived Twelve-Lead Configuration (TruST)

Overview

NOTE:

- Infinity TruST is intended for 12-lead ECG monitoring with a reduced electrode set. Reconstructed leads are intended for real-time assessment of ST segment changes.
- TruST is not available in neonatal mode.

For the Vista XL monitor, Infinity TruST is a 12-lead ECG obtained through a MultiMed pod. In general, the signal from a measured lead provides information common to other leads. When this information is appropriately combined, the signal of leads not otherwise configured can be inferred. This type of lead derivation has a high correlation with measured leads. TruST is available in adult and pediatric mode.

TRUST electrodes are placed in the six-lead standard configuration. As with the six-lead pod, waveforms from eight leads can be viewed on the Vista XL monitor, but TRUST also processes and displays four additional lead waveforms. These TruST leads are viewable in the same fashion as the conventional leads. See page 8-10 for “Six-Lead Standard/Infinity TruST” electrode placement.

WARNING:

- **There may be instances where the QRS morphology in one of the four TruST leads differs from that of an equivalent conventional lead. In these instances, always refer to the conventional lead.**
- **Do not select TruST leads for ECG processing.**

TruST Setup

You can select electrode configuration according to TruST twelve-lead format. TruST twelve-lead monitoring is available on the Vista XL monitor only if you are using the MultiMed six-lead pod. If a five or twelve-lead pod is connected, the TruST 12-lead selection is ghosted and unavailable.

To select TruST configuration:

1. Click on the **HR** parameter box.
2. Click on **ECG Options**.
3. Scroll to **TruST 12-Lead** and select **ON**.

ECG Signal Processing and Display

ECG Pod	Cable Set	Channels	Leads Available
NeoMed	3-lead [1]	ECG1	I or II or III
MultiMed 5	3-, 5-lead	ECG1, ECG2, ECG3 [2]	I, II, III, aVR, aVL, aVF, V [3]
MultiMed 6	3-, 5-, 6-lead	ECG1, ECG2, ECG3 [2]	I, II, III, aVR, aVL, aVF, V, V+[3]

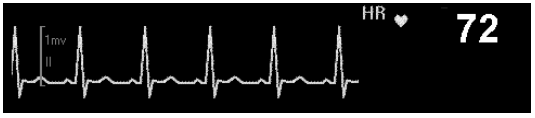
[1]Two-channel ECG and arrhythmia monitoring are not available in neonatal mode.
[2]ECG3 is available only when HR, ARR, and ST parameter boxes are on the Main screen.
[3]V and V+ are chest leads; aVR, aVL, and aVF are augmented leads.

TruST 12-Lead

ECG Pod	Cable Set	Channels	Leads Available
MultiMed 6	6-lead	ECG1[3]	I, II, III, aVR, aVL, aVF, V[1], V+[1], V2[2], V5[2]
		ECG2[3]	I, II, III, aVR, aVL, aVF, V[1], V+[1], V2[2], V5[2]
		ECG3	I, II, III, aVR, aVL, aVF, V[1], V+[1], dV1[2], V2[2], dV3[2], dV4[2], V5[2], dV6[2] NOTE: TruST leads are indicated by a prefix "d" before the V lead.
		Cable Type[1]	- -

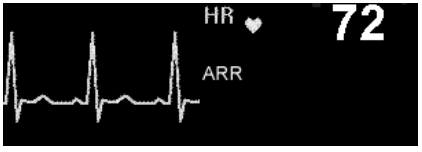
[1]Selection unavailable/ghosted when TruST 12-Lead is **ON**.
[2]Selection unavailable/ghosted when TruST 12-Lead is **OFF**.
[3]Channel does not support display of any TruST leads.

The monitor identifies QRS complexes with amplitudes between 0.2 and 5.0 mV and a QRS width of 70 to 120 ms for adults (or 40 to 100 ms for neonates; see note on page 8-16). It calculates heart rates within a range of 15 to 300 beats per minute, using the R-R intervals of the last 10 seconds and disregarding the two longest and two shortest R-R intervals. It averages the remaining intervals, and displays the result as the current heart rate in the HR parameter box on the main screen.

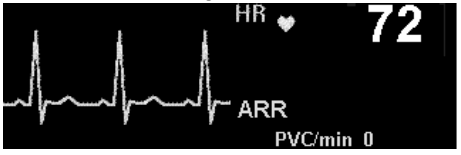


When you enable arrhythmia monitoring, the HR parameter box display changes accordingly. If you select **Basic**, the four basic arrhythmia calls ASY, VF, VT, and ARTF are available for display. If you select **Full** *and* you configure the main screen to display two or more ECG channels, a separate **ARR** parameter box appears under the **HR** parameter box (see page 9-4 for information about selecting an arrhythmia mode).

Basic Arrhythmia Mode



Full Arrhythmia Mode



Alarms and Alarm Conditions

- *Asystole and Ventricular Fibrillation* -- If ECG monitoring is active and the monitor displays at least one ECG waveform, it annunciates asystole and ventricular fibrillation alarms even when arrhythmia monitoring is set to **OFF**.
- *High P-Waves and T-Waves* -- High-amplitude (> 0.2 mV) P- or T-waves of long duration may register as integral QRS complexes. To ensure that the monitor detects low heart rate in such cases, place the lead with the highest R-wave (relative to the T- and/or P-wave) in channel ECG1. If the monitor continues to misinterpret P- or T-waves, reposition the electrodes or use a pulse sensor to monitor the patient.
- Disconnected Electrodes -- If more than one electrode is disconnected, messages are cycled. When any lead is reconnected, all lead data shows a 1 mV pulse in each waveform. The monitor displays the following messages, depending on whether the electrode is essential for QRS processing:

  ECG Leads invalid -- Disconnected electrode is essential

  <XX> Lead Off -- Disconnected electrode is not essential

ECG Setup Menu

- Click on the HR parameter box to access the ECG setup menu. Items and settings are described in the following table.

Quick Reference Table -- ECG Setup

Menu Selection	Description	Available Settings
Show All Leads	Displays all active ECG leads **Notes**: • While **Show All Leads** is displayed, other parameter boxes remain visible and working, and both alarms and recordings continue to operate: but you cannot use the rotary knob to access other menus. • You can also access **Show All Leads** using the fixed keys **Fast Access** (monitor) or **All ECG** (remote keypad). • You can print an ECG report that depicts each waveform if the monitor is on a network and a laser printer is available.	• Click on **Show All Leads** to display all connected ECG leads. • Click on the **Report** at control button at the bottom of the screen to print an ECG report on a network laser printer. • Click on **Notes** at the bottom of the screen to display remarks about the patient's physiological condition. Scroll to the appropriate note and click again. Notes are displayed on the screen and printed on generated reports. • Press the **Main Screen** fixed key to return to the main screen.

Menu Selection	Description	Available Settings
The Size ECG Submenu This submenu allows you to configure the following functions.		
Size ALL ECG	Changes display amplitude of ECG waveforms **Notes:** • If you connect a three-lead cable to the monitor, **Channel 2 Size** and **Channel 3 Size** are ghosted. • The monitor uses an AAMI-compliant regular QRS threshold when you select a channel size of 1, 2, 4, or 8 mV/cm. If you select a channel size of 0.25 or 0.5 mV/cm, the monitor lowers the detection threshold, and the AAMI requirement is not met. • The normal QRS detection threshold is approximately 0.35 mV, depending on the QRS width. If you select a channel size of 0.25 or 0.5 mV/cm, the monitor lowers the detection threshold to approximately 0.2 mV, depending on the QRS width. In such cases, the monitor may include QRS complexes ≥ 0.2 mV, for widths ranging from 70 to 120 ms, and include them in the heart rate calculation (see page 8-13 for more about QRS detection and channel size).	• Click on **Size ALL ECG** to change the amplitude of *all* waveforms on the **Show All Leads** and the main screen.
Channel <#> size		• Click on **Channel 1 size, 2 size,** or **3 size** to change the size of the individual ECG channels.

Menu Selection	Description	Available Settings
The Lead Setup Submenu This submenu allows you to configure the following functions.		
ECG Channels	Determines the number and format of displayed ECG waveforms **Note**: ECG1 and ECG2 do not support the display of any derived leads.	• Click on **ECG1** to display primary ECG signal. • Click on **ECG1 & 2** to display 2 ECG signals. • Click on **ECG1 & 2 & 3** to display 3 ECG channels. • Click on **Cascade** to cascade ECG1 data into second channel.
Channel 1 Channel 2 Channel 3	Selects leads for continuous display in ECG channel(s) on the main screen.	• Click on **Channel 1, Channel 2,** or **Channel 3**, then scroll list of available leads and click to select for display.
Cable Type	Detects automatically the number of leads connected via a MultiMed pod **Note:** Sometimes, however, you may have to select the connected cable type manually. If you cannot display ECG waveforms in **Auto Detect** mode, or if the message, *ECG Leads Invalid,* appears in the upper left corner of your screen, manually select the setting that matches the ECG lead set. **CAUTION**: Verify **Cable Type** setting whenever you begin ECG monitoring; the monitor retains a previous **Cable Type** setting.	• Click on **Auto Detect** for automatic detection of the number of leads in a cable set. The monitor compensates automatically for one disconnected neutral lead. (This feature is available only on this setting.) • Click on **5or 6 Lead** if you are using a 5-lead or 6-lead ECG cable. • Click on **3 Lead** if you are using a 3-lead ECG cable.
The ECG Options Submenu This submenu allows you to configure the following functions.		
Filter	Controls the channel bandwidth and displays a banner in the ECG1 channel if the setting is **OFF**or **ESU** No banner is displayed if you select **Monitor** (default setting). **CAUTION**: The ESU setting, when enabled, automatically disables pacer detection.	• Click on **OFF** for maximum bandwidth and greatest sensitivity to noise or artifact. • Click on **Monitor** to reduce baseline drift, muscle artifact, and power line interference (recommended for standard monitoring, display, recording, and analog output). • Click on **ESU** to reduce signal distortion from electrosurgical units. (See page 8-6 for information on electrosurgical safety.)

Menu Selection	Description	Available Settings
Pacer Detection **Note**: See page 8-4 for more on pacemaker detection.	Determines the monitor's ability to identify pacemaker pulse. Allows user to enable/disable pacer detection or choose more advanced Fusion selection. **Caution**: 'Fusion' mode pacer detection is not intended for use with large- voltage, unipolar pacemakers. It is intended for use only with biphasic pacemakers. Please observe the following: • Before selecting 'Fusion' mode be certain that the patient has a biphasic pacemaker (external or implanted) and that it is accurately programmed as appropriate for that patient. • Do not select 'Fusion' mode if you are uncertain what type of pacemaker is in use, or how it is programmed. • Select 'Fusion' Mode only in situations where it becomes necessary to suppress repeated false asystole and/or false low heart rate alarms.	In "Basic" mode: • Select **ON** to enable pacemaker detection. • Select **OFF** (default) to disable pacemaker detection. In "Advanced" mode: • Select **ON** to enable pacemaker detection. • Select **OFF** (default) to disable pacemaker detection. • Select **Fusion** to enable pacer detection, but minimize pacer tail rejection to reduce missed detection of pseudo-fused paced beats, which results in false asystole alarms. **WARNING**: **Selection of 'Fusion' mode may increase the risk of falsely counting pacer spikes as QRS complexes, and may cause cardiac arrest to be undetected. Special surveillance of any pacemaker patient monitored with this mode is strongly recommended.**
QRS Sync Marker	Displays a vertical white line for each detected QRS complex The monitor continuously generates synchronization output pulses with a maximum delay of 35 ms between R-peak and the synchronization pulse. **CAUTION**: Sync output pulses can trigger the timing of defibrillators during synchronized cardioversion.	• Connect device to the output marked *Sync* on the right side of the monitor. • Select **ON** to enable the **QRS Sync marker**. • Select **OFF** to disable the **QRS Sync marker**.
Pulse Tone Source	Selects the **ECG** or SpO_2 signal as the source for the pulse tone A blinking heart (♥) displays in the parameter box.	• Click on ECG to use the ECG signal as the source for the pulse tone. • Click on SpO_2 to use the SpO_2 signal as the source for the pulse tone.

Menu Selection	Description	Available Settings
Pulse Tone Volume	Regulates pulse tone volume	• Click on **OFF** to silence the pulse tone. • Click on volume (**5** to **100**%) to regulate the pulse tone.
TruST 12-Lead	Allows 12-lead monitoring for the Vista XL monitor through a MultiMed 6 pod	• Select **ON** to enable TruST 12-lead monitoring. • Select **OFF** (default) to disable TruST 12-lead monitoring.
The Brady Alarm Submenu (Visible in neonatal mode only) **Notes:** • When in neonatal mode, bradycardia is a low heart rate alarm. • The Brady Alarm, which is a life threatening alarm, can be configured independently of the low HR alarm, which is a serious alarm. This submenu allows you to configure the following functions.		
Brady Detection	Sets Brady Detection limit.	• OFF • **20 - 100 bpm** in 5 bpm intervals.
Brady Archive	Allows you to store and/or record automatically a bradycardia alarm event. You can later review stored alarms on the Event Recall screen.	• OFF • Record • Store (Default) • Str./Rec.
Other ECG Setup Functions		
HR Alarm	Accesses Alarm Limits table See Chapter 5, Alarms, for more information about setting and displaying alarm limits.	• Click on **HR Alarm** to open the Alarm Limits table with HR-associated alarms prioritized. • **WARNING**: When HR Alarm is “OFF” and ARR monitoring is “OFF”, ASY/VF alarms do not sound unless reset manually by the user.

Menu Selection	Description	Available Settings
HR Source	Selects the source for the heart rate Notes: • This is especially useful during electrosurgery, when the ECG channel is unavailable because of the risk of artifact. • When the monitor is part of a network, the rest of the system continues to display the HR label in the ECG parameter box, regardless of the source. For example, even if you select SpO_2 as the HR source at the monitor, the MultiView WorkStation displays HR in the ECG parameter box.	• Select **ECG** to derive heart rate from ECG signal. • Select **ART** to derive heart rate from Arterial Pressure signal. HR parameter box label changes to APR and displays values in red. If the monitor cannot detect a signal, it defaults to ECG for the heart rate. • Select SpO_2 to derive heart rate from pulse oximetry signal. HR parameter box label changes to PLS and displays values in white. The pulse visual blip and audio tone show no change indicating SpO_2 saturation values. • Select **AUTO** to derive heart rate from ECG signal or other available signals. If an ECG signal is unavailable, the monitor switches to ART, then SpO_2. The pulse visual blip and audio tone are derived from the same parameter as the selected HR source.
QRS/ARR Select	Facilitates accurate detection of HR and ARR calls by allowing you to select single- or dual-channel processing for maximum signal clarity Notes: • How the monitor responds to artifact depends on whether ECG monitoring is configured for single- or dual-channel processing (see column at right). • QRS/ARR Select is ghosted in neonatal mode. • Regardless of your configuration of this setting, the monitor resumes QRS processing but does not initiate a relearn when an artifact clears.	• Click on **ECG 1** to determine heart rate and arrhythmias based on the single best lead. **Note**: The message *ECG Artifact* appears any time the monitor registers artifact. During brief artifact, the heart rate is blanked. During extended artifact, the value is replaced by * * *. • Click on **ECG1&2** to determine heart rate and arrhythmias based on the two best leads. **Note**: The monitor assigns a weight to each of the two leads depending on their level of artifact. The monitor assigns a greater weight to the cleaner lead or channel. When the noise in one channel exceeds a certain level, the channel is excluded from the composite signal, and the monitor effectively shifts to single-channel processing. If both channels show excessive noise, the monitor indicates artifact until at least one of the leads is sufficiently noise-free.
ST Monitoring	Enables/disables ST Monitoring For detailed information, refer to Chapter 10, ST Monitoring.	• Select ON to enable ST monitoring. • Select OFF to disable ST monitoring.

Menu Selection	Description	Available Settings
ARR Monitoring	Selects the Arrhythmia mode For detailed information, refer to Chapter 9, Arrhythmia Monitoring.	• Click on OFF to disable arrhythmia monitoring. • Click on FULL to enable full arrhythmia monitoring. • Click on BASIC to enable basic arrhythmia monitoring.
RESP Monitoring	Enables/disables respiration monitoring For detailed information, refer to Chapter 11, Respiration.	• Select ON to enable respiration monitoring. • Select OFF to disable respiration monitoring.
Relearn	Creates a reference template based on identification of dominant QRS pattern **Note**: This function is ghosted when the monitor is not processing ECG signals.	• Click on **Relearn** to initiate a relearning process. See Chapter 9, Arrhythmia Monitoring, for more information about relearning a reference template.

Status Messages

Message	Definition and/or Possible Cause	Suggested Action
HR > # HR < #	Patient's heart rate outside the current alarm limits	• Observe the patient and treat if necessary. • Change the alarm limits.
HR Out of Range (High)	Patient's heart rate outside the upper measurement range (300 bpm).	• Observe the patient and treat if necessary.
LA Lead OFF LL Lead OFF RA Lead OFF RL Lead OFF Chest Lead OFF	Lead-off condition for the indicated lead detected Cause could be one or more of the following: • Broken cable • Loose lead wire • Faulty lead wire • Wrong lead • Dried out gel on electrode(s).	• Inspect and replace defective cables and wires. • Reapply gel on disposable electrode(s). • If a lead or electrode cannot be replaced, select another ECG lead for processing. • If monitoring augmented leads, verify the number of leads selected in the menu.
ECG Artifact	Patient's movement, shivering, tremors Bad electrode contact Excessive signal noise Interference from auxiliary equipment	• Calm the patient. • Check electrodes and reapply if necessary. • Ensure that the patient's skin is properly prepped. • Isolate the patient from auxiliary equipment, if possible.

Message	Definition and/or Possible Cause	Suggested Action
ECG Leads Invalid	QRS processing leads are invalid for > 10 sec. Bad electrode contact or faulty lead set Unplugged lead set Wrong Cable Type selected on ECG Lead Setup menu (See page 8-17.)	• Inspect and replace defective cables and wires. • Reapply gel on disposable electrode(s). • If a lead or electrode cannot be replaced, select another ECG lead for processing. • Verify that the number of leads selected in the ECG Lead Setup menu matches the applied lead set (see page 8-17).
ECG Report Server Busy - Try Later	Infinity CentralStation currently processing a report	• Wait a few minutes, then try again.
ECG H/W Failure	ECG hardware failure detected by 1 mV test at startup	• Contact Biomed or Dräger Medical Technical Support.
MultiMed Pod Disconnected	The MultiMed is not connected to the monitor during 3, 5, or 6-lead monitoring.	• Check cables and connection; replace cables if necessary. • If MultiMed pod is not in use, press Alarm Silence fixed key.

Chapter 9 Arrhythmia Monitoring

Overview

Arrhythmia monitoring is available for adult and pediatric patients. The mode you select (Full, Basic, or OFF) determines the events processed. Full arrhythmia is a locked option which must be activated by your Biomed. Arrhythmia monitoring is not available for neonates.

The monitor matches incoming beats against beats previously recorded and stored in a reference template. Through this process, the monitor can verify an arrhythmia event's occurrence, classify it, and draw clinically useful conclusions based on the frequency and morphology of the signal. The monitor considers all beats questionable if a baseline shift exceeds specified limits.

WARNING: Electrical artifacts of non-cardiac origin, such as seizure, may prevent detection of certain arrhythmias. Do not rely solely on ECG with seizure-prone patients.

NOTE: Arrhythmia detection may not work properly in all patients. The monitor classifies only QRS complexes ≥ 0.25mV, for widths ≥ 70ms. An artifact condition (**ARTF**) may occur when the ECG signal does not meet these minimums. While continuing to monitor HR, you can turn off ARR Monitoring for patients whose QRS complexes do not meet these minimums.

The monitor uses the results of QRS processing for arrhythmia analysis. During multiple-lead arrhythmia processing, each lead's QRS complexes are measured and compared against its learned dominant normal beat. The monitor classifies beats based on information acquired from all available leads.

About the Arrhythmia Template

The monitor creates a reference template based on its identification of the patient's dominant QRS pattern. It then classifies individual beats by comparing them with the learned reference template. In the third and final phase of arrhythmia processing, the monitor compares sequences of valid beats with the template.

In most situations, the learning phase takes about 30 to 40 seconds. If the monitor detects more than 100 QRS complexes and less than 16 matching beats, it displays the message, *<Unable to learn>*. While the monitor is in the learning phase, all arrhythmia alarms and trend collection are suspended; LRN appears in the parameter box; and the message, *Relearning*, displays in the local message area.

Beat and Rhythm Classification

Beat classification refers to the analysis of *individual* beats. If the new beat's features do not match those of the reference template, the new beat is classified as abnormal, paced, or questionable. The monitor uses all detected beats to calculate the heart rate, eliminating questionable beats from arrhythmia classifications.

Rhythm classification refers to the analysis of *sequences* of beats. The monitor compares the sequence of the last eight beats with the sequences stored in the monitor's memory. If it detects two or more events simultaneously, the monitor alarms in order of event priority.

The following table describes available beat classifications:

Label	**Event and Beat Classification**
ASY	*Asystole:* 4 seconds pass without the detection of a valid QRS complex
VF	*Ventricular Fibrillation:* The monitor identifies a sinusoidal waveform with fibrillation characteristics[1]
VT	*Ventricular Tachycardia:* N or more PVC's are detected in a time interval T = (60 * (N - 1)) / R, where N is defined as the VT count and R is defined as the VT rate
RUN	*Ventricular Run:* Series of 3 to N-1 consecutive PVCs with a beat-to-beat rate ≥ the VT rate[1]
AIVR	*Accelerated Idioventricular Rhythm:* Series of 3 or more PVCs with a rate less than the VT rate
SVT	*Supraventricular Tachycardia:* N or more consecutive normal beats, with a beat-to-beat rate greater than or equal to the SVT setting
CPT	*Ventricular Couplet:* Sequence of beats with the pattern: normal, PVC, PVC, normal
BGM	*Ventricular bigeminy*: Sequence of beats with the pattern: normal, PVC, normal, PVC, normal
TACH	*Sinus Tachycardia:* N or more consecutive normal beats, with a beat-to-beat rate ≥ TACH rate setting[2,3]
BRDY	*Sinus bradycardia:* 8 or more consecutive normal beats, with an average rate ≤ sinus bradycardia rate setting[2] **Notes:** • When in neonatal mode, bradycardia is a low heart rate alarm. • The Brady Alarm, which is a life threatening alarm, can be configured independently of the low HR alarm, which is a serious alarm.
PAUS	*Pause:* Sequence of two beats classified as normal or PVC, with interval ≥ pause rate value in seconds (±100ms)
ARTF	*Artifact:* More than 50% of beats in the last minute classified as questionable

Label	Event and Beat Classification
[1]Certain ventricular tachycardias have sinusoidal waveforms closely resembling those of ventricular fibrillation. Because of the similarity of these waveforms, the monitor may classify such types of ventricular tachycardia as ventricular fibrillation, the more serious of the two conditions. [2] "N" is the event count set in the Arrhythmia setup table's count column. [3]A PVC or other abnormal beat breaks the analysis sequence and restarts analysis.	

Automatic Learning and Relearning

After you connect ECG cables to the patient, the monitor begins to learn a reference template whenever you execute any of the following tasks:

- Turn on the monitor
- Exit Standby mode
- Click on **ARR Monitoring** or **QRS/ARR Select**
- Change the top-channel lead (ECG 1), *or* change the ECG2 channel lead during ECG1&2 processing

Arrhythmia Setup

Modes (Full, Basic, OFF)

You can configure the monitor to process arrhythmia according to the number and variety of events you wish to observe.

1. Click on the ECG parameter box to display the ECG menu.
2. Click on **ARR Monitoring**.

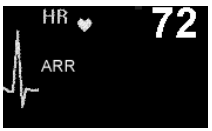
WARNING: When HR Alarm is "OFF" and ARR monitoring is "OFF", ASY/VF alarms do not sound unless reset manually by the user.

3. Scroll through the available settings (**Basic, Full**, or **OFF**) and click to verify your selection.

NOTE: If Full monitoring is installed as a locked option, you can select **Full**, **Basic,** or **OFF**. If not, the choices are **Basic** and **OFF**.

4. As shown in the following table, the monitor reports certain arrhythmia events even if you set **ARR Monitoring** to **OFF**. **Basic** arrhythmia mode allows you

to expand the list of events reported. When **ARR Monitoring** is set to **Full**, the monitor reports all available arrhythmia events.

ARR Mode	Available Display Parameters	Parameter box
OFF	• ASY (Asystole) • VF (Ventricular Fibrillation) • ARTF (Artifact)	
Basic	• ARR (Label to register arrhythmia occurrence) • ASY (Asystole) • VF (Ventricular Fibrillation) • ARTF (Artifact) • VT (Ventricular Tachycardia)	
Full	• All arrhythmia events (See page 9-3 for a complete list.) • PVC (Premature Ventricular Contraction)	

Channel - Lead Selection

Appropriate lead selection is essential for accuracy in arrhythmia monitoring. Ideally, you should assign the two best leads to the top two channels on the monitor. See page 8-15 for more detailed information.

Processing options are:

- **ECG1** (Single-channel option) -- Dedicates processing to the lead that occupies top channel on the monitor screen.
- **ECG 1 & 2** (Dual-channel option) -- Instructs the monitor to determine heart rate and arrhythmia based on the two best leads that occupy the two top channels on the monitor screen.

To configure the monitor for single- or dual-channel monitoring.

1. Click on the ECG parameter box to display the ECG menu.
2. Click on *QRS/ARR Select*.
3. Select **ECG1** or **ECG1 & 2** and click on your choice.

Arrhythmia Setup Table

When the monitor is operating in Full arrhythmia mode, the ARR Setup table allows you to configure arrhythmia monitoring according to your patient's needs. The monitor can detect all events listed in the first column of the table. Using the remaining columns, you can modify the attributes of each event. Fields that are not applicable for a certain event category are blank, while those that cannot be modified are ghosted.

NOTE: The PVC/min limit is set in the Alarm Limits table. The PVC/min current value is only displayed if the monitor is in Full arrhythmia mode. Refer to Chapter 5, Alarms for more information on setting alarm limits.

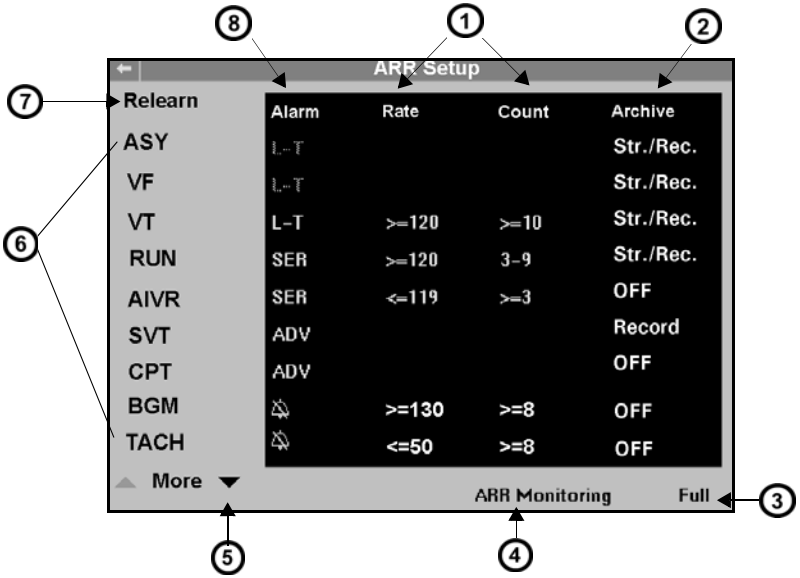
To access the ARR Setup table:

- Click on the ECG parameter box on the main screen

or

1. Press the **Alarm Limits** fixed key.

2. Click on **ARR** at the bottom right of the Alarm Limits table. The Arrhythmia Setup menu appears.



1	Set rate and count
2	Store or record events/alarms
3	Arrhythmia mode settings
4	Set arrhythmia mode
5	Click on arrow to access second page
6	List of parameters
7	Manual relearn
8	Configure alarms

Modifying Arrhythmia Functions

1. Access the ARR setup table (see page 9-6).
2. Scroll to the parameter whose arrhythmia functions you wish to configure and click.
3. Scroll to the function you wish to modify (the first column, *Alarm*, is highlighted when you first click on a parameter).
4. Click to access settings of the selected arrhythmia function.

5. Dial through settings and click to confirm your selection.
6. Repeat steps 2 - 5 to configure additional arrhythmia functions or parameters.

Quick Reference -- Arrhythmia Setup Table

Function	Description	Available Settings
Relearn	Initiates a relearn process. Dräger Medical recommends that you perform a relearn under the following conditions: • A lead is reconnected or electrodes are repositioned. • Eight hours have passed since last reference complex learned. • Questionable arrhythmia calls appear on the patient's ECG. • Other significant changes appear on the patient's ECG.	To learn or relearn the template: 1. Set **ARR Monitoring** to **Basic** or **Full.** 2. Verify the quality of the ECG signal. 3. Ensure that the patient's ECG displays a normal reference pattern. 4. Click on **Relearn** to begin a new learning phase.
Alarm	Sets the alarm grade for an arrhythmia event **Note**: Settings for Asystole (ASY) and Ventricular Fibrillation (VF) are life-threatening and cannot be modified.	• **L-T** (Life-threatening) • **SER** (Serious) • **ADV** (Advisory) • (OFF) **Note**: For more information on alarm grades, see page 5-2.
Rate	With count, determines the point at which an event call is triggered **Notes**: • You cannot modify the rate for the following parameters: ASY, VF, CPT, BGM or ARTF. • RUN and AIVR derive their settings from VT and cannot be modified. They are included to quantify their derivation, based on current VT values.	• VT -- 100 to 200, increments of 10 • RUN -- Same as VT Rate • AIVR -- $\leq VT_{Rate}$ - 1 • SVT -- 120 to 200, increments of 10 • TACH -- 100 to 200, increments of 10 • BRDY -- 30 to 105, increments of 5 • PAUS -- 1.0 to 3.5s, increments of 0.5s

Function	Description	Available Settings
Count	With rate, determines the point at which an event call is triggered **Notes**: • You cannot modify the count for the following parameters: ASY, VF, CPT, BGM or ARTF. • RUN and AIVR derive their settings from VT and therefore cannot be modified. They are included in order to quantify their derivation, based on current VT values.	• VT -- 5 to 15, increments of 1 • RUN -- 3 to VT_{Count} - 1 • AIVR -- Count ≥3 • SVT -- 3 to 10, +1 • TACH -- 5 to 15, increments of 1 • BRDY -- n/a • PAUS -- n/a
Archive	Determines whether the selected event is stored, recorded automatically, or both. You can view stored events on the Event Recall screen (see page 1-19). **Note**: The Archive function for ASY (Asystole) and VF (Ventricular Fibrillation) cannot be disabled.	• Store Stores selected arrhythmia event • Record Automatically generates an alarm recording of selected event • Str./Rec. Event stored and alarm recorded (even when event alarm is turned off) • OFF

Status Messages

Message	Event Definition	Suggested Action
PVC/min > UL	The PVC/min value is above the upper alarm limit.	• Check patient.
Cannot Learn Lead <X>	At the end of the Learning phase, the dominant normal complex could not be determined for Lead <X> (one of the two leads selected for QRS processing). Arrhythmia analysis proceeds using the other lead as a source. Lead <X> is ignored until a *Relearn* is initiated.	• Check leads. • Choose another lead for QRS processing.
Relearning	Monitor is learning a normal QRS complex as a reference template.	• N/A
Unable to Learn	After 100 beats, monitor cannot determine the dominant normal complex on any lead selected for QRS processing. Learning continues.	• Check electrode preparation.
Baseline Artifact	Artifact is blocking arrhythmia classification.	• Check electrode preparation.

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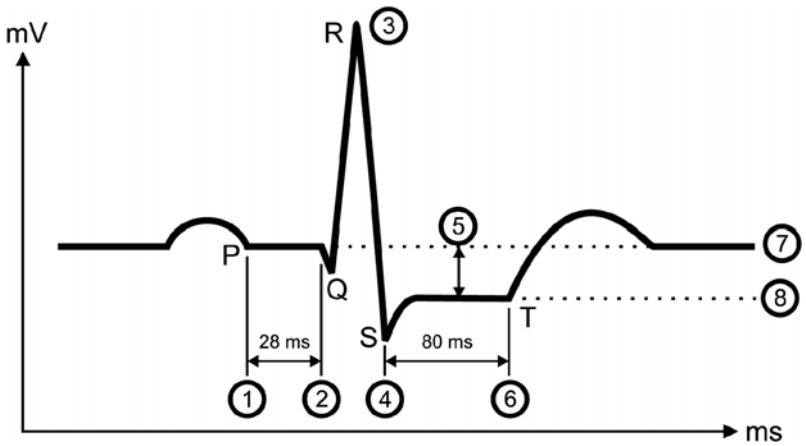
Chapter 10 ST Monitoring

Overview

ST segment deviation is defined as the displacement (in mm) above or below the isoelectric level. The measurement of deviation compares the *isoelectric point* to the *ST measurement point.*

The isoelectric point defines the point of zero voltage (no electrical activity, 0mm) with a default position of 28ms before the onset of the QRS complex on the horizontal (time) axis. The ST point occurs in the ST segment between the QRS offset (J point) and the T-wave, at a default position of 80 milliseconds after the QRS offset. The following figure illustrates a typical QRS complex.



1	Isoelectric Point (Default = 28 ms before QRS Onset)	**5**	ST Deviation
2	QRS Onset	**6**	ST Measurement Point (Default = 80 ms after QRS Offset)
3	Fiducial Point	**7**	Isoelectric Level
4	QRS Offset	**8**	ST Level

The ST analysis feature examines QRS complexes classified as “normal” beats from up to eight selected ECG leads. The monitor learns each ST lead, combining the measurements and features of normal beats into a composite (or average) QRS complex. It derives the ST segment deviation from this average.

When ST monitoring is enabled, current ST values are trended and can be reviewed on the trend display.

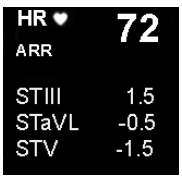
MultiMed Pods for ST Analysis

TruST Twelve-Lead ST Monitoring

For the Vista XL monitor, Infinity TruST is a Twelve-lead ECG obtained through the MultiMed pod. TruST twelve-lead ST processing requires installation of ARIES 12-lead Rest ECG software. TruST allows you to view the same number of leads as a six-lead monitor with an additional four TruST leads.

NOTE: If ARIES software is installed, the monitor issues an ST alarm even for those leads not displayed in the ST parameter box. TruST is part of the ARIES option.

ST Display



When ST Monitoring and ECG monitoring are enabled, the ST parameter box appears just below the HR parameter box on the Main Screen.

You can enable and disable ST monitoring on the ST Analysis menu or ECG setup menu (page 8-15). ST deviation values are displayed in the same format as strip recordings, where 1 millimeter (mm) on the grid corresponds to 0.1 millivolt (mV).

ST Analysis Setup

The ST Analysis menu allows you to execute most of the functions involved in analyzing the ST segment.

To open the ST Analysis menu:

- Click on the ST parameter box (if displayed),

or

1. Press the **Menu** fixed key on the front of the monitor.
2. Click on **Patient Setup**.
3. Click on **Parameters**. A list of available parameters appears.

NOTE: If ST monitoring has been disabled, ST does not appear in the parameter list.

4. Click on **ST**.

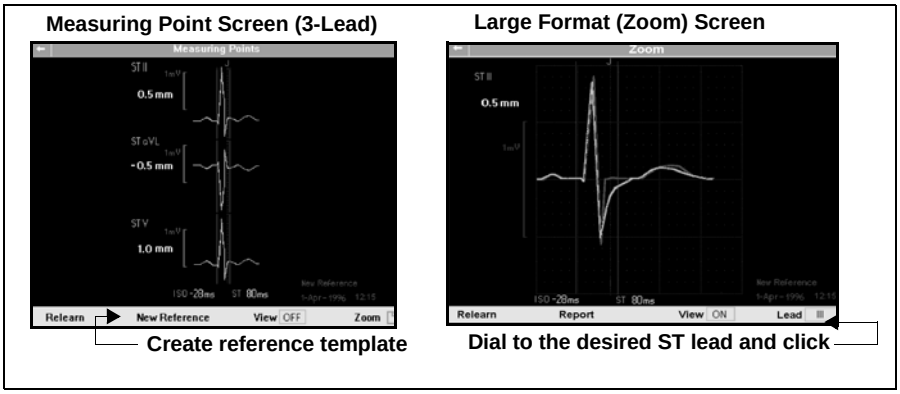
Quick Reference: ST Analysis Menu

Menu Item	Description	Settings
ST Monitoring	Enables / disables ST monitoring **Note**: **ST Monitoring** is ghosted if ECG is disabled or no leads are connected.	• ON • OFF
ST Lead1 ST Lead2 ST Lead3	Selects up to three ECG leads as sources for ST analysis and display in ST parameter box **Note**: All ST leads are monitored if ARIES software is installed.	None, I, II, III, aVR, aVL, aVF, **V[1], V+[1]**, V2, **V3[1], V 4[1], V5, V6[1], dV1[2], dV3[2], dV4[2], dV6[2]**, VM, CVM
ST Mini Trend	Displays up to one hour of trended ST data in mini-trend graphs on left side of main screen **Note**: See page 6-8 for detailed information about mini trends.	None, STI, STII, STIII, STaVR, STaVL, STaVF, **STV[1], STV+[1], STdV1[2], STdV3[2], STdV4[2], STdV6[2]**
[1]Selection unavailable/ghosted when TruST 12-Lead is **ON**. [2]Selection unavailable/ghosted when TruST 12-Lead is **OFF**		
Relearn	• Purges stored average S-T complexes • Blanks average S-T complexes currently displayed on the Measuring Points screen • Learns the patient's arrhythmia and dominant QRS rhythm • Identifies the new dominant QRS complex	**Notes**: • New complexes are displayed on the Measuring Point screen (see page 10-5). • **Relearn** is also accessible from the ECG and ARR setup menus. • All Relearn operations are stored in the trends database.
Show All Leads	Displays the waveforms of all connected ECG leads **Note:** Also accessible from the Main Menu/**Review** submenu and from the Remote Keypad (**All ECG** fixed key).	With an active **Show All Leads** screen: • Leads are displayed on a single "page." Parameter box display, alarm, and recording functions are not affected. • Rotary knob can only scroll **Show All Leads** menu items. • Parameter boxes are visible, but inaccessible.
Measuring Points	Displays average S-T complex for each monitored ST lead **Note**: See page 10-5 for more information.	• **ISO --** Changes the point that defines the isoelectric point • **ST --** Changes the point that defines the S-T measurement point • Recalculates the QRS complex
ST Alarms	Opens ST Alarm Limits Table	See page 10-7.

Measuring Points

The Measuring Points Screen

The starting and ending points for the QRS complex are automatically determined. In practice, however, the accurate determination of the isoelectric and ST measuring points requires careful clinical evaluation. On the Measuring Points screen, accessible via the ST Analysis menu (page 10-3), you can change the isoelectric and ST measuring points to ensure an accurate ST deviation measurement.



Changing the ISO and ST Points

When you change the ST and ISO measuring points on the Measuring Points screen, the monitor recomputes the ST deviation value accordingly (see page 10-6 for directions on changing the ST and ISO points). During this procedure, the changing ST deviation values are displayed in yellow beneath the current values, which appear in green. At the bottom of the screen, the placement of the ISO measuring point (in milliseconds) before QRS onset is displayed next to the label **ISO**, while the placement of the ST measuring point (in milliseconds) after QRS offset is displayed next to the label **ST**.

NOTE:

- It is good clinical practice to check the position of the isoelectric and ST measuring points before starting ST monitoring.
- After a Relearn is complete, the QRS onset and offset are locked until you initiate another Relearn.

On all trend displays, markers indicate changes in the placement of measuring points as well as Relearn operations. The labels **CHG** (Change) and **LRN** (Relearn) appear in time-stamped columns in the Trend Table and in the ST Trend Graphs. Also in the Trend Graphs, a *solid* white vertical line in the ST trend graphs marks the time of a

measuring point change, while a *dotted* vertical line marks the time a Relearn operation was initiated. Use the cursor to pinpoint the time of marked changes and Relearn operations (see page 6-4 for instructions on using the cursor in trend graphs).

NOTE: For information about events and procedures that automatically trigger a Relearn operation, please see page 9-4.

The following table describes procedures for changing the **ISO** (isoelectric) and **ST** points on the Measuring Points screen:

Changing the isoelectric measuring point	Changing the ST measuring point
1. Click on **ISO**. The current ISO measuring point position (in milliseconds) is highlighted. The vertical ISO line changes to yellow.	1. Click on **ST**. The current ST measuring point position (in milliseconds) is highlighted. The vertical ST reference line changes to yellow.
2. Use the rotary knob to move the vertical ISO line along the horizontal axis. As you move the line, the value (also in yellow) changes. The changing ST deviation values are displayed in yellow beneath the current values.	2. Use the rotary knob to move the ST vertical line along the horizontal axis. As you move the line, the ST value (also in yellow) changes. The changing ST deviation values are displayed in yellow beneath the current values.
3. When you reach the desired position on the average S-T complex, click to confirm the new ISO measuring point.	3. When you reach the desired position on the average S-T complex, click to confirm the new ST measuring point.
• The vertical line and the ISO value change from yellow to white.	• The vertical line and the ST position value change back from yellow to white.
• For each average S-T complex displayed, the value (in millimeters) for ST deviation changes to reflect the new ISO measurement point.	• For each average S-T complex displayed, the value (in millimeters) of ST deviation changes to reflect the new ST measuring point.
• The **ISO** and **ST** labels are ghosted if no ST complex is valid. The ST parameter box displays the new ST deviation value after changes are completed.	

ST Alarms Table

The ST Alarms table allows you to modify the alarm limits of multiple ST parameters in a single location. ST alarms are subject to the same alarm guidelines as other parameters (see Chapter 5, Alarms). In addition, control keys at the bottom of the screen allow you to execute the following alarm functions at the ST alarm table:

Menu Item	Description	Settings
Auto Set	Changes the upper and lower limits (mm or mV) for all active ST leads **Note**: The Auto Set feature on the Alarm Limits menu also uses this calculation to adjust alarm limits of active ST parameters (see page 5-14).	• Upper Alarm Limit Current value + 2mm (or 0.2mV) • Lower Alarm Limit Current value - 2mm (or 0.2mV)
Event Duration	Determines the time that a potential alarm condition must persist on ST leads before the monitor classifies it as a valid alarm condition	• OFF • 15 s • 30 s • 45 s • 60 s
Relearn	Initiates a *Relearn* operation (See page 10-4.)	N/A

To access the ST Alarms setup table:

1. Press the **Alarm Limits** fixed key on the front of the monitor.
2. Click on the **ST** control key at the lower right of the screen.
3. Follow the guidelines for modifying alarm limits on page 5-5.
4. Use the control keys at the top of the parameter list (**Auto Set**) and bottom of the screen (**Event Duration**, **Relearn**) to perform other ST alarm functions.

Status Messages

Message	Possible Cause	Suggested Action
ST <x> Out of Range High ST <x> Out of Range Low	The ST algorithm has calculated values ±15mm (or ±1.5mV) outside the high or low end of the ST measurement range.	• Check the isoelectric and ST measuring points. • Observe the patient and treat if clinically indicated.
Cannot Analyze ST	The monitor cannot determine ST values owing to: Absence of normal beats Artifact	• Perform a Relearn. • Calm the patient. • Check electrodes; re-apply if necessary. • Ensure that the patient's skin is properly prepped. • Isolate the patient from auxiliary equipment if possible.
ST <x> > <#> ST <x> < <#>	ST value is outside the upper or lower alarm limit.	• Observe the patient carefully and treat if clinically indicated. • Change the alarm limits.
ST <x> Lead Invalid	Bad electrode contact or faulty lead wire	• Inspect and replace defective cables and wires. • Reapply gel on reusable electrode(s). • Reapply electrodes. Make sure the patient's skin is properly prepped. • If a lead or electrode cannot be replaced, select another ST lead for processing.
MultiMed Pod Disconnected	The MultiMed is not connected to the monitor during 3, 5, or 6-lead monitoring.	Check cables and connection; replace cables if necessary.. If MultiMed Pod is not in use, press Alarm Silence key.

Chapter 11 Respiration

Overview

The monitor measures impedance respiration by passing a harmless high-frequency current between two ECG electrodes on the patient's chest. Electrical resistance (impedance) between the electrodes varies with the chest's expansion and contraction during inspiration and expiration. You can derive a respiration waveform and rate from these impedance changes.

The monitor can use ECG leads I or II for breath detection regardless of the lead selected for QRS processing. The measurement range for impedance respiration monitoring is 0 to 155 breaths per minute. The range for alarm settings is 5 to 150 breaths per minute. In neonatal and pediatric mode, the monitor can detect central apnea.

WARNING: This device does not monitor obstructive apnea.

Using the appropriate accessories, you can also monitor heart rate and SpO_2 and display associated values on an oxycardiorespirogram. See page 11-10 for more information.

RESP Precautions

WARNING:

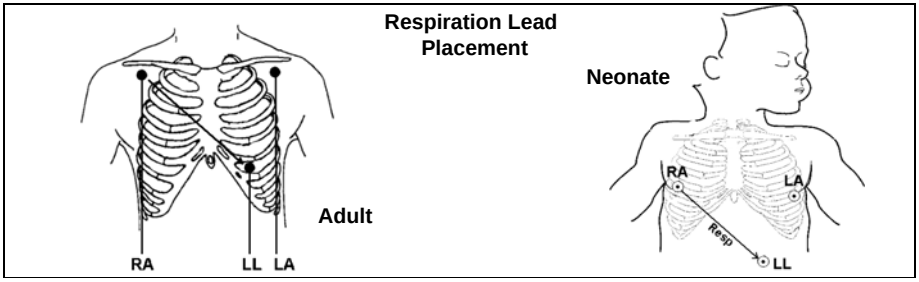
- **For general safety precautions regarding electrosurgery, see“Safety Considerations” on page VII of this Instructions for Use.**
- **Impedance respiration monitoring is inoperative when you are using the ESU Block (see page 8-7) or ESU shielded cables.**
- **Do not rely on impedance respiration monitoring as the sole method for detecting cessation of breathing. Patients at risk for respiratory crises should be observed closely. Heart rate limit alarms should be enabled and set appropriately. Dräger Medical recommends the monitoring of additional parameters that indicate the patient’s oxygenation status, such as $etCO_2$ and SpO_2.**
- **Large amplitude pacer spikes (100mV or greater) may interfere with the monitor’s ability to measure or detect respiration.**

Patient Preparation

Proper skin preparation and careful electrode positioning are essential for reliable results in impedance respiration monitoring. Follow the same recommendations as those for ECG monitoring (see page 8-15).

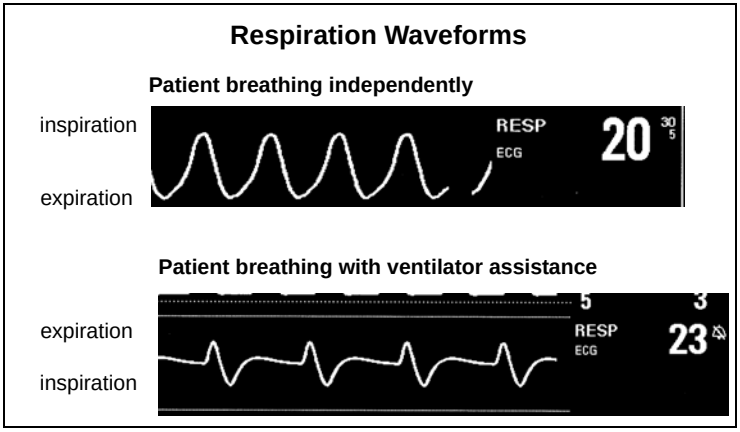
As a rule, place electrodes so that they generate the clearest possible signals with a minimum of artifact. Electrodes that adhere tightly and have a large conductive area give the best results. Use a 5-lead cable set (with RL as a neutral electrode) to improve the RESP signal. You may want to position the electrodes to span the maximum expansion and contraction of the lungs, especially in the case of deep abdominal breathers.

For neonates, place the RA and LA electrodes at nipple level, midaxillary line. Position the LL electrode below the diaphragm and umbilicus. Avoid the liver area and ventricles of the heart to prevent artifacts caused by pulsatory blood flow. The following figure illustrates the recommended placement of ECG leads for impedance respiration on an adult and a neonate:

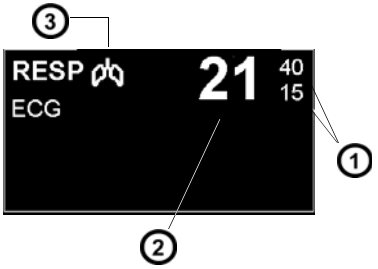


Display Features

Impedance changes are reflected in the respiratory waveform displayed to the left of the RESP parameter box. Waveform morphology differs depending on whether the patient is breathing with or without a ventilator, as shown below.



In the RESP parameter box, a lung symbol ( ) blinks whenever a breath is detected. The display of respiration alarms, alarm limits, and parameter values follows the standard display of other parameters.



1	Alarm limits
2	Respiration rate
3	Breath is detected

RESP Setup Menu

All impedance respiration functions are controlled from the RESP setup menu, which you can open in one of two ways:

- Click on the **RESP** parameter box on the main screen

or

1. Press the **Menu** fixed key on the front of the monitor.
2. Click on **Patient Setup**. A list of available patient setup functions appears.
3. Click on **Parameters** in the second column. A list of available parameters appears.
4. Scroll to **RESP** and click to display the RESP setup menu.

Quick Reference Table -- Respiration Setup

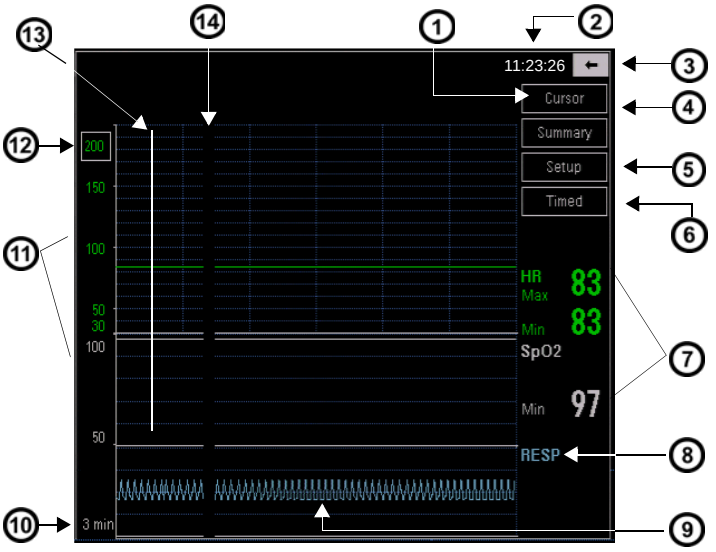
The Respiration Setup Menu		
Menu Item	**Description**	**Settings**
RESP Lead	Determines respiration lead	**I**, **II**
Mode	Determines processing mode for breath-related impedance changes	• **Auto** -- Optimal breath-detection threshold calculated at beginning of RESP monitoring *Intended for patients with regular breathing patterns.* • **Manual** -- No breath-detection threshold set by monitor at the beginning of RESP monitoring Instead, the adjustments you make to the waveform **Size** (see **Size**, below) also adjust the monitor's breath detection sensitivity. *Intended for adult or pediatric patients whose breathing patterns show excessive variation; or for neonates whose breathing rhythms tend to be irregular, and whose respiration signals may not be reliably evaluated in **Auto** mode.* **WARNING**: In **Manual** Mode, if the size of the respiration waveform is set too low, shallow breaths may not be counted. If set too high, cardiac artifact will be counted as breaths. Therefore, always use the **RESP marker** to verify breath detection at the desired amplitude.
Size	Adjusts size of waveform and/or breath detection threshold, according to **Mode** setting: **Auto** mode **—** Waveform only, without affecting the breath-detection threshold **Manual** mode **—** Waveform *and* breath-detection threshold Current, upper, and lower threshold settings are bracketed on the scale bar.	• **5 - 100%** (in 5% increments)

The Respiration Setup Menu		
Menu Item	**Description**	**Settings**
RESP marker	Superimposes a vertical line on RESP waveform when monitor detects a breath **Note**: The monitor may display the RESP marker in cases of artifact or other interference. To set breath-detection thresholds so that only valid breaths are counted: 1. Set the mode to **Manual**. 2. Enable **RESP Marker**. 3. Click on **Size.** 4. Set the Size value at the lowest value where the RESP marker appears.	• ON • OFF ⚠ Cautions: • RESP markers are not transmitted over the network and do not appear on remote views or recordings. • The RESP marker indicates the time of breath detection, not the beginning or end of respiration.
Coincidence Detect	Identifies respiration rate which lies within 20% of the heart rate, indicating that the monitor may be counting heart beats as respiration. ⚠ **Caution:** *Respiration/ heart rate coincidence could mask an apnea condition.*	• ON -- Monitor displays message *RESP Coincidence* whenever respiration/heart rate coincidence is detected (default for Neonatal patient monitoring). • OFF -- Monitor does not detect respiration/heart rate coincidence (default for Adult and Pediatric patient monitoring). **Note**: Enable respiration alarms before setting Coincidence Detect to **ON**.
RESP Monitoring	Enables and disables respiration monitoring **Note:** You can also enable and disable respiration monitoring on the Main Screen and ECG setup menus (see pages 2-2 and 8-15).	• ON • OFF
Apnea Time	Sets the time the monitor waits before reporting a cessation of breathing as an apnea event and sounds an alarm.	• OFF, 10 s, 15 s, 20 s, 25 s, 30 s **Note**: This feature is available in Neonatal and Pediatric patient mode only.
Apnea Archive	Allows user to store and/or record automatically an apnea alarm event. User can later review stored alarms on Event Recall screen.	• OFF, Record, Store (default), Str./ Rec. **Note**: This feature is available in Neonatal and Pediatric patient mode only.

The Respiration Setup Menu		
Menu Item	**Description**	**Settings**
Relearn	Learns the patient's respiration pattern when **Mode** is set to **Auto** **Note**: Initiate a Relearn if electrodes have been repositioned and/or if your patient's breathing pattern changes.	N/A **Note**: **Relearn** is ghosted in manual mode.
RESP Alarm	Displays respiration alarms on the Alarm Limits table.	N/A. See page 5-5 for information about the Alarm Limits table.

OxyCRG (OCRG) Monitoring

The monitor can display an oxycardiorespirogram (OxyCRG, or OCRG) in neonatal mode. The OCRG displays three or six minutes of a continuously updated beat-to-beat Heart Rate trend (bbHR), SpO_2, and respiration/$etCO_2$ waveform, as well as apnea events. The monitor continues to update main screen parameters, announce alarms, and initiate alarm recordings.



1	Activate cursor	**8**	**Respiration/$etCO_2$** label (Apnea label appears when an apnea event occurs and is displayed.)
2	Cursor time	**9**	**Respiration/$etCO_2$** waveform
3	Exit **OCRG** display	**10**	Time Base
4	Display **OCRG** Review, Summary Menu (see p. 12-10)	**11**	Values at cursor time
5	Display **OCRG** Setup Menu (See p. 12-12)	**12**	Scale
6	Trigger a timed recording of displayed parameters	**13**	Cursor
7	Current parameter values	**14**	Eraser bar

To display the OCRG screen:

1. Set the Patient Type to **Neonatal** (see page 2-5).
2. Connect SpO_2 sensors and ECG leads.
3. Set the apnea time on the RESP menu (see page 11-8).
4. Press the **Fast Access** fixed key.
5. Click on **OxyCRG** to display the OCRG screen.

Scale

You can change the bbHR scale as follows:

1. Using the rotary knob, highlight the value at the top left corner of the grid and click.
2. Dial to desired scale setting and click.

Values are shown in the following table (you can modify only the HR scale).

Parameter	Scale	Definition
bbHR	10-180 bpm (lowest setting) 130 - 300 bpm (highest setting)	Highest (Max) and lowest (Min) bbHR value over the last three minutes
SpO_2	50 -100%	Lowest saturation value over last three minutes

Cursor

When you click on Cursor, a vertical bar appears on the trend area of the screen, and cursor time is displayed in the upper right corner.

The numbers on the left side of the screen no longer represent scale values, but rather parameter values at the time marked by the cursor. The monitor continues to display current (real-time) values on the right of the screen. When you move the cursor to the right or the left with the rotary knob, the cursor-time values and the cursor time are modified and displayed accordingly.

Review Summary Screen Overview

Use the Review Summary screen to view stored Bradycardia, SpO_2, and Apnea events. This screen also allows you to access data associated with each event. The monitor stores up to 75 total events, but only retains associated data from the 50 most recent OCRG events (new data overwrites the old).

When an OCRG trigger event occurs, an orange bar appears in the appropriate parameter graph on the OCRG Review Summary screen. Whenever an OCRG event occurs, the monitor automatically captures bradycardia, SpO_2, and apnea event data (if available). Event data associated with the trigger event appears in the other two rows (BRDY, SpO_2, or Apnea) color coded as follows:

- Bradycardia - Green
- SpO_2 - White

Apnea - Blue

Accessing Review Summary Screen

To access the OCRG review screen either:

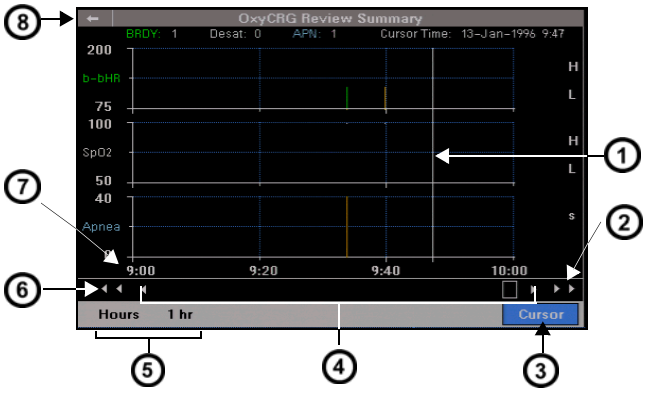
- Enter the Alarm History Table and click on quick access key **OxyCRG Review**.

or

- Click the Summary button on the OCRG screen.

NOTE:

- The OCRG Review Summary screen has no time-out. It stays active until user cancels the display.
- The OCRG Review Summary screen does not update automatically. User must click the back arrow, then click **Summary** button again for updated data.



1	Cursor
2	Right Paging button
3	Cursor Button
4	Horizontal Scroll Bar
5	Time interval setting
6	Left Paging button
7	Time bar
8	Back Arrow

Scrolling through OCRG data

You may scroll through data on the OCRG Review Summary screen in two ways:

- Use the Left or Right paging button.

1. Turn the rotary knob until the Left or Right paging buttons are highlighted.
2. Click the knob to scroll through OCRG Review Summary data without blanking the data.

- Use the Horizontal Scroll bar.

1. Turn the knob until the scroll bar is highlighted.
2. Click once.
3. Turn the knob to update the time bar.

NOTE: Updating the time bar blanks the data until the end of the next step.

Once the time bar shows the time frame desired, click the knob again and the data refreshes.

Time interval setting

To change the time interval scale on the time bar, use the Hours button on the OCRG Review Summary screen.

1. Turn rotary knob until the **Hours** button is highlighted.
2. Press knob to click the **Hours** button.
3. Turn knob to select time interval.

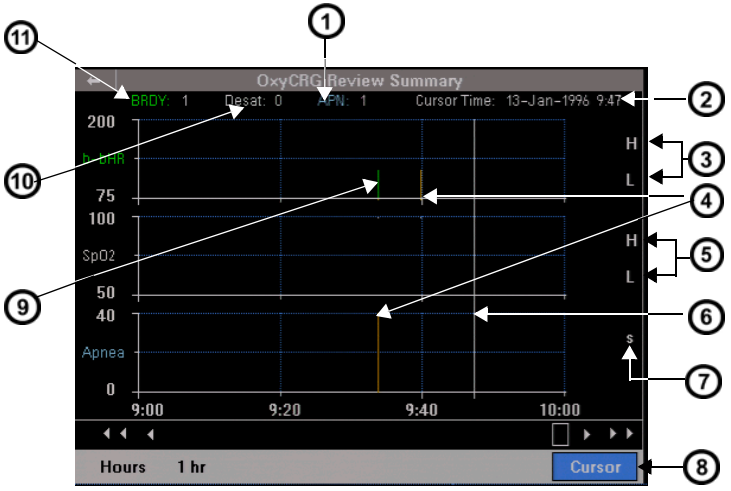
NOTE:

- Default time interval is **4** hours.
- Time intervals available on this screen are **1, 2, 4, 6, 12,** or **24** hours.

4. Click knob and the screen will update to new time interval.

Using the cursor

To view the Event Recall menu, use the **Cursor** button on the OCRG Review Summary screen.



1	Number of apnea events for data on display	**7**	Apnea time
2	Cursor date/time	**8**	Cursor Button
3	BRDY high/low values	**9**	Associated data (green)
4	Trigger event (orange)	**10**	Number of desaturation events for data on display
5	SpO_2 high/low values	**11**	Number of bradycardia events for data on display
6	Cursor		

To access the Event Recall menu from the OCRG Review Summary screen:

1. Turn rotary knob until **Cursor** button is highlighted.
2. Press knob to click **Cursor** button. Cursor and Cursor time appear on screen.
3. Turn knob to move cursor along the data graphed.
4. Move cursor until it overlaps a trigger event. BRDY and SpO_2 high/low data (if available) displays. Apnea time (if available) displays.

5. Press knob and Event Recall menu for this event displays.

NOTE:

- If event cannot be viewed, error tone will sound and “Event Data Not Available” will display. (For more information on the Event Recall screen, see p.1-29.)
- If you have difficulty displaying the trigger event with the cursor, set the time interval scale to a shorter time interval (see p. 11-14).
- If cursor is not overlapping an event, pressing the rotary knob cancels cursor mode.

Quick Reference Table -- OCRG Review Summary

The OCRG Review Summary Menu		
Menu Item	**Description**	**Settings**
Left Paging button (Double Arrows)	Scrolls left through **OCRG Review Summary** data without blanking data.	N/A
Right Paging button (Double Arrows)	Scrolls right through **OCRG Review Summary** data without blanking data.	N/A
Horizontal Scroll Bar	Turning the knob moves horizontal boxcar within scroll window. This updates the **Time bar**, blanking data. Pressing knob after time bar update, restores review screen data.	N/A
Hours	Changes time interval for data on OCRG Summary screen. Press knob to select **Hours** button. Turn knob to select time interval setting. Press knob again for new time interval data to display.	• 1 min • 2 min • 4 min • 6 min • 12 min • 24 min
Cursor	Displays **Cursor** and **Cursor date/time**. Turning knob moves cursor. When cursor rests on an event, press knob and **Event Recall** menu displays for this event. If there is no data for the event, an error tone sounds, and “Event Data Not Available” appears.	N/A

OCRG Setup Menu

Settings for the second and third channel and the Time Base for the Oxy CRG menu are controlled from the OCRG setup menu. To Open OCRG Setup:

1. Press the **Fast Access** fixed key.
2. Click on **OxyCRG** to display the OCRG screen.
3. Click the Setup button on the OCRG screen.

NOTE: The OCRG setup menu has no time-out. It will stay active until the user cancels the display.

Quick Reference Table -- OCRG Setup

The OCRG Setup Menu		
Menu Item	**Description**	**Settings**
Parameter 2	Displays list of label choices for updating second channel of **OCRG** menu.	• SpO_2 •
Parameter 3	Displays list of label choices for updating third channel of **OCRG** menu.	• RESP • $etCO_2$
Time	Displays **Time Base** choices. **Note:** When **Time Base** choice is selected, a clinical password menu appears. After the password is entered, the new **OCRG** Time Base will take effect.	• 3 min • 6 min

Second and Third Channel Label

You may set the second and/or third channel of the OCRG menu.

1. Click the **Setup** button on the OCRG screen.
2. Click **Parameter 2** and select **SpO_2**.

or

3. Click on **Parameter 3** and select **RESP** or **$etCO_2$**.

Time Base

You may select either a three minute or a six minute OCRG time base. The default time base is three minutes.

To change the OCRG time base to six minutes:

1. Click the **Setup** button on the OCRG screen.
2. Click **Time Base**.
3. Click on **6 min**.

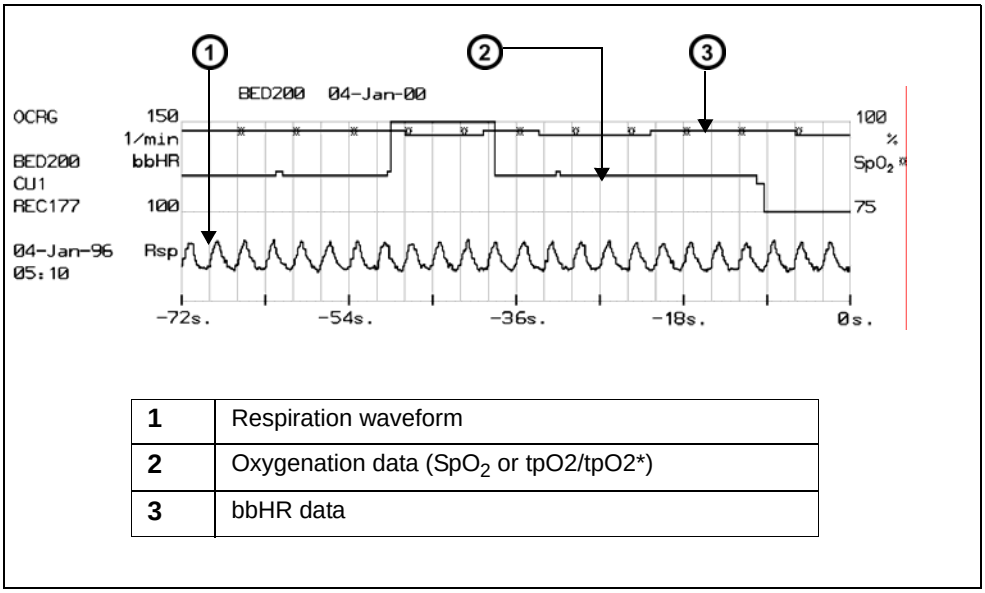
4. Enter clinical password.

NOTE:

- The clinical password menu has no time-out. It will stay active until the user clicks **Accept**.
- After the clinical password is entered, the new OCRG Time Base takes effect and is displayed on the lower left of the OCRG menu.

Recordings

The monitor prints OxyCRG alarm and manual (**Timed**) recordings only when the oxycardiorespirogram is displayed. If no recorder is connected, the monitor stores OxyCRG alarm recordings for later printing. For more information about manual and alarm recordings, see Chapter 7, Recordings. A typical OCRG recording follows.



1	Respiration waveform
2	Oxygenation data (SpO_2 or tpO2/tpO2*)
3	bbHR data

Status Messages

Message	Possible Cause	Suggested Action
RESP > #	The respiration rate is above the upper alarm limit.	• Check the patient and treat if necessary. • Check the placement of electrodes. Change their position if necessary. • Move the electrodes away from the source of interference.
RESP < #	The respiration rate is below the lower alarm limit.	• Check the patient and treat if necessary. • Check the placement of electrodes. Change their position if necessary.
RESP Out of Range (High)	• The respiration rate is higher than 150 breaths per minute. • The monitor may be counting artifacts as valid breaths. • The monitor may be counting interference caused by faulty equipment.	• Check the patient and treat if necessary. • Check the placement of electrodes. Change their position if necessary. • Move the electrodes away from the source of interference.
RESP Apnea (neonatal or pediatric mode only)	No respiration has been detected for <XX> seconds.	• Check the patient and treat if necessary. • Check the placement of electrodes. Change their position if necessary. • Carry out a RESP Relearn or reset breath-detection sensitivity in **Manual** mode.
RESP Coincidence	The patient's heart rate and respiration rate fall within 20% of each other.	• Observe the patient carefully. Treat if necessary. • Check and change the electrode placement if you receive a coincidence message until you obtain a clear respiration signal.

Message	Possible Cause	Suggested Action
RESP: Can't detect coincidence	RESP Coincidence is enabled but there is excessive ECG artifact, or ECG leads are off.	• Calm the patient. • Ensure that the patient's skin is properly prepped. • Isolate the patient from auxiliary equipment. • Check electrodes. Reapply gel or change the electrode if necessary. • Inspect and replace defective cables and wires. • If a lead or electrode cannot be replaced, select another lead for processing (from the ECG menu).
RESP Signal Saturated	RESP signal detected by monitor has excessive baseline shift.	• Check patient cable and lead wires carefully. • Replace any cable or lead wire that is suspect. • Reapply gel or change the electrode. • Check the MULTIMED pod and replace if necessary.
RESP Lead Off	The cause could be one or more of the following: • Broken cable • Loose lead wire • Faulty lead wire • Dried out gel on electrodes • MULTIMED pod defective	• Check patient cable and lead wires carefully. • Replace any cable or lead wire that is suspect. • Reapply gel or change the electrode. • Check the MULTIMED pod and replace if necessary.
RESP Relearning	The user has turned on respiration monitoring or has clicked on Relearn.	• None required
RESP Artifact	Persistent artifact detected.	• Check patient cable and lead wires carefully. • Check electrode placement. Change their position if necessary.
RESP H/W Failure		• Call your Biomed or Dräger Medical Technical Support.

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Chapter 12 Non-Invasive Blood Pressure

Overview

The monitor can acquire and process non-invasive blood pressure (NBP) signals and display the results. Blood pressure measurements are determined by the oscillometric method and are equivalent to those obtained by intra-arterial methods, within the limits prescribed by the Association for Advancement of Medical Instrumentation, Electronic Automated Sphygmomanometers (AAMI/ANSI SP-10).

The monitor's NBP system inflates and then deflates a pneumatic cuff wrapped around the patient's arm or leg. A hose links the cuff to the monitor, which determines systolic, diastolic, and mean blood pressures for adult, pediatric, or neonatal patients. The monitor can initiate blood pressure measurements singly, at set intervals, or continuously over a 5-minute period.

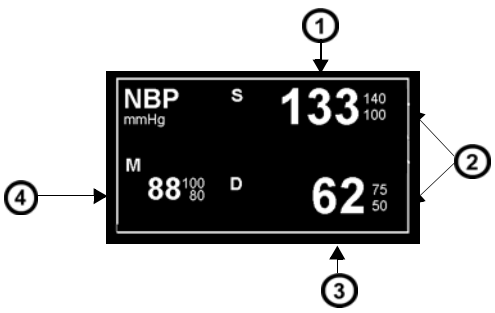
NOTE: NBP functionalities should be calibrated yearly by your Biomed or other qualified personnel, as described in the monitor's Service Manual (see , Safety Considerations of this Instructions for Use).

The monitor can be configured to sound an attention tone whenever an NBP measurement is completed (see page 2-10 for information).

Display Features

The monitor displays non-invasive blood pressure in the form of numerical values and trends. There is no NBP waveform. For information on trended data, see Chapter 6, Trends.

The NBP parameter box shows the latest readings for mean, systolic and diastolic pressure. See page 2-5 for more information on prioritizing and displaying parameter boxes.



1	Systolic pressure
2	Alarm limits (crossed bell icon if alarm is disabled)
3	Diastolic pressure
4	Mean pressure

NBP Setup

Safety Considerations

WARNING: Obstructions may cause the cuff to inflate and deflate improperly and result in inaccurate readings. Check the hose and cuff for damage and dirt. Do not allow the hose and cuff to get in contact with fluids, and make sure that they are not compressed or kinked.

NOTE:

- Place the cuff so that it does not apply pressure to joints.
- Reliable NBP measurements may be difficult to obtain from patients experiencing convulsions, tremors, and various arrhythmias.

Software and Hardware Cuff Pressure Cutoffs

The cuff deflates automatically if a measurement takes longer than 2 minutes in **Adult/ Pediatric** mode or 90 seconds in **Neonatal** mode. To protect the patient from excessive pressure, inflation limits have been established in all patient categories; see Appendix B, Technical Data, for more information.

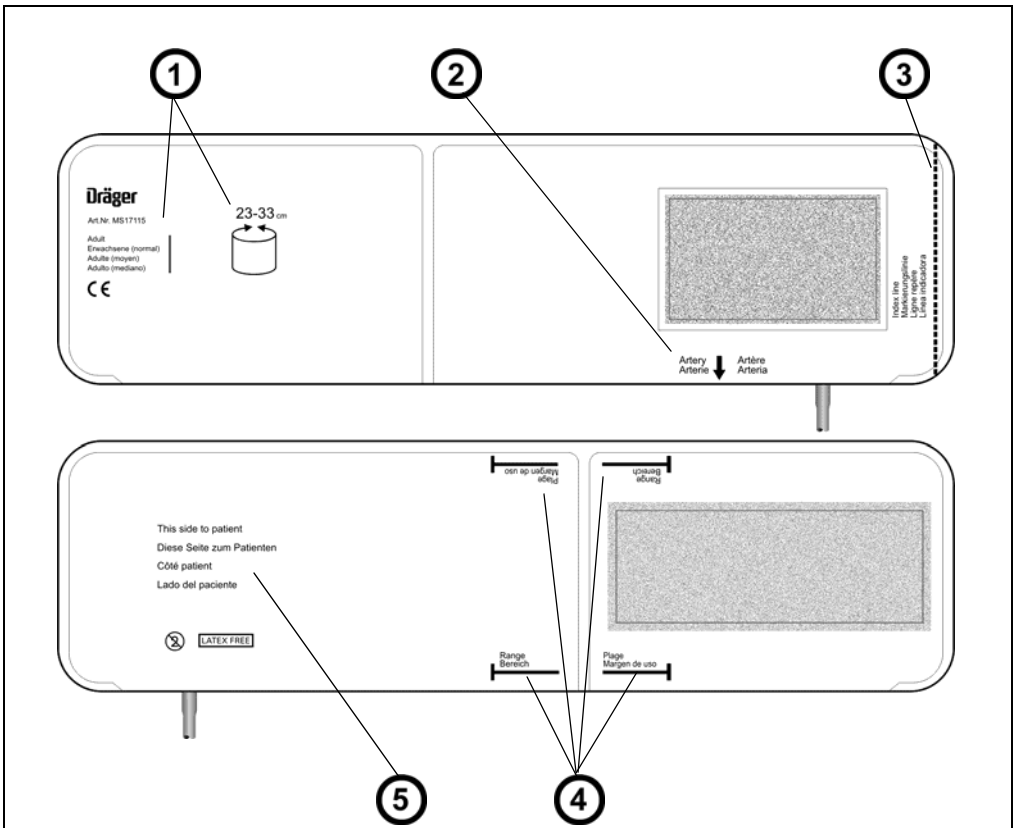
Cuff Selection and Placement

The quality of NBP monitoring depends largely on the quality of the signals received by the monitor. For this reason, it is important to select the correct cuff size for your patient. Cuff sizes are clearly marked on the cuff. Measure the circumference of your patient’s limb. Use only Dräger provided cuffs with your monitor, otherwise the correct functioning of the device may be compromised (see Appendix C, Approved Options and Accessories).

WARNING: The accuracy of the NBP measurement is based upon the correct sizing of the blood pressure cuff, in relation to the patient's arm circumference. The wrong sized cuff, or cuffs falling outside the range or size manufactured by Dräger Medical, may cause inaccurate measurements. Use only Dräger Medical provided cuffs and ensure patient's limb circumference falls within the designated range on the cuff. Use of any non-approved cuffs may compromise the correct functioning of the device.

STEPS: Applying the NBP Cuff

1. Ask the patient to sit or lie down. The limb should be relaxed, extended and placed on a smooth surface for support.
2. Place the cuff at 2 to 5 cm above the elbow crease (or in the middle of the back of the thigh). The cuff label “this side to patient” must be placed against the skin.
3. Place the ARTERY ⬇ marker over the artery, pointing to hand or foot. Once the cuff is applied, the cuff label “index line” must fall within the area marked as “range.”
4. Wrap the deflated cuff snugly around the limb without impeding blood flow.
5. Caution the patient not to talk or move upon inflation of the cuff.



1	Cuff Size Indicators	**4**	Range Labels
2	Artery Label	**5**	Label: This side to patient

3	Index Line	

To avoid kinks in the hose, center the cuff bladder on the artery so that the hose is to the left or to the right of the artery. Ideally, blood pressure measurements should be taken with the cuff positioned at heart level. If the cuff is not placed at heart level, adjust the displayed systolic and diastolic readings +8mmHg for each 10cm above the heart and -8mmHg for each 10cm below the heart. .

WARNING:

- **Do not place cuff on a limb with an intra arterial line, otherwise interrupted or erroneous measurement readings may result.**
- **Do not place cuff on injured or breached skin as it may further injure and/or breach the skin.**

NOTE:

- The accuracy of the NBP measurement is based upon the correct sizing of the blood pressure cuff, in relation to the patient's arm circumference. The wrong sized cuff, or cuffs falling outside the range or size manufactured by Dräger Medical, may cause inaccurate measurements. Use only Dräger Medical approved cuffs and ensure patient's limb circumference falls within the designated range on the cuff.
- There are separate hoses for Ped/Adult and Neonate patient categories. Select the appropriate hose based on intended monitoring application

Connecting the Hose — Push the hose end fitted with the plastic collar firmly into the connector on the left side of the monitor (see figure below.)

Vista XL

NOTE: In selecting a monitoring site, make sure patient connections do not interfere with each other. Dräger Medical recommends that you do not put an NBP cuff on a limb that is already used for other measurements.

Connecting the Cuff — Grasp the hose at the cuff connection and insert it into mating hose connector until it clicks into place. To remove cuff, retract the metal collar on the NBP adapter hose.

Setup Menu and Quick Reference Table

To access the NBP setup menu:

- Click on the NBP parameter box on the main screen;

or

1. Press the **Menu** fixed key on the monitor.
2. Click on **Patient Setup**.
3. Click on **Parameters** in the second column.
4. Click on **NBP**. The NBP menu appears.

The following table briefly describes functions available on the NBP menu.

Function	Description	Settings
Interval Time	Sets interval for series of single NBP measurements	• OFF, 1, 2, 2.5, 3, 5, 10, 15, 20, 25, 30, 45, 60, 120, 240 min
Venous Stasis	Stops blood flow to lower part of cuffed limb for a fixed time	• OFF • ON
Continuous Mode	Initiates successive NBP measurements for 5 minutes	• OFF • ON
Inflation Limit	Sets threshold for maximum cuff inflation, initial inflation will be less. **CAUTION**:A blood pressure systolic value higher than the inflation range may trigger an “NBP low inflation limit” message. In this case, manually check the patient’s blood pressure and select the next higher inflation limit, if appropriate.	• Neonatal patient category -- 140mmHg • **Pediatric** patient category **--** Pediatric -180mmHg Neonatal -140mmHg • **Adult** patient category **--** Adult - 270 mmHg Pediatric -180mmHg Neonatal - 140mmHg Note: User can select inflation limit equal to or lower than the patient category selected. (See above.) No other parameter functions are effected.

Function	Description	Settings
Calibrate Mode	Configures NBP calibration **Caution**: • Only qualified service personnel should access this function. • If you leave NBP Cal Mode ON accidentally, NBP will default to an NBP inactive state. To restore NBP to normal operating mode, power cycle the monitor.	• OFF • ON
NBP Alarms	Accesses NBP alarms and associated variables on Alarm Limits table	• N/A
NBP Chime	Produces a tone when NBP measurement is complete	• OFF • ON

Taking NBP Measurements

Single Measurements

To perform a single measurement:

- Push the **NBP START/STOP** fixed key on front of monitor.

The cuff inflates, then deflates. When an NBP measurement is in progress, the background turns white and the foreground turns black.

When the measurement is complete, a chime sounds (if selected by user) and new data appears. To stop a single measurement in progress, push the **NBP START/STOP** fixed key

NOTE: If an NBP reading is undetermined, the value of the previous reading in the p-box is blanked or displays ***

Interval Measurements

You can take a series of single measurements at specific intervals. The interval time is measured from the start of one measurement to the start of the next. To take a series of measurements:

1. Open the NBP menu (see page 12-7).
2. Click on **Interval Time**.

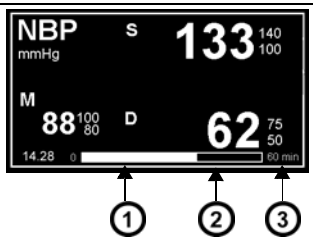
3. Dial to the time interval you want to use.
4. Click on the interval to confirm it.
5. Press the **NBP Start/Stop** fixed key

NOTE: To take the monitor out of interval mode press the **NBP Start/Stop** fixed key twice within one second.

If a series of measurements is already in progress, setting a new interval time resets the timer.

After the first measurement, the NBP parameter box displays results. A countdown bar indicates the amount of time left before the next measurement.

You can take additional single or continuous measurements without affecting the interval cycle. The minimum interval is 30 seconds between the end of one measurement and the start of another to ensure reperfusion of the limb. To stop an interval measurement in progress, press the **NBP Start/Stop** fixed key. The monitor stops the current measurement and resumes the cycle on schedule with the next interval measurement.



1	Time remaining
2	Time elapsed
3	Interval Time

Continuous Measurements

In continuous mode the monitor takes NBP measurements continuously over a period of five minutes.

To start continuous measurements:

1. Open the NBP menu (see page 12-7).
2. Click on **Continuous Mode**.
3. Click to toggle the mode **ON**. The monitor takes NBP measurements for five minutes and continuously updates the NBP parameter box. The previous measurement displays until the current one is complete.

The monitor waits at least two seconds between the end of one measurement and the start of another to ensure reperfusion of the limb. The entire continuous measurement cycle is aborted if there is an NBP alarm.To stop a continuous measurement in

progress, click again on **Continuous Mode** in the NBP menu or press the **NBP Start/ Stop** fixed key. The entire measurement cycle is canceled.

WARNING:

- **Use Continuous Mode only for short periods and under supervision. Clinically verify limb perfusion. Take special care when using continuous mode on neonates or hemomedically compromised patients.**
- **Rapid, prolonged cycling of non-invasive pressure measurements have on occasion been associated with petechia, ischemia, purpura, or neuropathy. Make sure that the cuff is properly attached and check the cuff site regularly to prevent cuff pressure from impeding the blood flow.**

Retried Measurements

If a measurement is unclear, the monitor aborts it and tries again, provided the inflation limit is set to Adult - 180 or 270 mmHg**.** The monitor does not retry at any other inflation limit settings. If a second attempt fails, the monitor displays an error message. Error messages may affect display or measurement, as follows:

- *Mean Only*--Monitor displays mean pressure in parameter box and replaces systolic and diastolic values with *** * ***

NOTE: In some cases, where conditions include very low systolic and diastolic pulse amplitude or significant motion, monitor may display a Mean (MAP) only measurement.

- *Cannot Measure*--Monitor stops measurement and replaces all NBP values with *** * ***
- *No Pulsation*--Monitor stops measurement
- *Open Line*--Monitor stops measurement
- *Measurement Timeout*--Monitor stops measurement

Venous Stasis

By inflating and maintaining a constant pressure in the cuff, the monitor stops the flow of blood to the lower extremity of the cuffed limb long enough to cannulate the patient. The cuff in Venous Stasis mode will occlude the limb for about as long as an

NBP measurement (approximately two minutes for adult and approximately one minute for neonatal).

WARNING:

- **Do not use Venous Stasis on any limb not indicated for NBP measurement (e.g., an arm with catheter).**
- **Press the NBP Start/Stop fixed key to deflate the cuff rapidly if an adverse effect occurs on the patient.**

To begin cuff inflation, click on Venous Stasis. Click again to terminate the procedure and deflate the cuff. During Venous Stasis, the monitor displays the cuff pressure in the upper right corner of the screen, while the label *STASIS* and time remaining are displayed in the NBP parameter box.

You cannot enable **Venous Stasis** if you are currently taking continuous measurements. Interval measurements are suspended during **Venous Stasis** but resume immediately after the cuff deflates.

The monitor determines initial and maximum cuff inflation pressure and inflation time according to the category of the patient, as shown in the following table:

Inflation	Adult	Pediatric	Neonatal
Initial and Maximum Inflation Pressure (mmHg)	80 ± 5	60 ± 4	40 ± 3
Inflation Time (secs)	120 ± 5	120 ± 5	60 ± 2.5

NOTE: Perform Venous Stasis on a different arm from that used to measure SpO_2 to assure proper SpO_2 monitoring.

Status Messages

Message	Possible Cause	Suggested Action
NBP s/d/m > # NBP s/d/m < #	NBP value (systolic, diastolic, mean) exceeds alarm limits.	• Check the patient and treat if necessary. • Change current alarm limits for patient.
NBP Low Inflation Limit	The patient's systolic pressure is higher than the maximum allowed inflation limit.	• Select the next higher NBP inflation limit setting.
NBP Check Cuff Size	Patient's pulsations are too small to determine blood pressure.	• Check the cuff size. • Move the cuff to another limb.

Message	Possible Cause	Suggested Action
NBP: Venous stasis started	Venous stasis mode is active.	• No action is required.
NBP: Venous stasis ending	There are 10 seconds remaining of Venous stasis mode.	• No action is required.
NBP: Venous stasis ended	Venous stasis mode is disabled or completed.	• No action is required.
NBP Check Hose Connection	Pressure cannot be maintained in the cuff. Inflation time is too short due to a blocked or kinked hose.	• Check connection between cuff and hose for debris. • Check hose and cuff for obstructions or kinking. Replace if necessary.
NBP Hose Unplugged	NBP hose is unplugged.	• Reconnect the hose.
NBP Mean Only	Patient's pulse is too low for monitor to derive systolic and diastolic pressure values but large enough to report mean pressure value.	• Check the patient and treat if necessary. • Check the hose and cuff. • Check size and placement of cuff.
NBP Cuff Cannot Deflate	Pneumatic failure.	• Check hose and cuff for obstructions. Replace if necessary. • If the message does not clear, contact Biomed or Dräger Medical Technical Support.
NBP Cuff Deflation Error	NBP pump or valves have been energized for longer than 2 minutes (Adult or Pediatric mode) or 90 seconds (Neonatal mode).	• Disconnect and reconnect cuff. • Check hose and cuff for obstructions. Replace if necessary. • If the message does not clear, contact Biomed or Dräger Medical Technical Support.
NBP Cuff Leak	The drop in cuff pressure after the end of the inflation cycle is too great.	• Check hose and cuff for leaks. Replace if necessary. • Restart the measurement. If the message does not clear, contact Biomed.
NBP Cannot Measure	Pulse profile is too poor to make a reliable measurement (usually owing to persistent motion artifact).	• Check the patient and treat if necessary. • Move cuff to a limb with less movement. • Restart measurement. If message persists contact biomed or technical support.

Message	Possible Cause	Suggested Action
NBP Blocked Line	The inflation rate is too high during the inflation cycle or the time to dump the residual cuff pressure at the end of the deflation cycle is too short.	• Select a different cuff. • Check the hose and cuff for damage. • Restart the measurement. If the message does not clear, contact Biomed or Dräger Medical Technical Support.
NBP Cannot Zero	Monitor is unable to zero transducer within 30 seconds from start of NBP program, usually because of motion artifact.	• Check the patient and treat if necessary. • Move cuff to a limb with less movement. • If the message does not clear, contact Biomed.
NBP Measurement Timeout	A measurement lasted longer than two minutes (Adult or Pediatric) or 90 seconds (Neonatal) and was aborted (usually because of motion artifact).	• Repeat the measurement.
NBP No Pulsation	Weak signal. Monitor is unable to detect a sufficient number of pulsations of adequate amplitude within two minutes.	• Check the patient and treat if necessary. • Check the hose and cuff. • Check for proper size, placement of cuff.
NBP Open Line	Inflation time during cuff inflation cycle is too long or inflation rate is too low.	• Check to ensure that the hose and cuff are properly connected to the monitor.
NBP Out of Range	Values are reported, but are out of specified range.	• No action is required.
NBP Overpressure	Cuff pressure is over 270 mmHg (Adult), 180 (Pediatric) or 140 mmHg (Neonatal). . Cuff deflates automatically.	• Check the patient and treat if necessary. • Check cuff for obstructions. • Retry the measurement.
NBP Retrying	Monitor failed to detect sufficient pulsations, aborted measurement, and started a new one.	• No action is required.
NBP Overpressure Circuit Failure	Cuff overpressure circuit has failed.	• Call Biomed or Dräger Medical Technical Support.

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Chapter 13 Invasive Blood Pressure

Overview

The monitor acquires invasive blood pressure (IBP) signals from Y-cables, HemoMed pod, or a combination of these devices. A transducer, connected to the cable or Hemomed , converts pressure data into electronic signals for monitor use.

These signals are automatically filtered to reduce the artifact generated by the fluid-filled catheter and tubing system, as well as by motion and catheter fling. The monitor detects individual beats by establishing thresholds based on running averages of systolic and diastolic pressures.

The monitor can process up to four IBP signals to which it assigns standard, generic, or automatic pressure labels. See page 13-12 to assign pressure labels.

Description of standard and automatic IBP labels follows:

IBP Labels			
Label	**Pressure Type**	**Measured Pressures**	**Measurement Range**
ART	Arterial	Systolic, Diastolic, Mean	-50 to +400 mmHg **Note**: see status messages, page 13-15.
LV	Left Ventricular	Systolic, Diastolic, Mean	
PA	Pulmonary Arterial	Systolic, Diastolic, Mean	
RV	Right Ventricular	Systolic, Diastolic, Mean	
CVP	Central Venous	Mean	
RA	Right Atrial	Mean	
LA	Left Atrial	Mean	
ICP	Intercranial	Mean	
GP1	Generic Pressure 1	Systolic, Diastolic, Mean	
GP2	Generic Pressure 2	Systolic, Diastolic, Mean	

Notes:

- During PWP measurements, the monitor displays only mean PA pressure.
- If the monitor detects static pressure, the algorithm computes mean pressure only. A static pressure condition occurs when the maximum and minimum values of a pulsatile pressure signal differ by less than 3 mmHg.
- If both ART and ICP are connected, the algorithm computes the difference between ICP and mean ART and reports it as Cerebral Perfusion Pressure (CPP).

Precautions

The following precautions apply to IBP procedures. Refer to your institution's clinical guidelines for further information. For general precautions regarding the use of accessories and peripheral devices, see "Safety Considerations" on page VII of this Instructions for Use. Refer to Appendix C for a list of transducers, adapter blocks, pods, and cables approved for use with the monitor. Any use of non-approved transducers may compromise the correct functioning of the device.

WARNING:

- **Never reuse a single-use transducer.**
- **Alarms for systolic, diastolic, and mean invasive pressures are disabled during Wedge pressure measurements; however, the crossed-bell icon does not appear in the parameter box.**
- **For the safety of the patient during Wedge measurements, keep the balloon-inflation time to the minimum necessary to acquire an accurate PWP value. Prolonged inflation of the balloon can result in pulmonary hemorrhage or infarction.**
- **Do not over-inflate the balloon during Wedge measurements. An over-inflated balloon can rupture the pulmonary artery.**
- **During Wedge measurements, the PA catheter may move into the wedge position before the balloon is inflated. One sign of this "catheter drift" is that the PWP waveform becomes wedge shaped. Follow your hospital's clinical guidelines to correct catheter position.**

ESU and Defibrillator Protection

WARNING: The monitor and Dräger Medical hemodynamic pods are protected against 50- and 60-Hertz line interference. Dräger Medical provided transducers offer protection for the patient against burns during electrosurgery or defibrillation. Use of non-approved transducers may compromise this protection. Refer to Appendix C, for a list of approved transducers.

Hardware Setup

For information and precautions regarding the use of HemoMed cables and transducers, see page 13-3.

Tubing

For maximum signal strength, choose the shortest possible length of high-pressure tubing for connection to the patient. Shorter tubing reduces signal attenuation and the effects of motion artifacts. High-pressure tubing limits signal dampening. Follow your hospital's clinical procedures in assembling the tubing system. Be sure to remove all bubbles from the system, as they dampen the signal and could lead to incorrect systolic pressure measurements.

Transducers

Transducers are available in a variety of shapes and sizes (see Appendix C, Approved Options and Accessories). For information on connecting the transducer to the monitor and HemoMed or Y-cable.

Zeroing

You can either zero a single transducer at a time or use the hemopod "Smart Zero" function to zero all static transducers simultaneously. You should zero a transducer under the following conditions:

- Immediately after you introduce the catheter into the patient's vascular system
- After you initially connect the transducer to a pressure pod
- Before each monitoring session
- Before you enter a calibration factor
- Whenever you change the tubing or transducer dome
- When the message *<IBP> Zero Required* is displayed

The following table outlines zeroing procedures:

Single Transducer Zero	Simultaneous "Smart Zero"
1. Make sure the transducer is at heart level. Dräger Medical recommends securing the transducer holders on the front of the hemomeddynamic pod for proper height.	
2. Close the transducer stopcock to the patient and open it to air.	

<table>
<tr><th>Single Transducer Zero</th><th>Simultaneous “Smart Zero”</th></tr>
<tr><td>3(a). Click on the parameter box associated with the transducer you want to zero. The parameter setup menu appears. Note: You can also access the parameter menu as follows:
1) Press the Menu fixed key to display the Main Menu.
2) Click on Patient Setup.
3) Click on Parameters.
4) Scroll to the desired parameter and click.</td><td rowspan="2">3(b). Press the →0← key on the hemomeddynamic pod you wish to zero. The monitor determines which of the pod’s transducers are open to air and then zeroes them.
➤ Note: If you use this step, 3(b), and are unable to zero a particular IBP with the →0← key, use the associated parameter box as described in 3(a). This method can be more effective.</td></tr>
<tr><td>4. Click on Zero.</td></tr>
<tr><td colspan="2">➤ Note: If the procedure is successful, the monitor displays the message: <IBP> zero accepted. If the procedure fails, the monitor displays the message: <IBP> did not zero. Check the waveform. If spikes exceed three millimeters, repeat the procedure. If procedure fails after two attempts, replace the transducer or consult your Biomed.</td></tr>
</table>

WARNING: In the rare circumstance that a pressure waveform is nearly static (flat), do not use the “Smart Zero” function, otherwise inaccurate measurement readings and misdiagnosis may result. If this is the case, open all stopcocks to air before pressing the →0← key.

Calibration Procedures

Calibration procedures differ depending on whether you are using a disposable (single-use) or reusable transducer. You do not need to calibrate disposable transducers, which are already calibrated at the factory to the monitor’s default value of 100. Prolonged use of reusable transducers, however, may adversely affect accuracy. When using reusable transducers, you must re-enter the calibration factor periodically, as follows:

1. Open the setup menu of the IBP parameter you wish to monitor (see pages 13-2 and 13-10).
2. Scroll to **Cal Factor** and click.
3. Dial the calibration factor and click to confirm.

CAUTION: *Always zero the transducer before calibration. You must calibrate the transducer within five minutes of a zero to obtain accurate measurements.*

You or your Biomed can obtain the calibration factor using one of the following methods. Using either method, you must first zero the transducer. Always record the new calibration factor and ensure that it is available to future users of the transducer.

Calibration Using a Manometer or Simulator

To recalculate the calibration factor using a manometer or a pressure simulator:

1. Open the setup menu of the IBP parameter you wish to monitor (see page 13-10).
2. Connect manometer or pressure simulator to the transducer.
3. Close transducer to the patient and open it to the manometer.
4. Use the manometer or simulator to create a pressure on the transducer within the associated pressure range.
5. Click on **Manometer Cal** when the pressure on the transducer is stable.
6. Use the rotary knob to highlight the reading on the manometer or simulator and click. The monitor calculates the new factor and displays it as the **Cal Factor** value.

Calibration Using a Water Column

To recalculate the calibration factor using a water column:

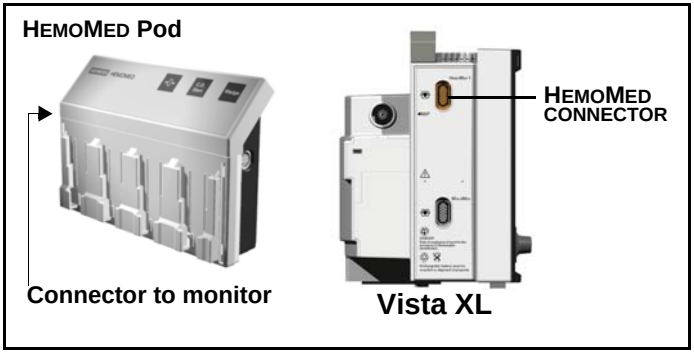
1. Add extension tubing if necessary, so the length of the tubing used to connect the transducer to the patient is at least 136 cm (136 cm of H_2O = 100 mmHg).
2. Fill the tubing with sterile flush solution, ensuring that there are no air bubbles.
3. Align the level of the tubing tip and the transducer membrane.
4. Open the transducer to the tubing.
5. Tape the tubing tip to an IV pole at a level 136 cm above the transducer dome.
6. Follow the procedure outlined above for the manometer, using 100 mmHg as the manometer value.
7. Remove excess calibration tubing before reconnecting the lines to the patient.

HemoMed

HemoMed is available for measuring invasive blood pressure.

— **Wedge** — Starts a pulmonary wedge pressure measurement.

— **C.O. Start** — Starts a cardiac output measurement.

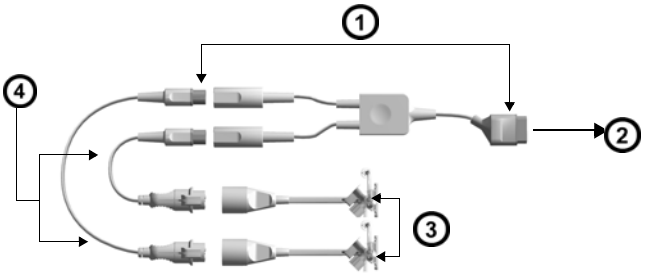


Transducer cables plug into adapter blocks on the back of the pod and can be mounted on the front panel. Slide the transducer into the slot nearest the associated pod connector.

1. Plug one end of the cable into the appropriate monitor connector.
2. Connect the other end of the cable into the hemomeddynamic pod connection port.

IBP Y-Cables

You can use the IBP Y-cable to monitor up to two IBP parameters without the HemoMed. When plugged into the monitor, the Y-cable can accommodate up to two transducers, letting you take two IBP measurements simultaneously. Measurements taken with a Y-cable use pressure labels P1a and P1b.



1	IBP Y-cable	**3**	IBP transducers
2	Plug into HemoMed connector on monitor	**4**	**Intermediate cables**

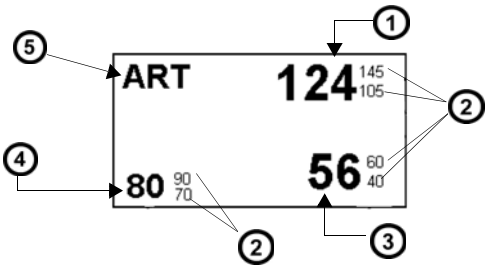
To connect the IBP Y-cable to the monitor:

1. Plug a transducer into the intermediate cable as shown.
2. Plug the other end of the intermediate cable into the Y-cable (7 or 10 pin).
3. Repeat steps 1 and 2 for a second transducer.
4. Plug Y-cable into a HemoMed pod or into the monitor.

NOTE: See Appendix C, Approved Options and Accessories, for a list of available cables.

Display Features

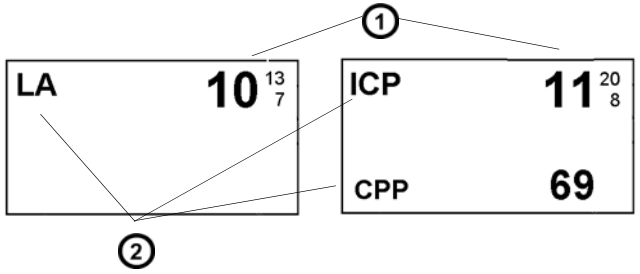
Special features characterize the display of IBP parameter values and waveforms. Parameter boxes vary in appearance according to whether the parameter is pulsatile or non-pulsatile. Parameter boxes for pulsatile pressures (ART, LV, PA, RV, GP1, GP2, P1a-P3d) display systolic, diastolic, and mean pressure values. A typical pulsatile pressure parameter box is shown below:



1	Systolic pressure	**4**	Mean pressure
2	Alarm limits	**5**	Parameter label
3	Diastolic pressure		

NOTE: You can increase the size of the mean pressure display in the IBP parameter box; see page 2-12 for more information.

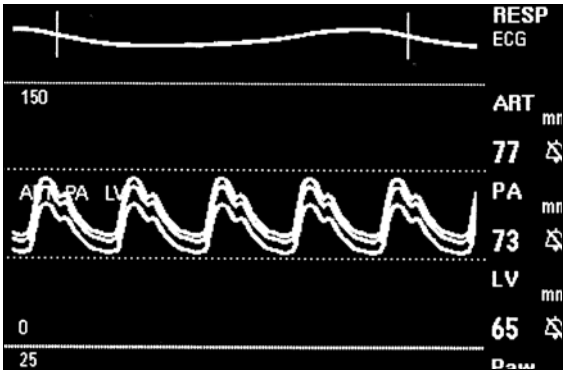
Parameter boxes for non-pulsatile pressures (LA, RA, CVP, ICP) display mean pressures only:



1	Mean pressures
2	Parameter labels

The CPP parameter is calculated and displayed whenever the ICP and ART parameters are monitored simultaneously (CPP = ART_{mean} - ICP). CPP is displayed in the bottom of the ICP parameter box.

IBP waveforms can be displayed in standard or overlapping format. When IBP waveforms are overlapped, you can show scale values for the overlapped parameters side by side (the order of the display corresponding to the priority of the parameter boxes) by setting **Common Scale** to *OFF* on the IBP setup menu (see page 13-11). The following figure shows overlapped IBP waveforms with **Common Scale** enabled.



IBP Setup

IBP setup is a two-phase process involving the following procedures. After configuring individual IBP parameters, you must assign them to connected IBP channels. These procedures are described in the following pages.

To access an IBP parameter setup menu:

- Click on the respective parameter box on the main screen; *or*

1. Press the **Menu** fixed key to display the Main Menu.
2. Click on **Patient Setup**.
3. Click on **Parameters**.
4. Scroll to the IBP parameter you want to configure (ART, LV, PA, RV, CVP, RA, LA, ICP, GP1, or GP2) and click. The setup menu appears, with the name of the parameter you have selected displayed at the top of the menu.

Quick Reference -- IBP Setup

Available functions, present on all IBP setup menus, are described in the following table:

IBP Setup Menus		
Menu Item	**Description**	**Available Settings**
Zero	Zeroes the transducer and displays time and date of last zeroing operation (see page 13-4)	N/A (read-only)
Scale	Sets the upper values of the IBP waveform scale	• For ART, CVP, LV, GP1, GP2, ICP, LA, P1-3 (a-d), PA, RA and RV: 5, 10, 15, 20, 25, 30, 35, 40, 50, 75, 100, 125, 150, 175, 200, 225, 250, and 300 mmHg
Filter	Adjusts filter applied to the IBP signal	• **8, 16,** and **32 Hz**
Cal Factor	Determines calibration factor	• 80 - 120
Last Cal Factor	Displays the time of the last successful calibration	• Not modifiable
Manometer Cal	Allows you to enter the manometer or simulator reading and start calibration (see page 13-6)	• 10 - 300
Pressure Overlap	Allows you to view up to four IBP parameters on a single baseline	• ON • OFF
Common Scale	Sets the waveforms to one scale	• OFF, 5, 10, 15, 20, 25, 30, 35, 40, 50, 75, 100, 125, 150, 175, 200, 225, 250, and 300
Wedge Start (PA setup menu only)	Starts a wedge pressure measurement Same function as the Wedge fixed key on a hemodynamic pod (see page 13-7)	• N/A
Pressure Labels	Displays Pressure Label screen (see page 13-12)	• N/A
<IBP Parameter> Alarms	Displays alarms for parameter and associated variable on Alarm Limits Table	• N/A
Large Mean	Increases size of all IBP Mean values	• ON • OFF

Labeling Pressure Channels

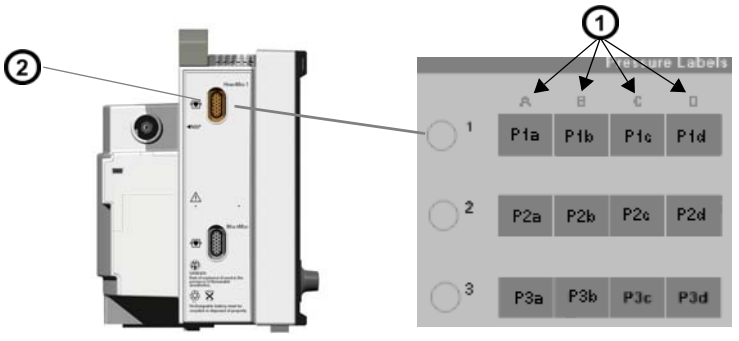
The pressure label determines how a signal is analyzed and reported to the monitor. When you assign a new label to a pressure channel, the monitor clears the parameters and conditions set for the previous label (including alarms and waveform scales) and replaces them with settings for the new label. Trends are stored according to the assigned label.

NOTE: **Zero, Cal Factor**, and **Cal Date & Time** settings are associated with the pressure channel and are kept despite a label change.

The **Pressure Labels** screen can display up to twelve IBP sources in a 3 x 4 matrix. The monitor assigns an automatic pressure label (**P**[**1-3**][**a-d**]) to each box.

WARNING: During Wedge measurements, the PA catheter may move into the wedge position before the balloon is inflated. One sign of this "catheter drift" is that the PWP waveform becomes wedge shaped. Follow your hospital's clinical guidelines to correct catheter position.

Signal sources are displayed in rows [1-3], with Row 1 representing data received from the HemoMed pod or Y-cableThe letters [a-d] identify the transducer location on the pod.



Vista XL

1	Transducer location letter
2	HemoMed or Y-cable connector

To assign a label to a pressure channel:

1. Access an IBP setup menu (see page 13-10).
2. Scroll to **Pressure Labels** and click.
3. Scroll to the channel you wish to label and click. The first label in the column on the right side of the menu is highlighted.
4. Scroll to the desired label and click.
5. Repeat steps 3 and 4 to assign other pressure labels.

NOTE: For detailed information about types of pressure labels, see page 13-2.

Pressure labels are color-coded to indicate their status. In order to assign a label, you must ensure that the HemoMed or Y-cable is connected to the monitor.

Color-Coding for Pressure Labels		
Background	**Text**	**Status**
Black	Green	• HemoMed or Y-cable connected to monitor • Transducer connected
	White	• HemoMed or Y-cable connected to monitor • Transducer not connected
Gray	White	• HemoMed or Y-cable not connected to monitor • Transducer not connected

Pressure Label Conflicts

Each pressure label can be assigned to one location at a time. If you try to re-use a label, the monitor displays a caution informing you that the label is in use and asks if you want to continue. If you choose **YES**, the monitor puts the label in the currently selected box and places an automatic pressure label (P1a– P3d) in the previous location.

Pulmonary Wedge Pressure Display

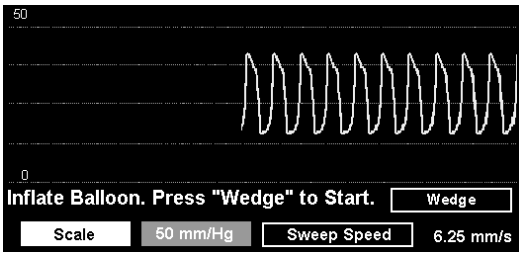
The monitor averages the PA waveform values for 10 seconds and calculates a wedge pressure value (PWP). During the measurement, the PA parameter box shows no systolic or diastolic values, and PA alarms are disabled.

Follow your hospital's procedures for setup, then take a PWP measurement as follows:

1. Verify that a PA catheter has been properly inserted and the catheter tip is situated in the pulmonary artery.
2. Press the **Wedge** fixed key on the HemoMed pod acquiring the PA signals, *or*

- Open the **PA** setup menu, scroll to **Wedge Start** and click.

The following screen appears:



3. Click on **Scale**.
4. Scroll to the desired waveform scale (**5, 10, 15, 20, 25, 30, 35, 40, 50, 75, 100, 125, 150, 175, 200, 225, 250,** or **300 mmHg**) and click.
5. Click on **Sweep Speed**.
6. Scroll to the desired sweep speed (**6.25**, **12.5**, **25**, or **50 mm/s**) and click.
7. Inflate the balloon and click on **Wedge** to start the measurement.

The message, Wedge in Progress, appears.

When the calculation is complete, the PA and RESP waveforms stop, a horizontal cursor line through the PA waveform indicates the new PWP value, and the monitor instructs you to deflate the balloon.

Control keys at the bottom of the screen allow you to save, navigate or quit the display:

After four minutes, the monitor automatically saves the PWP value and exits to the main screen. The PA and RESP waveforms resume their previous size and sweep speed, PA systolic and diastolic values are restored, and PA alarms are automatically enabled.

Status Messages

Message	Possible Cause	Suggested Action
<xx> S <#> <xx> D <#> <xx> M <#>	Pressure value outside alarm limits	• Check patient and take appropriate action. • Access the Alarm Limits menu and change the alarm limits. • Check equipment and replace if necessary.
<xx> Out of Range (High) <xx> Out of Range (Low)	Pressure signal out of measurement range	• Check patient and treat if necessary. • Access the Pressure Labels menu and assign the correct label. • Check equipment and replace if necessary.
<xx> Please Check Zero	The IBP zero stored in the monitor may not correspond to the peripheral device.	• Zero the transducer.
<xx> Static Pressure	Static pressure detected on a pulsatile signal, owing to: • A physiological condition, e.g., asystole • Transducer turned off to the patient • A catheter tip lodged against a vessel wall • A clot on the catheter tip	• Check patient and treat if necessary. • Open the system to the patient by turning the stopcock. • Follow hospital procedures for dislodging catheters. • Follow hospital procedures for clotted catheters.
<xx> Unplugged	Pressure transducer for specified parameter is either unplugged or defective	• Active pressure: Reconnect or replace the cable. • Inactive pressure: Turn off alarms.
<xx> Zero Required	Pressure transducer for specified parameter requires zeroing	• Zero the transducer.
<xx> Zero Accepted	Transducer zeroing successful	• None.
<xx> Did Not Zero	Transducer zeroing failed because of: • Excessive signal noise • A non-static waveform	• Keep all tubing motionless, then rezero. • Change the transducer. • Check stopcock, then rezero.

Message	Possible Cause	Suggested Action
Note: <xx> represents the IBP parameter label associated with the displayed message.		
<xx> Did Not Zero - Offset Error	Transducer zeroing failed because static pressure was too high or too low.	• Rezero the transducer. • Loosen and retighten the transducer dome, then rezero the transducer. • Replace the transducer.
<xx> Calibrating	Mercury calibration in progress	• Complete calibration before you begin monitoring the patient.
<xx> Cal. Accepted	Mercury calibration succeeded *or* user-entered calibration factor accepted.	• None
<xx> Cal. Failed - Not Static	Mercury calibration failed because input pressure was not static.	• Make sure transducer is closed to patient. • Check for leaks. • Keep all tubing motionless. • Rezero the transducer. • Refer to calibration procedures (page 13-6). • Loosen and retighten the transducer dome, then rezero the transducer. • Replace the transducer.
<xx> Cal. Failed - Out of Range	Mercury calibration failed because the measured value was too high or too low.	• Make sure the transducer is zeroed, then retry. If the retry fails, replace the transducer. • If calibration requires a factor outside this range, replace the transducer.
<xx> Zero before Cal.	During calibration, more than 5 minutes have elapsed since last successful zero.	• Zero the transducer.
<xx> H/W Failure	IBP channel hardware failure.	• Check hardware and replace. • Call Biomed or Dräger Medical Technical Support.
Hemo Pod [n] Disconnected	The hemo pod is not connected to the monitor.	• Check cables and connection. Replace cable if necessary.
Note: <xx> represents the IBP parameter label associated with the displayed message.		

Chapter 14 Calculations

Overview

The monitor performs physiological calculations using data acquired by the monitor and other devices. The monitor stores derived parameters and displays them on the Results (Calculations) screen, or Drug Calculator. Available inputs and calculated parameters vary depending on whether you use standard or optional Calculations software.

The monitor automatically calculates a set of hemodynamic parameters, called Mini Calcs, plus vent and lab values whenever you measure cardiac output (see page 20-12 for detailed information). The monitor can also be configured to calculate drug-related parameters, including concentration, rate, total dose, and total volume.

In addition to these standard calculation features, two additional features are available with the PhysioCalcs software option:

Hemo Calcs: The monitor calculates HemoMed parameters based on cardiac output, invasive blood pressure and patient data (e.g., height and weight).

Hemo/Oxy Calcs: This feature provides oxygenation parameters in addition to HemoMed parameters (for a complete list of hem/oxy/vent parameters, see page 14-5)

Physiological Calculations

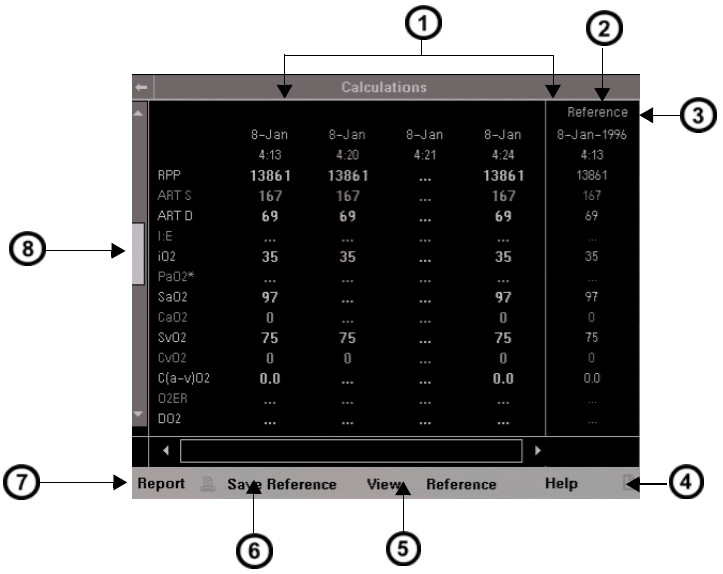
You can calculate and store hemodynamic and oxygenation parameters for display on the Calculations screen and print them on a laser printer.

NOTE: Before initiating a physiological calculation, you must measure pulmonary wedge pressure and cardiac output. See page 13-13 for PWP measurement and page 20-6 for C.O. procedures.

Obtain physiological calculations as follows:

1. Press the **Menu** fixed key to open the Main Menu.
2. Click on **Calculations**.
3. Click on **Hemo** or **Hemo/Oxy/Vent** to display the associated calculations menu.
4. Click on **Capture Values** to save the date and time of the capture and display the current values of input parameters. You can use captured values immediately or hold them for later calculations.
5. Click on **Results**. The Calculations screen appears, as shown on the following page.

NOTE: The Calculations screen does not display results for a derived parameter unless all relevant information has been entered.



1	Date and time stamps	**5**	Click and scroll to determine type of data displayed in View column: **Reference** – Values stored via Save Reference key; **Normal Range** – Standard ranges for parameter values; **Units** – Units of measure for parameter values.
2	View column	**6**	Save latest set of calculated data for display in View column
3	View category	**7**	Send report request to laser printer at central station
4	Display labels, definitions and ranges	**8**	Click and drag to scroll through list of parameters

You can access the **Hemo/Oxy/Vent** calculations menu more quickly as follows:

1. Click on the **Fast Access** fixed key.
2. Click on **Calculations** to display the **Hemo/Oxy/Vent** calculations menu.

If a value is missing or suspect (e.g., artifact), you can enter or modify its values as follows:

1. Highlight the parameter in question and click. A data entry keypad appears:
2. Click on the digits of the new value.

3. Click on *Accept* when you are done. The modified value immediately appears on the Calculations screen, marked with a pound sign (#)

4. Modified values are not written to Main Screen parameter boxes and waveforms, nor are they trended.

Hemodynamic Parameters

The monitor uses the following to calculate hemodynamic values:

Label	**Parameter Value Description**	**Derivation**	**Units**
ART S	Systolic Arterial Pressure	Monitored input	mmHg kPa
ART M	Mean Arterial Pressure	Monitored input	mmHg kPa
ART D	Diastolic Arterial Pressure	Monitored input	mmHg kPa
CCO, ICO.	Cardiac Output (continuous, intermittent)	Monitored input	L/min
CO	Cardiac Output (continuous, intermittent)	Manual entry	L/min
CVP	Central Venous Pressure	Monitored input	mmHg kPa
HR	Heart Rate	Monitored input	bpm
HT	Patient's height (length)	Manual entry	cm / in
PA M	Mean Pulmonary Artery Pressure	Monitored input	mmHg kPa
PWP	Pulmonary Capillary Wedge Pressure	Monitored input	mmHg kPa
WT	Patient's current weight	Manual entry	kg / lb

The following hemodynamic parameters are derived using the input parameters described above:

Label	**Parameter Description**	Derivation	Units
BSA	Body Surface Area	Boyd or DuBois Equation **Note:** *Boyd equation,* for patients whose weight is less than15 kg and whose height is less than 80 cm: $BSA = WT^{(0.7285 - 0.0188 \times (\log 10 WT)} \times HT^{0.3} \times 0.0003207$ *DuBois equation,* for all other patients: $BSA = WT^{0.425} \times HT^{0.725} \times 0.007184$ Body weight in grams; height in centimeters	m^2
CI, CCI, ICI	Cardiac Index (continuous, intermittent)	CO / BSA	$l/min/m^2$
LHCPP	Left Heart Coronary Perfusion Pressure	ART D - PWP	mmHg
LVSW	Left Ventricular Stroke Work	0.0136 x (ART Mean - PWP) x SV	g x m
LVSWI	Left Ventricular Stroke Work Index	0.0136 x (ART M - PWP) x SVI	$g \times m/m^2$
PVR	Pulmonary Vascular Resistance	80 x ((PAm-PWP) /CO)	dynes x sec/ cm^{-5}
PVRI	Pulmonary Vascular Resistance Index	80 x ((PAm-PWP) / CI)	dynes x sec/ cm^{-5}/m^2
RPP	Rate Pressure Product	ART S x HR	mmHg/min
RVSW	Right Ventricular Stroke Work	0.0136 (PA M - CVP) x SV	g x m
RVSWI	Right Ventricular Stroke Work Index	0.0136 x (PA M - CVP) x SVI	$g \times m/m^2$
SV	Stroke Volume	CO x 1000 / HR	ml
SVI	Stroke Volume Index	SV / BSA	ml/m^2
SVR	Systemic Vascular Resistance	80 x (ART Mean - CVP) / CO	dynes x sec/ cm^{-5}
SVRI	Systemic Vascular Resistance Index	80 x (ART Mean - CVP) / C.I.	dynes x sec/ cm^{-5}/m^2
TPR	Total Pulmonary Resistance	80 x PA mean / CO	dynes x sec/ cm^{-5}
TVR	Total Vascular Resistance	80 x ART Mean / CO	dynes x sec/ cm^{-5}

Oxygenation and Ventilation Parameters

The monitor uses the following parameters to calculate oxygenation and ventilation values.

Label	Parameter Description	Derivation	Units
Hgb	Hemoglobin concentration	Input data	g/dl
iO_2	Inspired Oxygen	Input data	%
PaCO2	Arterial CO2 Pressure	Input data	mmHg
PaO2	Arterial Oxygen Pressure	Input data	mmHg
PAUSE	Pause/Plateau Pressure	Input data	cmH2O
Pb	Barometric pressure	Input data	mmHg
PeCO2	Mixed Expired CO2 Pressure	Input data	mmHg
PEEP	Peak End Expiratory Pressure	Input data	cmH2O
PIP	Peak inspiratory Pressure	Input data	cmH2O
RRc, RRc*, RRv	Respiratory Rate	Input data	l/m
SaO2, SaO2*	Arterial Oxygen Saturation	Input data	%
SvO2	Venous Oxygen saturation	Input data	%
TVe	Expired Tidal Volume	Input data	ml/ breath

Drug Calculations

The monitor calculates the infusion rates of up to 44 drugs and displays the results in titration tables. You can assign and calculate up to four drugs per patient or monitoring session. Information pertaining to patient-specific drugs is automatically deleted when you discharge the patient from the monitor.

To meet the demands of a larger patient group, it is also possible to configure up to 40 default drugs. These drugs can be assigned only by the unit manager, or by others who have access to the password-protected Unit Manager menu. Nurses can, however, edit and recalculate default drugs from the unrestricted Drug Dosage menu. Data pertaining to default drugs is not deleted when a patient is discharged from the monitor.

Titration Tables

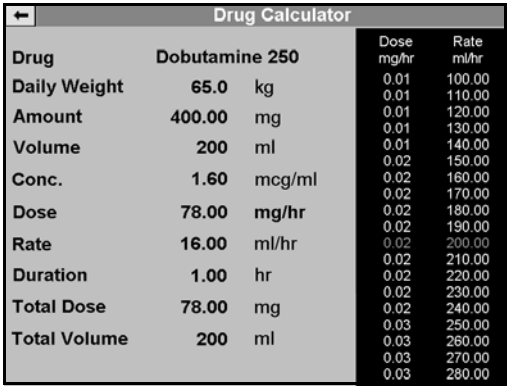
After you have entered the appropriate information, the monitor displays a titration table showing the units of measure you have specified on the Drug Calculator or Drug List Setup menu. Rates are displayed in green in the right column. Whenever you change an entry on the Drug Calculator menu, the monitor automatically updates titrated values.

To display a titration table, follow the instructions for calculating drugs on page 14-9.

If you click on a new drug, you will display the drug calculator menu.

1. Click on the drug whose titration table you wish to display.
2. Click on information category (e.g., **Daily Weight**).
3. Enter data as described on page 14-10.

The Dose and Rate are titrated if you have entered the appropriate input data for the calculation.The table is titrated again when you change any of the settings on the Drug Calculator menu. An example of a calculated titration table is shown below.



Numbered labels (**Untitled 1 - 4**) on the Drug Dosage setup menu are reserved for drugs specific to the current patient or monitoring session, while default drugs are listed simply as **Untitled**. After you have assigned a drug on the Drug Dosage menu, you can enter its infusion parameters, perform calculations, and view a titration table using the Drug Calculator menu. When you assign a drug to the Drug Dosage menu, its name automatically appears on the Drug Calculator menu, where you can quickly calculate a new infusion rate (see page 14-9).

Drug Calculator Setup

The following table summarizes tasks you can perform using the Drug Calculations function.

Drug Calculation		
Task	**Menu**	**Initial Step**
Patient-Specific Drugs (Slots 1-4)		
Calculate a drug	Drug Dosage	New Drug
Default Drugs (Unnumbered slots 5-40)		
Assign a default drug	Unit Manager	Drug List Setup
Enter amount, volume and dose units for default drug	Unit Manager	Drug List Setup

Assigning Drugs

After you assign a drug, its name appears on both the Drug Dosage menu and the Drug Calculator menu. To assign a drug:

1. Press the **Fast Access** fixed key. The Fast Access menu appears.
2. Click on **Drug Dosage**.
3. Click on **New Drug** to display drug or drug fields.
4. Click on one of the first four display fields on the list (**Untitled 1 - Untitled 4**) to assign drugs to a particular patient.

NOTE: Although you can access the Drug Calculator menu by clicking on a default drug, you can name or rename default drugs only on the Unit Manager menu (see page 14-11).

5. Click on **Drug**.
6. Click on **Name Drug** to display the text entry screen.
7. Enter the name of the drug you wish to assign by clicking on the letters under the text entry window. Edit your entry using the control buttons at the bottom of the screen.
8. Click on **Accept** to confirm.

Calculating a Drug

Use the following procedures to enter information on the Drug Calculator menu.

1. Press the **Fast Access** fixed key. The Fast Access menu appears.
2. Click on **Drug Dosage**.
3. Click on **New Drug** (see page 14-9).
4. Click on the new drug of your choice to display the Drug Calculator menu.
5. Scroll to a category and click to display the data entry box.

If you select **Conc.** (for Concentration), **Dose**, and **Total Dose**, the data entry box displays a field, where you can change the units of measure for these categories as follows:

1. Click on **Change Units**,
2. Use the rotary knob to select a unit of measure.
3. Click to confirm.

To enter a value for any of the Drug Calculator categories:

1. Click successively on single digits to enter a value for the selected category.
2. Click on **Accept** to confirm your choices and return to the Drug Calculator menu.

NOTE: To access dose units based on patient weight, you must enter the patient's **Daily Weight** on the Drug Calculator menu. The monitor recalculates saved drugs automatically whenever you modify the adult or pediatric Daily Weight entry. You must enter a Daily Weight whenever you calculate a drug for a neonate.

The following table lists available ranges for each category on the Drug Calculator menu.

Drug Calculator Menu	
Menu Item	**Range**
Drug (name)	N/A
Weight (of patient)	0-255.0 kg (adult, pediatric) 0-30,000 g (neonate)
Amount (of drug)	0-100,000,000,000 micrograms (mcg), m units, mEg, mmol 0-100,000,000 milligrams (mg), units, mol 0-100,000 grams (g), k units
Volume	0-10,000 ml

Drug Calculator Menu	
Menu Item	**Range**
Concentration	0-100,000,000,000 mcg/ml, m units/ml, mEg/ml,mmol/ml 0-100,000,000 mg/ml, units/ml, mol/ml 0-100,000 g/ml, k units/ml 0-100 m units/ml
Dose per hour	0-100,000,000,000 mcg/hr, mEg/hr, m units/hr, mmol/hr 0-100,000,000 mg/hr, units/hr, mol/hr 0-10,000 g/hr, k units/hr
Dose per minute	0-1,666,666,666.66 mcg/min, mEg/min, m units/min, mmol/min 0-1,666,666.66 mg/min, units/min, mol/min 1-1,666.66 g/min, k units/min
Dose/weight per hour	0-100,000,000,000/wt, mcg/kg/hr, mEg/kg/hr, m units /kg/ hr,mmol/kg/hr 0-100,000,000/wt mg/kg/hr, units/kg/hr, mol/kg/hr 0-0.100,000/wt g/kg/hr, k units/kg/hr
Dose/weight per minute	0-1,666,666,666.66/wt mcg/wt/min, mEg/wt/min, units/wt/min, mmol/wt/min 0-1,666,666.66/wt mg/wt/min, units/wt/min 0-1,666.66 g/wt/min, units/wt/min
Rate	0-10,000 ml/hr
Duration	0-10,000 hr
Total Dose	0-100,000,000,000 mcg, mEg, mmol 0-100,000,000 mg, units, mol 0-100,000 g, k units 1-100 m units
Total Volume	0-10,000 ml

Default Drug Setup (Unit Manager)

The unit manager can assign up to 40 default setups for the most commonly used drugs.

To assign default drugs:

1. Press the **Menu** fixed key.
2. Click on **Monitor Setup**.
3. Click on **Unit Manager**. A data entry box appears.
4. Scroll through the numbers and click successively on the single digits of the Unit Manager password. If you make a mistake, click on **Backspace** and try again.
5. Click on **Accept** to open the Unit Manager menu.

6. Scroll to **Drug List Setup** and click. The cursor highlights the first in a list of drugs on the right of the screen.
7. Click on **Untitled** or on the name of a drug you wish to change. The Drug List Setup menu appears (figure at right).
8. Click on **Name Drug** to display a text entry box.
9. Enter the name of the drug you wish to assign by clicking on the letters under the text entry window. Edit your entry using the control buttons at the bottom of the screen.
10. Click on **Accept** when you are done.

To calculate an assigned drug:

1. Open the Drug List Setup menu (see page 14-11).
2. Click on the data category. A text entry box appears.
3. Click successively on single digits to enter the desired value.
4. Click on **Change Units** to modify units of measure.
5. Scroll through available units of measure and click to select.
6. Click on **Dose Units**.
7. Scroll through available dose units and click to confirm.
8. Click on **Accept** to confirm your choices.

Chapter 15 Pulse Oximetry (SpO_2)

Intended Use

The Infinity Masimo SET® SpO_2 SmartPod® is intended for use under the direct supervision of a licensed heathcare practitioner (i.e. Physicians, Nurses, and Technicians). It is indicated for the continuous noninvasive monitoring of functional oxygen saturation of arterial hemoglobin (SpO_2) and pulse rate (measured by an SpO_2 sensor).

The Infinity Masimo SET® pod is indicated for use with adult, pediatric, and neonatal patients.

The Infinity Masimo SET® pod and accessories are indicated for use during both motion and non-motion conditions, and for patients who are well or poorly perfused in hospitals and hospital type facilities.

Overview

Dräger Medical's integrated SpO_2 technologies, OxiSure® and Infinity Masimo SET® SpO_2 SmartPod™ enhance the quality of SpO_2 monitoring, allowing you to measure accurately and effectively the percentage of functional hemoglobin saturated with oxygen (% SpO_2) in the patient's arterial blood. A light sensor on the patient's finger measures the absorption levels of red and infrared light. The monitor uses the difference between the two measurements to calculate the percentage of saturated hemoglobin. Because light absorption varies with blood volume and blood volume varies with pulse rate, the monitor can also derive a pulse rate (PLS).

The light sensor, available for adult, pediatric, and neonatal patients (see Appendix C, Approved Options and Accessories) is connected to the monitor via the MultiMed, NeoMed or Masimo SET pods.

NOTE: Certain SpO_2 solutions achieve specified accuracy in the presence of motion. (See Technical Data section for further information.)

Precautions

SpO_2 measurements are particularly sensitive to the pulsations in the artery and the arteriole. Measurements may not be accurate if the patient is experiencing shock,

hypothermia, anemia or has received certain medications that reduce the blood flow in the arteries.

WARNING:

- **Check the sensor at least every four hours. Move the sensor if there is any sign of skin irritation or impaired circulation.**
- **Use only Dräger Medical provided sensors. Only Masimo compatible sensors and cables can be used with the Masimo SET pod. Other sensors may not provide adequate protection against defibrillation. See Appendix C for a list of Dräger Medical-approved SpO_2 sensors.**
- **For Nellcor sensors, use only blue latched SpO_2 extension cables for SpO_2 monitoring. Do not use other extension cables.**
- **A pulse oximeter should not be used as an apnea monitor.**
- **Carboxyhemoglobin may erroneously increase readings. The level of increase is approximately equal to the amount of carboxyhemoglobin present.**
- **Dyes, nail polishes and other substances, may absorb an abnormal amount of red light, which can effect the accuracy of the measurement. Be sure to apply the sensor to a site free of any artificial pigments.**

CAUTION: *See the page VII of the Overview to this User's Guide for safety considerations about the use of electrosurgery devices with the monitor.*

Patient Preparation

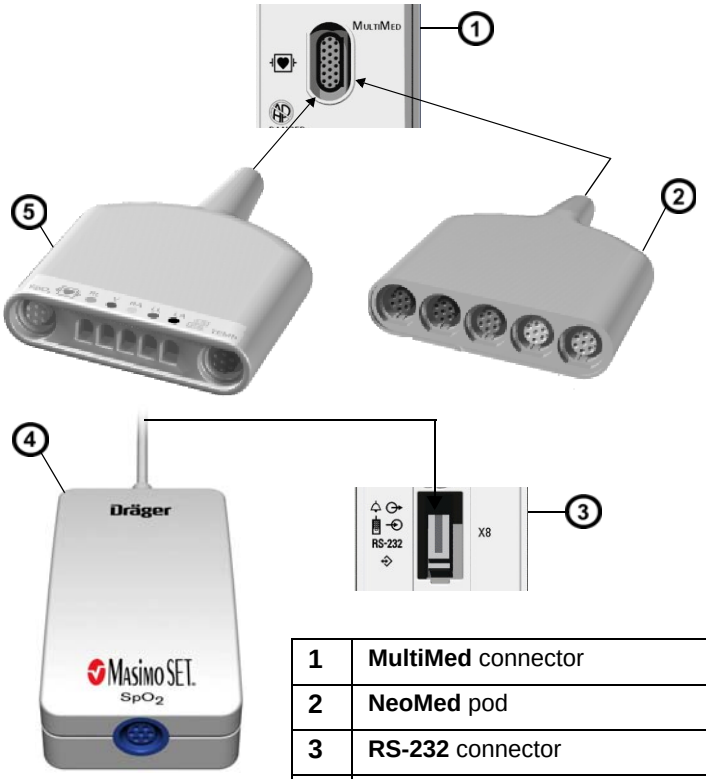
The accuracy of SpO_2 monitoring depends largely on the strength and quality of the SpO_2 signal.

If a finger is used as a monitoring site, remove any nail polish. Cut the patient's finger nails, if necessary, for better sensor placement. Use only Drager provided sensors and apply them per the sensor manufacturer's recommendation (see page C-10). Ambient light can interfere with pulse oximetry measurements if the sensor is not properly attached, causing erratic measurement or missing values. Ensure proper sensor placement and cover the sensor with opaque material if interference due to ambient light is suspected..

CAUTION: *Read the instructions provided with the sensor for optimal application techniques and for safety information.*

1. Select the sensor type and size best suited for your patient.
2. If the sensor is reusable, clean it before and after each patient use.
3. Position the sensor correctly and attach it to your patient.
4. Connect the sensor to the patient cable.

5. Inspect the sensor application site frequently. If the sensor is too tight it may damage the tissue and impede blood flow. If the sensor is damaged, do not use it.



1	**MultiMed** connector
2	**NeoMed** pod
3	**RS-232** connector
4	**Infinity® Masimo SET® SpO_2** pod
5	**MultiMed** pod

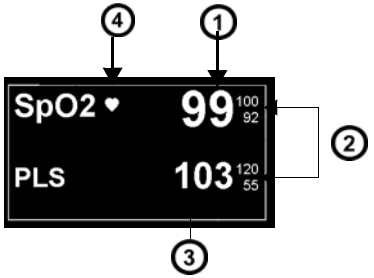
NOTE:

- Infinity® Masimo SET™ pod compatibility is a locked option. Contact your biomed for more information.
- Possession or purchase of the Masimo SET™ SpO_2 pod does not convey any express or implied license to use the device with unauthorized sensors or cables which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device.
- Masimo SET™ SpO_2 pod compatibility requires 510(k) review and is not yet commercially available in the US.
- Masimo SET™ SpO_2 pod compatibility is not yet licensed in accordance with the Canadian Medical Device Regulations.

Display Features

The monitor can display numerical readings in the SpO_2 parameter box and a pulse plethysmogram waveform in the adjacent channel.

The parameter box displays both the SpO_2 value and the pulse rate, as shown below:



1	**SpO_2 value**
2	**Alarm limits** (crossed bell if alarm is disabled)
3	**SpO_2-source pulse rate**
4	**Heart icon** blinks with each pulse if **SpO_2** is tone source

NOTE: The heart symbol is displayed only if SpO_2 is selected as the pulse tone source (see page 15-8 below).

SpO_2 Setup

To access the SpO_2 menu:

- Click on the SpO parameter box

or

1. Press the **Menu** fixed key.
2. Click on **Patient Setup**.
3. Click on **Parameters** to display a list of available parameters.
4. Click on **SpO_2**.

Quick Reference Table -- SpO_2 Setup

Click on the following items to execute SpO_2 setup functions.

Menu Item	Description	Settings
Pulse Tone Source	Selects source for the pulse tone and displays a blinking heart (♥) in the corresponding parameter box. The higher the pitch, the higher the heart rate (HR) or SpO_2 saturation percentage. **Note**: You can also set the pulse tone source from the ECG setup menu.	• **ECG** -- Monitor uses the ECG signal as the pulse tone source • SpO_2 -- Monitor uses the SpO_2 signal as the pulse tone source
Pulse Tone Volume	Sets the volume of the pulse tone. **Note**: You can also set the pulse tone volume from the ECG menu.	• OFF, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, or 100
Waveform Size	Determines the size of the pulse plethysmogram waveform **Note**: If the waveform height exceeds the display channel's size, the waveform is clipped. SpO_2 signal processing is not affected.	• 10 - 100% (increments of 10)

Menu Item	Description	Settings
Averaging Mode	Determines speed of calculation for the average SpO_2 value **Note**: Averaging modes are both defined at a pulse rate of 60 beats per minute.	• **Normal —** **Via MultiMed:** Reflects 90% of an SpO_2 change within 30 seconds (less sensitive to artifact, but slower to alarm) **Via Masimo SET:** Averaging over eight seconds • **Fast —** **Via MultiMed:** Reflects 90% of an SpO_2 change within 15 seconds (quicker to alarm, but more sensitive to artifact) **Via Masimo SET:** Averaging over two to four seconds
SpO_2 Alarm	Accesses SpO_2 alarms on the Alarm Limits table (see page 5-5) **Note**: Set SpO_2 Alarm Validation in the Unit Manager menu (see page 2-13).	• N/A

Status Messages

Message	Possible Cause	Suggested Action
SpO_2 > # SpO_2 < #	Patient's SpO_2 falls outside the current upper or lower alarm limits.	• Observe the patient and treat if necessary.
PLS > # PLS < #	Patient's pulse rate falls outside the current upper or lower alarm limits.	• Observe the patient and treat if necessary.
(Neonatal only) SpO_2 < ALV-20%	Patient's SpO_2 falls below the current lower alarm limit by 20% or more.	• Observe the patient and treat if necessary.
PLS Out of Range (Low/High)	Pulse rate is outside the measuring range of the monitor	• Observe the patient and treat if necessary.

Message	Possible Cause	Suggested Action
SpO_2 Transparent	Too much light is reaching the sensor's light detector. The transparency condition usually occurs because the sensor is off the finger. Another cause is that too much ambient light is reaching the sensor's light detector.	• Check to ensure that the sensor is properly attached to the patient's finger. • Remove light source. • Cover the sensor with opaque material. • Check to ensure that no ambient light can reach the detector. • Contact Dräger Medical Technical Support.
SpO_2 Unrecognized Sensor	The monitor does not recognize the sensor connected as valid.	• Check for defective or unapproved sensor. • Replace the sensor. • Contact Biomed or Dräger Medical Technical Support.
[1]SpO_2 Light Blocked	Insufficient light is reaching the sensor's light detector. **Note:** With detached or partially detached disposable sensors, the light emitters and detectors may have become misaligned.	• Check to ensure that the light sensor is properly attached to the patient's finger, and that the finger is free of blocking substances. • Check for defective sensor and replace if necessary.
SpO_2 Artifact	A persistent artifact is detected.	• Ensure the SpO_2 sensor is properly attached to the patient, the monitoring site is free of patient motion and all cables are properly connected. • Contact Dräger Medical Technical Support.
SpO_2 Weak signal	Pulse amplitude is too low. Physiological: - Poor perfusion (shock). - Low body temperature.	• Check patient's condition. • Ensure the SpO_2 sensor is properly attached to the patient and all cables are properly connected. • Relocate sensor to another extremity. • Contact Dräger Medical Technical Support.
SpO_2 No Measurement	The monitor has not been able to compute a valid measurement within the last 30 seconds because of unstable measurement conditions.	• Ensure the SpO_2 sensor is properly attached to the patient at a site free of patient motion and all cables are properly connected. • Contact Dräger Medical Technical Support.

[1] This message does not appear when the Masimo SET SpO_2 SmartPod is in use.

Message	Possible Cause	Suggested Action
SpO_2 Regulation Error	Inconsistent light level detected by sensor. Excess Ambient light detected.	• Ensure the SpO_2 sensor is properly attached to the patient. • Remove or shade any external sources of light entering the sensor. • Contact Dräger Medical Technical Support.
SpO_2 Unplugged	Sensor cable not connected to the MultiMed pod.	• Check to ensure that cables are securely connected. • Check for defective sensor.
SpO_2: non-Masimo compatible sensor	Monitor is configured for Masimo and a non-Masimo compatible sensor is connected. **Note:** SPO_2 compatibility is a locked option. Contact your biomed for more information.	• Replace with Masimo compatible sensor. • Contact Biomed.
SPO_2: non-Nellcor compatible sensor	Monitor is configured for Nellcor and a non-Nellcor compatible sensor is connected. **Note:** SPO_2 compatibility is a locked option. Contact your biomed for more information.	• Replace with Nellcor compatible sensor. • Contact Biomed.
Incompatible SpO_2 Cable	SpO_2 cable part #33 78 614 is no longer supported	• Replace with compatible SpO_2 cable (see Appendix C, Approved Options and Accessories)
Duplicate Device Connected	MultiMed pod (with SpO_2 sensor) and Infinity Masimo SET pod are connected simultaneously.	• Disconnect duplicate device. (For a complete list of Drager Medical provided SpO_2 accessories available with this product, see Appendix C, Approved Options and Accessories)

SpO_2 MicrO2+®

Overview

SpO_2 MicrO2+ can be used as a second SpO_2 in all modes. It is a small, battery operated pulse oximeter that is supported via RS232 cable using the X8 connector on the monitor.

The SpO_2 MicrO2+ parameter box is labeled SpO_2*. No waveform is displayed with SpO_2*, but alarms are set on the Alarm Limits menu (See Chapter 5). SpO_2* is not supported for OCRG.

NOTE: You cannot use the keypad and SpO_2 MicrO2+ simultaneously

Parameters

Parameter	Label	Units	Range
SpO_2	SpO_2*	%	1 to 100
PLS	PLS*	b/min	30 to 250
Delta SpO_2	ΔSpO_2%	%	0 to 99

NOTE:

- ΔSpO_2% is the absolute value of (SpO_2 - SpO_2*).
- Both SpO_2 and SpO_2* must be connected to get a ΔSpO_2% value.
- If PLS and PLS* are not within +/- 6 bpm, the ΔSpO_2% parameter field will be blank.

SpO_2 MicrO2+ Setup

To access the SpO_2 MicrO2+ menu:

- Click on the SpO_2* parameter box

or

1. Press the **Menu** fixed key.
2. Click on **Patient Setup**.
3. Click on **Parameters** to display a list of available parameters.

4. Click on **SpO_2***.

Click on **SpO_2* Label** to set the label in the parameter box. Choices are **None, Pre-ductal,** and **Post-ductal**. If you choose **None**, the **SpO_2*** parameter box will have no label.

Click on **SpO_2* Alarm** to go to the **SpO_2*** entry in the Alarm Limits menu.

SpO_2 MicrO2+ Trends

The **SpO2*, PLS*,** and **ΔSpO2%** trends can be seen in the trend/graph table (see Chapter 6).

- If both SpO_2 and SpO_2* are connected:

1. SpO_2 and SpO_2* are displayed on the same trend/graph, with both parameter labels. The SpO_2 trend is white and SpO_2* trend is blue.
2. PLS and PLS* are displayed on the same trend graph, with both parameter labels. The PLS trend is white and PLS* trend is blue.
3. Click on the Cursor to see the SpO_2, SpO_2*, and ΔSpO2% values.

NOTE: ΔSpO2% does not appear if there is no delta for that data point.

4. The Trend Setup menu has combined selections for the channel in Manual Display mode for SpO_2/SpO_2* and also for PLS/PLS*.

- If only SpO_2 or SpO_2* (Not both) are connected:

1. SpO_2 and SpO_2* are displayed on their own trend/graphs.
2. PLS and PLS* are displayed on their own trend/graphs.
3. The Trend Setup menu has separate selections for each channel in Manual Display mode for SpO_2, SpO_2*, PLS, and PLS*.

Status Messages

Message	Possible Cause	Suggested Action
SpO_2* > # SpO_2* < #	Patient's SpO_2* falls outside the current upper or lower alarm limits.	• Observe patient and treat if necessary.
PLS* > # PLS* < #	Patient's pulse rate falls outside the current upper or lower alarm limits.	• Observe patient and treat if necessary.
PLS* Out of Range (High)	Pulse rate is outside the measuring range of the monitor	• Observe the patient and treat if necessary.
ΔSpO_2% > UL	ΔSpO_2% is greater than the upper limit	• Observe patient and treat if necessary.
SpO_2* Transparent	Too much light is reaching the sensor's light detector. The transparency condition usually occurs because the sensor is off the finger. Another cause is that too much ambient light is reaching the sensor's light detector.	• Check to ensure that the sensor is properly attached to the patient's finger. • Remove light source. • Cover the sensor with opaque material. • Check to ensure that no ambient light can reach the detector. • Contact Dräger Medical Technical Support.
SpO_2* Unrecognized Sensor	The detected sensor calibration resistor is not of an allowable value.	• Check for defective or unapproved sensor. • Replace the sensor. • Contact Biomed or Dräger Medical Technical Support.
SpO_2* Light Blocked	Insufficient light is reaching the sensor's light detector. **Note:** With detached or partially detached disposable sensors, the light emitters and detectors may have become misaligned.	• Check to ensure that the light sensor is properly attached to the patient's finger, and that the finger is free of blocking substances. • Check for defective sensor and replace if necessary.
SpO_2* Artifact	A persistent artifact is detected.	• Ensure the SpO_2 sensor is properly attached to the patient, the monitoring site is free of patient motion, and all cables are properly connected. • Contact Dräger Medical Technical Support.

Message	Possible Cause	Suggested Action
SpO_2* Weak signal	Pulse amplitude is too low. Physiological: - Poor perfusion (shock). - Low body temperature.	• Check patient's condition. • Ensure the SpO_2 sensor is properly attached to the patient and all cables are properly connected. • Relocate sensor to another extremity. • Contact Dräger Medical Technical Support.
SpO_2* No Measurement	The monitor has not been able to compute a valid measurement within the last 30 seconds because of unstable measurement conditions.	• Ensure the SpO_2 sensor is properly attached to the patient at a site free of patient motion and all cables are properly connected. • Contact Dräger Medical Technical Support.
SpO_2* Searching	Searching for valid pulses from which to compute measurements	• Ensure the SpO_2 sensor is properly attached to the patient.
SpO_2* Regulation Error	Inconsistent light level detected by sensor. Excess Ambient light detected.	• Ensure the SpO_2 sensor is properly attached to the patient. • Remove or shade any external sources of light entering the sensor. • Contact Dräger Medical Technical Support.
SpO_2* Unplugged	Sensor or sensor cable not connected to the MultiMed pod.	• Check to ensure that cables and sensor are securely connected. • Check for defective sensor.
SpO_2* Incompatible	MicrO2+ software version does not match	• Contact Dräger Medical Technical Support
SpO_2* Disconnected	MicrO2+ is disconnected	• Reconnect MicrO2+
SpO_2* H/W Failure	Front-end hardware circuit failure.	• Contact Dräger Medical Technical Support.

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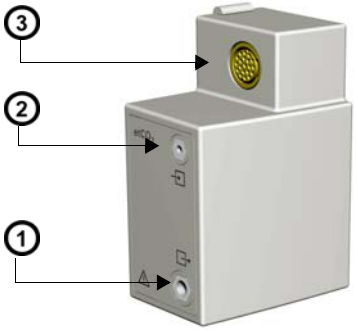
Chapter 16 $etCO_2$ (End-Tidal CO_2) Monitoring

Overview

End-tidal CO_2, or $etCO_2$, is the level of carbon dioxide in the airway at the end of expiration. The monitor reports $etCO_2$ and its associated parameters iCO_2 (Inspired CO_2) and RRc (Respiration Rate) via an optional free-standing multigas unit, an $etCO_2$ module. $EtCO_2$ module acquires signals from a Capnostat® sensor. For mainstream monitoring, the sensor fits over a specially designed adapter in the intubated patient's airway or breathing circuit. For sidestream detection, a sampling pump delivers signals from the adapter to the module.

NOTE: $etCO_2$ readings assume body temperature of 37°C and humidity of 100%, otherwise $etCO_2$ readings may vary.

Ports and outlets are clearly marked on the front of the $etCO_2$ module. Use these labels as a guide when connecting the module to the monitor and peripherals.



Slide into slot on rear of monitor until the module rests securely.	
1	Sidestream output port
2	Sidestream input port
3	Capnostat sensor cable

Sampling Methods

Mainstream

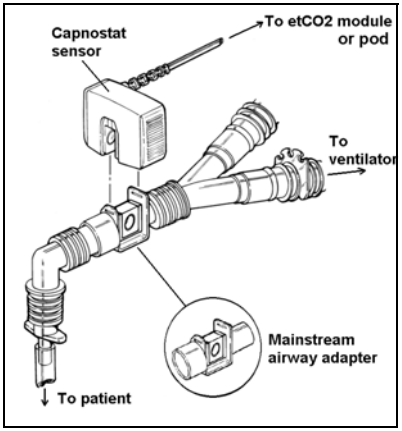
For mainstream detection, the sensor is located within the patient's airway or breathing circuit, allowing you to monitor individual breathing cycles of the intubated patient. This method is appropriate for neonatal as well as adult and pediatric patients.

CAUTION:

- *Always position the airway adapter vertically to prevent patient secretions from obscuring the adapter windows.*
- *If you are switching adapter types (e.g., from sidestream to mainstream, or adult to neonatal), you must calibrate the adapter as described on page 16-12.*

Mainstream Monitoring Setup

1. Click on $etCO_2$ parameter box to access $etCO_2$ setup menu.
2. Click on **Measurement Mode**.
3. Click on **Main**.
4. Select a mainstream airway adapter. Make sure the windows are clean and dry. Clean or replace the adapter if necessary.
5. Align the marks on bottom of the adapter with the sensor.
6. Snap firmly into place.
7. Insert the adapter in a vertical position between the elbow and ventilator circuit "Y".
8. Position sensor cable away from patient.
9. Confirm proper connection on the $etCO_2$ setup menu.

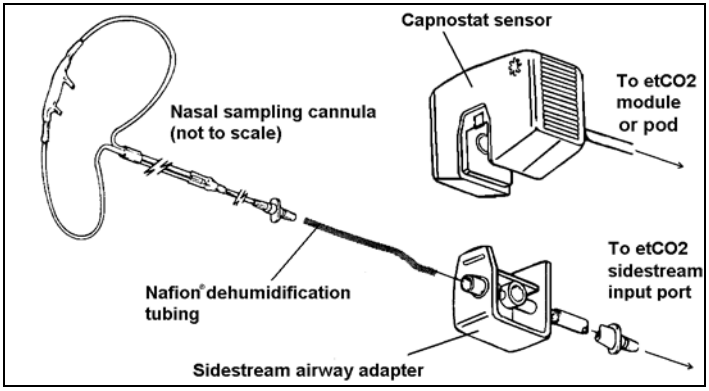


Sidestream (Adult and Pediatric Patients Only)

Sidestream monitoring is appropriate for non-intubated patients or for intubated patients who are breathing independently. A pump in the $etCO_2$ device samples the patient's

inspired and expired air as it passes a nasal sampling cannula. You cannot measure flow, volume or pressure via sidestream monitoring.

NOTE: Sidestream monitoring is not intended for use on neonates and is therefore disabled in Neonatal mode.



Sidestream Monitoring Setup

1. Click on the $etCO_2$ parameter box to access the setup menu.
2. Click on **Measurement Mode**.
3. Click on **Side**.
4. Make sure the sidestream pump in the $etCO_2$ device turns on, and that you feel suction at the input port.
5. Select a sidestream airway adapter. Make sure the windows are clean and dry. Clean or replace the adapter if necessary.
6. Use the sidestream sampling tubing to connect the airway adapter to the input connector on the face of the $etCO_2$ module . (Dräger Medical recommends the NAFION® dehumidification tubing set. See Appendix C, Approved Options and Accessories)
7. Connect a nasal sampling cannula to the dehumidification tubing set if one is used. Otherwise, connect the cannula directly to the sidestream airway adapter.

NOTE: Dehumidification and cannula tubing can affect the calibration of the airway adapter. Calibrate the adapter if you change to different combinations or lengths of cannula and dehumidification tubing.

8. Align the marks on the bottom of the adapter and the bottom of the CAPNOSTAT sensor. Snap the airway adapter into the sensor until you hear a click.
9. If you are switching adapter types (e.g., from mainstream to sidestream, or from neonatal to adult), you must calibrate the adapter as described on page 16-12.
10. Attach the O_2 tubing to the ventilator and enter the O_2 setting to be used.
11. Access the etCO_2 menu and select **O2 Compensation** when using the etCO_2 module.
12. Dial in the O_2 setting you used in Step10. Click to confirm your choice.
13. Insert the cannula tips into the patient's nostrils, pass the cannula tubing behind the ears, and slide the retaining sleeve up so that the tubing is snug under the chin.
14. Secure the CAPNOSTAT sensor to the bedding or to the patient's bedclothing.
15. Make sure the sensor cabling and nasal cannula tubing are secured and out of the patient's way.

NOTE: Always position the airway adapter vertically to prevent patient secretions from obscuring the adapter windows.

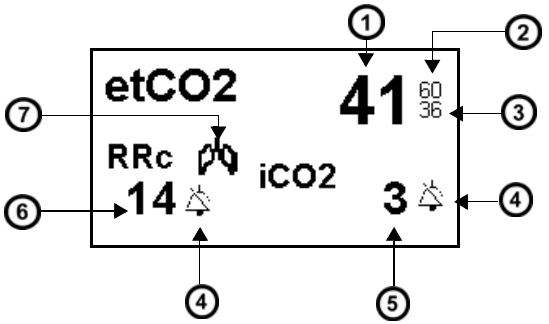
Display Features

The monitor reports etCO_2 data as waveforms and parameter values. Current parameter values appear in the etCO_2 parameter box. For information on displaying trended etCO_2 values, see Chapter 6, Trends.

Parameters

The etCO$_2$ parameter box displays the following parameters and their current values.

.

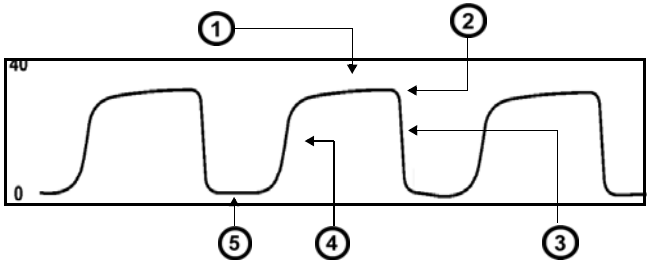


1	**End-tidal CO_2 value –** Highest average CO_2 in the airway during expiratory period.	**5**	**Inspired CO_2 value –** Minimum average value of CO_2 in the airway over the inspiratory period
2	Upper alarm limit	**6**	Respiration rate
3	Lower alarm limit	**7**	**Respiration icon** (blinks with each breath)
4	Disabled alarm icon		

WARNING: EtCO$_2$ alarms do not activate until the first breath is detected after turning on the monitor or discharging a patient.

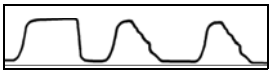
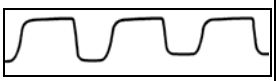
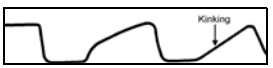
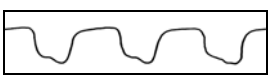
Capnograms

The monitor also displays an instantaneous CO_2 reading as a waveform or capnogram. A typical capnogram is shown below:



1	Expiratory plateau (level of CO2 in lungs ceases to increase significantly)
2	End-tidal concentration point (end of expiration phase, where etCO_2 is measured)
3	Onset of inspiration phase
4	Expiration phase
5	Baseline during inspiration

You can use capnograms to troubleshoot problems with equipment or monitor configuration as well as to monitor a patient's clinical status. The following table shows some of the more common problems identifiable through capnogram analysis:

Capnogram	Description	Immediate and possible causes
	Alveolar plateau shows downward slope that merges with descending limb	Inadequate Seal Around Endotracheal Tube • Leaky or deflated endotracheal or tracheostomy cuff • Artificial airway that is too small for the patient
	Elevated waveform baseline with corresponding increase in $etCO_2$ level	Rebreathing • Insufficient expiratory time • Faulty expiratory valve • Inadequate inspiratory flow • Malfunction of a CO_2 absorber system • Partial rebreathing circuits
	Change in slope of ascending limb. Possible absence of an alveolar plateau	Obstruction in Apparatus • Partial obstruction in expiratory limb of breathing circuit • Foreign body in upper airway • Partially kinked or occluded artificial airway • Herniated endotracheal/ tracheostomy tube cuff • Bronchospasm
	Elevated baseline, with pronounced slope on descending limb	Faulty Ventilator Circuit Valve • Rebreathing (see above)

$etCO_2$ Setup

Accessing Setup Menu

- Click on the main screen $etCO_2$ parameter box to open the $etCO_2$ setup menu

or

1. Press the **Menu** fixed key on the front of the monitor. The Main Menu appears.
2. Click on **Patient Setup**. A list of available patient setup functions appears.

3. Click on **Parameters** in the second column. A list of available parameters appears.
4. Click on **etCO$_2$**. The etCO$_2$ setup menu appears.

Quick Reference Table--etCO$_2$ Setup

The following table explains etCO$_2$ setup functions.

Function	Description	Settings
Calibration		
Sensor Cal.	Displays date and time of last Capnostat sensor calibration	N/A
Adapter Cal.	Initiates airway adapter calibration	N/A
Gas Compensation Gas compensation offsets inappropriate levels of anesthetic agents by ensuring that gas percentages in each respiratory phase add up to 100. Each gas in any gas mixture exerts a partial pressure of the total. Room air, for example, is made up of approximately 79% nitrogen and 21% oxygen. Gas concentration is usually expressed as a percentage, while partial pressure is measured in mmHg or kPa.		
N2O Compensation (module only)	Compensates for presence of nitrous oxide, not normally present in room air but typically used in the operating room. Significant concentrations of nitrous oxide can cause the monitor to overestimate the level of etCO$_2$ by approximately 5%.	• ON • OFF
O2 Compensation (module only)	Compensates for patient's supplemental oxygen. Failure to compensate for supplemental oxygen can also result in inaccurate measurements.	• 21% - 100%
Other etCO$_2$ Setup Functions		
Scale	Determines size of currently displayed waveform	• 40 mmHg • 60 mmHg • 80 mmHg • 100 mmHg (pod only)
Respiratory Sweep Speed	Sets waveform sweep speed on screen display.	• 6.25 mm/s • 12.5 mm/s • 25 mm/s • 50 mm/s

Function	Description	Settings
Averaging	Sets interval for CO_2 measurements **Note:** The monitor reports the maximum value of $etCO_2$ during the specified sampling interval.	• **Breath (**end-expiration point) • 10 s • 20 s •
Atm. Pressure Mode	Determines automatic or manual setup for atmospheric pressure compensation **Note**: Atmospheric pressure compensation should be set by qualified personnel only. Consult with your biomed/service before changing the Atm. Pressure Mode setting to **Manual**.	• Auto • Manual
Atm. Pressure	Specifies current atmospheric pressure. This function is ghosted if you have selected **Auto** under Atm. Pressure Mode.	• **540** to **800 mmHg** in increments of 5
Measurement Mode	Configures the monitor for mainstream or sidestream monitoring	• Main • Side
Respiration Filter	Filters signal artifact caused by cardiogenic oscillations or Baines rebreathing bumps, which could cause the monitor to display an erroneously high respiration rate (RRc)	• **Normal**--Disables the filter • *Special*--Enables this filtering at the expense of a certain degree of monitor responsiveness
Apnea Alarm	Displays Apnea Alarm menu.	• RRc Apnea Time • *Apnea Archive*
$etCO_2$ Alarm	Accesses Alarm Limits table, where you can set upper and lower alarm thresholds.See Chapter 5, Alarms, for information about setting and displaying alarm limits.	N/A WARNING: $EtCO_2$ alarms do not activate until the first breath is detected after turning on the monitor or discharging a patient

Quick Reference Table -- Apnea Alarm submenu

The following table explains apnea alarm submenu functions.

Function	Description	Settings
RRc Apnea Time	Specifies time monitor waits before reporting a cessation of breathing as an apnea event.	• OFF, 10, 15, 20, 25, and 30 s
Apnea Archive	Allows you to store and/or record automatically an alarm event for apnea. You can later review stored alarms on the Event Recall screen.	• OFF, Record, Store (default), Str./Rec.

Cleaning, Calibration and Verification

Cleaning

For information on cleaning ventilation tubing, sensors and adapters, see Chapter 21, Cleaning and Disinfecting.

Adapter Calibration

Calibrate the adapter every time you switch adapter types — for example, when you switch from a mainstream to a sidestream adapter, or from an adult to a neonatal adapter. You do not normally have to calibrate an adapter if you are replacing it with another of the same type.

To calibrate an airway adapter:

1. Click on the $etCO_2$ parameter box to access the setup menu.
2. Click on **Adapter Cal.** A popup message appears: $etCO_2$ Place Adapter in Room Air.

   Connect the CO_2 sensor onto the airway adapter and hold them away from any source of CO_2 (including the patient's mouth and your own).
3. Click on *Continue*. The calibration takes approximately 15 seconds, during which the following message appears: $etCO_2$ Calibrating Adapter
4. When calibration is successful, the monitor displays the message: $etCO_2$ Adapter Cal. Accepted. If calibration fails, the monitor displays a status message (see "Status Messages" on page 16-14).

Sensor Calibration and Verification

To ensure accurate readings, calibrate the Capnostat every time you connect it to a different $etCO_2$ module. Calibration is unnecessary if you disconnect the sensor and later reconnect it to the same device. You can display the date and time of the last Capnostat sensor calibration by clicking on **Sensor Cal.** in the $etCO_2$ menu. Verify the sensor calibration periodically to ensure it is functioning correctly, or when you suspect changes or inaccurate readings.

To calibrate and verify the Capnostat sensor:

1. Make sure the monitor is turned on and properly connected to the module.
2. The monitor displays a message informing you that the sensor is warming up (~2 minutes at room temperature).

3. When the sensor reaches a stable temperature, the monitor instructs you to place the sensor on the Zero cell.
4. Locate the Zero and Reference cells on the sensor cable (see figure right).
5. Place the sensor on the Zero cell. The calibration process begins automatically and takes about 20 seconds.
6. When calibration is complete, the monitor instructs you to place the sensor on the reference cell.
7. Place the sensor on the Reference cell. The monitor displays the message: $etCO_2$ Verifying Sensor Cal.
8. When the verification is complete, the monitor displays the message: $etCO_2$ Sensor Cal. Verified.

You can now use the sensor.

If verification fails, the monitor again displays the message $etCO_2$ Place Sensor on Zero Cell. In this case, repeat the process from Step 5. A status message appears if calibration fails again (see table at the end of this chapter).

Status Messages

Message	Condition	Suggested Action
$etCO_2$ < # $etCO_2$ > #	Upper or lower alarm limits exceeded by value #	• Check the patient and treat if necessary. • Change alarm limits. • Check equipment and replace if necessary.
iCO_2 < # iCO_2 > #		
RRc < # RRc > #		• Check ventilator for: • Inspiratory flow • Expiratory time • Faulty expiratory valve
RRc Apnea	No breath is detected for a period exceeding the RRc apnea time set by the user.	• Check the patient and treat if necessary.
$etCO_2$ H/W Failure	Hardware malfunction	• Disconnect the $etCO_2$ module, then reconnect it. If the message persists. • Return the device to Biomed and try a new one.
$etCO_2$ Calibrate Atm. Press.	Corrupt EEPROM	• Shift to Manual mode and dial in pressure. If automatic pressure required, return to Biomed.
$etCO_2$ Sensor Unplugged	$etCO_2$ sensor has been disconnected.	• Disconnect then reconnect the $etCO_2$ sensor. If the message persists, try another sensor.
$etCO_2$ Sensor Warming Up	CAPNOSTAT has not yet reached a stable temperature.	• Wait for sensor to warm up (up to three minutes at room temperature). If message fails to clear, call Biomed.
$etCO_2$ Sensor Failure	CAPNOSTAT source current is out of range or sensor did not warm up within 8 minutes.	• Try sensor again. If the message persists, try a new sensor.
$etCO_2$ Sensor Too warm	External heat source is warming the sensor.	• Replace the sensor. • Remove heat source. • If the problem persists, disconnect and reconnect the sensor.
$etCO_2$ Place Sensor on Zero Cell	Last sensor calibration failed or sensor is not the last sensor calibrated on this device.	• Place the sensor on the zero cell and wait for zeroing to complete.

Message	Condition	Suggested Action
$etCO_2$ Sensor Temp Not Stable	The sensor temperature is unstable following warm-up.	• Wait at least three minutes for the message to disappear. If the message persists, replace the sensor.
$etCO_2$ Out of Range (High)	CO_2 value is out of range (high).	• Check the patient and treat if necessary. Recalibrate sensor.
$etCO_2$ Check Airway Adapter/Cal	Airway adapter is dirty, not fully seated, or out or calibration.	• Make sure the adapter is properly seated. Clean and calibrate the airway adapter.
$etCO_2$ Calibrating Sensor	Calibrating on zero cell	• Informational message; no action required
$etCO_2$ Cannot Cal. Sensor	Calibration on zero cell could not be completed because of CAPNOSTAT temperature instability.	• Check for any heat sources warming the sensor and remove them. • Wait at least three minutes for the temperature to stabilize.
$etCO_2$ Adapter Failure	Airway adapter is dirty, not fully seated, or out or calibration.	• Make sure the adapter is properly seated. • Clean and calibrate the airway adapter.
$etCO_2$ Place Sensor On Ref Cell	Calibration on zero cell completed successfully.	• Place sensor on the reference cell and wait for calibration to complete.
$etCO_2$ Sensor Cal. Failed	Calibration on zero cell failed.	• Recalibrate. If the message persists, try a new sensor.
$etCO_2$ Verifying Sensor Cal	Calibrating on reference cell.	• Informational message; no action required
$etCO_2$ Sensor Cal. Verified	Verification completed successfully.	• Informational message; no action required
$etCO_2$ Calibrating Adapter	Airway adapter cal. (zeroing in room air) in progress.	• Informational message; no action required
$etCO_2$ Cal. Failed, Breaths?	Breaths detected during the 20 second period following activation of the Adapter Cal. key.	• Make sure the sensor is not connected to the patient's ventilator breathing circuit or close to a CO_2 source. Recalibrate.

Message	Condition	Suggested Action
$etCO_2$ Cannot Cal. Adapter	Airway adapter cal. (zeroing in room air) could not be completed because of CAPNOSTAT temperature instability, or because the CAPNOSTAT was on the zero cell.	• Recalibrate holding sensor in room air (not on zero cell). • Wait at least eight minutes for temperature to stabilize and recalibrate. • Remove any heat source warming the sensor and recalibrate. • Remove sensor from Zero cell, place on the adapter, and recalibrate.
$etCO_2$ Adapter Cal. Accepted	Airway adapter cal. (zeroing in room air) completed.	• Informational message; no action required
$etCO_2$ Adapter Cal. Failed	Airway adapter cal. (zeroing in room air) failed.	• Make sure the adapter is properly attached to the sensor and that its windows are clean. If the problem persists, try another adapter.
$etCO_2$ Adapter Cal. Required	Sidestream measurement mode was initiated, requiring air way adapter cal. (zeroing in room air) to calibrate pump.	• Calibrate the new adapter.
$etCO_2$ Tubing Blocked	Sidestream tubing obstructed, or filter is clogged.	• Clear blockage in the tubing. • Replace the module.
$etCO_2$ Tubing Leak	Sidestream tubing has a leak.	• Change the tubing.
$etCO_2$ module Disconnected	The $etCO_2$ module is not connected to the monitor.	• Check cable and connection. Replace cable if necessary.
$etCO_2$ module Incompatible	Corrupt EEPROM. Wrong software or hardware version	• Try a new module. • Consult your hospital's Biomed.

Chapter 17 FiO_2 (Fractional Inspired O_2) Monitoring

Overview

The monitor measures fractional inspired oxygen concentration (FiO_2), in neonatal mode only, via the NeoMed pod and an FiO_2 sensor. The FiO_2 sensor is typically placed in the incubator or under the oxygen hood and near the infant's head. As varying concentrations of oxygen diffuse into the sensor, two electrodes generate a current proportional to the partial pressure of oxygen in the air of the hood or incubator. The monitor measures this electrical current and converts it to a percentage, which it then displays on the monitor.

Because the sensor responds to partial pressure of oxygen (and not percentage), changes in barometric pressure can affect the reading even if the percent of oxygen being monitored stays the same. Changes in humidity change the percentage of oxygen in the air (but not the partial pressure). As a result, the reading does not change and may not accurately reflect the concentration of oxygen. For example, if 100% oxygen is displayed as saturated with 100% humidity, the actual concentration of oxygen is 97%.

The FiO_2 sensor, which has a minimal response to gases other than oxygen, is sensitive to changes in barometric pressure and humidity. Do not handle the sensor unnecessarily, as your body heat can temporarily cause it to produce error.

FiO_2 sensors contain lead. Dispose of sensors properly and in accordance with local regulations.

FiO_2 values are trended (see Chapter 6, Trends).

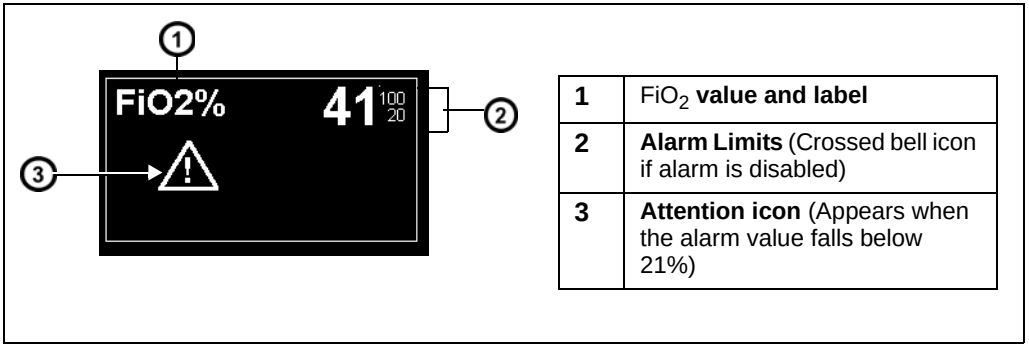
Precautions

WARNING:

- **Do not use in hyperbaric chambers or in the presence of flammable or anesthetic agent. See Chapter 2, Overview.**
- **Setting alarm limits below 21% may expose patients to low oxygen levels, which may compromise primary organ function.**
- **Secure excess cable away from the patient's head and neck.**
- **Failure to understand the effects of pressure, humidity, and temperature on the O2 sensor can result in inaccurate oxygen monitoring (see page 17-2 for more information).**
- **Sensors contain caustic material. Avoid contact with eyes, skin or clothing. Dispose of a leaking sensor immediately in accordance with local regulations.**
- **Electrical fields from other equipment may cause erratic values. You may need to move the sensor away from other devices.**

Display Features

FiO_2 values are displayed in a parameter box as shown below.

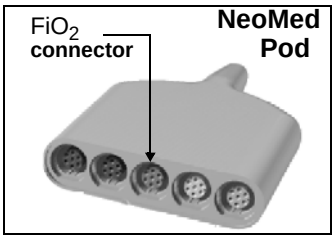


1	FiO_2 **value and label**
2	**Alarm Limits** (Crossed bell icon if alarm is disabled)
3	**Attention icon** (Appears when the alarm value falls below 21%)

FiO_2 Setup

The monitor acquires FiO_2 signals from the sensor via the NeoMed pod. To connect the pod to the sensor:

1. Set the patient category on the monitor to **Neonatal**.
2. Plug an FiO_2 sensor cable into the FiO_2 connector on the NeoMed pod.
3. Plug the NeoMed pod into the MultiMed connector on the monitor.
4. Attach a sensor into the FiO_2 sensor cable. Push the sensor firmly into cable receptacle until you hear it click.



5. Place the sensor in the incubator or under the oxygen hood.

Menu Access

The FiO_2 menu displays the date and time of 1-point and 2-point calibrations (see below). The menu item **Last O2 Cal** is informational only. It displays the date and time of the last successful calibration, either 1-point or 2-point. To open the FiO_2 menu:

- Click on the *FiO_2* parameter box on the Main Screen

or

1. Press the **Menu** fixed key.
2. Click on **Patient Setup**.
3. Click on *Parameters*.
4. Click on *FiO_2*.

Calibration

Every time a sensor is connected to the NeoMed pod, you must calibrate the monitor to the sensor. The monitor does not display FiO_2 values until it is calibrated.

There are two types of calibration. 1 Point calibration measures the oxygen in room air, typically 21%, and calibrates the monitor to that measurement. 2 Point calibration uses two measurements, room air and 100% oxygen, to calibrate the monitor. 2 Point calibration provides more accurate FiO_2 monitoring because the monitor is calibrated to two different measurements.

One Point calibration should be performed daily. Two Point calibration should be performed weekly. You should also calibrate the monitor as follows:

- Periodically, to verify the correct functioning of the sensor
- Daily, if you are monitoring a patient's FiO_2 on a daily basis
- When you suspect that sensor characteristics have changed
- When the accuracy of the monitor is in question
- When there is a change in humidity or barometric pressure of the monitoring site

1 Point Calibration (Room Air)

A one-point calibration of the sensor to room air (21% oxygen) should be performed on a daily basis:

1. Make sure the monitor is turned on and that the NeoMed and the monitor are set up for FiO_2 monitoring (see page 17-4).
2. Expose the sensor to room air.
3. Open the FIO_2 menu (see page 17-4).
4. Click on **1 Point Cal.** A message appears: *21% Calibration in Progress -- Calibration may take from 1-10 minutes.*
5. Wait for the message *21% Calibration Complete* to appear. (A message informs you of a failed calibration. Try calibrating again; if the message persists, try a new sensor.)
6. Return the sensor to the incubator or oxygen hood.

2 Point Calibration (Cal Gas)

NOTE: Contact your Biomed for help with 2-point calibration.

A two-point calibration of the system, to 100% dry oxygen and room air (21% oxygen), should be performed every week:

1. Make sure the monitor is turned on, that the NeoMed pod is properly connected, and set up for FiO_2 monitoring.
2. Set up the sensor for O_2 calibration following your hospital's guidelines.
3. Open the FiO_2 menu (see page 17-4).
4. Click on **2 Point Cal.**

5. Supply 100% O_2 when instructed by the monitor.
6. Click on **Continue**. A message appears informing you that the calibration is in progress and requesting you to wait until calibration is complete before proceeding with room air calibration.
7. Wait for the system to calibrate. When calibration is finished, the following message appears:

   100% Calibration Complete

8. Follow the instructions on page 17-5 to calibrate the system to room air (1 Point Calibration).
9. Return the sensor to the incubator. A status message appears if calibration fails. Refer to the table at the end of this chapter for status messages.

Status Messages

Message	Condition	Suggested Action
FiO_2 < #	O2 value exceeds set alarm limits (high).	• Check the patient and treat if necessary. • Recalibrate the system.
FiO_2 > #	O_2 value exceeds set alarm limits (low).	• Check the patient and treat if necessary. • Recalibrate the system.
FiO_2 Cal. Canceled	The calibration has been stopped.	• Try to calibrate again.
FiO_2 Cal Failure	The monitor could not calibrate the FiO_2 sensor.	• Recalibrate. If the message persists, try a new sensor.
FiO_2 Cal Accepted	Calibration was successful.	• Informational message only.
FiO_2 21% Cal. in Progress	Monitor is performing 21% (1-point) calibration.	• Wait.
FiO_2 100% Cal. in Progress	Monitor is performing 100% (2-point) calibration.	• Wait.
FiO_2 Cal Required	The sensor needs to be calibrated.	• Perform a calibration.
FiO_2 Cal Paused	Monitor is waiting for you to expose the sensor to room air (during 2-point calibration).	• Remove the sensor from the T-piece and expose it to room air.

Message	Condition	Suggested Action
FiO_2 H/W Failure	Hardware malfunction.	• Disconnect the NeoMed pod, then reconnect it. If the message persists, return the pod to Biomed and try a new one.
FiO_2 Pod Unplugged	The monitor cannot detect a NeoMed pod.	• Check the connections and verify the pod is correctly plugged into the monitor.
FiO_2 Sensor Unplugged	The monitor is not detecting a sensor.	• Check sensor connections.
FiO_2 Sensor Failure	The sensor is not accurately measuring oxygen.	• Try the sensor again. If the message persists, try a new sensor.

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Chapter 18 Scio® Four Modules

Intended Use

The Scio Four modules sample breathing gases from adults and pediatrics. The gas modules continously measure the content of CO2, N2O, O2, and one of the anesthetic agents, Halothane, Isoflurane, Enflurane, Sevoflurane, and Desflurane in any mixture and communicates real time and derived gas information to the Infinity monitors.

With etCO_2 the monitors can measure end tidal carbon dioxide, inspired carbon dioxide, and respiration rate in either mainstream or side-stream measurement mode; and with etCO_2+Respratory Mechanics, spirometry and carbon dioxide can be monitored. The monitors can interface with specific third party devices via an MIB protocol converter.

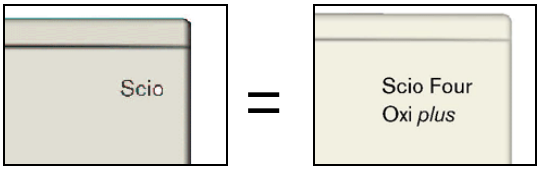
Overview

NOTE: Dräger Medical's MultiGas and MultiGas+ modules are not supported by VF6 and VF7 software.

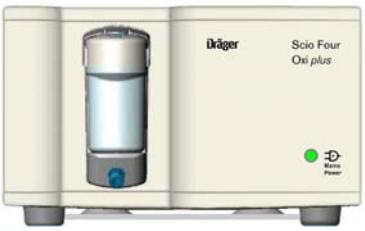
The Scio module is a free-standing unit that samples breathing gases from adult and pediatric patients in non-, partial- and total rebreathing systems.

NOTE:

- The Scio module comes in four different models, with four different levels of performance. Please note which model you are using.
- All references to "the Scio module" in this chapter refer to all four models of the Scio module: Scio Four Oxi plus, Scio Four Oxi, Scio Four plus, and Scio Four. Model-specific information is documented as required.
- If your Scio module is labeled simply "Scio" in the upper right of the front panel, then the funtionality of your module will match the "Scio Four Oxi plus".



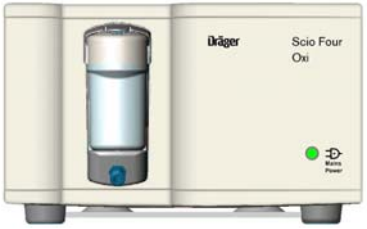
Scio Four Oxi plus



The Scio Four Oxi plus continuously measures the content of CO_2, N_2O, O_2 and one of the anesthetic agents Halothane, Isoflurane, Enflurane, Sevoflurane and Desflurane in any mixture. It automatically identifies the anesthetic agent that is present in the highest concentration. It communicates real time and derived gas information to the host system. The monitor saves values derived by the modules in its trend storage. The Scio Four Oxi plus module calculates both inspiratory and expiratory O_2 values (iO_2 and etO_2).

Scio Four Oxi

The Scio Four Oxi continuously measures the content of CO_2, N_2O, O_2 , and one of the anesthetic agents Halothane, Isoflurane, Enflurane, Sevoflurane and Desflurane in any mixture.



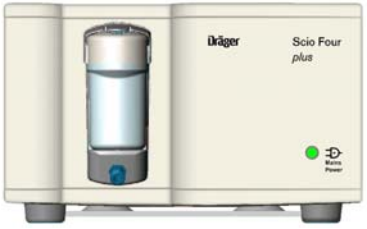
CAUTION: The primary anesthetic agent must be set manually by the user. See page 18-23.

NOTE: Scio Four Oxi displays **AA?** in Agent pbox until user selects agent in the parameter menu.

Scio Four Oxi communicates real time and derived gas information to the host system. The monitor saves values derived by the modules in its trend storage. The Scio Four Oxi module calculates both inspiratory and expiratory O_2 values (iO_2 and etO_2).

Scio Four plus

The Scio Four plus continuously measures the content of CO_2, N_2O and one of the anesthetic agents Halothane, Isoflurane, Enflurane, Sevoflurane and Desflurane in any mixture. It automatically identifies the anesthetic agent that is present in the highest concentration.



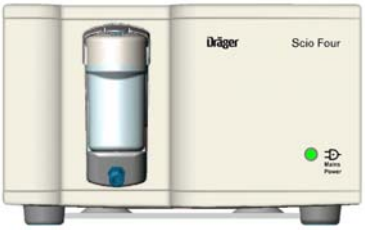
CAUTION: Scio Four plus does not measure O_2.

NOTE: Scio Four plus blanks the O2 label and data in pbox.

Scio Four plus communicates real time and derived gas information to the host system. Except for N_2O, the monitor saves values derived by the modules in its trend storage.

Scio Four

The Scio Four continuously measures the content of CO_2, N_2O, and one of the anesthetic agents Halothane, Isoflurane, Enflurane, Sevoflurane and Desflurane in any mixture.



CAUTION:

- *Scio Four does not measure O_2.*
- *The primary anesthetic agent must be set manually by the user.* *See page 18-23.*

NOTE:

- Scio Four displays **AA?** in Agent pbox until user selects agent in the parameter menu.
- Scio Four blanks the O2 label and data in pbox.

Scio Four communicates real time and derived gas information to the host system. The monitor saves values derived by the modules in its trend storage.

Quick Reference Table -- Scio models

Scio Model	Functionality
Scio Four Oxi plus	Measures CO_2, N_2O, O_2 and auto agent ID.
Scio Four Oxi	Measures CO_2, N_2O, O_2 and manual agent ID.
Scio Four plus	Measures CO_2, N_2O and auto agent ID.
Scio Four	Measures CO_2 and N_2O and manual agent ID.

CAUTION:

- *Federal law restricts this device to sale by or on the order of a physician.*
- *The gas information is intended to be used by trained and authorized health care professionals only.*

Full technical descriptions of the Scio module are available from your local Dräger Medical representative.

WARNING:

- **Sampling of the respiratory gas from the patient breathing circuit can reduce the delivered patient tidal volume and clinicians should adjust the fresh gas supply as necessary.**
- **The Scio module samples breathing gases at a sample flow rate of 200 ±20 or 150 ±20 ml/min. Modules with a sample flow rate of 200 ±20 ml/min. specify this flow rate on the back panel. If the flow rate is not specified on the back panel, the module has a flow rate of 150 ±20 ml/min.**

The Scio module uses infrared light for the measurement of CO_2 and volatile anaesthetics. A small amount of the patient respiratory gas is drawn through a measuring chamber. An infrared light is shone through the chamber and the gas sample absorbs different amounts of light. A paramagnetic cell is used for the measurement of O_2. This cell uses a physical reaction that is proportional to the O_2 concentration. Mechanical shocks during measurement or the presence of other paramagnetic agents can distort the measurement of oxygen concentration.

Due to the response time of the sensors and the gas sample flow rate, the stated accuracy of O_2, CO_2, N_2O and anesthetic agents is limited by respiratory rate and inspiratory to expiratory (I:E) ratio.

- **(Scio Four Oxi plus and Scio Four Oxi only)** For O_2 measurements, the stated accuracy of Scio is maintained to a respiratory rate of 60 BPM with an I:E ratio of 1:2.

- For CO_2 measurements, accuracy is maintained to a respiratory rate of 75 BPM with an I:E ratio of 1:2.
- For N_2O measurements, accuracy is maintained to a respiratory rate of 75 BPM with an I:E ratio of 1:2.
- For anesthetic agents, accuracy is maintained to a respiratory rate of 60 BPM with an I:E ratio of 1:2.

The effect of respiratory rate and I:E ratio settings on accuracy were determined in a simulated breathing system using square wave gas concentration waveforms.

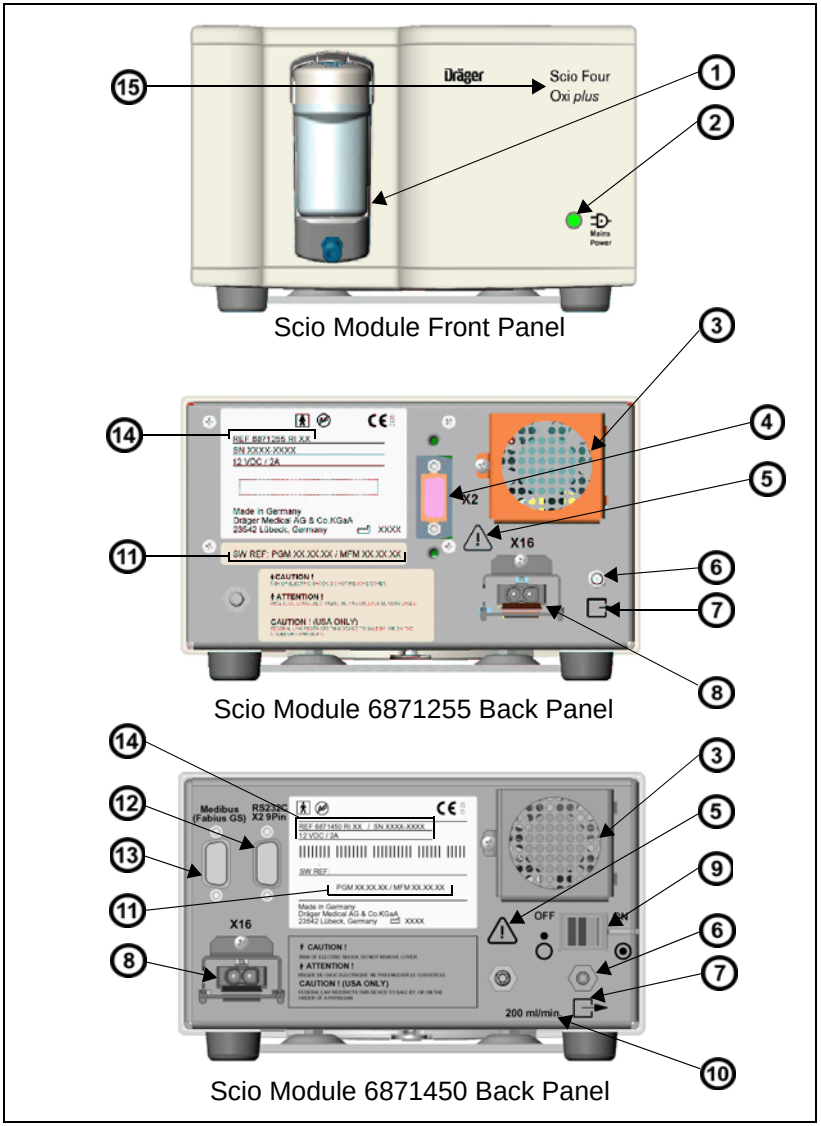
WARNING:

- **The presence of aerosols in the breathing circuit should be avoided (displayed agent concentration may be affected and/or watertrap membrane may be affected).**
- **The presence of organic cleaning solutions or gases containing freon will impare the accuracy of the Scio module.**

CAUTION:

- *The Scio module purges and zeroes itself approximately once every two hours. The typical zeroing cycle lasts no longer than 25 seconds. Waveforms flatline and P-box values blank from the screen during this cycle.* **Multigas Zero in Progress** *appears in the message area. (Note: An extended zeroing cycle may be performed after initial power-up of unit.)*
- *To prevent damage to the watertrap and measuring system:*
  Do not use the water trap with nebulizers.
  Do not allow alcohol or cleaning agent/disinfectant to enter the water trap.
  Do not wash or sterilize the water trap.

Hardware Setup



1	Water trap	**8**	External **Power Supply connector**
2	External Power indicator	**9**	**ON/OFF** switch
3	**Fan** exhaust **screen**	**10**	**Flow Rate** label
4	X2 connector	**11**	**Software version** label

5	**Safety** label: "Attention! Consult the accompanying document."	**12**	RS232C connector (X2 9 pin)
6	Exhaust port	**13**	**Medibus** connector
7	**Safety** label: "Gas out"	**14**	**Hardware version** label
		15	Model name (example only)

Site of Operation

The site of operation must meet the temperature, humidity, and atmospheric pressure requirements listed in Appendix C. In addition, observe the following guidelines:

- Make sure that the platform which supports the module is large enough, level, and stable.
- Make sure that the fan exhaust screen at the rear of the module and the ventilation holes on the underside are not obstructed.
- Place the module at least 25 cm (10 inches) from any possible source of ignition, such as sparking.

- Place the module close enough to the patient so that the sampling tubing can reach the airway T-connector and the exhaust tubing the hospital's exhaust gas scavenging system without stretching.

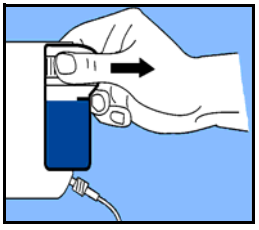
WARNING:

- **Do not use mobile phones within 33 feet (10 m) of the Scio module. Wireless phones may cause failure.**
- **Do not expose the Scio Module to mechanical vibrations or shock during measurement. Mechanical vibrations or shock can have adverse effects on gas measurement values.**
- **The operation of the Scio module in magnetic resonance imaging environments (MRI) is not supported.**
- **Do not use a Scio module near devices with microwave or other high-frequency emissions. These emissions may interfere with the modules' operation.**
- **When placing the module, assure adequate ventilation/ heat dissipation and avoid direct contact of the patient with the pod's exterior surface.**
- **Vista XL and the Scio Module must both be connected to a hospital outlet (for the US: hospital grade outlet) within the same medically used room.**
- **When the Vista XL is used with the Scio it meets the Class A limits of CISPR11. The system is not intended for connection to public mains.**
- **To minimize the risk of injury to patient, place the Scio Module and cables carefully and securely.**

CAUTION: *To avoid damage to this device, use only Drager Medical provided accessories (See Appendix C, Approved Options and Accessories)*

Installing the Water Trap

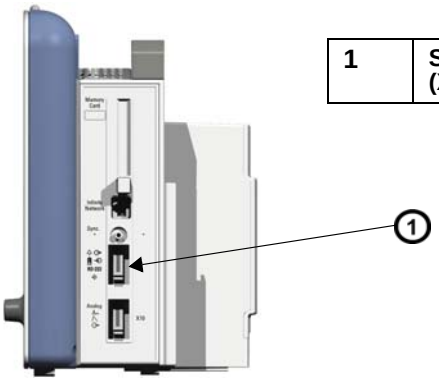
Install the water trap into its receptacle on the Scio module by pushing against the Scio. A click will indicate that it is seated properly. Confirm that the water trap is empty. (For information on replacing the water trap, see page 18-28.)



Cable Connections

The Scio module connects directly to the Vista XL monitor via the Scio Direct Connect cable in the X8 connector.

Vista XL (Right View)



1	**Scio Direct Connect cable** connector **(X8)**

Tubing Connections

WARNING:

- **Sampling tubing should be kept as short as possible (but not stretched) to minimize dead space and optimize response time. Long sampling lines degrade the performance of side stream measurements, may affect accuracy, and result in slower response times.**
- **Always use Dräger Medical provided Scio sampling tubing (polypropylene). *Never* use standard pressure-sensor tubing (PVC). PVC tubing absorbs anesthetic agents, which it later releases (degassing). The use of standard PVC tubing can result in erroneous agent concentration readings.**
- **To avoid the risk of explosion, do not use flammable anesthetic agents such as ether and cyclopropane with the Scio module.**
- **Incorrect or loose connection of tubing may allow gas leakage. Leakage can result in erroneous readings.**

CAUTION: *Do not use the module without a watertrap, otherwise the correct functioning of the device may be compromised.*

Connect the module and tubing as follows:

1. Connect one end of the sampling tubing to the water trap, and the other end to the airway T-connector. (For information on changing sampling tubing and T-connector, see page 18-27).
2. If return of sample gas is not possible, connect one end of the exhaust tubing to the exhaust port at the rear of the module (see drawing on page 18-8), and the other end to the hospital's gas-scavenging system

NOTE: If possible, use sample gas recirculation:

- to prevent increased anesthetic agent concentration in the operation room.
- to conserve anesthetic agents.
- to prevent undesired losses of volume during low-flow application.

WARNING: Accumulation of exhaled metabolic products may occur during low flow anesthesia, therefore monitoring of oxygen concentration is mandatory. Flushing the circuit with fresh gas at regular intervals may be necessary particularly if decreasing oxygen concentrations are measured.

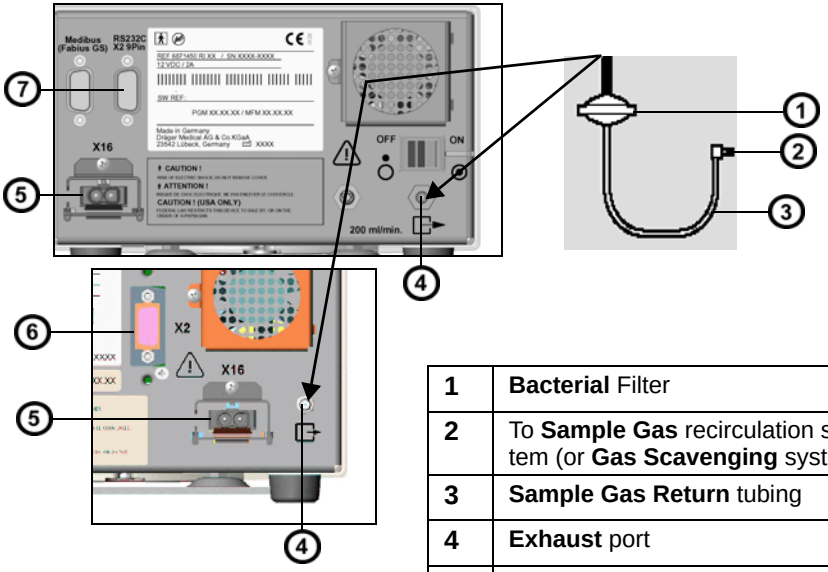
3. Connect Recirculating sample gas tubing as follows:

- For Dräger COSY breathing system (Fabius GS):
  - — Use Sample Gas Return kit.
  - — Push the rubber sleeve on to the exhaust port on the back of Scio and plug the connector into the socket on the front of the COSY(Fabius GS) until it clicks into place.
- For other breathing systems:
  - — Use Sample Gas Return kit with an integrated bacterial filter and connect it to the breathing system used adjacent to the expired gas valve so that the returned sample gas is routed through the CO_2 absorber.

CAUTION: *Replace Sample Gas tubing Bacterial filter every 6 months.*

NOTE: The exhaust port is a hose barb type connector.

— Strtrictly follow the instructions for use of the breathing system.



1	**Bacterial** Filter
2	To **Sample Gas** recirculation system (or **Gas Scavenging** system)
3	**Sample Gas Return** tubing
4	**Exhaust** port
5	External **Power Supply connector**
6	**X2 connector**
7	**RS232C connector** (**X2** 9 pin)

4. Connect one end of the Scio connecting cable to the X2 connector (③) at the rear of the module and the other end to the /IDS connector marked X3 . (See “Cable Connections” on page 18-11.) If you are using a breakout box, connect the end to the connector on the breakout box.
5. Connect the power supply to the external power supply connector (②) at the rear of the module.
6. Connect the power supply cord to a hospital outlet (for the US: a hospital grade outlet).

Warm-Up

Upon start-up, the Scio module passes through an initialization and warm-up period. During this time, the $etCO_2$* (in some models O_2) and/or Agent parameter boxes display a question mark.

WARNING: During warm-up, reported values might not be accurate. To achieve full accuracy, a typical warm-up period of 7 minutes is recommended. Refer to the *Technical Data* appendix for a detailed description of Scio accuracy.

Calibration

The Scio module is self-zeroing and does not need calibration by the clinical staff.

A yearly check of the Scio calibration components should be performed by authorized technical personnel.

SCIO Setup

Scio parameters are displayed in the $etCO_2$* (in some models O_2/N_2O) and Anesthetic Agent parameter boxes. Each has its own setup menu, described in the following pages.

WARNING: Under extreme monitoring conditions (and if a network functionality is in use) intermittent spikes may be present on the Scio waveform. Parameter box data is not affected.

NOTE:

- Some Scio parameter labels are marked by an asterisk (*) to distinguish them from parameters monitored by the $etCO_2$ module.
- In some models, you can display the O_2/N_2O and agent parameters in a single combined parameter box (see 18-24).

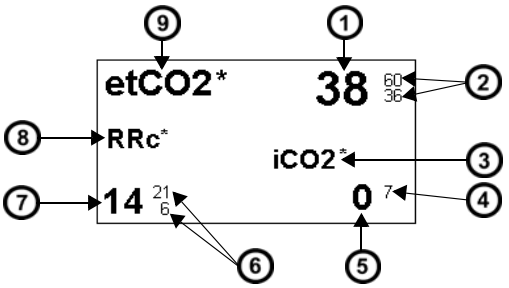
$etCO_2$* Monitoring

The $etCO_2$* waveform displays the instantaneous CO_2 measurements calculated by the Scio module. The $etCO_2$* parameter box displays the current values for:

Inspired CO_2 (iCO_2*)[③] — The level of CO_2 in the airway during the inspiration phase (⑤).

End-tidal CO_2 ($etCO_2$*)[⑨] — The level of CO_2 in the airway at the end of expiration (①).

Respiration Rate (RRc*)[⑨] — The patient's respiration rate, derived from the $etCO_2$* signal by calculating an average rate over the two most recent breaths (⑦).



1	$etCO_2$* (end-tidal CO_2) value	**6**	Alarm limits
2	Alarm limits	**7**	Respiration rate value
3	iCO2* (inspired CO_2) label	**8**	Respiration rate label
4	Alarm limit (Upper limit only)	**9**	$etCO_2$* label
5	iCO2 value		

WARNING: $EtCO_2$* alarms do not activate until the first breath is detected after turning on the monitor or discharging a patient.

NOTE: The monitor does not alarm for $etCO_2$* or inspiratory and expiratory agent limit violations until it has established a valid respiratory rate.

To access the Scio $etCO_2$* setup menu:

- Click on the $etCO_2$* parameter box

or

1. Press the **Menu** fixed key.
2. Click on **Patient Setup**.
3. Click on **Parameters** to display a list of available parameters.
4. Click on **$etCO_2$***.

Quick Reference Table -- $etCO_2$ Setup*

Click on the following items to execute $etCO_2$* setup functions:

The $etCO_2$* Setup Menu		
Menu Item	**Description**	**Settings**
Scale	Sets $etCO_2$* waveform scale	• 40, 60, 80
Respiratory Sweep Speed	Sets waveform sweep speed on screen display.	• 6.25 mm/s • 12.5 mm/s • 25 mm/s • 50 mm/s
Agent Display	Displays a separate Agent parameter box;. Ghosted if the monitor is displaying combined MultiGas parameter box (see 18-24).	• ON, OFF
Pressure Comp.	Sets compensation for ambient atmospheric pressure	• Auto • 760 mmHg
RRc* Apnea Time	Sets time that the monitor waits before reporting a cessation of breathing as an apnea event	• OFF, 10, 15, 20, 25, 30 s
Apnea Archive	Allows you to store and/or record automatically an alarm event for apnea. You can later review stored alarms on the Event Recall screen.	• OFF, Record, Store (default), Str./Rec.
MultiGas Zero	Manually zeroes the Scio module. **Note**: During zeroing, the monitor temporarily blanks Scio parameter values.	N/A
Auto Zero Delay	Delays automatic zeroing for 5 minutes for uninterrupted monitoring. **WARNING**: **Delaying the auto zero may inpact the accuracy of the device.** **Note**: Gas sensors in the Scio module are automatically zeroed and calibrated against room air. During zeroing, the monitor temporarily blanks Scio parameter values. One minute before automatic zeroing, the monitor sounds an attention tone and displays the message *Auto zero in <1 minute*.	N/A
$etCO_2$* Alarms	Accesses $etCO_2$* alarms in Alarm Limits table (see this Instructions for Use Chapter 5)	

O_2/N_2O Monitoring (*Scio Four Oxi plus and Scio Four Oxi*

only)

The O_2 waveform indicates O_2 concentrations calculated by the Scio module. The O_2 parameter box can display the current concentration values for the following parameters:

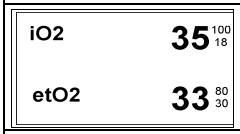
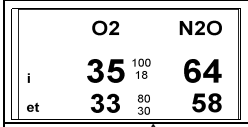
Inspired O_2 (iO_2) — The level of O_2 in the airway during the inspiration phase

Expired O_2 (etO_2) — The level of O_2 in the airway during the expiration phase

N_2O — The concentration of N_2O in the patient's airway

The appearance of the O_2 parameter box varies depending on whether or not the N_2O display is turned on in the O_2 menu.

Typical O_2/N_2O parameter box displays are shown below.

Parameter Box	Description
	ScioModule: N_2O display turned off. This module calculates both iO_2 and etO_2 values.
	Scio Module: N_2O display turned on. This module calculates both iO_2 and etO_2 values.
Notes: The ⚠ symbol in the parameter box indicates that the O_2 lower alarm limit has been set to a value less than 21% (the percentage of O_2 in room air). The O_2 parameter box does not show N_2O alarm limits because N_2O does not alarm.	

To access the O_2(/N_2O) setup menu:

- Click on the O_2/N_2O parameter box

or

1. Press the **Menu** fixed key.
2. Click on **Patient Setup**.
3. Click on **Parameters** to display a list of available parameters.
4. Click on **O2**.

Quick Reference Table -- O2/N2O Setup

Click on the following items to execute O_2/N_2O setup functions

The O_2 ($/N_2O$) Setup Menu		
Menu Item	**Description**	**Settings**
MultiGas Parameter	Enables combined MultiGas parameter box display (see 18-24).	• ON, OFF
O2 Scale	Sets O_2 waveform scale	• 50 %, 100 %
N2O Display	Displays N_2O values **Notes:** This selection is ghosted and not available if the monitor is configured to display a combined Scio parameter box (see page 18-24). There is no alarm function for N_2O and the parameter box does not show N_2O alarm limits.	• ON, OFF
MultiGas Zero	Manually zeroes the Scio module. **Note**: During zeroing, the monitor temporarily blanks Scio parameter values.	N/A
Auto Zero Delay	Delays automatic zeroing for 5 minutes for uninterrupted monitoring (see 18-16 for information)	N/A
1 Point Cal.	See 18-14 for further information on calibration functions	
2 Point Cal.		
Last O2 Cal.		
O2 Alarms	Accesses Limits table (see this Instructions for Use Chapter 5)	N/A

Agent Monitoring

You can identify agent waveforms and parameters by color (*Halothane*--Red; *Desflurane*--Light blue; *Enflurane*--Orange; *Sevoflurane*--Yellow; *Isoflurane*--Purple).

The Agent parameter box shows the inspiratory and end-tidal values for the currently monitored agent.

(Scio Four Oxi plus & Scio Four plus only.) If the module has not yet identified or cannot identify the agent, the Agent parameter box displays **Agent?**

WARNING: If the monitor displays a question mark next to an agent's parameter label, the displayed agent concentration values may not meet the specified accuracy and should be used with caution.

(Scio Four Oxi & Scio Four only.) There is no automatic agent identification with this module. User must set desired agent manually. See page 18-23.

WARNING:

- **Use care when setting agent ID manually. If incorrect agent ID is selected, incorrect measurements will occur.**
- **Scio Four Oxi & Scio Four cannot recognize anesthetic gas mixtures. If anesthetic gases are mixed, incorrect measurements will occur.**

NOTE:

- If the user has not selected an anesthetic agent yet, **AA?** is displayed in the parameter box.
- The Agent ID resets to blank upon a power cycle or patient discharge.

MAC Values

Standard MAC Values

NOTE: Standard MAC values are used when the module is connected via a Scio connecting cable (PN: 78 76 878 or 78 76 886) in the X3 or Scio/ISD connector and **Standard** setting is chosen on the **MAC Calc.** menu.

When the monitor has identified an agent, the parameter box shows a value for the standard minimum alveolar concentration of the agent (Standard MAC value).

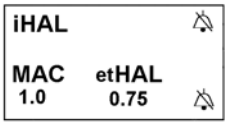
WARNING:

- **Standard MAC values are merely a guideline based on the anesthetic requirements of an *average* adult patient. Age and other factors are not taken into account.**
- **The monitor's standard MAC values cannot be applied to children or neonates.**
- **The MAC value applies only to the end-tidal respiratory gas agent concentrations.**

1 standard **MAC** (minimum alveolar concentration) is equal to the alveolar anesthetic concentration at one atmosphere (760 mmHg) at which 50% of all patients no longer respond to noxious stimuli, and corresponds to the following expiratory agent concentrations..

Agent Concentrations (1 MAC)						
Agents	HAL	ENF	ISO	SEV	DES	N_2O
Values via a Scio connecting cable	0.77%	1.7%	1.15%	2.1%	6.65%*	105%
* Original MAC value from ASTM F 1452 is 7.3, however this is based on an average age of 25 years. The value of Desflurane shown here has been compensated to age 40 according to the Mapleson formula.						

The table below shows typical Agent parameter box displays when using standard MAC values.

Parameter Box	Description
	Agent identified.

Age-Based MAC Values

Age-based MAC takes the impact of the patient's age on MAC values into consideration.

NOTE:

- Age-based MAC values are used when the Scio module is connected via a Scio connecting cable (PN: 78 76 878 or 78 76 886) in the X3 or Scio/ISD connector and Age-based MAC setting is chosen on the MAC Calc. menu.

Age-based MAC calculates the patient's age based on the Birth Date entered in the **Patient Admit** menu. Once it has identified an agent, the parameter box shows a value for the minimum alveolar concentration of the agent (Age-Based MAC value).

WARNING:

- **Age-based MAC values only apply if the patient's age is greater than or equal to 1 year.**
- **If the patient's age is less than 1 year, age-based MAC for 1 year shall apply.**
- **If user does not enter patient age, 40 yrs is the default setting.**
- **Please consult packaging information regarding MAC and age for inhaled anesthetics.**

1 age-based **MAC** (minimum alveolar concentration) is equal to 1 **MAC** (see below) x 10^{bx}. , where:

■b = -0.00269[yr^{-1}], negative factor, slope of $\log_{10}$ (MAC), unit: $years^{-1}$

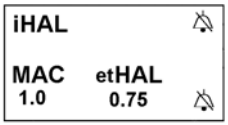
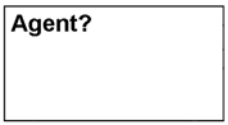
and

■x = age - 40.

The following values are used as a basis for all **MAC** calculations related to the age of the patient:

Agent Concentrations (1 MAC)						
Agents	HAL	ENF	ISO	SEV	DES	N_2O
*Values via a Scio connecting cable **(X3 or Scio/ISD)***	0.77%	1.7%	1.15%	2.1%	6.65%	105%

The table below shows typical Agent parameter box displays when using Age-based MAC values.

Parameter Box	Description
	**Via a Scio connecting cable (X3 or Scio/ISD) only:** Agent identified. (Age-based MAC values displayed).
	**Via a Scio connecting cable (X3 or Scio/ISD) only:** Agent not yet identified in automatic identification mode.

To access the Agent setup menu:

- Click on any Agent parameter box if displayed

or

1. Press the **Menu** fixed key.
2. Click on **Patient Setup**.
3. Click on **Parameters** to display a list of available parameters.
4. Click on **AGENT** to display the Agent menu.

Quick Reference Table -- Agent Setup

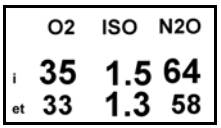
Click on the following items to execute Agent setup functions:

The Agent Setup Menu		
Menu Item	**Description**	**Settings**
Agent Scale	Sets Agent waveform scale	• 1, 2, 3, 5, 10, or 20%
Agent Display	Displays a separate Agent parameter box **Note:** Ghosted if the monitor is displaying combined MultiGas parameter box (18-24)	• ON, OFF

The Agent Setup Menu		
Menu Item	**Description**	**Settings**
Agent ID *(Scio Four Oxi and Scio Four only)* **Note**: The Agent ID resets to blank upon a power cycle or patient discharge.	Configures Scio Four Oxi or Scio Four module to measure the concentration levels of a user-specified anesthetic agent. **•Use care when setting agent ID manually. If incorrect agent ID is selected, incorrect measurements will occur.** **•Scio Four Oxi & Scio Four cannot recognize anesthetic gas mixtures. If anesthetic gases are mixed, incorrect measurements will occur.** **Note**: If the user has not selected an anesthetic agent yet, **AA?** is displayed in the parameter box.	• HAL • ISO • SEV • ENF • DES
MultiGas Zero	Manually zeroes the Scio module. **Note**: During zeroing, the monitor temporarily blanks Scio parameter values.	N/A
Auto Zero Delay	Delays automatic zeroing for 5 minutes for uninterrupted monitoring. **WARNING**: **Delaying the auto zero may inpact the accuracy of the device.** **Note**: Gas sensors in the Scio module are automatically zeroed and calibrated against room air. During zeroing, the monitor temporarily blanks Scio parameter values. One minute before automatic zeroing, the monitor sounds an attention tone and displays the message *Auto zero in <1 minute*.	N/A
Agent Alarms	Accesses Agent alarms in Alarm Limits table (see this Instructions for Use Chapter 5)	

Combined Display (O2/Agent/N2O) (*Scio Four Oxi plus only*)

The O_2/N_2O and Agent parameters can be combined to share a single waveform channel and MultiGas parameter box. Typical combined MultiGas parameter boxes are shown below

Parameter Box	Description
	The Scio module has identified an agent and displays concentration levels for O_2, isoflurane, and N_2O.

To enable the combined MultiGas parameter box display:

1. Open the Main Screen setup menu (see page 2-2).
2. Click on **More** to go to the Main Screen menu's second page.
3. Select **MultiGas Parameter**; click the knob to select **ON**.

NOTE:

- You can also enable MultiGas Parameter from the O_2 menu (see 18-17).
- The combined MultiGas parameter box takes the place of the O_2 parameter box on the Main Screen. Make sure that the O_2 or the MultiGas parameter is appropriately assigned on the parameter priority list (see Chapter 2).
- When you select the combined MultiGas parameter box, N_2O values are automatically enabled for display.

To access the combined (O_2/Agent/N_2O) setup menu:

1. Ensure that **MultiGas Parameter** is **ON**.
2. Return to the Main Screen.
3. Click on the O_2/Agent/N_2O combined parameter box.

Quick Reference Table -- Combined Display Setup

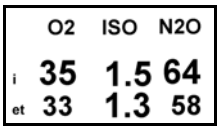
Click on the following items to execute setup functions for Combined (O2/Agent/N2O) MultiGas monitoring and display.

The Combined (O_2/Agent/N_2O) Setup Menu		
Menu Item	**Description**	**Settings**
Waveform	Selects waveform for display	• O_2, Agent

The Combined (O_2/Agent/N_2O) Setup Menu		
Menu Item	**Description**	**Settings**
MultiGas Parameter	Enables combined MultiGas parameter box display (see 18-24)	• ON, OFF
O2 Scale	Sets O_2 waveform scale (see 18-16)	• 50 %, 100 %
N2O Display	Displays N_2O values in O2/N2O parameter box (see 18-18)	• ON, OFF
Agent Display	Displays a separate Agent parameter box (see 18-22)	• ON, OFF
Note: During the combined display, the N_2O and Agent displays are automatically turned on and their selections are ghosted on the combined menu. You can only access these selections and turn the displays off, once you have turned off the combined MultiGas parameter display.		
Agent Scale	Sets Agent waveform scale	• 1-20 % in increments of 1
MultiGas Zero	Manually zeroes the Scio module. **Note**: During zeroing, the monitor temporarily blanks Scio parameter values.	N/A
Auto Zero Delay	Delays automatic zeroing for 5 minutes (see 18-16 for detailed information)	N/A
O2 Calibration	Selects desired O2 calibration	• 1 Point Cal.* • 2 Point Cal.* • Last O2 Cal.*
	*See page 18-11 for further information on calibration functions.	
O2 Alarms	Accesses O_2 alarms in the Alarm Limits table (see this Instructions for Use Chapter 5)	

Dual Agent Display (*Scio Four Oxi plus & Scio Four plus only*)

If **combined** O_2/N_2O/Agent display is selected, the primary agent is displayed.



NOTE: When two Agents are detected, the one with the higher expired MAC value is the primary

If **single agent** display is selected, the inspired and expired concentrations for two agents is displayed. The MAC value is the total expired MAC value for the two agents and N_2O.

Maintenance and Repair

To ensure safety, the Scio module requires routine cleaning (see Vista XL User's Guide Chapter 21, Cleaning and Disinfecting). Monitoring accessories such as sampling tubing, T-connectors, water traps, and fan filters are not reusable and need to be replaced at regular intervals.

General equipment inspection and maintenance is required. Once a year, check all devices, accessories, and cables for damage and test the ground resistance, chassis and patient leakage currents as well as all alarm functions. Make sure that all safety labels are legible. Maintain a record of these safety inspections.

WARNING:

- **Occupational safety: Used sampling tubing, T-connectors and water traps could be contaminated and must be handled and disposed of with care. Infection hazard may be present. Dispose of these items in accordance with local regulations.**
- **Because of the danger of electric shock, never remove the cover of any device while it is in operation or connected to a power outlet.**

Changing the Sampling Tubing and T-Connector

The sampling tubing and T-connector that connect the Scio module to the patient's airway are not reusable. They must be replaced under the following conditions:

- A new patient is connected to the module
- The cleanliness of the tubing or connector is suspect or compromised

NOTE: Use only Dräger Medical provided sidestream sampling lines, otherwise the correct functioning of the device may be compromised. Dräger Medical does not assume responsibility for the reliability and safety of Scio measurements, if non-approved tubing is used.

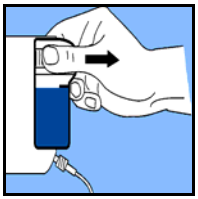
Emptying the Water Trap

The water trap should be emptied if the contents have reached the 'full' mark.

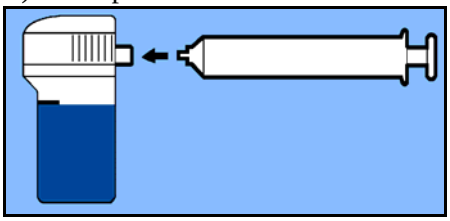
NOTE: If water trap has been in use for 4 weeks, it must be replaced. (See "Replacing the Water Trap" below.)

To empty the water trap:

1. Disconnect the sampling tubing.
2. Remove the trap from its connector by holding it firmly on the ridged surfaces and pulling it out from the Scio module.



3. Connect an empty syringe (size > 20 ml and without a needle) to the port on the back of the water trap.



4. Aspirate water trap contents into syringe.
5. Remove syringe and discard.

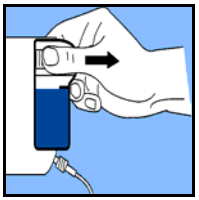
NOTE: Do not attempt to clean water trap.

6. Reseat water trap by pressing it against the Scio. A click will indicate that it is seated properly.
7. Reconnect the sampling tubing. (Before monitoring a new patient, exchange the tubing and T-connector, See page 18-27.)

Replacing the Water Trap

To replace the water trap:

1. Disconnect the sampling tubing.
2. Remove the trap from its connector by holding it firmly on the ridged surfaces and pulling it out from the Scio module
3. Insert the new trap by pressing it against the Scio. A click will indicate that it is seated properly.
4. Connect the sampling tubing. (Before monitoring a new patient, exchange the tubing and T-connector, See page 18-27.)



Cleaning the Fan Filter

The fan filter should be cleaned 1 time per month.

> **NOTE:** If fan filter has been in use for 1 year, it should be replaced. (See "Replacing the Fan Filter" below.)

To clean the fan filter:

1. Locate the fan on the rear of the module (see drawing on page 18-8).
2. Grasp the plastic fan filter and remove it from its holding slots.
3. Vacuum up any accumulation of dust at the fan port and inside the filter.
4. Reinsert fan filter.

Replacing the Fan Filter

To change the fan filter:

1. Locate the fan on the rear of the module.
2. Grasp the plastic fan filter and remove it from its holding slots.
3. Vacuum up any accumulation of dust at the fan port.
4. Insert a new filter.

Status Messages

Message	Condition	Suggested Action
i [parameter] > # et [parameter] < #	The inspired or expired concentrations of the parameter fall outside the current upper or lower alarm limits for that parameter	• Observe the patient and treat if necessary. • Adjust the alarm limits for that parameter.
i [parameter] out of range (high) i [parameter] out of range (low)	The inspired concentrations of the parameter fall outside the monitor's measuring range	• Observe the patient and treat if necessary. • Check connections. • Unplug and re-plug Scio module. • Power-cycle monitor or un-dock and re-dock monitor. • Call Manufacturer.
et [parameter] out of range (high) et [parameter] out of range (low)	The expired concentrations of the parameter fall outside the monitor's measuring range	
Agent?	The module has not yet identified or cannot identify agent because : • Agent is unknown (ie., not HAL, DES, ISO, SEV or ENF) • Agent concentration is too low • Vaporizer is leaking • Traces of disinfectant are present	• For Scio Four Oxi or Scio Four) select agent manually • Check/replace vaporizer.
etN2O > 82%	etN2O > 82%	• Check N2O concentration in the fresh gas flow. • Flush.
MultiGas Sample Line Occlusion	Scio module sample line occluded Watertrap full, defective, or not installed.	• Check sample line and replace if necessary. • Check watertrap, replace or install, if necessary.
MultiGas Zero in Progress	Scio module zero in progress	• Wait
MultiGas Zero Accepted	Zero successful	• None

Message	Condition	Suggested Action
MultiGas Zero Failed	Zero performed using the wrong gas Occlusion or leak present HW problem	• Verify surrounding environmental atmosphere is not contaminated. • Check for leaks and occlusions. • Call Manufacturer.
Check Watertrap/ Sample Line	Watertrap is full or sample line is blocked	• Replace sample line • Empty or replace watertrap (see 18-27)
MultiGas Too Warm	Fan port blocked Hardware problem	• Clear/unblock port. • Call Manufacturer.
MultiGas Data Invalid	Communication problem	• Unplug and re-plug Scio module. • Power-cycle monitor or un-dock and re-dock monitor. • If message persists, call Manufacturer.
MultiGas Warming Up	Scio module is warming up and is operating at reduced accuracy	• Do not rely on Scio Module values.
MultiGas Incompatible	Scio H/W or S/W incompatibility	• Check version numbers. • Call Manufacturer.
MultiGas Initialization	Device initializing	• Wait
MultiGas Unplugged	Scio module has become disconnected	• Check the connection and reconnect if necessary. • If message persists, call Manufacturer.
MultiGas H/W failure	Loss of communication or hardware problem detected	• Check connections. • Unplug and re-plug Scio module. • Power-cycle monitor or un-dock and re-dock monitor. • Call Manufacturer.

Chapter 19 Body Temperature

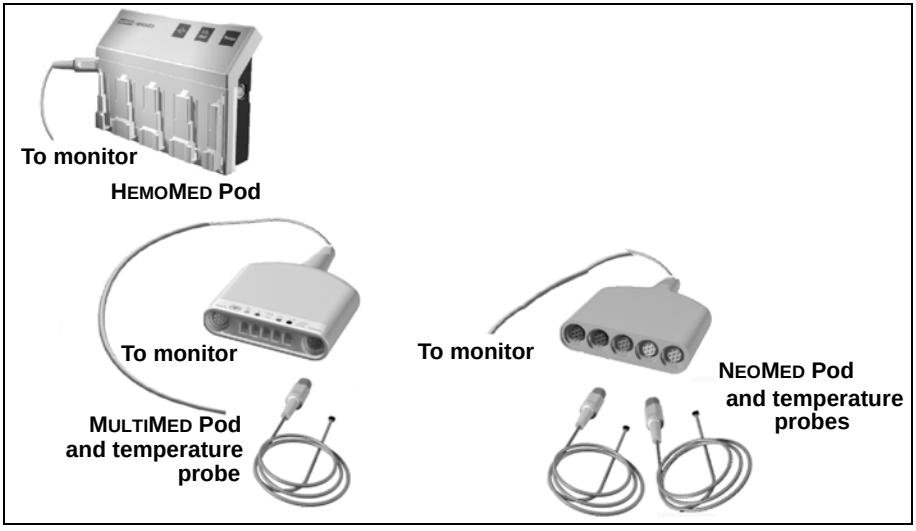
Overview

The monitor measures core and surface body temperature by means of a temperature probe connected to the MultiMed or NeoMed pod. As part of the cardiac output monitoring function, the monitor can also measure blood temperature via the HemoMed (see page 20-9 for more information). You cannot monitor body temperature with the HemoMed.

The MultiMed pod houses one connector for a temperature probe. With a Y-cable, however, you can process up to two temperature signals. The NeoMed pod is equipped with two temperature probe connectors.

NOTE: Temperature functionalities and associated probes should be calibrated at least every two years by qualified personnel to ensure accuracy of ± 0.1ºC.

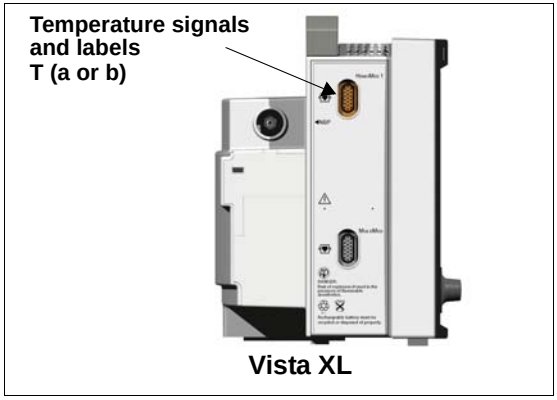
To measure body or blood temperature, connect the monitor to the appropriate device as shown below. Follow the instructions on page 20-9 to monitor blood temperature with one of the HemoMed pod. Use the MultiMed to measure body temperature.



Temperature Display

All temperature readings appear on the main screen according to their position in Parameter Priority (see page 2-6). The following display conventions govern temperature labels and values.

The monitor displays temperature monitoring results in one parameter box for each pod connector (MultiMed). The variables “a” and “b” denote the first or second probe connector from the MultiMed with Y-cable or NeoMed ΔT1). The symbol ΔT represents the absolute value of the difference between the two direct values (| Ta - Tb |). The bottom half of the temperature parameter box displays either the second temperature probe reading or the delta temperature (ΔT).



Temperature Setup

To access the temperature setup menu:

- Click on the desired temperature parameter box (if displayed);

or

1. Press the **Menu** fixed key.
2. Click on **Patient Setup**.
3. Click on **Parameters.**
4. Click on **TEMP** to monitor the temperature signal (see page 19-3).

The TEMP setup menu displays only two items:

TEMP Display -- Configures the bottom half of the parameter box to display either the reading of the second temperature probe (b) or the difference between the first probe's reading and the second (Δ**T,** the delta value)

TEMP Alarms -- Accesses temperature alarm settings on the Alarm Limits table (see page 5-5).

ESU and Defibrillator Precautions

The monitor and MultiMed, NeoMed and HemoMed are protected against high-frequency interference from defibrillators and electrosurgical units and against 50- and 60-Hertz power line interference.

Place a protective rubber sheath over the probe to prevent the possibility of burns during electrosurgery or defibrillation. Do not use surface probes.

Status Messages

Message	Possible Cause	Suggested Action
> # < #	Temperature exceeds upper or lower alarm limits	• Check the patient and treat if necessary. • Check equipment and replace if necessary.
Out of Range (High) Out of Range (Low)	Temperature value greater or less than measuring range	• Check the patient and treat if necessary. • Check equipment and replace if necessary.
Can't Derive ΔT(#)	Cable defective or unplugged	• Check equipment and replace if necessary. • Connect 2nd temperature probe.
Unplugged	Cable defective or unplugged	• Check equipment and replace if necessary.
H/W Failure	Temperature circuitry failure	• Contact Dräger Medical technical support.

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Chapter 20 Cardiac Output

Overview

The monitor uses thermodilution to measure blood flow pumped by the heart. A solution of known temperature and volume is injected into the blood stream in the right atrium. The injectate mixes with and cools the surrounding blood. The blood temperature reaches its minimum relatively quickly and then warms up slowly until it returns to the blood temperature baseline. The total drop in the patient's blood temperature is inversely related to the patient's cardiac output: the lower the cardiac output, the more the injectate cools the blood down, and vice versa. A thermistor in the catheter tip continuously measures the temperature of the blood as it leaves the heart.

The monitor restores C.O. settings to their default values when you discharge a patient or select **New Patient** after turning on the monitor. If you subsequently press the **C.O. Start** fixed key (or if you press **C.O. Start** after a catheter is disconnected), the monitor displays the C.O. setup menu, sounds a tone, and requests that you confirm current setup data. Press the **C.O. Start** fixed key within 30 seconds to confirm the current setup data, display the C.O. Averaging screen and begin measuring cardiac output.

Blood flow is measured in liters per minute. In computing cardiac output, the monitor takes the following factors into account:

- Injectate volume, temperature, density, and specific heat
- Blood baseline temperature, density, and specific heat
- Temperature changes of the blood-injectate mixture
- Area under the temperature curve

Accuracy

To optimize cardiac output measurement:

- Follow the recommendations made by the manufacturer. Dräger Medical recommends you place the prefilled syringes or the closed injectate delivery system into an ice bath.
- Check the ice bath regularly and add ice as needed to maintain a temperature between 0°C and 5°C. Accuracy of measurements made with the thermodilution method increases as the temperature of the injectate approaches 0°C.
- Verify the injectate volume.
- Verify the computation constant. An incorrect computation constant is a common cause of error.
- Use an in-line injectate system. Systems that measure the temperature of the injectate in the ice bath may introduce error, since the injectate temperature changes in the time between its removal from the ice bath and injection. Use an in-line temperature sensor to eliminate this source of error.
- If you hand-fill your syringes, fill them with the same volume each time. The recommended amount is 10cc for adults and 5cc for pediatric patients. Avoid touching the body of the syringe. The warmth of your hand will warm the injectate very quickly.
- Inject the entire volume in one swift, continuous motion.
- Perform the injection at end-expiration. Taking successive cardiac output measurements at different points in the respiratory cycle can give different measurements, especially for patients on mechanical ventilators.
- Discard results that are widely different from the general trend, and those associated with irregularly-shaped (e.g., notched) curves.

NOTE: If you use a room temperature injectate, use 10 cc for the injectate volume, *unless clinically contraindicated.*

Main Screen Display

When Cardiac Output (C.O.) measurements are active, the most recently saved C.O. average appears in the upper right of the C.O. parameter box on the main screen.

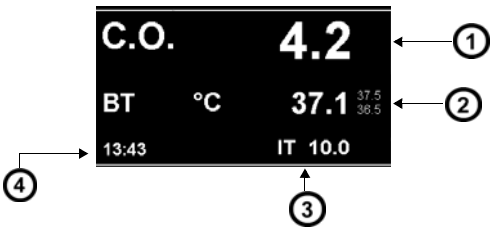
Cardiac Output (C.O.) — Average of the last series of measurements saved in liters per minute (L/min).

Blood temperature (BT) — Patient's blood temperature acquired from the HemoMed pod currently used to measure C.O.

Time of the C.O. Average — Time the currently displayed C.O. average was taken.

Injectate temperature (IT) — Temperature of the injectate solution acquired from the HemoMed pod being used for C.O. measurements.

Below is a typical C.O. parameter box:



1	Last saved C.O. average
2	Blood temperature (reading and alarm limits)
3	Injectate temperature
4	Time of last saved C.O. average

NOTE: If no new measurements have been taken for 24 hours, the C.O. average and time stamp are blanked.

C.O. Setup

Hardware

The HemoMed pod is used with the monitor for cardiac output monitoring.

C.O. Setup Menu

To access the C.O. setup menu:

- Click on the C.O. parameter box on the main screen.

or

1. Press the **Menu** fixed key to display the Main Menu.
2. Click on **Patient Setup**.
3. Click on **Parameters**.
4. Scroll to **C.O.** and click to display the C.O. setup menu.

Quick Reference -- C.O. Setup

WARNING: Always confirm that the settings you enter on the C.O. setup menu accurately represent the catheter you are using to measure cardiac output. An incorrect entry can put the patient at risk by compromising C.O. measurements.

Menu Item	Description	Available Settings
C.O. Start	Starts C.O. measurement (see page 20-9)	• N/A

Menu Item	Description	Available Settings
Catheter Type	Displays the currently selected catheter type.	Click on one of the following to change the catheter type: • BD/Ohmeda • Edw./Baxter • Arrow • Other **Note:** Due to corporate mergers, Baxter cardiac output catheters and accessories may be labelled as being from Edwards. Ohmeda output catheters and accessories may be labelled as being from Becton Dickinson (BD). Contact Edwards and/or BD if there is any doubt as to the identity of the cardiac output catheters or accessories.
Catheter Size	Displays the currently selected catheter size. Note: If Other is selected for Catheter Type, this field is ghosted.	Click on one of the following to change the catheter size: • **5, 7,** or **7.5 F**
Injectate Volume	Displays the currently selected volume of the injectate used to measure cardiac output. Note: If Other is selected for Catheter Type, this field is ghosted.	• **3.0, 5.0,** or **10.0 cc**
Comp. Constant	Compensates for discrepancies in catheters; see page 20-7 for more detailed information	• N/A
Mode	Determines the mode of measurement for cardiac output; see page 20-6 for more detailed information	• Auto • Manual
BT Alarm	Opens Alarm Limits table beginning with temperature parameters	• N/A

Measurement Mode

Procedures for measuring cardiac output differ according to the mode of measurement you select. You ordinarily measure C.O. in automatic mode. If unstable blood temperatures, artifact, or other conditions prevent an automatic measurement, you can still take C.O. measurements by selecting manual mode. (**Manual** is the default setting on the C.O. setup menu.)

In automatic mode, you must wait for a *READY* signal that the baseline blood temperature is stable before making a C.O. injection. When the *READY* signal appears, the monitor begins calculating a C.O. value as soon as it detects the temperature drop caused by the injectate. In automatic mode, the monitor will not begin to search for a change in blood temperature until the *READY* signal appears. If the blood temperature becomes unstable, the signal disappears, and the monitor does not attempt to detect a thermodilution curve until the patient's blood temperature is stable again.

In both manual and automatic modes, the monitor sounds an attention tone when the C.O. value has been computed. On the C.O. Averaging screen, the value is displayed in the next available box, and the **Save AVG** field is updated. The value in the Main Screen parameter box does not change until you save the C.O. average.

To change the measurement mode, open the C.O. setup menu as described on page 20-5 and select the desired mode. Procedures for measuring C.O. in automatic or manual mode are described on the following page.

Catheters (Comp. Constant)

The monitor compensates for discrepancies in catheters used to measure C.O. The catheter compensation factor is listed as **Comp. constant** on the C.O. setup menu.

If you use an Edwards/Baxter, BD/Ohmeda, or Arrow catheter, the computation constant is automatically chosen for you. You can, however, enter a different value (whenever, for instance, you change either injectate volume or temperature). Choosing a catheter type determines the available choices under **Catheter Size** and **Injectate Volume**. The following tables list the computation constants for Edwards/Baxter, BD/Ohmeda, and Arrow catheters.

		Injectate Temperature (IT) Sensor connected		IT Sensor disconnected
Catheter Size	**Injectate Volume**	**IT = -5° to +16°**	**IT = 16° to 27°C**	**IT = 0°C**
7F	10 cc	0.561	0.608	0.542
7F	5 cc	0.259	0.301	0.247
7.5F	10 cc	0.574	0.595	0.564
7.5F	5 cc	0.287	0.298	0.257
5F	5 cc	0.285	0.307	0.270

		Injectate Temperature (IT) Sensor connected		IT Sensor disconnected
Catheter Size	**Injectate Volume**	**IT = -5° to +16°**	**IT = 16° to 27°C**	**IT = 0°C**
7.5F	10 cc	0.579	0.628	0.566
7.5F	5 cc	0.281	0.309	0.270
7.5F	3 cc	0.160	0.181	0.151
7F	10 cc	0.579	0.628	0.566
7F	5 cc	0.281	0.309	0.270
7F	3 cc	0.160	0.181	0.151
5F	5 cc	0.291	0.316	0.279
5F	3 cc	0.170	0.188	0.160

		Injectate Temperature (IT) Sensor connected	
Catheter Size	**Injectate Volume**	**IT = -1°C (±1°C)**	**IT = 24°C (±1°C)**
7.5F	10 cc	0.532	0.586
7.5F	5 cc	0.249	0.265
7.5F	3 cc	0.131	0.155
7F	10 cc	0.541	0.601
7F	5 cc	0.250	0.273
7F	3 cc	0.134	0.156
5F	5 cc	0.267	0.303
5F	3 cc	0.157	0.192

If you choose **Other** as the catheter type, you must enter a computation constant in order to display or select the catheter size and injectate volume. Consult documentation included with the catheter for computation constants, and select one that corresponds to the injectate volume and temperature that you will be using.

To enter a computation constant:

1. From the C.O. menu, click on **Comp. Constant**. A data-entry screen appears on the menu's right side:

2. Enter the computation constant and click on **Accept** to confirm your entry.

WARNING: An incorrect computation constant may yield incorrect C.O. measurements, which could lead to an inappropriate medical intervention. If you have entered a Comp. Constant manually, confirm it is correct for the catheter you are using.

NOTE: The new computation constant is not displayed until the measurement is completed.

C.O. Measurement Procedures

To measure C.O. in automatic mode:

1. Press the **C.O. Start** fixed key on the HemoMed pod to display the C.O. Averaging screen. A tone sounds and a *READY* message appears when the monitor detects a stable blood temperature.
2. Inject the saline solution into the patient's bloodstream after you see the *READY* message. A thermodilution curve appears, displaying the change in blood temperature.

NOTE: If the *READY* signal fails to appear or appears only intermittently, switch to Manual mode and repeat step 2.

3. Repeat step 2 to take an additional measurement, making sure you wait for the *READY* signal. If no injectate is detected within four minutes, the Averaging screen closes, and you must repeat steps 1 and 2 for additional C.O. measurements.

To measure C.O. in manual mode:

1. Press the **C.O. Start** fixed key on the HemoMed pod or select **C.O. Start** on the C.O. setup menu. **The READY message becomes visible for 30 seconds or until a C.O. waveform is detected**.
2. Immediately inject the saline solution and wait for the monitor to calculate a C.O. value. The monitor begins to calculate a C.O. value as soon as it detects a blood temperature drop.

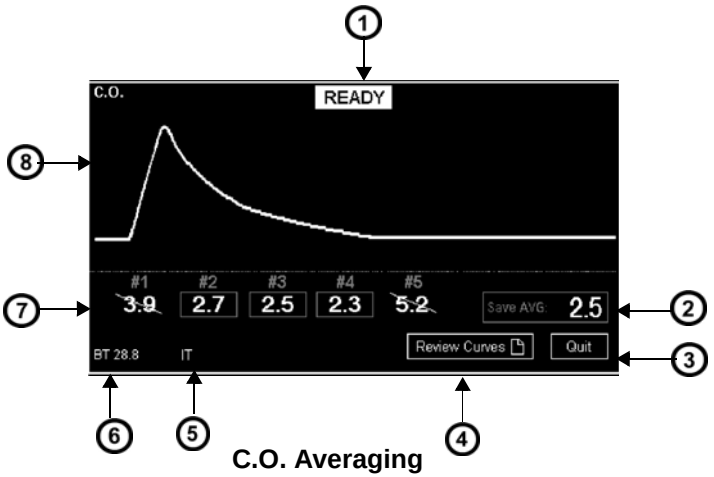
NOTE: In manual mode, the READY signal is informational only. Do not wait for the READY signal before injecting the solution.

3. If the monitor fails to detect the temperature drop caused by the injectate, the waveform disappears after 30 seconds. An attention tone sounds, an error message appears in the local message area, and three asterisks (*** * ***) appears in the **Save AVG** field. Repeat steps 1 and 2 for additional measurements.

NOTE: **C.O. Start** is available as a menu item only when you are in manual C.O. measurement mode. As soon as you initiate a C.O. measurement in either mode, the **C.O. Start** key is disabled and the **C.O. Start** menu item is ghosted until a value is reported.

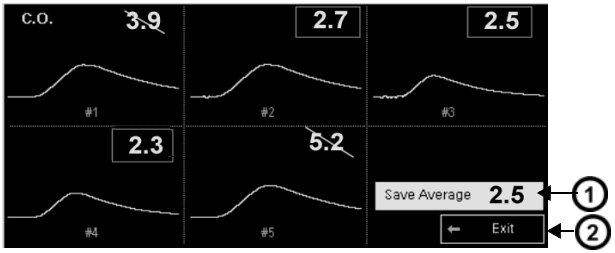
Averaging C.O. Measurements

Differences in injection technique can cause variations in measurements performed on the same patient. To compensate for such discrepancies, you can review results of up to five measurements and use them to compute a C.O. average. The C.O. Averaging screen is displayed whenever you begin a C.O. measurement. The Review Curves screen duplicates the five values displayed on the C.O. Averaging screen with their corresponding thermodilution curves.



C.O. Averaging

1	**Stable blood temperature detected** (see page 15-11)	**5**	Current Injectate Temperature
2	Current average of C.O. values (Click to save; displays *** if values are out of range)	**6**	Current Blood Temperature
3	Exit C.O. Averaging screen (C.O. value not stored)	**7**	C.O. measurement values (Newest value at right; click on value to exclude it from average and mark with slash)
4	**Access Review Curves screen** (see below)	**8**	**Thermodilution Curve --** Highest point represents lowest blood temperature (measured at exit from the heart)



Review Curves

1	**Current average of C.O. values** (Click to save; displays *** if values are out of range)
2	Return to C.O. Averaging screen

Saving a C.O. Average

Click on **Save AVG** to save the average of all indicated values and end the C.O. measurement session. The average is written to trends and updated in the Main Screen parameter box to the time of the latest measurement included in the average. You also save the calculated average any time you quit the C.O. Averaging screen by accessing another menu or the Main Screen, or whenever four minutes to pass without a C.O. measurement.

HemoMed Calculations (MiniCalcs)

MiniCalcs are a standard feature with your monitor. Whenever you measure cardiac output, the monitor automatically calculates a set of related HemoMed parameters, marks them with a time-stamp and stores them in a special database. You can later view these derived parameters on the Calculation Results screen and print them on an Infinity network laser printer. HemoMed calculations are not trended.

NOTE: The Mini-Calcs function is a reduced version of the locked options Hemomeddynamic and Hemomeddynamic/Oxygenation/Ventilation calculations.For more information, see Chapter 14, Calculations.

To ensure accurate calculations:

- Be sure the patient's *current* height and weight are entered in the Patient Admit Screen. Incorrect or missing height and weight result in incorrect or blank output values.
- For a complete set of calculations, perform both a pulmonary wedge (PWP) measurement and a C.O. measurement. Blank values on the Calculations (Results) screen result from failure to perform both measurements.

HemoMed Parameters

NOTE: For a more detailed list of input and derived parameters, including units of measure and derivation, see page 14-5.

WARNING: Check that the weight you enter reflects the patient's current weight and not his or her "admit" weight. Failure to enter accurate weight for a patient could result in inaccurate calculations and seriously compromise the patient's treatment.

The monitor uses the following parameters to calculate derived HemoMed (**Hemo**) values:

- *HR* -- Current Heart Rate

- *ART M* -- Current Mean Arterial Pressure
- *PA M* -- Current Mean Pulmonary Artery Pressure
- *PWP* -- Most recent Pulmonary Capillary Wedge Pressure
- *CVP* -- Current Central Venous Pressure
- *C.O.* -- Most recent Cardiac Output
- *ART S* -- Current Systolic Arterial Pressure
- *ART D* -- Current Diastolic Arterial Pressure
- *HT* -- Patient's height (length) as entered
- *WT* -- Patient's weight as entered

The monitor calculates the following HemoMed parameters automatically, using units of measure indicated in parentheses:

- *SV* -- Stroke Volume (ml)
- *SVR* -- Systemic Vascular Resistance (dynes x sec./cm^{-5})
- *CI* -- Intermittent Cardiac Index (liters/min/m^2)
- *SVI* -- Stroke Volume Index (ml/m^2)
- *SVRI* -- Systemic Vascular Resistance Index (dynes x sec./cm^{-5}/m^2)
- *BSA* -- Body Surface Area (m^2)
- *CCI* -- Continuous Cardiac Index (liters/min/m^2)

Status Messages

Message	Possible Cause	Suggested Action
BT > UL BT < LL	Blood temperature is outside alarm limits, owing to: A physiological condition. Inappropriate alarm limits. A defective sensor or cartridge.	• Check the patient and treat if necessary. • Change alarm limits. • Check equipment and replace if necessary.
BT Out of Range (High) BT Out of Range (Low)	Blood temperature is outside the measurement range (25° to 43°C), owing to a defective sensor or cartridge.	• Check equipment and replace if necessary.
C.O. Out of Range (High) C.O. Out of Range (Low)	Cardiac Output is greater (or less) than 20 liters/min. because of: • A physiological condition. • Unstable baseline. • Incorrect injectate volume, catheter size, or Comp. Constant. • Defective catheter, cable, or cartridge.	• Check the patient and treat if necessary. • Use cooler injectate. • Enter the correct values in the C.O. menu. • Repeat the measurement. If message persists, replace defective components.
C.O. Injectate Too Cold	Injectate is cooler than -5°C.	• Use an injectate within the allowable range of -5° to +30°C.
	Defective cable or HemoMed.	• Check equipment and replace if necessary.
C.O. Injectate Too Warm	Injectate is warmer than +30°C.	• Use an injectate within the allowable range of -5° to +30°C.
	Injectate probe not connected.	• Check probe connection. If problem persists, replace the probe.
	Defective cable.	• Repeat the measurement. If problem persists, replace defective part.
C.O. No Temperature Change	The detected temperature change was < 0.1°, because: • C.O. START was pressed but no injection was made. • Injectate volume too small. • Defective catheter. • Injectate temperature too warm.	• Repeat the measurement. • Use a larger injectate volume. • Repeat the measurement. If problem persists, replace the catheter. • Use colder injectate.

Message	Possible Cause	Suggested Action
C.O. Use Cooler Injectate	• Difference between patient's blood temp temperature and injectate temperature of less than 5°C. • The injectate temperature of greater than 30°C.	• Use a cooler injectate.
C.O. Injectate Set to <IT value>!	C.O. START has been pressed, but no injectate probe is connected. The monitor assumes a temperature of 20°C.	• No injectate probe is connected; assume that the injectate temperature is at 20 °C (default).
C.O. Average Saved	The C.O. average has been saved.	• None required.
C.O. Transducer Unplugged	A cable or transducer has become disconnected.	• Reconnect the cable or transducer. • If message persists, replace defective part.
C.O. Poor Baseline	The baseline temperature curve did not return to baseline within 30 seconds of pressing C.O. START because of: • Unstable patient temperature. • Defective catheter, cable, or cartridge.	• Follow hospital procedures. • Repeat the measurement. If message persists, replace the defective components.
C.O. Pod Fault - Bad Ref.	The pod reference resistance is either too high or too low.	• Remove and reconnect the Hemo pod. Repeat the measurement. If message persists, replace the pod and contact Dräger Medical Technical Support.
C.O. Catheter Fault - Bad Ref.	• The catheter reference resistance is too low. • Unknown catheter type.	• Check the catheter and replace if defective. • Contact Biomed or Dräger Medical Technical Support.
C.O. Check Injectate Probe	Injectate temperature probe not connected or disconnected during a measurement.	• Connect the probe and repeat the measurement.

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Chapter 21 Cleaning and Disinfecting

Overview

WARNING: Because of the danger of electric shock, never remove the cover of any device while it is in operation or connected to power.

Clean and disinfect the product per hospital approved protocol. Agents tested by Draeger and shown to have no harmful effect on the materials utilized in the device include:

- Diluted alcohol - a 1:3 solution of alcohol should be used
- A 1:10 solution of sodium hypochlorite (household bleach)
- Phenol

CAUTION: *The use of more aggressive reagents suchs as alcohol should not be used on the monitor's glass, or the glass may be damaged.*

Draeger makes no claims regarding the efficacy of the listed chemicals,their methods as a means for disinfecting, the ability of the agents to control infection, their environmental impact, safe handling, or any related precautions in their use. Refer to information provided by the manufacturer of the cleaning solution for more information in these areas.

Monitor and Peripheral Devices

Moisture can damage the monitor and its peripherals (e.g., the MultiMed pod, battery charger). Please read the following instructions carefully before you clean the base unit or peripheral devices. Special instructions for cleaning particular devices and accessories are provided in the following pages.

- Do not spray cleaning agents on the monitor or peripherals. Wipe them with a cloth moistened with a soap solution.
- Disinfect the surfaces with a gauze moistened with diluted alcohol or a gluteraldehyde-based disinfectant.

- Dry thoroughly with a lint-free cloth.

CAUTION:

- *Do not immerse or rinse the monitor and its peripherals. If you accidentally spill liquid on a device, disconnect the unit from the power source. Contact your Biomed regarding the continued safety of the unit before placing it back in operation.*
- *Do not use disinfectants that contain phenol, which can leave spots on plastic surfaces. Do not autoclave or clean the monitor or its peripherals with strong aromatic, chlorinated, ketone, ether, or ester solvents, sharp tools, or abrasives. Never immerse electrical connectors in water or other liquids.*

Patient Cables

- Clean the patient cables with a gauze pad moistened with a soap solution.
- Dry thoroughly with a lint-free cloth.
- To disinfect patient cables, wipe the cables with a gauze moistened with diluted alcohol or a gluteraldehyde-based disinfectant.
- Dry thoroughly with a lint-free cloth.

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CAUTION:

- *Do not use phenol-based disinfectants, which vinyl absorbs. Do not use strong aromatic, chlorinated, ketone, ether, or ester solvents. Do not immerse the cables for any prolonged period in alcohol, mild organic solutions, or highly alkaline solutions.*
- *Do not immerse the Procal+ cable in any liquid.*
- *Do not use excessive pressure or flex cables unnecessarily when cleaning. Excessive pressure can damage the cables.*
- *Never boil or autoclave the cable. Vinyl can withstand temperatures up to 100°C but begins to soften around 90°C. Handle gently when hot and wipe away from the tip, toward the cables.*

ECG

Reusable ECG Electrodes

Periodically clean the electrode cup with a toothbrush. Use a soft brush under running water to remove any gel residue. Wipe electrodes with a gauze pad moistened with a soap solution.

Disinfect electrodes by wiping with a cloth moistened with diluted alcohol or a gluteraldehyde-based disinfectant.

Dry thoroughly with a lint-free cloth.

ESU Block

Do not immerse or rinse the ESU Block. Clean with a cloth moistened with soap solution. Read the operating instructions accompanying the ESU for additional information.

NBP

Wipe the NBP cuff with a cloth moistened with soap and water or a solution based on household bleach (1:10), gluteraldehyde, alcohol, or phenol.

CAUTION: *The NBP cuff can be immersed in cleaning solution, but do not allow solution to enter the tube as this interferes with the operation of the cuff and the cartridge. The warranty is void if cleaning solution is allowed to enter the tubing or the cuff.*

IBP

Transducers

Always handle transducers and other pressure accessories with great care. Do not apply excessive pressure to a transducer diaphragm. Do not subject transducers to water, steam, hot air sterilization, ether, chloroform, or similar chemicals. Always protect the connector from moisture.

Consult the documentation supplied with your transducer for specific cleaning and sterilizing instructions.

HemoMed Transducer Plate

Remove the transducer mounting plate from the front of the HemoMed. Wash the plate with hot soapy water.

SpO_2

CAUTION:

- *These instructions pertain to reusable sensors only.*
- *Do not irradiate, steam-autoclave, or immerse the sensor or its cable in water or other liquid. See cleaning instructions supplied with the SpO_2 sensor in use for further information.*

Clean reusable SpO_2 sensors by wiping them with a gauze pad moistened with a soap solution. To disinfect sensors, wipe using a cloth moistened with a 70% alcohol solution. Dry thoroughly with a lint-free cloth before applying to patient.

SET Pod

1. To clean the SET pod disconnect it from the monitor.

Clean the pod with a gauze moistened in enzymatic detergent or a solution of green tinctured soap and water. Dry thoroughly with a lint-free cloth.

CAUTION:

- *Do not use organic solvents.*
- *Do not sterilize by steam, heat, radiation or ETO.*
- *Do not use sharp objects.*
- *Make sure that NO liquid enters the pod.*

$etCO_2$

Capnostat Sensor

Clean sensor surfaces, including the sensor windows, with a damp cloth. Never immerse the sensor or attempt to sterilize it. Dry with a lint-free cloth. Making sure the sensor windows are clean and dry before you use them.

Airway Adapter

Rinse airway adapters in a warm soapy solution, then soak them in a liquid disinfectant or in pasteurized or cold-sterilized glutaraldehyde.

Dry with a lint-free cloth, making sure adapter windows are dry and free of any residue before they are used.

Sidestream Sampling Pump ($etCO_2$ only)

The $etCO_2$ module contains a small pump that draws air from the nasal cannula, through the sidestream airway adapter, and out the exhaust port (see page 16-2). Suggested cleaning procedures are outlined below.

> ***CAUTION:*** *Cannulas and tubing used for nasal sampling of $etCO_2$ are for single-patient use only. Dispose of used cannulas and tubing in accordance with your institution's policy.*

The following fluids are acceptable for cleaning:

- Isopropyl alcohol.
- Cidex™ or equivalent.
- A 5.25% water solution (by weight) of sodium hypochlorite (bleach).

The following items are required for cleaning the $etCO_2$ module:

- A 60 cc catheter-tip syringe.
- A 2-foot section of 1/8- or 3/16-inch tubing to drain off fluid after it passes through the $etCO_2$ pump.
- A receptacle to receive the fluid after it drains.

Cleaning the Sidestream Pump

CAUTION:

- *Always use a syringe to flush cleaning solutions through the pump as described in the instructions below.*
- *Do not attempt to use the sidestream sampling pump itself to move cleaning solutions through the system. This may cause accelerated wear on the pump bearings.*

To clean the sidestream pump:

1. Set $etCO_2$ measurement mode to **Side** (for Sidestream monitoring).
2. Remove the $etCO_2$ module from the monitor.
3. Remove all sidestream sampling tubing from the module connectors.
4. Attach the section of 1/8- or 3/16-inch tubing to the exhaust (sidestream output) port on the module, and run it to a drainage receptacle placed below the module.
5. Fill the 60cc catheter-tip syringe with cleaning fluid, and fix it to the sidestream input connector on the $etCO_2$ module.
6. Flush the fluid slowly through the pumping system and out through the tubing connected to the exhaust port. Repeat two more times for a total of 180cc of fluid.
7. Remove the syringe. Leave remaining fluid in the pumping system for 30 minutes. This disinfects the system.
8. After 30 minutes, fill the syringe with distilled water and flush through the system. Repeat two more times.
9. Empty the syringe and use it to push several volumes of air slowly through the system. This clears most of the solution from the pump.
10. Repeat step 9 one or more times to ensure as much fluid as possible has been cleared from the system.
11. Remove the syringe from the module, but keep the drain tubing in place.

Drying the Sidestream Pump Subsystem

After you have cleaned and removed most of the fluid, it is important to dry the pump subsystem completely.

To dry the sidestream pump subsystem:

1. Reattach the etCO_2 module to the monitor. The sidestream sampling pump starts running, and there is suction at the input port on the face of the module.

NOTE: If the sidestream pump fails to start, make sure the Capnostat sensor is disconnected. The pump is designed to shut down while a connected sensor is warming up.

2. With the input sidestream port still open and the drain tubing still connected, let the pump run for several minutes to remove any water still trapped in the system.
3. Block the sidestream input port with your finger for several seconds and then unblock it. Repeat at least ten times.
4. Move your finger to the sidestream output port and block the port with your finger for several seconds and then unblock it. Repeat at least ten times.
5. Remove the drain tubing, and allow the sidestream pump to continue running for at least 30 minutes.

FiO_2

Clean the FiO_2 sensor by wiping external surfaces with a cloth lightly dampened with a mild detergent or isopropyl alcohol.

Disinfect the external surface of the FiO_2 sensor using a cloth moistened with ethanol or Cidex.

CAUTION: *Do not autoclave, gas sterilize, or irradiate the oxygen sensors. Do not clean the sensor with chemicals other than alcohol or a mild cleaning agent.*

Temperature

Wash temperature probes in a 3% hydrogen peroxide or 70% alcohol solution.

Disinfect probes with a gluteraldehyde-based disinfectant.

CAUTION: *Do not use phenol-based disinfectants, which vinyl absorbs. Do not use strong aromatic, chlorinated, ketone, ether, or ester solvents.*

A Glossary

Ω	Ohm
μA	Micro Ampere
μV	Micro Volt
%PACED	Percentage of pacemaker-initiated beats
AC	Alternating Current
ACE	Arrythmia Classification Expert
Airway adapter	In $etCO_2$ monitoring, a device inserted in a patient's airway tubing to which a capnostat sensor is attached See also *Capnostat.*
Airway CO_2	See *$etCO_2$.*
AIVR	Accelerated Idioventricular Rhythm
Agent	A gas used in anesthesia The MultiGas modules detect and measure five agents: Halothane, Isoflurane, Enflurane, Sevoflurane, and Desflurane
ART	Arterial pressure
ARTF	Artifact
ASY	Asystole
aVF (ECG)	Left leg augmented lead
aVL (ECG)	Left arm augmented lead
aVR (ECG)	Right arm augmented lead
Battery-backed memory	The circuits inside the monitor that retain information after turning off the monitor Patient settings, for example, are saved in battery-backed memory.
bbhr	beat-to-beat Heart Rate
BGM	Bigeminy
BRDY	Sinus Bradycardia
BSA	Body Surface Area (m^2)
BT	Blood Temperature

Capnogram	A waveform indicating the changing levels of CO_2 measured in the patient's breathing cycle
Capnostat	A sensor used to measure CO_2 levels in a patient's expired and inspired air
CCI	Continuous Cardiac Index
Cdyn	Dynamic Compliance
CI	Cardiac Index
CO	Cardiac Output
CO2	Minute Elimination
CPP	Cerebral Perfusion Pressure
CPT	Ventricular Couplet
CVP	Central Venous Pressure
D or Dia	Diastolic pressure
Desflurane	An anesthetic agent
EEF	End Expiratory Flow
End-Tidal CO_2	The carbon dioxide level measured at the peak of the exhalation phase of the breathing cycle See also *iCO_2* and *RRc.*
Enflurane	An anesthetic agent
ESU	Electro-Surgical Unit
$etCO_2$	End-Tidal CO_2
Exit arrow	A left-pointing arrow found at the top left of each menu and at the end of certain menu lists Click on the arrow to return to the previous menu.
External battery	An optional battery capable of powering the monitor for up to 50 minutes See **SLA.**
FiO_2	Fractional inspired oxygen
Fixed keys	Function buttons located on the front of the monitor Fixed keys are also found on the HemoMed pod, on the NBP module, and on the R50 Recorder.
G or g	Gravity force
Generic Pressure parameter	A general-purpose blood pressure parameter that enables you to configure pressure channels for later assignment
GP1, GP2	See *Generic Pressure parameter*
Halothane	An anesthetic agent
HemoMed	A module used to mount blood pressur
hr	Hour
HR	Heart Rate

Hz	Hertz
IBP	Invasive Blood Pressure
iCO_2	Inspired CO_2
ICP	Intracranial Pressure
I:E	Inspiratory/Expiratory Ratio
Impedance respiration	Respiration monitoring based on the measurement of changes in electrical impedance that accompany the expansion and contraction of the chest
in	inches
Inspired CO_2 (iCO_2)	In $etCO_2$ monitoring, the level of carbon dioxide measured during the inspiration phase of the breathing cycle
InspT%	Inspiratory Time %
Internal battery	A permanent lead-acid battery capable of powering the monitor for up to 75 minutes.
Isoelectric line	In electrocardiology, a reference line representing the resting state of the heart
IT	Injectate Temperature
LA (ECG)	Left Arm
LA (IBP)	Left-Atrial pressure
LCD	Liquid Crystal Display
LL	Left Leg
Local message area	Along the top left of the main screen; displays error and status messages See also *Network Message Area.*
LV	Left-Ventricular pressure
M or Mean	Mean pressure
Main menu	The top level menu in the Vista XL menu system Press the **Menu** fixed key to access.
MAP	Main Arterial Pressure
MCL	Modified Chest Lead
Memory card	A PCMCIA storage device used for upgrading software, retrieving monitor logs for use by service personnel, and for storing monitor setups A memory card reader is on the left side of the monitor.
min	Minute
mm/s	Millimeter per Second
mmHg	Millimeter of Mercury
ms	Millisecond
MultiMed	The pod that receives the following patient cables: ECG lead set, SpO_2 extension cable, and a temperature probe

MV	Minute Volume
MValv	Alveolar Minute Volume
MVWS	Infinity CentralStation
Network message area	Along the top right of the main screen; displays network messages when the monitor is connected to the network See also *Local Message Area.*
NBP	Non-Invasive Blood Pressure
NBP hose	The plastic tube used by the NBP module to inflate the blood-pressure cuff
OxyCRG or OCRG	Oxycardiorespirogram
PA	Pulmonary-Arterial pressure
Parameter	A monitored physiological function (eg, heart rate, blood temperature)
PAUS	Pause
PeCO2	Mixed Expired CO2
PEEP	Positive end-expiratory pressure
PEF	Peak Expiratory Flow
PIF	Peak Inspiratory Flow
PIP	Peak Inspiratory Pressure
PLS or pls	Pulse Rate as calculated from the SpO_2 measurements
Pulse Oximetry (SPO_2)	A technique for calculating the percentage of functional (ie, oxygen-saturated) hemoglobin in the patient's blood
PVC/min	Premature Ventricular Contractions per minute
PWP	Pulmonary Wedge Pressure
R50	A strip recorder used to print a paper copy of patient data (alarms, waveforms, and trends)
RA (ECG)	Right Arm
RA (IBP)	Right Atrial pressure
Raw	Airway Resistance
RESP	Respiration Rate as measured by ECG electrodes
RL	Right Leg
Rv	Right Ventricular pressure
RRc	Respiratory Rate as calculated from the end-tidal CO_2 ($etCO_2$) capnograph
RSBI	Rapid Shallow Breath Index
RUN	Arrhythmia call
s	Second, Spontaneous
S or Sys	Systolic pressure

SCIO Modules	A peripheral device that provides measurement of respiatory and anesthetic gases
SLA	Sealed lead-acid battery; used for the external battery
SpO_2	Percentage of oxygen-saturated hemoglobin in the blood, as measured by pulse oximetry
ST deviation	The displacement of the ST segment of the ECG waveform over the isoelectric line
Strip chart	The paper copy of patient data printed out from a recorder
SV	Stroke Volume
SVI	Stroke Volume Index
SVR	Systemic Vascular Resistance
SVRI	Systemic Vascular Resistance Index
SYNC or Sync	Synchronization
Ta	Patient temperature (through the MultiMed pod)
TACH	Tachychardia
TENS	Transcutaneous Electric Nerve Stimulator
TV	Tidal Volume
TValv	Alveolar Tidal Volume
TVCO2	Tidal Volume CO2
V	Volt
V (ECG)	Chest
VCO2	minute elimination

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B Technical Data

Overview

This appendix contains technical specifications for the physical and functional aspects of the patient monitoring system. These specifications apply to adult, pediatric, and neonatal patients.

Upon request, Dräger Medical makes any technical information required to perform maintenance and/or calibration of serviceable items available to qualified technical personnel.

Overall Regulatory Standard Compliance

EN 60601-1 and applicable collateral and particular standards

EN 60601-1-2

Electromagnetic Compatibility

This section is intended to provide information with regard to electromagnetic compatibility for the Dräger Delta series of patent monitors (hereafter referred to as 'equipment'). It supplements the information that already exists elsewhere in the instructions for use.

Much of the information below is derived from requirements specified in the electromagnetic compatibility standard for medical electrical equipment IEC 60601-1-2: 2001published by the International Electrotechnical Commission and, available from a variety of sources. While primarily aimed at device manufacturers this contains a large amount of information that may be useful to interested users of medical equipment.

The information contained in this section (such as separation distances) is in general specifically written with regard to the Dräger patient monitors specified above. The numbers provided will not guarantee faultless operation but should provide reasonable

assurance of such. This information may not be applicable to other medical electrical equipment, older equipment may be particularly susceptible to interference.

NOTE:

- Medical electrical equipment needs special precautions regarding electromagnetic compatibility (EMC) and needs to be installed and put into service according to the EMC information provided in this section and the instructions for use which accompanied your monitor.
- Portable and mobile RF communications equipment can affect medical electrical equipment.
- Cables and accessories not specified within the instructions for use are not authorized. Using other cables and/or accessories may adversely impact safety, performance and electromagnetic compatibility (increased emission and decreased immunity).
- The equipment should not be used adjacent to or stacked with other equipment; if adjacent or stacked use is inevitable, the equipment should be observed to verify normal operation in the configuration in which it will be used.
- When using wireless networking be aware that the system operates at 2.4 GHz range*. Other equipment, even if compliant with CISPR emission requirements could interfere with reception of wireless data. When selecting new wireless systems (e.g. cell phones, pager systems, cordless phones etc) for use in installations where wireless networking is used, care should always be used to insure that operating frequencies are compatible. For example selecting cordless phones that operate at 2.4 GHz will likely cause difficulty with the phones and networking components.
- Low level signals such as EEG and ECG are particularly susceptible to interference from electromagnetic energy. While the equipment meets the testing described below, it is not a guarantee of perfect operation, the 'quieter' the electrical environment the better. In general, increasing the distance between electrical devices, will decrease the likelihood of interference.

Electromagnetic Emissions

This equipment is intended for use in the electromagnetic environment specified below. The user of this equipment should assure that is used in such an environment.		
Emissions:	**Compliance according to:**	**Electromagnetic environment:**
RF emissions (CISPR 11)	Group 1	The equipment uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.*
CISPR Emissions Classification	Class B	The equipment is suitable for use in all establishments including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions (IEC 61000-3-2)	Class A	
Voltage fluctuations / flicker (IEC 61000-3-3)	Complies	

NOTE:

- Note that when used with the wireless option the equipment emits electromagnetic energy in order to communicate with the Infinity Network. Nearby electronic equipment may be affected.
- Radio frequency characteristics are specified above. See the documentation that accompanies the wireless products for further details.

Electromagnetic Immunity

This equipment is intended for use in the electromagnetic environment specified below. The user of this equipment should assure that is used in such an environment.

Immunity against	**IEC 60601-1-2 test level:**	**Compliance level (of this device:**	**Electromagnetic environment:**
electrostatic discharge, ESD (IEC 61000-4-2)	contact discharge: ± 6 kV air discharge: ± 8 kV	± 6 kV ± 8 kV	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be kept at levels to reduce electrostatic charge to suitable levels.
electrical fast transients / bursts (IEC 61000-4-4)	power supply lines: ± 2 kVlonger input / output lines: ± 1 kV	± 2 kV ± 1 kV	Mains power quality should be that of a typical commercial or hospital environment.
surges on AC mains lines (IEC 61000-4-5)	Common mode: ± 2 kV differential mode: ± 1 kV	± 2 kV ± 1 kV	Mains power quality should be that of a typical commercial or hospital environment.
power frequency magnetic field 50/ 60 Hz (IEC 61000-4-8)	3 A/m	3 A/m	Equipment which emits high levels of power line magnetic fields (in excess of 3A/m) should be kept at a distance to reduce the likelihood of interference.
voltage dips and short interruptions on AC mains input lines (IEC 61000-4-11)	dip >95%, 0.5 periods dip 60%, 5 periods dip 30%, 25 periods dip >95%, 5 seconds	>95%, 0.5 per. 60%, 5 per. 30%, 25 per. >95%, 5 sec.	Mains power should be that of a typical commercial or hospital environment. If user requires continued operation during power mains interruptions insure that batteries are installed and charged. Insure that battery life exceeds longest anticipated power outages or provide and additional uninterruptible power source
Immunity test	**IEC 60601 test level:**	**Compliance level:**	**Electromagnetic environment-guidance:**
			Portable and mobile RF communications equipment should be used no closer to any part of the, including cables, than therecommended separation distance calculated from the equation applicable to the frequency of the transmitter as below. **Recommended separation distance**

Conducted RF rf coupled into lines (IEC 61000-4-6)	150 kHz - 80 MHz	3 V/m	d=1.2/V1](Square root of)P
radiated rf (IEC 61000-4-3)	80 MHz - 2.5 GHz	3 V/m	d=1.2/V1](Square root of)P d=1.2/V1](Square root of)P where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[1], should be less than the compliance level in each frequency range[2]. Interference may occur in the vicinity of equipment marked with the following symbol:

[1]Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the equipment is used exceeds the applicable RF compliance level above, the equipment should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the equipment.

[2]Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Recommended separation distances

Recommended separation distances between portable and mobile RF communications equipment and the equipment

Rated maximum output power of transmitter W	**Separation distance according to frequency of transmitter in meters**		
	150 kHz - 80 MHz d=1.2/V1](Square root of)P	80 MHz to 800MHz d=1.2/V1](Square root of)P	800 MHz to 2.5 GHz d=1.2/V1](Square root of)P
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

NOTE:

•For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

•At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

•These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption andreflection from structures, objects and people.

System Components

Vista XL Base Unit

Physical Attributes	
Size (H x W x D): (without modules)	224 x 330 x 102 mm (8.8 x 13.0 x 4.0 in)
Weight:	Without external battery:7.0 kg (15.5 lb) With external battery:7.7 kg (16.9 lb)
Cooling:	Convection
Enclosure:	Plastics: ABS/PC, FR 110
Printed circuit boards:	Board: Glass/epoxy Fr4 Solder: Lead/tin Copper etch Lithium battery
Heatsink assemblies:	Cast magnesium alloy
Internal Battery:	Lithium Ion
NBP assembly:	Silicon tubing, steel, copper wire
Packaging:	Corrugated cardboard, Urethane foam
Electrical Specifications	
Input voltage:	11 to 15 V DC
Power consumption:	≤70 Watts (fully loaded)
Protection class:	Internally powered (per IEC 601-1) and for use with specified Class I power supplies.
Battery life:	180 minutes (230 minutes with optional External Battery) **Note:** Battery life varies with parameter configuration. The battery charge specified above is under the following load conditions: MultiMed with ECG leads and SPO_2 sensor, 2 temp probes, HemoMed pod with 4 IBP transducers, NBP taking measurements every 15 minutes, LCD Transport Brightness at 50%.
Battery charge time:	**Internal:** 4.5hrs. at 25°C **External:** *(Optional)* 3.5hrs. at 25°C
Patient leakage current:	≤10 μA
Mode of operation:	Continuous with external power supply; for a limited time with battery backup.
Note: • All materials must be disposed of or recycled properly and in accordance with local regulations.	
Environmental Requirements	

Temperature range:	Operating:10°C to 40°C (50°F to 104°F) Storage: -20°C to +40°C (-4°F to +104°F)
Relative humidity:	Operating:20% to 90%, non-condensing Storage: 10% to 95% (with packaging)
Atmospheric pressure:	Operating:525 to 795 mmHg (70 to 106 kPa) Storage: 375 to 795 mmHg (50 to 106 kPa)
Protection against ingress of water:	EN 60101-2-27, 44.3.
Analog Output	
Signals:	ECG, arterial blood pressure (ART)
Delay:	≤25 ms
QRS Sync Output	
QRS:	Output high for 50 ms every time a QRS is detected. QRS detected:+12V ±5%, 560 Ω source impedance. Output low (no QRS): <0.8V @30 mA sync current.
User Interface	
Controls:	Fixed keys and rotary knob
Alarms:	3 levels: Life-threatening, Serious, Advisory
Screen	
Type:	Thin Film Transistor Liquid Crystal (TFT-LCD) Display, Active Matrix.
Size:	Vista XL:264 mm (10.4 in.) diagonal
Viewing area:	Vista XL:211 x 158 mm (8.3 x 6.2 in)
Resolution:	Vista XL:640 x 480 pixels
Color capability:	512
Trend storage	
Data storage:	24 hours of trended parameter information
Data resolution:	30 second sampling
Trend graphs:	1, 2, 4, 8, 12 and 24 hour display formats
Trend tables:	1, 5, 15, 30, and 60-minute display formats

External Battery

Physical Attributes	
Size (H x W x D):	62 x 182 x 24 mm (2.4 x 7.2 x 0.9 in)
Weight:	635g (1.4 lb)
Electrical Specifications	
Battery life:	50 minutes
Charging time:	3.5 hours at 25°C
Battery type:	Lead-Acid
Notes: • Battery life varies with parameter configuration. Specified above is battery life under following load conditions: MULTIMED with SPO_2 sensor, 2 temp probes, HemoMed pod with 4 IBP transducers and a catheter, NBP taking measurements every 15 minutes, LCD transport brightness at 50%, and no continuous tone being generated. • Battery life may diminish after extended use.	
Environmental Requirements	
Temperature range:	Operating:10°C to 40°C (50°F to 104°F) Storage: -15°C to +40°C (20°F to 104°F)
Relative humidity:	Operating:20% to 90%, non-condensing Storage: 10% to 95% (with packaging)
Atmospheric pressure:	Operating:525 to 795 mmHg (70 to 106 kPa) Storage: 375 to 795 mmHg (50 to 106 kPa)

Battery Charger

Physical Attributes	
Type:	SLA (sealed lead acid)
Size (H x W x D):	216 x 393 x 295 mm (5.5 x 10 x 7.5 in)
Weight:	738g (1.6 lb)
Cooling:	Convection cooled
Electrical Specifications	
Input voltage range:	100 - 240 VAC
Mains frequency:	50/60 Hz (nominal)
Power consumption:	2A @ 100 Vac, 1A @ 240Vac max. (fully loaded)
Protection class:	Class I (per IEC 601-1)
Environmental Requirements	
Temperature range:	Operating:10°C to 40°C (50°F to 104°F) Storage: -40°C to +85°C (-6°F to +185°F)
Relative humidity:	Operating:20% to 90%, non-condensing Storage: 10% to 95% (with packaging)
Atmospheric pressure:	Operating:525 to 795 mmHg (70 to 106 kPa) Storage: 375 to 795 mmHg (50 to 106 kPa)
Regulatory Approvals	
UL 544, IEC 601-1 This device bears the CE label in accordance with the provisions of the Directive 89/336/EEC* of May 3, 1989 concerning electromagnetic compatibility. * Modified by Council Directive 91/263/EEC, 92/31/EEC and 93/68/EEC	

R50 N Infinity Recorder

Physical Attributes	
Size (H x W x D):	180 x 120 x 222 mm (7.1 x 4.72 x 8.74 in.)
Weight:	1.64 kg (3.6 lb)
Connections:	AC Power Connector; X14 Infinity Network; X7 R50 Recorder; Potential Equalization Connector

Cooling:	Convection
Type:	Transportable equipment
Electrical Specifications	
Input voltage range:	100-240 VRMS
Mains frequency:	50/60 Hz
Power consumption:	1.0 A max
Protection class:	Class I
Chassis leakage current:	<300 µA @ 120VAC, <500 µA @ 220VAC
Mode of operation:	Continuous
Protection against water ingress:	Ordinary
Fuses	Replace as marked, F2A-250V **Note**: There are no other user-replaceable parts for this device.
Environmental Requirements	
Temperature range:	Operating:15°C to 40°C (55°F to 104°F) Storage: -20°C to 40°C (-4°F to 104°F)
Relative humidity:	Operating:30% to 95%, non-condensing Storage: 10% to 95%, non-condensing with packaging
Atmospheric pressure:	Operating:550 to 775 mmHg (73 to 103 kPa) Storage: 375 to 795 mmHg (50 to 106 kPa)
CAUTION: *The Recorder is not suitable for use in the presence of flammable anaesthetic mixtures with air, or flammable anaesthetic mixtures with oxygen or nitrous oxide.*	

Monitoring Accessories

$etCO_2$ Module

Physical Attributes

Size (H x W x D):	Module: 150 x 93 x 65 mm (5.9 x 3.6 x 2.6 in) CapnostatTM III Sensor: 33 x 42 x 22 mm (1.3 x 1.7 x 0.9 in)
Weight:	Module: 0.5 kg (1.1 lb) CapnostatTM III Sensor:18 g
Connections:	Sensor connector, female luer side-stream sampling port, male luer sample exhaust port
Adult airway adapter dead space:	<5 cc
Neonatal airway adapter dead space:	< 0.5 cc
Moisture resistance:	Airway adapter can be immersed in water without damage
Note: CapnostatTM III sensor size and weight exclude cable.	
Electrical Specifications	
Power source:	Powered directly from monitor
Protection against electric shock:	Type CF (per IEC 601-1)
Mode of operation:	Continuous
Environmental Requirements	
Temperature range:	Operating:10°C to 40°C (50°F to 104°F) Storage: -20°C to 50°C (-4°F to 122°F)
Relative humidity:	Operating:20% to 90%, non-condensing Storage: 10% to 95% (with packaging)
Atm. pressure:	Operating:525 to 795 mmHg (70 to 106 kPa) Storage: 375 to 795 mmHg (50 to 106 kPa)

HemoMed

User Interface	
User Controls:	Fixed keys (IBP Zero)
Displays:	HemoMed:none
Connections:	HemoMed: 4 invasive pressures, C.O., single cable connecting pod to monitor
Physical Attributes	
Size (H x W x D):	140 x 205 x 60 mm (5.5 x 8.1 x 2.3 in.)
Weight:	HemoMed: 0.7 kg (1.6 lb.)
Electrical Specifications	
Power source:	Powered directly from the monitor
Protection against electric shock:	Type CF
Mode of operation:	Continuous
Defibrillation protection:	Per IEC 601-2-34
Environmental Requirements	
Temperature range:	Operating:10°C to 40°C (50°F to 104°F) Storage: -20°C to 50°C (-4°F to 122°F)
Relative humidity:	Operating:20% to 90%, non-condensing Storage: 10% to 95% (with packaging)
Atmospheric pressure:	Operating:525 to 795 mmHg (70 to 106 kPa) Storage: 375 to 795 mmHg (50 to 106 kPa)

SCIO Four/SCIO Four Oxi/SCIO Four plus/SCIO Four Oxi plus Module

Physical Attributes	
Size (H x W x D) *with watertrap*:	115 x 190 x 270 mm (4.80 x 7.5 x 10.5 in)
Weight:	Scio Four: 3.024 Kg (6.66 lbs) Scio Four Oxi: 3.444 Kg (7.59 lbs) Scio Four plus: 3.037 Kg (6.69 lbs) Scio Four Oxi plus: 3.457 Kg (7.62 lbs)
Cooling:	Fan
Mains frequency:	50/60 Hz
Power requirement:	< 0.8 A at 100-120 Vac; <0.4 A at 200-240 Vac

Chassis Leakage Current:	≤ 300 µA (per UL 544) ≤ 500µA (per IEC 60601-1)
Electric Shock Protection:	Type BF
Protection Class:	Class 1
Mode of operation:	Continuous
Power:	from specified power supply
Sound Pressure level	≤ 45 dB(A)
Air Ingression, leakage	< 45 ml during zeroing, < 10 ml/min leakage
Sample Flow rate	150 ml/min. ± 20 ml/min. (or 200 ±20 m/min, if so specified on back-panel)
Environmental Requirements	
Temperature range:	Operating:10°C to 40°C (50°F to 104°F) Storage: -20°C to 70°C (-4°F to +158°F)
Relative humidity:	Operating:5% to 90% Storage: 5% to 95%
Atmospheric pressure	Operating:525 to 795.1 mmHg (70 to 106 kPa) Storage: 375 to 795.1 mmHg (50 to 106 kPa)

Notes:

- Readings comply to ATPS conditions.
- This device is not intended for use in the presence of flammable gases.

FiO_2 Sensors

Physical Attributes	
Size (H x D):	40 x 30 mm (1.59 x 1.2 in)
Weight:	35 g (<1.2 oz)
Connections:	NeoMed Pod, interface cable
Mounting:	16 mm thread x 1 mm pitch
Sensor type:	Galvanic fuel cell (partial pressure)
Useful life:	Approximately 1 year
Note: This sensor contains lead and caustic material. Dispose of or recycle properly and in accordance with local regulations.	
Environmental Requirements	
Temperature range:	Operating:10°C to 40°C (50°F to 104°F) Storage: -10°C to 50°C (14°F to 122°F)
Relative humidity:	Operating:20% to 90%, non-condensing Storage: 10% to 95% (with packaging)
Atm. pressure:	600 to 900 mmHg (80 to 120 kPa)

Monitoring Specifications

WARNING: The following parameters are not monitored in neonatal mode: arrhythmia, sidestream etCO_2, cardiac output, and ST.

ECG

Display:	Up to 8 leads
Available leads:	
Adult and Pediatric (regular) with TruST OFF:	I, II, III, aVR, aVL, aVF, V, V+, V1-V6 (aVR/aVL/aVF/V only with 5-lead set; V+ only with 6-lead set)
Adult and Pediatric with TruST ON:	I, II, III, aVR, aVL, aVF, V2, V5, dV1, dV3, dV4, dV6 **Note:** TruST leads are indicated by a prefix “d” before the V lead.
Neonatal:	I, II, III, aVR, aVL, aVF, V, V+ (aVR/aVL/aVF/V only with 5-lead set; V+ only with 6-lead set)
Measuring range:	15 - 300 1/min

Accuracy:	±2 1/min or ±1% (whichever is greater)
QRS detection:	Amplitude:0.5 - 5.0 mV Duration:70 - 120 ms (Adult and Pediatric) 40 - 120 ms (Neonatal)
Frequency ranges:	filter = Monitor:0.5 - 40 Hz filter = ESU:0.5 - 16 Hz filter = OFF:0.05 - 40 Hz **Note:** Printed ST and Rest-ECG reports conform to EC-11 diagnostic bandwidth requirements.
Degree of protection against electric shock:	Type CF
Defibrillation protection:	In accordance with IEC 601-2-27
Arrhythmia detection:	Adult and Pediatric:Yes Neonatal:No
Pacer detection:	Adult and Pediatric:Yes, on leads I, II, or III Neonatal:No
Unit will detect pacers with the following characteristics:	
Amplitude	±2 to ±700 mV
Width (d_p)	0.2 to 2.0 ms
Rise/Fall times (min.)	0.1 d_p, 100 ms
Overshoot (min.)	0.025 a_p, 2 mV
Recharge time constant	4 to 100 ms

ST-Segment Analysis

Sensing leads:	3 lead cable:I, II, or III (user-selectable) 5 lead cable:(choice of 3 leads) I, II, III, aVR, aVL, aVF, or V 6 lead cable:(choice of 3 leads) I, II, III, aVR, aVL, aVF, (w/TruST Off) V, V+ 6 lead cable:(choice of 3 leads) I, II, III, aVR, aVL, aVF, (w/TruST On) V1-V6, dV1, dV3, dV4, dV6 **Note:** TruST leads are indicated by a prefix “d” before the V lead.
ISO point:	Adjustment range:Complex start to fiducial point Default: QRS onset - 28msec
ST measurement point:	Adjustment range:Fiducial point to complex end Point default:QRS offset +80msec
ST complex:	Length: 892msec (225 samples) Frequency response:0.05 to 40 Hz
Update interval:	15 seconds, 1 normal beat required
Trend intervals:	1, 2, 4, 8, 12, 24 hours

Trend resolution:	One data point every 30 seconds
ST level alarm adjustment range:	1 to 15mm
ST event alarm duration:	OFF, 15, 30, 45, 60 seconds
Alarm severity:	Serious
Alarm Auto Set:	Current value ±2mm

Respiration

Sensing leads:	I or II (user-selectable)
Measuring method:	Impedance pneumography
Detection threshold:	0.15Ω - 4.0Ω in manual mode (user adjustment) Adult and Pediatric:0.20Ω - 10.5Ω in auto mode (automatic adjustment) Neonatal:0.20Ω - 1.5Ω in auto mode (automatic adjustment)
Measuring range:	0 - 155 breaths per min
Measuring accuracy:	±1 1/min or 2% of rate (whichever is greater)
Apnea Detection?	Adult and Pediatric:No Neonatal:Yes

Non-Invasive Blood Pressure (NBP)

Parameter display:	Systolic, Diastolic, Mean
Measuring method:	Oscillometric technique
Modes of operation:	Manual (single measurement), Continuous (5 minutes), or Interval
Interval times:	1, 2, 2.5, 3, 5, 10, 15, 20, 25, 30, 45, 60, 120, and 240 min
Measuring range (Adult - 270mmHg):	Heart rate:30 - 240 bpm Systolic NBP:30 - 250 mmHg Mean NBP:20 - 230 mmHg Diastolic NBP:10 - 210 mmHg
Measuring range (Pediatric - 180mmHg):	Heart rate:30 - 240 bpm Systolic NBP:30 - 170 mmHg Mean NBP:20 - 150 mmHg Diastolic NBP:10 - 130 mmHg
Measuring range (Neonatal - 140mmHg):	Heart rate:30 - 240 bpm Systolic NBP:30 - 130 mmHg Mean NBP:20 - 110 mmHg Diastolic NBP:10 - 100 mmHg

Connections:	Quick-release hose connector with single airway
Default inflation pressure:	Adult (270):160 mmHg ±10mmHg Pediatric (180):120 mmHg ±10 mmHg Neonatal (140):110 mmHg ±10 mmHg
Inflation pressure after a valid measurement (±10 mmHg):	Adult (270):Previous NBP_{SYS} + 25 mmHg Pediatric (180):Previous NBP_{SYS} + 25 mmHg Neonatal (140):Previous NBP_{SYS} + 30 mmHg
Inflation pressure after an alarm:	Adult (270):160 mmHg ±10 mmHg Pediatric (180):120 mmHg ±10 mmHg Neonatal (140):110 mmHg ±10 mmHg
Maximum inflation pressure:	Adult (270):265 mmHg ±5 mmHg Pediatric (180):180 mmHg ±10 mmHg Neonatal (140):142 mmHg ±10 mmHg
Minimum inflation pressure:	Adult (270):110 mmHg ±10 mmHg Pediatric (180):90 mmHg ±10 mmHg Neonatal (140):70 mmHg ±10 mmHg
Maximum measurement time:	Adult (270):2 min ±1 sec Pediatric (180):2 min ±1 sec Neonatal (140):90 sec ±1 sec (60s French homologation)
Maximum measurement time including a retry:	Adult (270):3 min ±1 sec Pediatric (180):3 min ±1 sec Neonatal (140):90 sec ±1 sec (60s French homologation)
Software safety cut-off:	Adult (270):273 ±3 mmHg Pediatric (180):215 ±3 mmHg Neonatal (140):153 ±3 mmHg
Hardware safety cut-off:	Adult (270):300 ±30 mmHg Pediatric (180):300 ±30 mmHg Neonatal (140):157 ±8 mmHg
Static cuff accuracy:	±3 mmHg
Calibration range:	Adult and Pediatric:10 - 260 mmHg ±3 mmHg Neonatal:10 - 150 mmHg ±3 mmHg
Degree of protection against electric shock:	Type CF
Defibrillation protection:	per EN 60601-2-30 (IEC 601-2-30)

Invasive Blood Pressure (IBP)

Measuring method:	Resistive strain gauge transducer
Display resolution:	1 mmHg
Measuring range:	-50 to 400 mmHg
Frequency ranges:	DC to 8 Hz, DC to 16 Hz, and DC to 32 Hz (user selectable)
Accuracy:	±1 mmHg or ±3% exclusive of transducer (whichever is greater)
Zero balance range:	±200 mmHg
Transducer specifications:	Dräger Medical-approved transducers with a resistance of 200 to 3000Ω and an equivalent pressure sensitivity of 5µV/V/mmHg ±10%
Degree of protection against electric shock:	Type CF
Defibrillation protection:	per IEC 601-2-34

Cardiac Output

Parameter display:	Cardiac output, Blood Temperature, Injectate Temperature
Measuring method:	Thermodilution
Measuring range:	Cardiac output:0.5 to 20 l/min Blood temperature:25°C to 43°C (77°F to 109°F) Injectate temperature:-5°C to +30°C (23°F to 86°F)
Accuracy:	**Cardiac output:** ±5% (with 0° C injectate) Injectate temperature: ±0.25°C
Degree of protection against electric shock:	Type CF
Defibrillation protection:	IEC 601-1A2

Pulse Oximetry (SpO_2)

Parameter display:	Saturation (%SpO_2), pulse rate
Measuring method:	Transmission-spectrophotometry
Measuring range:	SpO_2: 1 - 100% Pulse rate: 30 - 250 1/min
Calibration range:	70-100%

Display range:	0-100%
Display update period:	2 seconds
Maximum hold from previous update:	30 seconds (in the event of artifact or other error)

Measuring accuracy, Adult mode[1]:

SpO_2:
0 to 69% not specified
70 to 100% sensor-specific as follows:

Dräger :	
OxiSure Sensor - D	±2
Nellcor : [2,3]	
D-25/D-25L, D-20, I-20, N-25, OxiMAX MAX-A, OxiMAX MAX-AL, OxiMAX MAX-P, OxiMAX MAX-N, OxiMAX MAX-I	±2
Nellcor :	
DS100A	±3
Masimo: [2,3]	
LNOPADT, LNOPPED, LNOPNEO, LNOPNEO SS,LNOP-YI	±2
Masimo:	
LNOP-DCI, LNOP-DCIP, NR125	±2
EAR	±3.5
Pulse Rate:	±3 beats/min or ±3% (whichever is greater)

Measuring accuracy and notes continued on next page.

Measuring accuracy, Neonatal mode[1, 2]:

SpO_2:
0 to 69% not specified
70 to 100% sensor-specific as follows:

Nellcor:	
N-25, OxiMAX MAX-N	±3
Masimo:	
LNOPNEO, LNOPNEO SS, LNOP-YI	±3
Pulse Rate:	±3 beats/min or ±3% (whichever is greater)

Notes:

1) SpO_2 accuracies are expressed as ± "X" digits between indicated saturation levels. Accuracy of the SpO_2measurement is specified within 1 SD (standard deviation)

2) Accuracy of saturation measurements on neonates is increased by ±1 digit as compared to accuracy on adult patients to account for the theoretical effect on oximeter measurements of fetal hemoglobin in neonatal blood.

SpO_2 alarms:	High: Adjustable, 20 to 100% Low: Adjustable, 20 to 100%
Nominal wavelength:	**Nellcor**: Red: 660 nm IR: 910 nm **Masimo**:Red: 660 nm IR: 905 nm

Power:	**Nellcor:** Red: 3 mW(max.)**Masimo**:Red: 0.9 mW(max.) IR: 4 mW(max.) IR: 0.9 mW(max.) Note: LED drive is current limited by hardware mechanisms.
Degree of protection against electric shock:	Type CF
Defibrillation protection:	In accordance with IEC 601-1A2

Pulse Oximetry (SpO_2) *Via Masimo SET SmartPod*

Parameter display:	Saturation (%SpO_2), pulse rate, perfusion
Measuring range:	%SpO_2: 1 - 100% Pulse rate: 25 - 240 /min Perfusion: 0.02 - 20%

Measuring accuracy:

Saturation (%SpO_2) - During No Motion Conditions:(1)

0 to 69% not specified

70 to 100%:

Adults, Pediatrics ±2 digits

Neonates ±3 digits

Saturation (%SpO_2) - During Motion Conditions:(2, 3)

0 to 69% not specified

70 to 100%:

Adults, Pediatrics(2) ±3 digits

Neonates(3) ±3 digits

Pulse Rate (bpm) - During No Motion Conditions:(1)

Adults, Pediatrics, Neonates 25 - 240 bpm ±3 digits

Pulse Rate (bpm) - During Motion Conditions:(2, 3)

Adults, Pediatrics, Neonates 25 - 240 bpm ±5 digits

(1) The Infinity® Masimo SET® SpO_2 SmartPod™ pulse oximeter with LNOPoAdt sensors has been validated for no motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies in the range of 70-100% SpO_2 against a laboratory co-oximeter and ECG monitor. This variation equals plus or minus one standard deviation.

(2) The Masimo SET® pod with LNOP-Adt sensors has been validated for motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies while performing rubbing and tapping motions at 2 to 4 Hz at an amplitude of 1 to 2 cm and a non-repetitive motion between 1 to 5 Hz at an amplitude of 2 to 3 cm in induced hypoxia studies in the range of 70 - 100% SpO_2 against a laboratory co-oximeter and ECG monitor. This variation equals plus or minus one standard deviation.

(3) The Masimo SET® pod with LNOP-Neo and Neo Pt sensors has been validated for motion and no motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies while performing rubbing and tapping motions at 2 to 4 Hz at an amplitude of 1 to 2 cm and a non-repetitive motion between 1 to 5 Hz at an amplitude of 2 to 3 cm in induced hypoxia studies in the range of 70 - 100% SpO_2 against a laboratory co-oximeter and ECG monitor. 1% has been added to the results to account for the effects of fetal hemoglobin.

Nominal wavelength:	Red: 660 nm IR: 905 nm
Radiant Power at 50 mW pulsed:	**Min**: 0.13 mW **Max**: 0.79 mW
Resolution:	SpO_2: 1% Pulse rate: 1 b/min

Low Perfusion Performance:(4)	>0.02% Pulse Amplitude: >0.02% Saturation (%SpO_2): ±2 digits and %Transmission >5%: Pulse rate: ±3 digits
(4) The Masimo SET® pod has been validated for low perfusion accuracy in bench top testing against a Biotek Index 2 simulator and Masimo's simulator with signal strengths of greater than 0.02% and a % transmission of greater than 5% for saturations ranging from 70 to 100%. This variation equals plus or minus one standard deviation.	
Interfering Substances:	Carboxyhemoglobin may erroneously increase readings. The level of increase is approximately equal to the amount of carboxyhemoglobin present. **WARNING: Dyes, nail polishes and other substances, may absorb an abnormal amount of red light, which can effect the accuracy of the measurement. Be sure to apply the sensor to a site free of any artificial pigments.**

End-Tidal CO_2 ($etCO_2$) *via $etCO_2$ module*

Parameter display:	$etCO_2$, iCO2, Respiration Rate (RRc)
Measuring method:	Dual wavelength, non-dispersive infrared absorption
Measuring modes:	Adult and Pediatric:Mainstream and Sidestream Neonatal:Mainstream only
Warm up:	≤ 5 min (at 25°C)
Measuring range:	0-99 mmHg CO2 partial pressure
Accuracy:	0 - 40 mmHg:±2 mmHg 41 - 70 mmHg:±5% of reading 71 - 99 mmHg:±8% of reading Stable over 24 hours, over full range of readings at atmospheric pressure
Calibration:	Verify once a day Calibrate when moving the sensor from one module to another Calibration time:< 20 s
Compensation:	Balance: User-selectable Atm. pressure:Automatic or user-selectable (540 - 800 mmHg)
Sampling flow rate:	180 ±12 ml/min (Sidestream measuring mode)
Apnea detection?	Module: Adult and Pediatric:No Neonatal:Yes Pod: Yes in all three patient categories

RRc range (Pod):	Mainstream:0-149 breaths/min Sidestream:0-69 breaths/min Accuracy:±1 breath/min
Rise time:	Mainstream:<100 ms Sidestream:<200 ms
Delay time:	Mainstream:<100 ms Sidestream:<450 ms
Total system response time:	Rise time plus delay time

FiO_2

Oxygen measurement range:	5-100% O2
Accuracy:	One point calibration:≤ 14.2% FS (at RTP) Two point calibration:≤ 3% FS (at RTP)
Warm up:	Value available immediately after calibration
Nominal response time:	97% in 30 seconds (flow rate = 2L/min at RTP)
Alarm limit range:	18-100%
Stability of accuracy:	±3% over an 8-hour interval
Protection against electric shock:	Type CF
Standards:	IEC 601-1, ISO 7767 (applicable sections only, Oxygen analyzers for monitoring patient breathing mixtures)
Note: RTP = Room temperature / pressure 23°C±3and ambient barometric pressure	

Temperature

Parameter display:	Absolute temperature, delta temperature (with HemoMed pod)
Measuring range:	**Absolute:**-5°C to 50°C (23°F to 122°F) **Delta:** 0°C to 55°C (32F to 131°F)
Resolution:	0.1°C
Accuracy:	Absolute:±0.1°C Delta: ±0.2°C
Average Response Time:	< 2.5 seconds
Probe Accuracy:	±0.1°C 0°C to 50°C
Degree of protection against electric shock:	Type CF
Defibrillation protection:	In accordance with IEC 601-1A2
Note: Range and accuracy values are also applicable to HemoMed pod.	

C Approved Options and Accessories

Power Supply

Power Cords

Power cord Cont. Europe, CEE 7	4321712
Power cord North America, 5-15R	4321720
Power cord Australia and New Zealand AS 3112	1851705
Power cord Great Britain, BS 1363	1851713
Power cord Switzerland, SEV 1011	4321613
Power cord China AS 3112	1859714

Power Adapters

Infinity Vista XL Power Supply This is a replacement for power supply 5955393. The voltage is auto-switchable.	MS18284
Power adapter	5955393

Grounding Cable

Grounding Cable, 5 m *Connects monitor chassis to earth ground* *Has two spring catches*	2171767

MOUNTING

Shelf Mount, Docking Station *Shelf mount for interface plate*	4720087
Wall Mount *Universal mount for interface plate , 23 cm extending arm*	4720111
Rolling Stand *Mobile rolling stand for attaching interface plate (with basket)*	4722240
EasiArm Mount Kit *Includes Mount, Mount Plate (PGEA) and GCX and Westbrook wall track*	7498913
Rail mount for power supply *Plate for mounting power supply on horizontal rails*	4720095
R50 countertop plate *Plate to stabilize R50 Recorder on a countertop* *For use with Interface Plate 3376493*	5197384

External Battery

External Battery Pack	5592097
Battery Charger *Charging station for four lead acid battery packs*	5597377

Internal Battery

Lithium-ion Battery	5732354

Memory Card

Data Card *Memory Data Card (for patient data transfer)*	4718248

External Connection Accessories

RS232 UART cable, 3 m	4714346
QRS Sync Cable, 3 m *One end unterminated*	4314667
Analog Output Cable, 5 m *One end unterminated*	4314618
Alarm Output Cable, 5 m *For connecting an IDS to a nurse-call system* *5 m cable with one end unterminated*	5194928
Alarm Output Cable, Interface Plate, 5 m *For connecting to a nurse-call system* *5 m cable with one end unterminated*	4314626
Y-cable, recorder and alarm output *For simultaneous recorder and alarm output connection from an Interface Plate*	4313578
Transmitter Analog ECG cable *Connects transmitter to MultiMed cable, to display lead II. For use with Infinity Telemetry or TruST Telemetry transmitter*	4316621
Vital Connection cable *Connects Infinity Telemetry transmitter to monitor via the X8 connector*	MS15421
CPS cable, 25 m	5194910
Export Protocol cable	MS15045

Remote Keypad

Remote Keypad *Keypad for remote control of the Infinity Vista XL monitor*	5203042

Network Patch Cables

Patch cable, 1.2 m *Shielded cable to connect to a network wallplate*	4726373
Patch cable, 2.4 m *Shielded cable to connect to a network wallplate*	4726381
Patch cable, 4.9 m *Shielded cable to connect to a network wallplate*	4726399
Patch cable, 20 m *Shielded cable to connect to a network wallplate* *Comes with extra connector for field termination*	4725557

R50 Recorders and Recorder Cables

R50 recorder (includes paper)	5952630
R50-N recorder (includes paper and a mounting plate)	5740068
Recording paper, 10 rolls	4711201
R50 Recorder Cables, Interface Plate, 1.5 m *Cable to connect an R50 Recorder to the interface plate*	4721770
Recorder Cable, 0.6 m *Cable to connect an R50 Recorder to a monitor equipped with an interface plate*	4313586

Vista XL Monitor Options

Vista XL 5 to 6 Channel Option *Expands display to six channels*	MS15057
Vista XL 6 to 8 Channel Option *Expands display to eight channels*	MS15058
ACE Full Arrhythmia Option *Adds calls for run, bigeminy, couplet, PVC, and accelerated ventricular rhythm*	MS15054
3-Lead ST Analysis Option *Not required if ARIES option is installed*	MS15055
Handle Hook mount, Vista XL	MS15202
Wireless Option	MS15059
OR mode (stored in monitor)	MS17653
TruST Option	MS15852

ECG

MultiMed and NeoMed Pods

WARNING: The NeoMed pod is not intended for use during electrosurgery. To protect patients from burns, do not use this pod in an ESU environment.

MultiMed 5 pod, 2.5m accommodates: *ECG 3- and 5-lead patient cables* *1 temperature probe (2 probes with Y-adapter)* *1 SpO_2 extension cable*	3368391
MultiMed 5 pod, 1.5m accommodates: *ECG 3- and 5-lead patient cables* *1 Temperature probe (2 probes with Y-adapter)* *1 SpO_2 extension cable*	5950196
MultiMed 6 pod, accommodates: *ECG 3- 5-, and 6-lead patient cables* *1 Temperature probe (2 probes with Y-adapter)* *1 SpO_2 extension cable*	5191221
NeoMed pod, 2.5m accomodates: *ECG 3-lead patient cable* *2 Temperature probes* *1 SpO_2 extension cable* *1 FiO_2 sensor cable* *(Pod includes mount for incubator)*	5590539
NeoMed ECG adapter cable *1.5 m interface cable for connection of neonatal leads only (not for OR use)*	5592162
ECG ESU BLOCK, 5-lead *Only for use during electrosurgery (can use with 3- or 5-lead ECG lead sets)*	5947226
ECG ESU BLOCK, 6-lead *Only for use during electrosurgery (can use with 3-, 5- or 6-lead ECG lead sets)*	7486140
ECG electrodes, disp., 50 pcs *Adult, pregelled, not for ambulatory use*	4527750
Adapter pin, neonatal ECG electrodes, 10pcs *For connection of neonatal electrodes to the MULTIMED pod and ECG intermediate cables*	5194779
Neonatal ECG electrodes, disposable, 300 pcs (100 packages of 3 electrodes)	5195024

ECG Leads

IEC Color Code 1 (IEC1) is the European color scheme:

3-lead	RA red, LL green, LA yellow
5-lead	RA red, LL green, LA yellow, RL black, V white
6-lead	RA red, LL green, LA yellow, RL black, V white, V+ gray & white

IEC Color Code 2 (IEC2) is the AHA/US color scheme:

3-lead	RA white, LL red, LA black
5-lead	RA white, LL red, LA black, RL green, V brown
6-lead	RA white, LL red, LA black, RL green, V brown, V+ gray & brown

Note: Unless otherwise specified all lead-set lengths are 1 meter (1 m).

Standard ECG Leads and Lead Sets

ECG 3-lead grabber-set, IEC1	5956433
ECG 5-lead grabber-set, IEC1	5956466
ECG 6-lead grabber-set, IEC1	5956482
ECG 3-lead grabber-set, IEC2	5956441
ECG 5-lead grabber-set, IEC2	5956458
ECG 6-lead grabber-set, IEC2	5956474

MonoLead - One Wire ECG Lead Set Solution

ECG MonoLead 3, IEC1	MS14555
ECG MonoLead 3, IEC2	MS14556
ECG MonoLead 5, IEC1	MS14559
ECG MonoLead 5, IEC2	MS14560
ECG MonoLead 6, IEC1	MS14683
ECG MonoLead 6, IEC2	MS14682
Adapter MonoLead 3/5 to MultiMed 5 pod *Required to connect the MonoLead 3/5 to the MultiMed 5 pod.* **NOTE:** The ESU 5-lead block is compatible with this adapter. This adapter does not replace the ESU block.	MS14679
Adapter MonoLead 3/5/6 to MultiMed 6 pod *Required to connect the MonoLead 3/5/6 to the MultiMed 6 pod.* **NOTE:** The ESU 6-lead block is compatible with this adapter. This adapter does not replace the ESU block.	MS14680

MonoLead, dual pin version

ECG MonoLead 3, Dual Pin, IEC1, 2m	MS16160
ECG MonoLead 3, Dual Pin, IEC2 , 2m	MS16233
ECG MonoLead 5, Dual Pin, Limb, IEC1, 2.5m	MS16161
ECG MonoLead 5, Dual Pin, Limb, IEC2, 2.5m	MS16229
ECG MonoLead 5, Dual Pin, Chest, IEC1, 2.5m	MS16232
ECG MonoLead 5, Dual Pin, Chest, IEC2, 2.5m	MS16230

Pulse Oximetry (SpO_2)

NOTE: SpO_2 compatibility is a locked option. Contact your biomed for more information.

Dräger Sensors

Reusable

Dräger Reusable SpO_2 Sensor, adult — MS13235

SpO_2 adult sensor for finger application
Patient weight > 40 kg (88 lb.)

NOTE: Not for use with MicrO2+.

Masimo Sensors

Reusable

MASIMO LNOP-DCI, adult — 7270312

SpO_2 adult sensor for finger application
Patient weight > 30 kg (66 lb.)

MASIMO LNOP-DCIP, pediatric — 7270304

SpO_2 pediatric/adult sensor for finger application
Patient weight > 10 - < 50 kg (> 22 - < 110 lb.)

MASIMO LNOP-YI — 7497014

SpO_2 multisite sensor
finger application - Patient weight > 10 kg (22 lb.)
great toe application - Patient weight > 3 - <10 kg (> 6.6 - < 22 lb.)
across foot or palm and back of hand - Patient weight < 3 kg (6.6 lb.)

MASIMO LNOP TC-I — 7497006

SpO_2 ear sensor
for application on earlobe or pinna - Patient weight > 30 kg (66 lb.)

Adhesive Single-Patient Use

MASIMO LNOP ADT, adult, 20 pcs. — 7496990

SpO_2 adult sensor for finger application
Patient weight > 30 kg (66 lb.)

MASIMO LNOP PDT, pediatric, 20 pcs. — 7496982

SpO_2 pediatric sensor for finger application
Patient weight 10-50 kg (22-110 lb.)

MASIMO LNOP NEO, neonatal, 20 pcs. — 7496974

SpO_2 neonatal sensor for application across the foot
Patient weight < 10 kg (22 lb.)

MASIMO LNOP NEO SS, neonatal, 20 pcs. 7496966

SpO_2 neonatal sensor for preterm application across the foot
Patient weight < 10 kg (22 lb.)

Nellcor Sensors

Reusable

Nellcor Durasensor DS-100A SpO_2 Sensor, adult 7262764

SpO_2 adult sensor for finger application
Patient weight > 40 kg (88 lb.)

NOTE: Not for use with MicrO2+.

Adhesive Single-Patient Use

Nellcor OxiMAX MAX-A, adult, Latex-free, 24 pcs MX50065

SpO_2 adult sensor for finger or toe application
Patient weight > 30 kg (66 lb.)

Nellcor OxiMAX MAX-AL, adult, Latex-free, 24 pcs MX50071

SpO_2 adult sensor for finger or toe application
Patient weight > 30 kg (66 lb.)

Nellcor OxiMAX MAX-I, infant, Latex-free, 24 pcs MX50067

SpO_2 infant sensor for finger or toe application
Patient weight 3-20 kg (6.7-44 lb.)

Nellcor OxiMAX MAX-N, neonatal/adult, Latex-free, 24 pcs MX50068

SpO_2 neonatal sensor for foot application
Patient weight < 3 kg or >40 kg (<6.7 lb. or >88 lb.)

Nellcor OxiMAX MAX-P, pediatric, Latex-free, 24 pcs MX50066

SpO_2 pediatric sensor for finger or toe application
Patient weight 10-50 kg (22-110 lb.)

Pods

Masimo SET SpO_2 pod kit MS16901

1 MASIMO SET SpO_2 pod
1 MASIMO SET SpO_2 pod Mount
1 MASIMO Extension cable

Extension Cable, 3 m MS17041

Connects Masimo SET SpO_2 pod to Masimo LNOP sensor

Cables

SpO_2 blue latched Nellcor extension cable, shielded, 1 m 3368433

SpO_2 blue latched Nellcor extension cable, shielded, 2 m 3375834

SpO_2 Masimo ProCal+ cable, 2 m 7492601
NOTE: Not for use with Masimo SET pod.

SpO_2 Masimo ProCal+ cable, 1.5 m NOTE: Not for use with Masimo SET pod.	MS13926

Dual SpO_2

MicrO_2+ Pulse Oximeter, Masimo	7269686
MicrO_2+ Pulse Oximeter, Nellcor	7263614
Dual SpO_2 cable with converter	7499614

Temperature

Temp adapter cable, 1.5 m	5198333
Temp Y-cable (for MultiMed 5/6)	5592154

Core Probes

For use in electrosurgery, esophageal and rectal applications

Temperature probe, adult, 1.5m	4329889
Temperature probe, adult, 3m	5204644
Temperature probe, pediatric, 1.5m	4329848
Temperature probe, pediatric, 3m	5204651
Temp protective covers, 10 pcs ***WARNING:*** *Covers contain latex. Use with all probes except skin probes*	7014616

Skin Probes

Not for use in electrosurgery

Temperature probe, skin, adult, 1.5m	4329822
Temperature probe, skin, adult, 3m	5204669
Temp skin probe, pediatric, 10 pieces	7498921

Non-Invasive Blood Pressure (NBP)

NBP Cuffs

Reusable	
Child cuff, 12-19 cm arm circumference, Latex-free	MS14430
Small adult cuff adult, 17-25 cm arm circumference, Latex-free	MS14427
Adult cuff, 23-33 cm arm circumference, Latex-free	MS14428
Large adult cuff, 31-40 cm arm circumference, Latex-free	MS14425
Thigh cuff, 38-50 cm thigh circumference, Latex-free	MS14426
Single-Patient Use	
Neonatal cuff #1, 3.1-5.7 cm arm circumference, Latex-free, 10 pcs	2870181
Neonatal cuff #2, 4.3 - 8.0 cm arm circumference, Latex-free, 10 pcs	2870199
Neonatal cuff #3, 5.8 - 10.9 cm arm circumference, Latex-free, 10 pcs	2870207
Neonatal cuff #4, 7.1 - 13.1 cm arm circumference, Latex-free, 10 pcs	2870215
Neonatal cuff #5, 8.3 - 15.0 cm arm circumference, Latex-free, 10 pcs	2870173

NBP Connecting Hoses

NBP connection hose, child/adult, 3.7 m	12 75 275
NBP connection hose, neonatal, 2.4 m	28 70 298

Invasive Blood Pressure (IBP)

Vista XL IBP Options

Vista XL IBP II option *Provides HemoMed and IBP Y-cable connection on the* Vista XL *monitor*	MS 15 0610

Hemodynamic Pods

HemoMed pod (includes 3 m connection cable and universal pole mount)	5588822

Hemodynamic Pod Connecting Cables

HemoMed intermediate cable, 3 m *Cable to connect HemoMed to monitor*	5591925
HemoMed intermediate cable, 5 m *Cable to connect HemoMed to monitor*	5591933
IBP Y-cable, 7 pin, 0.3 m *Cable for monitoring 2 pressures without hemopod Requires specific intermediate cable for each IBP transducer*	5592147
IBP Y-cable, 10 pin, 0.3m *Cable for monitoring 2 pressures without hemopod Requires specific intermediate cable for each IBP transducer*	5731281
IBP adapter, 10 pin to 7 pin *Connects pressure transducer cables to the monitor with 7 pin connectors*	3368383

IBP Accessories

Hemo pod adapter, Abbott/Medex *Adapter block to connect* Abbott/Medex *pressure transducers to the HemoMed pod (Two for each HemoMed pod)*	5196998
Hemo pod adapter, Edwards/Baxter *Adapter block to connect Edwards/Baxter pressure transducers to the HemoMed pod (Two for each HemoMed pod)*	5196980
Note: Due to corporate mergers, Baxter accessories may be labelled as being from Edwards. Contact Edwards if there is any doubt as to the identity of the accessories.	
Hemo pod adapter, Ohmeda *Adapter block to connect Ohmeda/Abbott/Medex pressure transducers to the HemoMed pod (Two for each HemoMed pod)*	3375941
Hemo pod adapter, SensoNor/Memscap *Adapter block with 7-pin shielded input connectors for HemoMed pod to provide connectivity with 7-pin pressure transducer cables, including SensoNor 840. (Two for each HemoMed pod)*	4329160
Hemo pod adapter, 10 pin *Adapter block to connect 10 pin connectors to HemoMed pod (Two for each HemoMed pod)*	3375958

IBP SensoNor/Memscap Cables and Transducers

IBP intermediate cable, SensoNor, 3.7m	4321563

Dome for SensoNor 840, 50pcs	4529954
IBP-set disp. SensoNor 840, 10pcs *Disposable monitoring kit for SensoNor 840 pressure transducers, sterile*	4530226

IBP Transducer Plates

IBP4 transducer plate *HemoMed pod transducer plate for IBP transducers (fits most transducers)*	4721424
IBP4 transducer plate - Medex/SensoNor *HemoMed pod transducer plate for Medex/SensoNor transducers*	4721416
Hemo transducer plate, Abbott/Braun *For HemoMed pod* *Holds Abbott/Braun transducers*	5192112
Hemo transducer plate, Abbott/Transpac IV *For HemoMed pod* *Holds Abbott/Medex Transpac IV transducers*	7270460

Cardiac Output

C.O. intermediate cable, 1m *Connects C.O. accessories to HemoMed pods*	3368458
C.O. catheter-cable *Connects catheter to intermediate cable*	8419160
C.O. thermistor-cable, Ohmeda *Use with thermistor T-piece 5741975*	8420077
C.O. thermistor T-piece, 25 pcs *Ohmeda disposable in-line injectate sensor for measurement of injectate temperatures* *For use with cable 8420077*	5741975
C.O. thermistor cable, Edwards/Baxter	8539983

Notes:

- Due to corporate mergers, Baxter cardiac output catheters and accessories may be labelled as being from Edwards. Ohmeda output catheters and accessories may be labelled as being from Becton Dickinson (BD). Contact Edwards and/or BD if there is any doubt as to the identity of the cardiac output catheters or accessories.
- Cardiac output monitoring requires a special tubing set that you must order directly from Ohmeda or Baxter.

End-Tidal CO_2 ($etCO_2$)

$etCO_2$ Module and Pods

$etCO_2$ module	4319310

Sensors

$etCO_2$ CAPNOSTAT™ III Sensor *Reusable $etCO_2$ sensor with 2.4 m cable. Suitable for adults, children, and neonates* *Includes calibration and reference cell, adult airway adapter and 5 cable clips.*	4322975

Main Stream Accessories

$etCO_2$ airway adapter, adult, dead space < 5cc	4721796
$etCO_2$ airway adapter, neonatal, dead space < 0.5cc	4721788

Side Stream Accessories

$etCO_2$ airway adapter, sidestream *Not for use with neonates*	4714437
$etCO_2$ Nafion tubing, 10 pcs	4714429
$etCO_2$ sampling cannula, adult, 10 pcs	4714395
$etCO_2$ sampling cannula, pediatric, 10 pcs	4714387

FiO_2

FiO_2 sensor cable	5597898
FiO_2 sensor cell with O-ring	9004979

MultiGas Monitoring

Scio Four Gas Modules

Scio Four Oxi plus Module	6871801
Scio Four Oxi Module	6871803
Scio Four plus Module	6871802
Scio Four Module	6871804
Power supply	5953539 or MS18508

MultiGas Accessories

Water Trap, disposable, 30 pcs *Disposable water trap to capture bulk fluids. For use with sampling line 8290286*	MS13826
External airway filter, 10 pcs *0.8 m airway filter*	1276695
Sample Gas Return Kit	M32692

Scio Four Accessories

Water Trap (Set of 12)	6870567
Sample line (Set of 10)	8290286

Scio Connecting Cables

SCIO direct connect cable X8, 1.8m *Cable to connect Scio Module to Vista XL(X8 connector)*	6871581
SCIO "Y" cable X8 - X3 *Cable to connect Scio and Masimo SET SpO_2 SmartPod*	MS16989

These Instructions for Use only apply to:
Infinity Vista XL
VF7
with the Serial No.:
If no Serial No. has been filled in by Dräger, these Instructions for Use are provided for general information only and are not intended for use with any specific machine or device. This document is provided for customer information only, and will not be updated or exchanged without customer request.

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Directive 93/42/EEC
for medical devices

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